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POSSIBILITIES OF ENLARGING/MANAGING LARGER HABITATS FOR RE-INTRODUCED RHINOS WITH SPECIAL REFERENCE TO DUDHWA TIGER RESERVE, UTTAR PRADESH, INDIA

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ABSTRACT

The Great Indian One Horned Rhinoceros was once found throughout the Indus, Brahamaputra and Gangetic flood plains and nearly foothills of South Asia. Due to rampant poaching and loss of suitable habitat, rhinoceros are now restricted to a few isolated pockets of protected areas in Assam and West Bengal in India and in Nepal as well. Few Great Indian One-Horned Rhinoceros roaming in the Terai area of Central North India are believed to have disappeared in 1878 near Pilibhit, Uttar Pradesh. One of the conservation measures adopted for the species is the establishment of additional viable populations in suitable areas in the former ranges of its distribution to increase the areas under rhinoceros, thereby reducing the risk of extinction. In the years 1984 and 1985, rhinos from Assam and Nepal were re-introduced in the Dudhwa Tiger Reserve in Uttar Pradesh to establish a new viable breeding population. The newly established population in Dudhwa seems to be doing well as the population rose to seventeen from the seed population of seven, but problems have arisen of inbreeding depression (all being progenies of single dominant male) and hostility amongst the male are inevitable. Keeping this in view, Badhi-Churaila sector in Belreiyen Range of the Park has been identified where few females and the males from the existing area will be translocated. It is also proposed to introduce few more females and male rhinos of different genetic base in this newly created area to solve the problem of inbreeding depression and male hostility.

Key words : Rhinos, Re-introduced, In-breeding depression, Dudhwa National Park.

Introduction

In ancient times, all the three Asiatic species of rhinoceros roamed over the Indus, Gangetic and Brahamputra flood plains of the Indian sub- continent. In the relics of Mohenjo-Daro era, some rhino seals were found which are preserved in the Indian National Museum, New Delhi. The records say that on his invasion of India, Timur hunted and killed many rhinos on the frontier of Kashmir in 1398 AD and there are evidences that rhino existed in the western parts of the

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subcontinent as far North-West as Peshawar till 16th Century. Babur, in his famous memoirs, *Baburnama*, described how he hunted rhino in bush country near the Indus as late as 1519 AD.

Of the three species of rhino that roamed over the Indo-Gangetic and Brahamaputra floodplains, two species namely Javan Rhinoceros (*Rhinoceros sondaicus*) which was once 'fairly common' in the Sundarbans became extinct in India about 1900 AD and Sumatran Rhino (*Didermoceus sumatrensis*) disappeared from the Lushai hills of Assam around 1935.

The only species of Asiatic Rhinoceros that exists in the Indian subcontinent is the Great Indian One-Horned Rhinoceros (*Rhinoceros unicornis*), which was once widely distributed throughout Indo-Gangetic and Brahmaputra floodplains of the subcontinent.

The causes of disappearance of Great Indian One-Horned Rhinoceros from several locations of its former range of distribution and decline of population were primarily the following :

- Destruction and fragmentation of Rhino habitat primarily for extension of agriculture
- Hunting of Rhino for sports during Mughal period and early days of British Rule in India
- Poaching of Rhino for horns and other parts attributed to have magical medicinal values

It is interesting to note that in Assam, Col. Pollock a Military Engineer engaged in laying of roads in Brahmaputra Valley almost shot a Rhino or a Wild Buffalo for breakfast every day. A sportsman in Bengal Dooars, possibly an English Planter fired about 100 shots at a number of Rhinoceros in a day, killing five and seriously wounding more than twenty five. Maharaja Nirpendra Narayan of Coochbehar shot 208 Rhinoceros between 1871 to 1907.

The Great Indian One-Horned Rhinoceros also would undoubtly have ceased to exist, but for the strict protection given to it when its population fell to a very low level at the beginning of this century. Even though there is no precise documentation regarding the population of Rhino that existed in India at the turn of the century, its population was believed to be around 100 in the beginning of the current century – roughly 50 to 60 in Assam and 40-50 in West Bengal. At

Fig. 1

Rhino distribution in the Indian subcontinent - Past and present

present the Great Indian One-Horned Rhinoceros has total population of about 2,500 animals in the world, that too only in India and Nepal. In India, currently its population is restricted to four natural population in Assam, *viz.* Kaziranga, Manas, Orang and Pabitara; two natural populations in West Bengal *viz.* Jaldapara and Gorumara; one re-introduced population in Dudhwa NP and one migratory population in Katerniaghat in Uttar Pradesh. A few Rhino exist in Bhutan adjacent to Manas Tiger Reserve, Assam.

In Nepal, the three Rhino populations are in Royal Chitwan NP, Royal Bardia N.P and Sulkhlaphanta WLS. The Rhino of Royal Chitwan NP is a natural population while Royal Bardia NP and Sukhlaphanta WLS have re-introduced populations. Kaziranga National Park in Assam (India) has the highest population of Rhino (about 1,600) and Pobitora WLS (85 rhinos in 16 km^2 area) followed by Royal Chitwan NP in Nepal (about 600).

In 1979, the Asian Rhino Specialist Group of IUCN Species Survival Commission emphasized the need for continuous efforts in protection and monitoring of the species and "to establish additional viable population in suitable areas, preferably in the former distributional range of the rhino". Thus, on the basis of this logic the IUCN Rhino Specialist Group and the Rhino sub-committee of the Indian Board of Wildlife (IBWL) recommended the establishment of additional Rhino population in India and the Rhinos were re-introduced in Dudhwa Tiger Reserve, U.P. in the year 1984.

Table 1

Indian Rhino Population in India and Nepal (1999)

Country	State	PA	Estimated Population
India	Assam	Kaziranga NP	1649
		Manas WLS	5
		Orang WLS	46
		Pobitara WLS	83
	West Bengal	Jaldapara WLS	53
		Garumara NP	19
	Uttar Pradesh	Dudhwa TR	13
		Katerniaghat WLS	4
Nepal		Royal Bardia NP	52
		Royal Chitwan NP	600
	Total		2524

Source : Report on the Regional Meeting for India and Nepal of the IUCN/SSC Asian Rhino specialist Group, Kaziranga, Assam, India, 21-27 February 1999.

Rhino Re-introduction Programme in Dudhwa

Need for Rhino Re-introduction

1. *Restricted Location* : Conservationists generally agree that an endangered species whose habitat type has by human impact been reduced and split up into separated "islands", should live in as many of those "islands" as possible. This reduces the risk of extinction. The same applies to Great Indian Rhinoceros and it became imperative to create as many "islands" as possible especially in its former ranges of distribution (Schenkel, 1981). Re-introduction is necessary mainly to establish new viable breeding populations and safeguard this species from poaching and natural calamities (Mishra and Dinerstein, 1987).

2. *Increasing Population of Rhinos in Assam leading to conflict* : Due to dedicated efforts to protect Rhinos in Kaziranga National Park, Pobitora WLS and other Protect Areas in Assam, the population pressure is high and during recent years population surplus has been observed. These animals have spread up and down and across the Brahmaputra valley. However, most areas into which the Rhinos move are used for agriculture (Schenkel, 1981). Kaziranga has an unusually high density of population and Pobitora has about 85 rhinos in 16 km^2 area. From the point of view of conservation, the only alternative is to translocate them to other Protected Areas where they can thrive well.

3. *Protection from Natural Calamities* : Inspite of the protective measures, the persecution of this animal continues due to exceptionally high price of its horn. In Kaziranga National Park during the period between 1983-1989, 235 rhinos were killed by poachers and in the same period 368 died due to natural causes related to flood, old age and illness (Dutta, 1991). In the recent past, poachers wiped out the entire rhino population of Laokhowa WLS. Despite extremely strong protection measures, rhinos are also poached from other protected areas as well.

Natural calamities like floods are also equally disastrous for Rhinoceros population in Kaziranga; cattle grazing is another problem. Cattle presence in wild increases the chances of disease transmission, though so far there has not been a record of disease transmission (Sinha, 1999). One-Horned Rhinoceros is a hardy animal and seldom falls prey to disease that affects other herbivores, domestic or wild. But any epidemic outbreak can cause great loss to the animal. In 1944 and 1947 due to suspected case of Anthrax and another unidentified, disease several Rhinos died in Kaziranga National Park (Dutta, 1991). In 1979 too, haemorrhage septicemia was detected in Kaziranga National Park in 10 cases (Sinha, 1999).

4. *Increasing Rhino Habitat in as many "islands" as possible* : Habitat destruction is another major problem for rhino. The prime rhino habitats are under various threats from encroachments, cattle grazing, agriculture activities, illegal felling and flood. It had been cleared in past for agricultural purposes and developmental activities. The whole area of Terai and flood plains of Brahmaputra is a highly fertile belt. Encroachment of forestland for agricultural activity is a wide spread problem more or less everywhere in India. Increasing the rhino habitat with strong protection is the only alternative.

Thus, by considering the current highly restricted distribution with poaching pressure, habitat specificity, and in consideration to the scattered small population, it became imperative to re-introduce the species in suitable habitats in its former range of distribution as one of the measures to be adopted for the long-term survival of the Indian Rhinoceros. The IUCN Rhino Sub-Committee of the Indian Board of Wildlife (IBWL) recommended the establishment of an additional Rhino population in India and consequently rhinos were re-introduced in Dudhwa National Park in 1984.

Selection of Dudhwa National Park for Rhino Re-introduction

Following up on the recommendation of the Asian Rhino specialist group, the wildlife status evaluation committee of the Indian Board of Wildlife appointed a sub committee to consider alternative areas for establishing a rhino population by translocation in suitable habitats. This sub-committee considered the ecological requirements of potential areas for the re-introduction of Indian rhinoceros and established the following criteria :

- Diversity of habitat, including flooded grasslands with a variety of food plants.
- Ample shade and water bodies for wallowing and drinking especially in the hot season.
- Protection from all forms of human disturbance and harassment, including pollution, poaching and the introduction of disease via domestic stock. It is equally important that conflict with cultivation adjacent to areas of re-introduction be avoided, especially in view of rhino's liking for crops such as paddy and sugarcane.
- Translocation to an area which are not yet inhabited by rhinos, but the area falls under the former range of rhino distribution in the past

On the basis of above criteria, possible alternative habitat suggested were Dudhwa National Park (UP), Jaldapara (WB), Champaran (Bihar), Intaki in Nagaland and Lalighabri Sanctuary of Arunachal Pradesh. Among these various areas considered by the Sub-Committee, Dudhwa National Park was thought to be the most promising which met all the above-mentioned criteria.

- Dudhwa National Park was found to be the most suitable because of the significant similarities to habitats of Kaziranga National Park. Dudhwa National Park contains diversity of habitat, including flooded grasslands with a variety of food plants and ample shade and water for wallowing and drinking.
- Adequate protection is available in Dudhwa Tiger Reserve because of its status as National Park and later as Tiger Reserve.
- The area is a portion of the historic range of the rhino. The last one having shot in 1878 in Pilibhit district, which is in proximity to now Dudhwa Tiger Reserve.

Prof. Schenkel, the then chairperson of Asian Rhino Specialist Group, confirmed the suitability and observed, "Dudhwa is the area most suitable for establishing a new local population of Indian rhinoceros. The area is protected, large enough and contains suitable habitat", and this was further supported by the vegetation survey conducted by the Botanical Survey of India that revealed the presence of several food

species of Rhino that were common to Dudhwa, Kaziranga and Manas National Park. These are:

Grasses	10 species
Herbs and climbers	6 species
Hydrophytes	6 species
Shrubs and under shrubs	7 species
Trees	12 species

Preferred grasses : Rhinos generally prefer grasses like *Saccharum* spp., *Cynodon dactylon, Arundo donax, Polytoca digitata, Hygroryza aristata, Vetiveria zizanioides, Imperata cylindrica, Themeda spp., Chrysopogen aciculatus, Puspalidum flavilum, Narenga porphyrocoma, Phyragnutes karka,* etc.

Preferred sedges : The preferred sedges like *Cyperus* spp. and herbs, shrubs and saplings of species like *Polygonum plebelium, Ageratum conyzoides, Erigeron* spp., *Artemesia nilagirica, Eupatorium odoratum, Solanun* spp., *Colebrookia oppositifolia, Murraya koenigii, Trewia nudiflora, Litsaea* spp., *Premna* sp., etc.

Preferred acquatic plants : They also prefer aquatic plants like *Hydrilla verticillata, Vallisneria spirolis, Hygroryza aristata, Potamogeton sp., etc.*

It is estimated that the rhino population in Kaziranga takes about 77% grasses and 23% herbs and shrubs. Wide range of materials eaten by rhinos suggests that the animal is not very specific in its choice. However, majority of above mentioned food plants are available in the Dudhwa National Park (Hazra and Shukla, 1982).

The U.P. Forest Department came forward with an area of approximately 90km^2 in the South-west part of the Park (South Sonaripur and Bellarian ranges) It was estimated an area of 90 km^2 could support an ultimate maximum number of 90 rhinos considering one rhino per km^2 (Sale and Singh, 1987). In addition, there are other areas of good rhino habitat in Dudhwa Tiger Reserve. In order to prevent released rhinos from wandering out of Dudhwa into adjacent cultivation and to assist their initial establishment in optimal habitat, a 27 km^2 area was enclosed by a stranded electric fence. A 9 km critical section near the park boundary was additionally protected against accidental escape by construction of rhino and elephant proof trench outside the electric fence. Holding stockades for the new arrivals were built within the fences zone, and Dudhwa field staff was sent to Assam for training in rhino management.

Finally, re-introduction of Rhino in Dudhwa took place in two phases – one in 1984 and the second in 1985. Rhino re-introduction in India could become possible due to the keen interest of the former Prime Minister of India, Smt. Indira Gandhi and her full support to the rhino re-introduction programme.

The 1984 translocation from Assam

Early in 1984 a group of about 10 rhinos living outside Pobitora Wild Life Sanctuary in Assam was selected by the Assam Forest Department for the capture operation. The fact that these rhinos were causing considerable damage to cultivated crops and proving difficult to protect adequately provided enhanced justification for the translocation experiment. (It remains a mystery why the translocation of rhinos were done from Pabitara WLS

because one of the main reasons of translocation and creation of another viable breeding population was to reduce the high density of rhino from Kaziranga National Park and to prevent rhino population from natural calamities). Between 11 and 21 March 1984, six animals were captured by drug immobilization. These were crated, revived, transported to stockades a few kilometers from the capture area and released. After release, animals were encouraged to wallow and in most cases satisfactory feeding was established within two to three days. A team of veterinarians rendered necessary health care, mostly consisting of treatment of superficial lacerations received during the capture. The first animal captured, a large male, escaped from its stockade during the night.

On 30th March, the five remaining animals (a sub-adult, two elderly females, a young adult and one older male) were crated, driven in trucks to Guwahati Airport and headed into an Aeroflot Il 76 cargo aircraft chartered by the Government of India. Three of the animals were lightly sedated prior to loading and they all remained calm during the two and a half hour flight from Guwahati to New Delhi. After food and water at Delhi Airport, the rhinos were driven through the night to Dudhwa National Park, where they were uncrated into individual stockades. One female died due to stressful abortion after 11 days but the remaining four settled well; three were released from the stockades on 20 April 1984 and the large male was released on 9 May, after being fitted with radio collar. Another female died on July 31 1984 after a bid to tranquilize her to treat a wound. Thus, there were left only three rhinos, one female and two males.

The 1985 translocation from Nepal

To establish a rigorous breeding nucleus of rhinos in Dudhwa, it was decided to introduce more stock from a different population. The collaboration of His Majesty's Government of Nepal was obtained in the exchange of four adult female rhinos, from the Royal Chitwan National Park, for 16 domesticated Indian elephants. By selecting only females, the reproductive potential in Dudhwa would be more than doubled and eventual mating of these animals with the totally unrelated Assam males would ensure maximum genetic vigour. Capture took place on 28-31 March 1985. All four female rhinos, estimated to be between 5 and 7 years old, were immobilized and sledged into crates, which they were revived. They were immediately driven 720 km to Dudhwa and all withstood the 24-hour journey. They were released into the wild after a week.

Present status – A success story

Of the total of nine rhinos translocated to Dudhwa Tiger Reserve seven survived in excellent health and these consisted of the young female and both the males of 1984 translocation from Assam, and all four young females of the 1985 from Nepal. Thus, these seven rhinos constituted the seed population of rhinos at Dudhwa National Park. In 1988, one adult male from Assam died after a fight with another dominant male. Again in 1991, a female, from Nepal, died due to internal infection and abortion. She also lost her male calf in 1993 killed by the dominating male.

The first evidence of breeding in the re-introduced population was detected in the form of remains of a newly born calf in

Table 2

Demographic (age-wise) status of existing Rhinoceros in Dudhwa TR (2002)

Sex		
Male	Female	Calf
1. 25 years	1. 23 years	1. 1 year
2. 11 years	2. 22 years	2. 1 year
3. 10 years	3. 21 years	3. 1 year
4. 4 years	4. 19 years	
	5. 13 years	
	6. 13 years	
	7. 10 years	
	8. 8 years	
	9. 5 years	
	10. 5 years	
	11. 3 years	
Total 4	11	3

a patch of tall grass in August 1987. There were no signs of predation; hence it may have been a case of premature birth or any such natural circumstances. The first successful calving occurred in early 1989. Three more calves followed this in the same year. The breeding success followed then and the seed population of 7 has since increased to 18 till date (Sinha *et al.*, 2003).

All the rhinos are kept in an area of 27 km^2. Area encircled by a power fence in South Sonaripur Range. Everyday, four riding elephants are used for monitoring. During rainy season, monitoring of the fence in the southern part of the RRA is done on boats in the Suheli River. There are two boats for this purpose. Seldom were all rhinos sighted everyday due to the tall grassland conditions. All the adult rhinos are identified individually by recording different physical traits. The fortnightly report is submitted to the Deputy Director of the park and then forwarded to the CWLW. Monitoring is done in relation to their movements, feeding and social behaviour. In addition to these, special protection in this Rhino Re-introduction Area (RRA) is given top priority. The all round increase in the status of protection of the area has helped other endangered wildlife such as Hispid Hare and Bengal Florican. The herbivore population especially Swamp Deer has increased tremendously in the RRA.

Methodology

A rapid survey was conducted in the Dudhwa Tiger Reserve to collect information on present distribution of rhinos, identification of potential habitats for enlarging the rhino habitat in the near future, land use pattern, ground verification of vegetation and major threats.

Interaction with the various levels of forest staff with a view to collect information related to current situation in RRA, problems and issues, threats etc. in potential rhino habitat was carried out. Various secondary information related to rhinos was collected from literature and forest records.

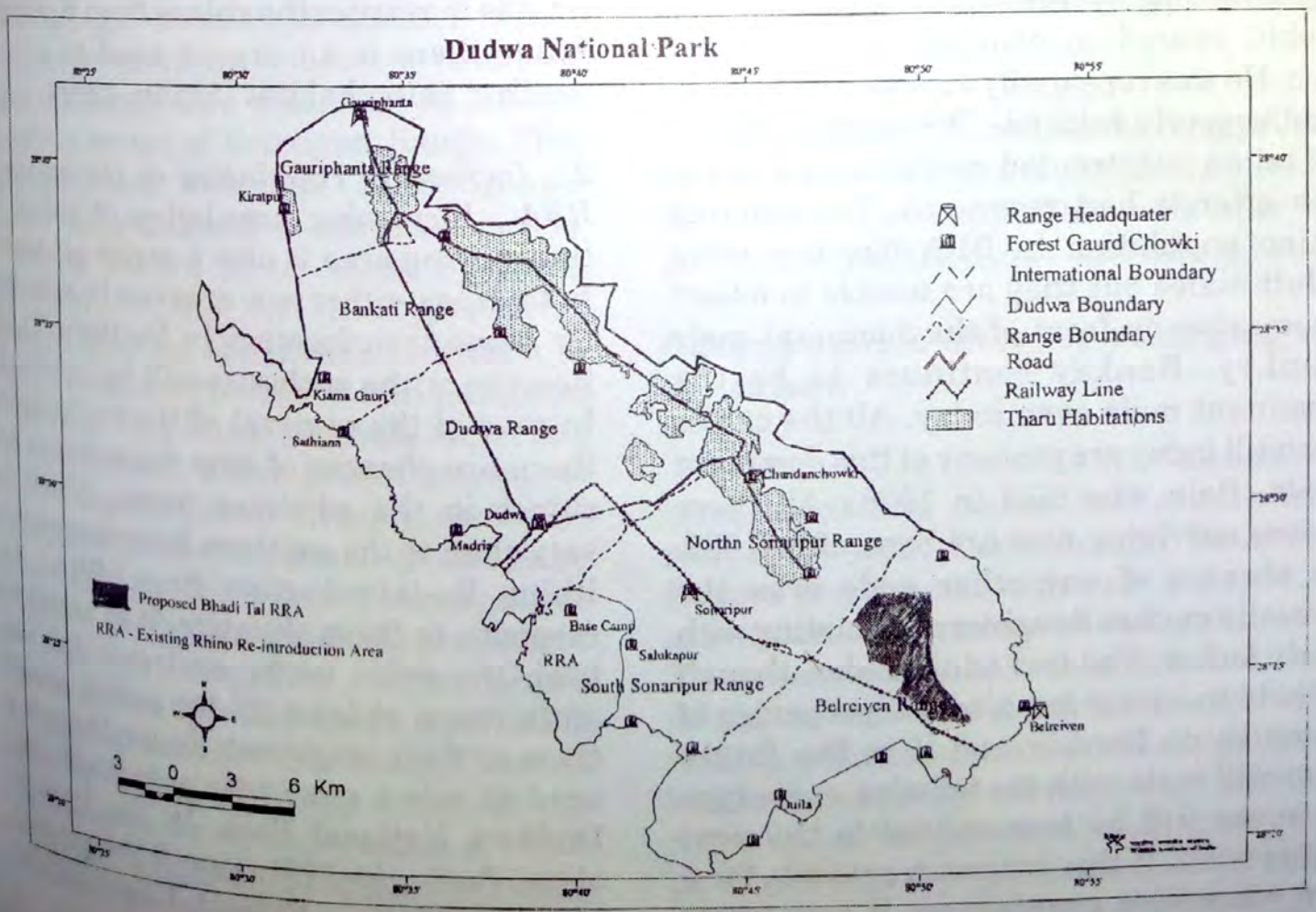
Study Area

The Dudhwa National Park declared as Dudhwa Tiger Reserve under Project Tiger in 1987 in the Kheri District of Uttar Pradesh and lies between 28° 18' North latitude and 80° 57' E longitude, approximately 30 km South of the Nepal Himalayas. It is 490 km^2 in extent with buffer zone of 124 km^2 under the park administration.

The park is a compact block of approximately 50 km in length by 10 km in width. The Mohana and Suheli Rivers constitute respectively the northern and the southern boundaries. An area of 25 km^2 within Kakraha block surrounded by a power fence constitutes the Rhino Re-introduction Area (RRA). A section of the fence perimeter has a parallel stretch of trench. The RRA habitat is a mix of tall wet grassland, woodland complex with ten perennial swamps. South of the RRA flows the river Suheli.

The area identified for creation of a satellite population falls in the Bhadi-Churaila sector of the Reserve, which fulfills all habitat requirements for the Rhino rehabilitation. The area has already been surveyed for its habitat suitability and found fit for rehabilitation of Rhinos. The extent of area to be fenced in the Bhadi-Churaila sector has been decided on the basis of estimated number of animals in the population to be built in due course of time and habitat requirement of Rhinos for different purposes. This area comprises of Sal forest (336 ha), Grassland (608.23 ha) and Wetland/Swamp (129.00 ha), which fulfill the need of rhino, and is one of the prime rhino areas in Dudhwa.

As whole vegetation consist of some of the best forests of Sal (*Shorea robusta*) in India, mixed moist forest, riparian communities, tall wet grassland with patches of short grasses. Interspersed within the grassland are a number of swamps within the park, grassland covers 20% of the total area. So far, 75 species of trees, 21 species of shrubs, 17 species of climbers, 77 species of grass and grassland



plants, 179 species of aquatic plant have been listed.

Results and Discussion

Need for Enlarging Rhino Habitat

1. *Augmenting Genetic Variability* : The original objective was to release 30 rhinos in Dudhwa National Park. The reasons why this was not carried out after release of two batches are financial and administrative. However, due to breeding the number has increased from seven to seventeen. Out of the seven seed population, only two were male named Raju and Bankey. Initially, Raju had asserted his dominance but with passage of time Bankey became dominatant and killed Raju in one of their regular fights in October 1988. During 1991 an attempt was made to counter the anticipated problem of inbreeding by introducing a male, named Rohit, reared in captivity from Kanpur Zoo. He was repeatedly attacked by Bankey and severely injured. This animal had to be taken out, treated and returned to the zoo after it had recovered. The existing rhino population in RRA has two more adult males but they are unable to assert themselves in front of the dominant male Bankey. Bankey continues to be the dominant male even today. All the calves born till today are progeny of this dominant male (Raju who died in 1988). All these calves surviving now are born after 1989. In absence of any other male even the sexually mature daughters are mating with their father. The two adult males, though unable to assert are also the progenies of same rhino Bankey and if in the future they will mate with the females, same type of genes will be transmitted to the next generation. If this situation prevails for a few successive generations, it may cause inbreeding depression, which is a threat for genetic viability. So, there is an urgent need to introduce some other male with different genetic base. And keeping in view the past experiences with Bankey's behaviour, newly translocated male rhinos should be kept in separate enclosure to avoid the chance fighting among them. Hence, there is an urgent need of enlarging rhino habitat (Sinha, 1999).

2. *Reducing conflict amongst males in existing RRA* : Bankey has driven one of the two adult males in existing population out from the main fence on several occasions. Therefore, separate contiguous minifence has been created to provide safe heaven to one of these animals. The two males are often seen parading on their respective sides of the common section of the fence. The operation failures of the fence and even functional fence also are unable to restrict the rhinos from fighting. Thus, there is an urgent need to create another rhino habitat (Sinha, 1999).

3. *Increasing Population in the existing RRA* : Increasing population of rhino in the existing area is also a major problem. In this case, either new area can be selected for rhino translocation in Dudhwa Tiger Reserve or the enclosure will be removed. In case of the removal of the enclosures, there are chances of crop depredation by rhinos in the adjoining areas, which is very close to the southern boundary of the Rhino Re-introduction Area (RRA). In response to these situation, it is better to keep the rhino under enclosure for few more years, at least till the people accept them as their neighbors. Hence, there is a need to select some new area inside the Dudhwa National Park. In the light of above facts, in 1991, one of the present authors (SPS - Project Coordinator,

Corridor Project of USWLS), strongly recommended for the urgency of creating another viable breeding population of rhino in Dudhwa Tiger Reserve. He proposed Bhadi-Churaila area in Belreiyan Range of Dudhwa Tiger Reserve. Dr. Sinha's recommendation and proposal has been accepted and Bhadi-Churaila sector of Dudhwa National Park has been identified for creation of additional rhino habitat as this fulfills all habitat requirements for the rhino rehabilitation.

The area selected for enlarging Rhino habitat

On the basis of above recommendations, the area was identified for creation of another viable population of rhino in Dudhwa Tiger reserve. Finally, in 2002, the work went underway and proposed area was to be enclosed by power fence for the creation of another viable population of rhino inside the Dudhwa Tiger Reserve. The area falls in Bhadi-Churaila sector of Belreiyan Range. This area provides water for drinking and wallowing, shade and an adequate variety of plants known to be eaten by rhino elsewhere. One of the essential prerequisites for rhino re-introduction is vast grassland with water for drinking and wallowing. This Bhadi-Churaila sector has two permanent water bodies known as Bhadi Taal and Churaila Taal respectively. Apart from these two permanent and large water bodies, there are various other smaller water bodies, which are permanent as well as, seasonal. The Rhino Subcommittee of Indian Board for Wildlife (IBWL) has identified this Bhadi-Churaila sector in Belreiyan Range as one of the possible sites for re-introduction of rhino in their original recommendation. Feasibility study with regard to the habitat availability for the re-introduction of rhino in Dudhwa by the Botanical Survey of India led by Dr. Hajra carried out a detailed survey of the vegetation of Dudhwa in relation to the rhino feeding ecology. The detailed study clearly established a number of floral elements common to Dudhwa National Park (U.P.) and Kaziranga (Assam), both of which are excellent rhino habitats.

The advantage of the area selected is that it is in the central location of Belreiyan Range. There is no danger of rhino wandering in the human occupation and cultivation in case of operation failure of power fence. While in case of existing rhino re-introduced area, it is adjacent to the southern boundary of the park, which lacks a buffer zone and outside of which is an area of dense human occupation and cultivation. Bhadi-Churaila sector is centrally located and sufficient buffer is available.

This Bhadi-Churaila sector comprises an area of 10.74 km^2 and the fencing work was started in 2002. The work was in progress when the study was carried out.

Other possible sites for enlarging in the future

There are excellent "phantas" (grassland) and water bodies in other ranges as well. Dudhwa and Sathiana Ranges are blessed with vast expanse of grasslands with number of viable swamps. These areas can also be rehabilitated with rhinos in due course of time when the rhino population increases. There exists a viable connectivity between the existing rhino and other grasslands. All these can be joined together in due course of time with the increase in rhino population and

Table 3

The Bhadi-Churaila Habitat (Belreiya Range)

Block/Comptt.	Sal Forest (ha)	Grassland (ha)	Wetland/Swamps (ha)
Bhadi-2	180.09	-	-
Bhadi-3a (Part)	-	30.00	105.00
Bhadi-3C	18.21	354.88	105.00
Bhadi-6a	88.63	-	-
Bhadi-6b	-	106.43	-
Laudaria-2 (Part)	35.39	-	-
Laudaria – 3B	4.04	96.62	24.00
Laudaria – 4 (Part)	9.72	20.30	-

Total Area = 1,073.31 ha (10.733 km^2)
Total length of the fence = 17 km
(Source: Proposed Plan for Bhadhital Rhino Area, 2002)

the fenced areas be extended in the boundaries of the park only.

Proposed Action Plan

1. *Fencing the newly identified RRA* : At the time of the present study, the work of fencing of newly identified RRA i.e. Bhadi-Churaila sector of RRA was in progress, entailing erection of 3,000 fencing posts. The three-strand power fence will cover entire proposed area of 17 km long stretch of perimeter before releasing the rhinos.

2. *Releasing rhinos in the newly created RRA from the existing RRA* : After the completion of power fencing, three females and one male from the existing RRA will be released in this newly created Bhadi-Churaila sector of RRA. This will provide immediate relief to the conflict situation in the existing RRA and enhance breeding in the newly created RRA.

3. *Releasing fresh batch of rhinos to augment the genetic variability* : Since all the rhinos born in the existing re-introduction area are progenies of a single bull Bankey, the problem of inbreeding depression needs to be addressed timely. In order to overcome this problem, there is a proposal to introduce fresh batch of rhinos – one male and three females, either from Royal Bardia NP in Nepal or Assam to broaden the genetic base (Sinha *et al.*, 2002).

4. *Monitoring* : Presently four elephants are engaged in the monitoring work. Mahouts and staff scan the area and send the report to the headquarter and office of the Deputy Director. Monitoring is an important activity to see their health condition, movement pattern and other behavioral aspects. With the creation of new RRA, more elephants and Mahouts as well as monitoring staff are required.

5. *Infrastructure support* : A road is to be built along the inner side of the entire fence to familiarize patrolling and fire management. The monitoring parties are

provided with walkie-talkie sets so that they are always in contact while conducting monitoring.

6. *Habitat Management* : This is one of most important aspect of the proposed action plan. It has several components :

(i) *Grassland Management* : For the management of grasslands, annual burning is one of the most important exercises. This discourages the invasion of woodland and facilitates new shoots, thereby increasing nutritional value. But the annual burning is to be made in consideration of the other endangered species like Bengal Florican, Hispid Hare, prey species of tiger and sensitivity to breeding requirements of species that are obligate of the grasslands. For example, in the grasslands utilized by Bengal Florican, the grass is cut first prior to burning. Burning is done in patches while the areas used by the Hispid Hare are protected from the fire (Sinha *et al.*, 2001). Controlled and cool burning plays an important role in management of grasslands especially relating to timing and pattern of prescribed burning.

(ii) *Wetland management* : Water is the lifeline of rhino. Though there are permanent swamps in the newly created RRA, for creation of additional wallowing grounds and waterholes as well as supplementing the existing 'taals' (water bodies), new borings and pumping sets are required.

(iii) *Weed Removal* : Removal of weeds from the "phantas" (grasslands) and water bodies also is an important aspect of habitat management.

(iv) *Woodland manipulation* : The newly created RRA contains predominantly Sal trees along with other species. Though felling and removal of tree from PA is totally banned, the problem needs to be addressed to check the invasion of trees into grasslands. The removal of trees is required from the point of view of extension of rhino habitat.

7. *Research Work* : With the passage of time, continuing research is required in relation to its habitat, food availability intraspecific behaviour and health aspects.

8. *Veterinary Care* : In Dudhwa, at present there are working elephants for monitoring purpose as well as for tourists. These working elephants need proper care and upkeep. Veterinary care is also needed from time to time for rhinos. Hence, establishment of veterinary units is required.

9. *Local Awareness* : Villages located at the fringes are already facing the problem of elephants and other herbivores straying into their agricultural fields. Re-introduction of rhino is another added burden to their problem. Due to proper power fencing and constant monitoring, rhinos generally do not stray into agricultural fields and there is no such report till date from the existing RRA. But with the creation of new RRA, the rhino population is bound to increase. Therefore, to make the conservation programme more successful, participation of fringe villagers is of utmost importance, so that they may compromise with the situation, at least their hostility can be reduced.

10. *Ecotourism* : The original rhinos disappeared in this area around 1878. Re-introduction of rhinos has fascinated the tourists. Now every tourist who visits the National Park wants to have a glimpse of

this mighty animal. More elephants and mahouts are required for this purpose.

11. *Eco-development* : The fringe villagers are the worst sufferers in the process of building up the PAs. They are deprived of the forest produces required by them for their day-to-day livelihood. In addition, they become the victims of wildlife depredation including loss of life. To ameliorate the economic hardships of these people, economic support in the form of eco-development programme has become very essential.

12. *Anti-poaching measure* : Protection is the *sine qua non* for any PA. Some conservationists give importance to protection to the extent that PA does not require any input except protection. This is true to the great extent. The success story of increased rhino population in Kaziranga National Park, Assam, Royal Chitwan NP, Nepal and other rhino bearing PAs is primarily due to effective anti-poaching network built up in these areas. Dudhwa Tiger Reserve shares 56 km of international boundary with Nepal. With the re-introduction of rhinos, the determined poachers may be tempted as the rhino horn fetches good revenue in the international market. Moreover, Tharu villages located in the Northern fringe of the park have relation in Nepal. For them, too, it may be a temptation. The facilities provided presently are not adequate. Sophisticated arms and training of anti-poaching personnel is of utmost importance to make the Rhino Re-introduction Programme successful.

13. *Setting up of field Headquarter in the RRA* : There is a requirement of setting up of headquarter, possibly near Chhanga nala area for better monitoring of newly re-introduced rhinos. This will also require appropriate funds.

14. *Construction of watchtowers* : Watchtowers need to be constructed in this new area for monitoring activities.

15. *Requirement of more elephants* : More elephants are required for monitoring the rhinos in the newly re-introduced rhino area for as well as for the tourists At present the elephants are less in number and to fulfill the requirement s of tourists and monitoring activities they are overworked which badly affects their health.

16. *Financial Aspects* : All the above mentioned points in Proposed Action Plan will see light of day only if adequate financial provision is available. Initially, the Government of India has provided financial support for the translocation and conservation of the rhino in newly reintroduced area. But with the passage of time, no funding is available from the Central Government for the conservation of rhino in Dudhwa. At present, the entire effort is being borne by the State Government as a part of the Forestry budget. Thus, the financial input is obviously very small. With the increase of rhino population in Dudhwa NP and gradual change of management strategies, the requirement of financial support is essential.

The Expected Outcome

1. The creation of the Bhadi-Churaila sector of RRA shall reduce the prevailing conflict situation among the males in the existing population. Fresh batch of rhinos either from Nepal or Wild captive rhinos will also

be reintroduced in this area to broaden the genetic base.

2. Intensive management efforts to be applied for Rhinos are bound to benefit the existing take off population of the highly endangered Swamp deer in the area. These expectations are based on the observations recorded in the existing RRA. The existing RRA is located on the south Sonaripur Range and this Range has recorded the highest number of all the five deer's found including swamp deer and hog deer amongst the nine ranges of Dudhwa Tiger Reserve (UP Forest Department, 2001).

3. There exists a viable connectivity between the existing and newly created RRAs through the grasslands of Bankey Tal area. Thus two populations can also be joined in due course of time when the Rhino population increases by extending the fenced areas.

4. Last but not the least, the conservationists' ultimate objective of creating as many separated viable "islands" as possible to reduce the risk of extinction will be fulfilled when the re-introduced rhinos of Dudhwa once again haunts the entire Terai area.

Conclusion

The re-introduction of rhinos in Dudhwa NP has resulted in the first viable population of rhino in these Terai areas of U.P. since the last century. This was the first experiment of re-introduction of Asian rhinos in the world and it is a success story now. Following India's footsteps the Government of Nepal also has re-introduced rhinos in Royal Bardia National Park from Royal Chitwan National Park. Both these re-introduction programmes proved highly successful and there is every hope that it will undoubtedly lead to further use of this approach to repopulate the selected areas of the rhino's former ranges of distribution. We must endeavour to cover more and more areas of former ranges of rhino distribution, if we do no want the present rhino habitat to assume the character of "open air museum" where endangered species are kept under rigorous protection. With the concept of landscape level of habitat management as the Restoration and Development of Corridor Project and Terai Arc Landscape Programme, there is hope that this mighty animal will once again roam freely in its ancestor's home that is encroached by man. The areas need to be extended and provided with more corridor types outlets so that animals can roam around in different areas freely.

As long as the myth of the aphrodisiac and medicinal value of the rhino horn persists, the animal will never be safe from poaching, which has become a lucrative business. Strong protection and mass awareness seems to be the only and the best alternative.

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