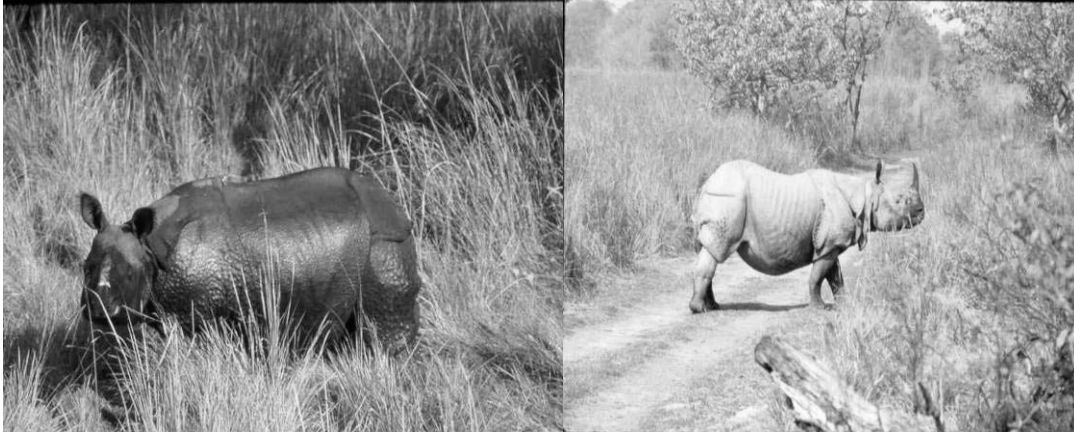


THE ASIATIC ONE HORNED RHINOCEROS
(*Rhinoceros unicornis*) IN INDIA AND NEPAL -
ECOLOGY MANAGEMENT AND CONSERVATION
STRATEGIES



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INTRODUCTION

The Asiatic one-horned Rhinoceros/ Greater Indian One-horned Rhinoceros (*Rhinoceros unicornis*) is perhaps the most endangered species of Indian mega fauna and one of the five remaining species of rhinoceros of an approximately 30 genera that once roamed the world (Nowak and Paradiso, 1883). Rhinoceroses first appeared in the late Eocene period. The oldest Indian rhinoceros like species was *Brontops robustus*, but the genus *Rhinoceros* may be traced back to the Pliocene period in northern India, and fossilized remains show that these animals were dwellers of riversides and marshes. In India, the rhinoceros has an old and traditional-linked history. The representation of the rhinoceros ichnographically or its mention in written accounts has been reviewed by a number of authors including Yule and Burnell (1903), Ali(1927), Ettinghausen (1950), Rao (1957) and Rookmaaker (1982). Although most of these quote sixteenth and seventeenth century accounts by medieval authors and other secondhand information's, the accounts by Al Beruni and Ibn Batuta, two historians and scholars of the same period, are among the more authentic and details one. Akbar the third Mughal emperor of India (1542-1605), records the existence of rhinoceros near Sambhal in Uttar Pradesh (Jarrat, 1949). Another Mughal emperor, Jahangir, records them in his memoirs as inhabiting Aligarh in Uttar Pradesh.

Table.1. Fossil remains of Asiatic One-horned Rhinoceros

Country	Site	Era	Reported by
India	Ganganagar, Raj	3500-400BC	Banerjee and
India	Langhnaj,Guj	Pre-Pottery	Chakravoorty,1973
India	Lake Kanevel, Guj	phase	Zuener,1952., Lutton-
India	Siwalik Hills	8000-1200BC	Brock,1965
		Miocene-Lower	Momin et al., (1973)
India	Mirzapur, UP		Baker and Durand (1836), Falconer and Cautely (1847),
India	Banda, UP	Not Known	Falconer(1868),

India	Chirand, Bihar	Not Known	Lydekkar(1876)
India	Madras, Tamil	c.1700BC	Cockburn(1883)
India	Nadu	Not known	Cockburn(1883)
	Gokak,Belgaum,	Not known	Nath (1976)
	Kar	2500-1500BC	Lydekkar(1880)
	Harappa	c.300BC	Foote (1874)
	Mohenjo Daro		Prashad(1936)
Pakistan			Marshall (1931)

(Source: WWF- Traffic India Publication-1996)

A large number of miniature paintings and other objects depicting rhinoceroses were made in India between 1500 and 1650 and a famous miniature painting of circa 1600, showing Emperor Jahangir hunting rhinoceroses. Although animals are easily recognizable as Greater One-horned Rhinoceros, all three Asian rhinoceros once inhabited the Indian subcontinent. The Javan Rhinoceros (*Rhinoceros sondaicus*) and Sumatran Rhinoceros (*Diceros sumatrensis*) become extinct in India in the early part of this century and the Greater One-horned Rhinoceros is therefore now the only rhinoceros species left in the wild in the country Dey (1999) and Menon (1996).

MORPHOLOGICAL FEATURES OF ASIATIC ONE-HORNED RHINOCEROS

The Asiatic Rhino averages 170-180 cm (5 ft 10 inch to 6 feet) at the shoulders with a girth of 335 cm (11 ft) behind the withers and weigh around 2 tons. The Great Indian Rhino has a single horn of averages 35 - 40 cm length. The skin of this massive creature is divided into great shields by heavy folds before and behind the shoulders and in front of the thighs. The fold in front of the shoulders not continued right across the back, a distinctive character of this rhinoceros. On the flanks, shoulders, and hindquarters, the skin is studded with masses of rounded tubercles. With its grotesque build, long boat-shaped head, its folds of

armour, and its tuberculated hide, the animal looks like a monster of some bygone age (Prater, 1948).

A record specimen of Indian Rhino horn exhibited in the British Museum had a length of almost 62 cm and a base circumference of almost same. The so called Rhino horn is not a horn at all. A typical horn consists of a core of bone covered by a sheath of Keratin (Fibrous protein). The presence of a keratin sheath distinguishes from antler and real horns, when fully developed consist of entirely of bone. The horn of the rhino is not a true horn because it does not have a core of bone. Instead of it's a compact mass of keratin fibers, not fixed to the skull and resting epidermally on a bony cushion. There are numerous instances of rhinos losing their horns and being replaced by new one. The average weight of an Indian rhino horn is around 750 gms. In International markets of far east price of one kilogram of powdered horn cost around 40,000 US dollar. Such high price lures and proves to be the strongest incentive for poaching (Dutta, 1991).

Table.2. Growth Pattern of horn in Asiatic One Horned Rhinoceros

Age of Rhinoceros	Measurements
At Birth	No Protuberance
6 months	1.1 to 1.65 cm
1 Year	3.3 to 5.5 cm
2 Year	6.6 – 8.8 cm, Basal circumference 17.6 to 22 cm
3 Year	8.8 – 13.2 cm, Basal circumference 17.6 to 44 cm
3-20 Year	19.8 to 22 cm, fully mature horn
25 – 30 Years	Reduction in height due to wear and tear

(Source: Ghosh, 1993)

In the case of the Indian rhino identifying a male and female in the wilderness is difficult when animal is in the grasslands. But in the open area if carefully observed than on the basis of genital, collar folds and shape of the head can identify male and female. In case of males collar folds and head is massive as compared to female rhinos. In females the skull is slightly thinner, the base of the horn is narrower and the horn is slimmer. However for sub adult rhino and calf such determination is impossible without physical examination (Dutta, 1991).

ECOLOGICAL ASPECT

Basically, Indian one-horned rhinoceros is a grazer or grass eater. It also browses on certain herb, shrub species, and small tree species and fruits fallen on the ground. Rhinos are associated with the water bodies by using it for feeding, wallowing and resting. It is an adherent of wallowing (remain immersed in mud or stagnant water) during the hotter part of the day to lower its body temperature and also to relief from ectoparasites. Rhinos feed on number hydrophytes like *Trappa* spp, *Hygorrhiza*, Water lily, Nymph, *Vallisnaria* and its roots. It has been observed that after burning of grassland within a week rhino feed on half burned sward of grasses with dry pith and also lick the ash on the ground (Sinha and Sawarkar, 1991).

The area which an animal normally occupies during the course of grazing, mating and rearing young ones is called its home range. A male usually have larger home range as compared to female and female accompanying young ones. The size of home ranges also depends upon the size of the available habitat, the nature of vegetation, the number of animals in a particular area. On an average roughly 10 hectares of area used by the individual rhino which differs is area specific depending on the availability of the habitat which also shared by other rhinos.

Once the mating took place it takes 16- 18 months as gestation period and gives birth to single calf. Usually mother rhino keep her calf away from other rhino and

is very aggressive. This period is crucial to new born calf when it can be killed by a tiger.

There are number of causes of mortality among adult rhinos are internal infection and hemorrhagic septicemia, female rhino attacked by male rhino and aborted, injured due to accident and paralyzed, stressful abortion and infection, anthrax and rabbies. In case of calf mortality premature death due to abortion, tiger predation, lung congestion and pneumonia, killed by dominating male rhino, internal infection and enteritis are the main cause of death (Sinha and Sawarkar, 1991).

BEHAVIOURAL ASPECT

The Great Indian One horned Rhino is solitary in nature with brief association of male to female during mating and get separated. Calf stays with its mother for atleast four years. From time to time rhino meet with each other in the common ground like grazing areas and during mud bath in the water bodies and stays together without showing any aggression. It has been observed in Kaziranga NP when 32 rhino were wallowing in a small pool of water and were tolerant to each other (Dutta, 1991, Deb Roy. per comm., 1999). In Dudhwa NP, 9 rhinos were seen together in water body comprising adult females with their calves and the dominating male. But no aggression seen among them but females keeping distance from male and keeping eye on the movement (Sinha and Sawarkar, 1991).

Mating in rhino is initiated by female rhino running around potential breeding male by making loud sound and frequently squirting urine. During this female rhino pushes the male rhino. Male rhino chases female rhino for hours till female rhino get exhausted and stays in one place and mating took place. If another potential male is nearby than severe fight between two took place and on number occasion it become fatal and another male can loose its horn. In Dudhwa NP, one of the two fighting male lost its horn and become submissive and died in 1988. On

some occasion died because of internal injuries and infection like haemorrhagic septicemia. It has been also observed that female rhino mated while accompanying her 4 year calf. Later calf gets separated from mother. Among rhinos sexual maturity starts at the age of 7 years in males and 5 years in females. It has been recorded in 3 cases among reintroduced rhino population in Dudhwa NP that female rhino mated within an age of 7 years were aborted (Sinha et al, 2001).

Mother always tries to keep away her calf from the male. It has been also observed that on number of occasion dominating male of the area accompanying young calf while its mother was busy in grazing. The moment mother becomes conscious of presence of male near her calf it chased away the male. Male calf when separated from mother usually made company with another male but keep its self away from dominating male of the area. Tolerance between female to female is more as compared among males. Communication between rhinos is through audible and ultrasonic sound in varied frequencies. Rhino can identify each other by sniffing the pedal gland secretion left behind on the path ways.

Since tiger and rhinos share the same habitat of flood plain. Tiger became the main predator and the young calves within 6 months to one year of age are more prone. It has been observed that when mother rhino carelessly grazing calf usually move around and the tiger gets enough time to catch the calf and drag it away. Female always try to chase away tiger as far as possible. During this chase mother rhino lost contact with her calf and it has been observed that tiger gets enough time to kill the calf.

Legal Status

The first attempt to conserve the rhino in Assam came through Assam Forest Regulation 1891 and subsequently through Assam Rhinoceros Prevention Act 1915 upgraded in 1954 as Assam Rhinoceros Act. 1954. In 1908 a reserve was created in Brahmaputra basin for protection of rhino which was subsequently as a

game sanctuary in 1915 and renamed as Kaziranga Wildlife Sanctuary in 1950. This was upgraded in the year 1974 to a National Park. Other Sanctuaries were also notified in the meantime.

In Bengal the initial control for Rhino conservation came through Indian Forest Act 1927 followed by the Bengal Rhinoceros Preservation Act 1932. Jaldapara game sanctuary was created in 1941 which was subsequently renamed as Jaldapara Sanctuary in 1976 and extended further in 1990. Gorumara Wildlife Sanctuary was created in 1949. This was subsequently extended and upgraded to a National Park in 1994.

The Wildlife (Protection Act 1972), which is applicable all over India, except Jammu & Kashmir, currently provides protection to Rhino and its habitat. In this Act Rhinoceros has been placed under Schedule - I (Part-I) which provides complete protection to the species in India (Dey, 1999).

CONSERVATIONAL IMPLICATIONS

At present the natural rhino population is mainly restricted in the reserves in Assam and West Bengal in India and Royal Chitwan National Park in Nepal. Two major existing rhino population are in Kaziranga NP (2084), Assam and The Royal Chitwan NP (408), Nepal. The remaining rhino population with the exception of that in Manas NP and Orang WLS with doubtful existence till 2008. In 2010-11, a total of 11 rhinos include 3 rhinos raised on the rescue centre near Kaziranga NP were translocated to Manas Tiger Reserve. This also includes a population of 64 rhinos in Pobitora WLS, Assam, wandering widely in surrounding agricultural areas and time to time poaching cases are reported.

The distribution of rhino in North Bengal used to extend up to Buxa Forest even up to 1950's. However, with the gradual loss of corridors between the grassland, forest and conversion of the PA's into isolated, island habitats surrounded by the tea gardens, habitations and agriculture. The species became restricted in two

PA's namely Jaldapara WLS with 125 rhinos and in Gorumara WLS with 35 rhinos (2010).

Despite of the protective measures and dedication of field managers and field staff to protect the persecution of this animal continues due to rising price of Indian rhino horn in the International markets especially in the Far - East countries for preparing oriental medicines. In Kaziranga NP from 1983-89, a total of 235 rhinos and mass killing in Manas NP, rhinos, were killed by the poachers for horns. New ways of poaching rhinos by electrocution in Kaziranga NP and Pobitora WLS, Assam and using pesticide in Jaldapara WLS in West Bengal. These examples are illustrative of the present threats to the rhinos and problems faced by the field staff and in number of cases field guards and officer were killed during encounters with the poachers.

By considering the current highly restricted distribution with poaching pressure, habitat specificity and in consideration to the scattered small population, it become imperative to reintroduce 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 this species. IUCN Rhino specialist group and Rhino Sub- Committee of the Indian Board of Wildlife (IBWL) recommended the establishment of an additional rhino population in India. The Dudhwa NP fulfilled all the criteria required for the reintroduction among the various sites surveyed in India by a panel of experts. Thus, Dudhwa NP becomes the first and currently the only site of reintroduction of the rhinos in India during 1984-85. Another reintroduced rhino population exist are in The Royal Bardia NP and Sukhlaphanta WLS in Nepal and reintroduction of rhinos took place from 1986 to 2004.

PAST AND PRESENT DISTRIBUTION OF INDIAN RHINO IN INDIA AND NEPAL

Once Indian One-horned rhinoceros (*Rhinoceros unicornis*) roamed over the Indus, Gangetic to Brahmaputra 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 the invading Emperor Timor hunted and killed many rhinos on the frontier of Kashmir in AD 1398 and there are evidences that rhino existed in parts of the west of subcontinent as far northwest as Peshawar till 16th Century. Babur, the founder of Mughal Empire in India in his famous memoirs – the Baburnamah described how he hunted rhino in bush country near the Indus as late as 1519 AD.

Out of three species of rhino that roamed over the Indo-Gangetic and Brahmaputra 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 in about 1935.

The only species of Asiatic Rhinoceros that exists in Indian subcontinent is the Great Indian One-Horned Rhinoceros (*Rhinoceros unicornis*). The *Rhinoceros unicornis* were 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:

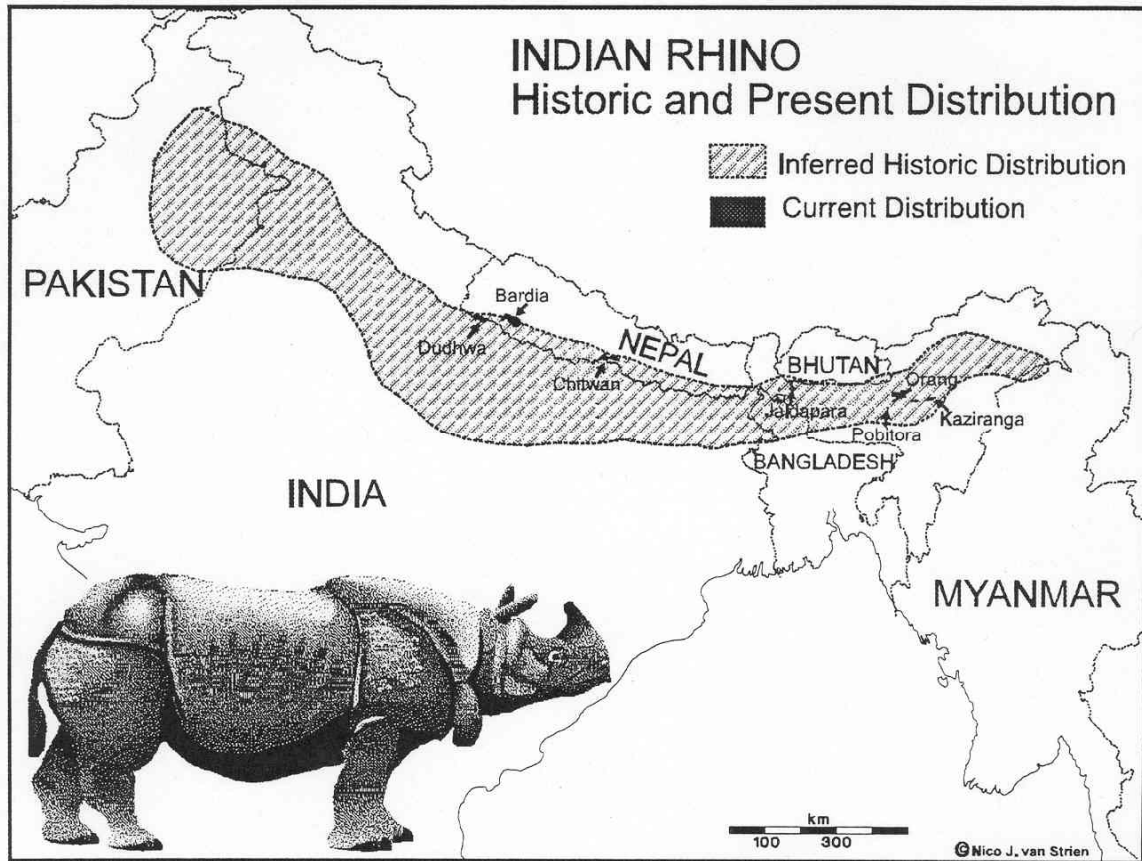
- Destruction and fragmentation of Rhino habitat primarily for extension of agriculture
- Hunting of Rhino for sports during Mughal period and early days of British Rule in India
- Poaching of Rhino for horns and other parts attributed to have magical medicinal values

It will be interesting to note that in Assam Col. Pollock a Military Engineer engaged in lying 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 fires 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 from 1871 to 1907.

The Great Indian One Horned Rhinoceros also would undoubtedly 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. Being roughly 50 to 60 in Assam and 40-50 in West Bengal. At present the Great Indian One Horned Rhinoceros has total population of about 2500 animals in the world, that too only in India and Nepal. In India, currently its population is restricted to four natural populations in Assam viz Kaziranga, Manas, Orang (Rajiv Gandhi WLS) and Pobitora, two natural populations in West Bengal viz Jaldapara and Gorumara and one re-introduced population in Dudhwa NP and one migratory population in Katarniaghat in Uttar Pradesh. There are 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 Sulkhaphanta WLS. The Rhino of Royal Chitwan N.P. is a natural population while Royal Bardia NP and Sukhlaphanta WLS have the re-introduced population. The Kaziranga National Park in Assam (India) has the highest population of Rhino (2084) and Pobitora WLS (84 rhinos in 16 sq km area) followed by Royal Chitwan N.P. in Nepal (408 rhinos) in 2010.



There is no precise documentation regarding the population of Indian 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 being roughly 50 to 60 in Assam and 40 to 50 in Bengal. The population in West Bengal rose to about 90 around mid 60's and the same in Assam to about 1500 in 1999. Maximum poaching of Rhino took place in West Bengal during the period 1968 to 1972, when 32 Rhinoceros was poached. In 1986 Rhino population in West Bengal came down to 22. Maximum poaching of Rhino in Assam took place in the year when about 70 Rhinos were killed by poachers. Since then there has been gradual rise in Rhino population in West Bengal which reported to be around 160 in 2010 and the India's population of rhino currently stand to about 2867 rhinos including reintroduced rhino population in Dudhwa NP (30), and the migratory rhino population at Katarniaghat WLS, Uttar Pradesh (2010).

Table. 3: Rhino Population in India and Nepal (2010)

Country	State	PA	Estimated Population
India	Assam	• Kaziranga NP	2084
		• Manas WLS	7
		• Orang WLS	68
		• Pobitara WLS	84
	West Bengal	• Jaldapara WLS	125
		• Gorumara NP	35
U.P.	• Dudhwa TR*	30	
	• Katarniaghat WLS	4-6	
Nepal		• Royal Bardia NP	20
		• Royal Chitwan NP	408
Total			2867

Source: Report on the Regional Meeting for India and Nepal of the IUCN/SSC Asian Rhino specialist Group, Kaziranga, Assam, India, 5-7 March 2007 and from official documents

Rhino Areas in India and Nepal

Rhino Areas in India

1. Kaziranga National Park, Assam

The Kaziranga National Park is bounded by the Brahmaputra River on the North and verdant hills of Karbi Anglong on the South, conjures up visions of animals, birds, flowers and vast rolling expanses of wild grasslands. Kaziranga is unique among Indian Wildlife habitats in that no visitor fails to see its most important resident, Rhino and Wild Buffalo, even if he makes but a single trip into it. Besides he will come across many animals and avifauna too.

The Park is of rough oval shape, approximately 50 km (31 miles) long and 16 km (10 miles) wide at his broadest point, and of 430 sqkm (166 sq miles) area. Recently additional area has been included in the National Park area covering

total area becomes 860 sq km. It lies on the south bank of the Brahmaputra, and its south side boundary follows for the most part the Mori Difaloo River which is close and parallel to National Highway No.37, the main arterial highway in Assam. Two other rivers, Difaloo and Bhengrai, flow through it, and a number of small streams originating in the Karbi Anglong Hills drain into these rivers or the beels. The whole area is one of vast swamps interspersed with great expanses of high, coarse grasses, often collectively called elephant grass around 5 m high or more, open forest, waterways, beel and reed beds. A feature of many of the beels is the excessive growth of the water-hyacinth, a plant exotic to the Park but introduced into it for some unknown reason. South of the highway are the Karbi Anglong Hills rising to 1220 m (4000 ft) which have a special significance to the park, as the wildlife seek refuge on the hills when virtually the whole park becomes inundated by the flood waters of the Brahmaputra and the other rivers during the monsoon. Much wildlife is lost at this time.

Some of the conservation values of Kaziranga National Park:

- a). The world largest population of Indian One horned Rhinoceros 2084 rhinos(65% of the total world rhino Population).
- b).The world largest population of wild Buffalo (50% of total world population) and Eastern swamp deer (65% of world population).
- c). The largest non disturbed and representative area of Brahmaputra valley flood plains grassland and forest with associated large herbivores, waterfowl and wetland values (including turtles, dolphins).
- d) Significant population of tigers and elephants.
- e). Transitional and successional examples of grassland to forest and flood plain to hill evergreen forest communities.
- f). Considerable research education and recreation value.

CONSTRAINT OF MANAGEMENT

Anthropogenic Pressure:

The Rhino bearing are mostly devoid of human settlement but these areas are subjected to tremendous biotic pressures mainly in the form of cattle grazing, collection of grasses, fuel wood, forest produce as food and timber for housing. Prohibitions of cattle grazing in this area are one of very important aspect as this may lead to spread of contagious diseases like Anthrax, Foot and Mouth, Rinderpest etc. In areas like Pobitora WLS, grazing pressure is tremendously high as the Sanctuary area is too small surrounded by human habitations and more than 3000 cattle's use to graze inside the Sanctuary daily. About one third of Pobitoras rhino tend to stray out during night and about 75 % poaching took place outside the sanctuary boundary. This biotic interference has created problems in the other rhino bearing areas.

Degradation of Habitat:

As a result of heavy grazing not only have the habitat attributes been adversely affected but an ecological process of invasion of weeds is also occurring. In the long run, this will create forage problem for the rhino well as other herbivores. Siltation of water bodies in the rhino bearing areas is also another major problem. Siltation in the rhino bearing areas, particularly in Kaziranga National Park, Orang and Pobitora Wildlife Sanctuary are becoming prominent since last two decades. The water bodies in these areas are gradually silted up causing reduction of short grassy areas which is vital foraging sites for rhinos.

Flood:

Floods are always considered to be a dreaded period for Kaziranga National Park and its animal life but since last decade the increasing level of multiwave flood is really threatening the future of the park and not only the rhino. Due to various reasons, much deforestation in the upper catchments area of the Brahmaputra, the intensity of the flood is continuously on the rise. During the flood period most of the animals including the rhinos have to migrate or move from the park and take

shelter on the adjacent high grounds in the Karbi Anglong Hills or wherever they may find proper shelter. These areas are populated and protection of the animal during the period of migration from and back to park becomes an uphill task as enforcement network is almost non-existent in such areas. Many animals, especially the deer and particularly the young, old and infirm lose their lives by drowning, poaching or run over by vehicular traffic on the highway.

Flood is also necessary and beneficial for maintaining the ecology and forests and though it has some adverse effect. The gradual rising of the water level and quick recession is undoubtedly beneficial but floods of severe intensity which submerge the entire park for a prolonged period deprive the animals from food and shelter.

Erosion:

The river Brahmaputra along the Northern boundary is well known for bank erosion as also huge accretion that is caused by depositing of silt during annual floods. These accretions gradually get established in the form of large and small islands and are colonized by grass thus forming ideal rhino habitat. But the land in the National Park is also eroded by flood and has already been reduced considerably, especially during the last three decades. The present area of the park, taking into account, the erosion as well as accretion, during a period of thirty years, as computed from the analysis of remote sensing data is 408 sq km. On the other hand the population of all the megaherbivores has increased in manifolds during the same period. Therefore, to attain the goal of progressive increase in the population of rhino as well as other species. It is essential that additional area included in the park by way of finalization of the proposal for six additional areas to Kaziranga National Park which are pending for a protracted period due to legal, administrative and financial reasons.

Poaching:

Poaching of rhinos has been the major threat to the Kaziranga National Park and will continue to do so as the superstitious belief regarding the aphrodisiac and

medicinal values attributed to the rhino horn persists. It has been observed and experienced that the intensity of poaching increased mainly due to escalation in high value of the horn consequent to imposing ban on its trade. The last sale of rhino horn took place in Assam took place during 1978 and though tenders were invited during 1980 but sale was stopped. That marked the beginning of greater intensity of poaching in Kaziranga National Park as well as other rhino inhabited areas. However, in recent past the onslaught of poachers in Kaziranga had been contained to considerable extent.

Though the poaching of rhino is not a recent phenomenon but the pressure on poaching has increased in manifolds. Primary reason for poaching is for its horn which fetches high price in the international markets. The rhino has become the target of the organized professional poachers supported by National and International smugglers. Containing poaching has thus become an extremely a hard task. The poachers continually change their poaching techniques to outwit the anti poaching staff of forest department. Though the age old practice of pit poaching is still continuing but electrocution method and use of sophisticated fire arms sometimes fitted with silencer are also used frequently. Moreover, the incident of poaching takes place any time of the day and night.

Table. 4. Showing numbers of rhino killed in Kaziranga NP due to different causes

Year	Population	Poaching	Natural Death	Total Mortality
1965		18		
1966		5		
1967		12		
1968		10		
1969		8		
1970		2		
1971		8		

1980	939	11	58	69
1981		24	39	63
1982		25	48	73
1983		37	46	83
1984	1080	24	50	78
1985		41	37	81
1986		41	38	83
1987		24	41	64
1988		24	105	129
1989		44	54	98
1990		35	57	92
1991	1129	23	79	102
1992		49	66	115
1993	1164	40	58	98
1994		14	37	51
1995	1200	27	53	80
1996		20	52	72
1997		12	48	60
1998		8	87	95
1999	1552			
2000				
2001		8		
2002		4		
2003		3		
2004 (June)	1700+	4		
2007	1855	NA	NA	NA
2010	2084	NA	NA	NA

Crop Raiding:

The animal depredation on crop and property and occasional cattle lifting by large predator cause considerable hardship to the poor people who reside on the fringe of the National Park. These people depend on their crops for living and most work their land with plough animals. When their crops are destroyed by animals or their plough animals killed by predators, their economy is shattered. Antagonism towards wildlife is a natural reaction. No amount of preaching and education on conservation can retrieve the situation. Thus it is essential for the Department to provide some material help of these people through compensation for crop losses and loss of livestock because of animal predation.

Fiscal Deficit:

Though the current infrastructure of Kaziranga National Park to counter the menace of poaching is inadequate but the field personnel's have exhibited remarkable vigilance to minimize poaching incidents. The budgetary allocations for maintenance and creation of infrastructure for anti-poaching are inadequate to fulfill even the minimum requirements. Consequently, it might result in profoundly detrimental impact on the management of Kaziranga National Park in the long run.

POBITORA WILDLIFE SANCTUARY, ASSAM

Pobitora Wildlife Sanctuary is situated 50 km east of Guwahati on the southern bank of the river Brahmaputra in the district Morigaon, Assam. It was originally a grazing reserve till 1971 providing grazing facilities to the surrounding villages together with permanent Buffalo and cattle camps all around. Finally in 1971, two areas covering an area of 1,584.62 hect was updated into reserve forest by Govt notification no. For/Sett/542/65/54 dated 8.11.1971. Due to increase in rhino population Pobitora Reserve Forest was declared as Pobitora Wildlife Sanctuary in 1987. In 1998, by considering the increase in rhino population an area of 38.84 sq km added to this sanctuary. Entire Pobitora Wildlife Sanctuary is surrounded

by crop fields and high tension wire passing through which helps poachers to kill rhinos.

The climate of the Pobitora WLS can be treated as Sub-tropical monsoon type with three distinct seasons. The dry mild winter which experiences occasional showers from Nov to Mid February. This period has an average maximum temperature of 20 °C and average minimum temperature of 9 °C. The humidity at this time is 40%. This is followed by a humid and windy summer from mid Feb to May with maximum temperature of 35 °C and minimum of 12 °C. The better part of this period experiences rains. The rainy season from May to September experiences an average rainfall of 2000mm. This period is both hot and humid. The maximum average temperature around 25 °C and humidity is above 95%. The entire area is part of the Brahmaputra flood plains. Being low-lying it is subject to annual floods. The soil is termed as fertile clay-loam with silt. The Garanga beel and Haduk beel are the perennial sources of water in the sanctuary. The shallow nullahs also scattered all around the sanctuary which feed both the perennial rivers. Due to floods during monsoon wetlands are silted.

Floral and Faunal diversity in Pobitora Wildlife Sanctuary

The vegetation of the sanctuary is classified in three distinguished forest types.

- 1). Eastern wet alluvial grassland
- 2). Barringtonia swamp forest
- 3). Low alluvial savannah (*Salmania- albizzia*) woodland

Due to excessive grazing for the years inside the sanctuary in some areas growth of the grasses are stunted and formed an open land. The intensity of grazing becomes highest during the winter season. An area of one sq km was electrically fenced in 1990 for release of Manipur brow antler deer (*Cervus eldi-eldi*) at the heart of the sanctuary. As a result of protection from grazing, better growth of grasses and profuse regeneration of *Albeggia procera* (Koroi) commonly seen in this area. A narrow belt of woodland covers the southern side of the sanctuary

along the bank of Garanga beel. Land use in Pobitora Wildlife Sanctuary as follows:

- a). Woodland -13.09 %
- b). Grassland- 72.25%
- c). Waterlogged areas-10.61%
- d). Swampy area - 4.05 %

The following species are commonly found in the Sanctuary.

Common tree species are: *Albezia procera*, *Salamania malabaricum*, *Baringtonia acutenguia*, *strabler asper*, *Sterculia vilosa*, *Triwia mediflora*, *Casca fistula*, *Tetramilis mudiflora*, *Legestromea flosregance*, *Ugenia spp*, *Ficus spp*, *Lenea grandis*, *Toona ciliate* etc.

Common grasses of this area are:

Erianthus ravanae, *Saccharum elephantus*, *Imperata cylindrical*, *Pollinia ciliate*, *Phraqgmities kakra*, *Saccharum munja*, *Arundo dank*, *Cynodon dactylon*, *Lapomea repetans*, *Enhydra fluctuans*, etc.

Pobitora W.L. Sanctuary is already included in the world map for the highest density of Rhino population. Apart from Rhino the other mammals recorded are:

1. Common leopard
2. Jungle Cat
3. Fishing cat
4. Leopard cat
5. Wild boar
6. Large India civet cat
7. Small Indian civet cat
8. Common fox
9. Jackal
10. Rufous tailed hare
11. Chinese pangolin
12. Feral buffalo

13. Flying fox
14. Short nosed fruit bat
15. Rhesus Macaque (visitors)
16. Barking deer (visitors)
17. Grey mask shrew
18. Common house rat
19. Three striped squirrel
20. Small Indian mongoose
21. Crab eating mongoose
22. Smooth Indian otter

Apart from mammal, so far 36 spp of fish and eight species of fresh water turtle and terrapin were check- listed.

Pobitora W.L. Sanctuary is a bird's paradise. So far 214 species of birds were check listed. The water fowl census has been carried out for last 9 years continuously. 1st year we have counter more than 20,000 birds inside the sanctuary.

Rhino population in Pabitora Wildlife Sanctuary, Assam

Pobitora was declared as Reserved Forest in the year 1971 with only 8 rhinos was counted. Initially after proper management inputs provided along with protection rhino population slowly reached to 85 in 2004 which is supposed to be highest rhino population in the world in an area of 16sq km. In 1987, scientifically management of grassland was carried out in Pobitora as well as in other rhino areas like Kaziranga NP and Orang Wildlife Sanctuary which showed positive results in the development of grasslands.

Table. 5. Census Figure of rhino in Pabitora Wildlife Sanctuary

Year	Number of Rhinos
1971	8
1987	54
1993	56
1995	68
1999	74
2010	84

In a span of 30 years the rhino population in Pabitora Wildlife Sanctuary increased from 8 to 84. The area under present management is only 16sq km the rest of the area yet to be handover to forest department.

Table.6. Poaching cases of Rhino in Pabitora Wildlife Sanctuary

Year	Bullet	Pit	Electrocution	Poison	Total
1987	-			2	2
1988	3				3
1989	2		2		4
1990	2				2
1991	1				1
1992	1		2		3
1993	4				4
1994	2	1	1		4
1995	2				2
1996	1		4		5
1997	3				
1998	3		1		
1999-2010	NA	NA	NA	NA	NA

Poaching is still a major problem but from 1998 due to over all protective measures and facilities provided has curbed the problem up to an extent.

Currently Pabitora Wildlife Sanctuary is facing number of problems which are as follows:

- a). Excessive livestock grazing
- b). Siltation
- c). Flood
- d). Encroachments
- e). Fragmentation
- f). Poaching

Due to over population of rhino which is around 30-40 rhinos stray out from the sanctuary and most of the time spent in the crop field. Especially during winter months most of the rhinos of Pabitora stray out of the Sanctuary and move out into Mongoldoi, Panbari, Kurua, Jagi road, Amsoi, Dharamtul covering an area of 100sq kms. Flood is another major threat to the Rhino population. Since Pabitora WLS have no highlands in side sanctuary and flood cause's major health problems to the animals. In the year 1998 this area faced worst flood condition and during this two rhino calves died. Due to flood almost all the lakes, nalas were heavily silted causing water scarcity during winter and summer months. Rhinos in search of water and food go out of the sanctuary in the neighboring areas and stay in the crop fields. Poacher gets proper opportunity and enough time to kill rhinos when rhino stays in the crop fields.

Encroachment is also a major problem in this area. Approximately 300 Bighas of land was encroached by local people. The entire matter is sub judice at Guwahati High Court.

Fragmentation is also a major problem to the Rhino population. Due to large scale settlement of human population in adjacent areas all the migration routes are no more exist which restrict the gene flow and all the rhinos belong to single population.

Livestock grazing is one of the severe and bringing an adverse impact on the sanctuary. Around 50% of the total grass lands have been degraded due to over grazing by livestock's. In few areas grasses reached a height of 20-30 cms in the restricted area of this Sanctuary. During the last flood entire sanctuary was submerged for 45 days under water and entire sanctuary was badly affected specially its grassland areas.

Orang Wildlife Sanctuary

Orang National Park lies between 26°30' N - 26°40'N and 92°15' E - 92°30' E. Archeological remains give evidence of a Shiva Temple proving existence of human settlement. The area was abandoned, perhaps due to some epidemic (Talukdar and Sharma, 1995). It was first declared as a Game Reserve within an area of 80.54 sq km in 1951. The area was an abandoned village where 26 man made ponds are still exists. Some of the areas were covered with various species of grasses, which lured different types of wild animals including the rhinos. It was later upgraded to a Wildlife Sanctuary in 1985 within an area of 75.6 sq km. Another 3.12 sq km was added to the Sanctuary in 1991. By considering the importance of the area declared as National Park in April 1999 with in a total area of 78.81 sq km.

The southern part of the park has the natural barrier of the Brahmaputra River. The park is situated at the alluvial flood plains of the Brahmaputra River and most of its area is seasonally flooded by the Brahmaputra and its tributaries the Dhansiri and Pachnoi. The average annual rain fall is 3000 mm. The annual average minimum and maximum temperatures are 7 C and 32 C respectively, and the humidity ranges from 66 to 95 percent. The altitude ranges between 30 to 80 m above sea level.

About 50 percent of the area (36.45sq km) of the National Park is grassland and 12.6 percent (9.53sq km) is swamp. The Other parts of the Park has mixed deciduous forest comprising natural forest patches of 1.98 sq km (2.60 %) and

planted forest patches of 9.83sq km (13.60 %). It also has a river island with in an area of 9.04 sq km (11.95 %).The park has pure grassland with association of *Themeda villosa*, *Arundo donax*, *Phragmites karka*, *Erianthus ravannae*, *Aluda mutica* etc.

The natural forest is mainly composed of *Sterculia villosa*, *Melia azadirachta*, *Toona ciliate*, *Dysoxylum binectariferum*, *Albizia procera*, *Callicarppa arborea* etc. The planted forest patches are mainly composed of *Dalbergia sisso*, *Bombax cieba*, *Acacia catechu*, *Gmelina arborea*, *Anthroceraecphallus kadamba*, *Tectona grandis* (Nath and Chowdhury, 1994).

Orang National Park is rich in faunal diversity and the Indian rhino is the dominant species in this area. Other species sharing the habitat are Bengal Tiger, Asiatic Elephant, Hog deer, Wild boar, Civet cat, Leopard cat Hare and Porcupine. Fish fauna comprise of *Labeo rohita*, *Labeo bata*, *Labeo nandina*, *Heteropneutes fossilis*, *Calisa faciatus*, *Clarius batracus*, *Channa striatus*, *Channa punctatus*, *Channa marulius*, *Catla catla*, *Pmhipnous cusshia*, *Mystus seenghala*, *Mystus vittatus*, *Notoptreus notopterous*, *Ompok pabo* and *Wallogo attu*.

Rhino Population in Orang National Park

Orang National Park provides an ideal habitat for the rhinos. Census carried out in 1991 shows an increasing trend over the 1985census. It is a great concern that due to number poaching cases has increased and rhino population came down in 1999. The 1999 census showed a more than 50 % reduction in the population of rhinos over the previous census.

Table. 7. The census figures from1985 to 1999 are as follows:

Year	Total Number of Rhino
1985	65
1991	97
1999	46
2010	68

Poaching of rhino in Orang National Park

The main threat to the rhinos in Orang National Park is heavy poaching activity. The mortality among rhino due to poaching from 1983 to 1994 was 41. But mortality of rhinos due to poaching between 1995 to 1999 was about 35. Poachers take full advantage of poor protection system in the National Park and rhinos stray out of the park during night hours for raiding crop fields and get killed by the poachers. The National Park is surrounded on three sides by number of villages and this makes the park more vulnerable to poaching. The poachers used to take shelter not only in the villages, but also in the riverine islands of the Brahmaputra River. The poachers are mostly outsiders who hire local people as guides and take full advantage of the weak surveillance of the park. Nowadays, poachers use sophisticated fire arms fitted with silencer to kill rhinos. The National Park has an established network of antipoaching camps spreading all over the National Park. Altogether there are 21 such field camps spreading all over the area which give effective protection. But during monsoon such temporary thatch hut and regular supply of food stuff is the major problem. Eventhough, considering the current situation there is need of more such camps with latest fire arms and more staff to check the poaching.

Table. 8. Number of cases of rhino death due to natural cause and poached 1980 to 2004 in Orang National Park

Year	Natural death	Poaching	Total
1980	2	3	5
1981	3	2	5
1982	8	5	13
1983	9	4	13
1984	7	3	10
1985	1	8	9
1986	1	3	4
1987	3	4	7
1988	2	5	7
1989	3	3	6
1990	1	-	1

1991	2	1	3
1992	3	2	5
1993	2	1	3
1994	4	6	10
1995	8	9	17
1996	4	10	14
1997	3	11	14
1998	3	12	15

Main Threats

The protection measures in Orang National Park have to be improved further and it has been realized that the National Park needs more forest staff, arm and ammunition and other infra- structures to be more effective anti- poaching initiatives. Poaching of rhinos and encroachment are the main threats to the National Park. Some of the NGOS are working in this area helping in many ways.

Different methods used by the poachers to kill rhino are as Follows:

Altogether, six methods are reported to be used by the poachers in Rhino areas of India and Nepal. Out of this use of noose trap by using steel wire is used rarely and on only two occasions first in Manas NP, Assam. Both noose and spearing for rhino poaching are reported in Chitawan NP, Nepal. Most common method is by using silencer fitted in automatic rifle to kill rhinos without making any sound.

Methods used are:

1. Shooting with the help of fitted silencer in automatic or semi automatic rifle
2. Use of Poison in pumpkin
3. Electrocutation
4. Trapping in pit hole
5. Spearing (Few cases reported)
6. With help of noose made of steel wire (Few cases reported)

(Source of Assam section: Shri S. Doley, IFS, Chief conservator of forest, Forest Department of Assam AND Shri. B.S. Bonal, IFS, Former Director, Kaziranga NP, Shri Talukdar, ACF, Forest Department, Assam, presented in IUCN- AsRSG meeting, Kaziranga NP, 1999)

DISTRIBUTION OF THE GREAT INDIAN ONE HORNED RHINOCEROS IN NORTH BENGAL, WEST BENGAL

Bist (1994) has elaborately compiled valuable information on the past and present distribution of the Great Indian One Horned Rhinoceros in North Bengal. Other than the existing areas in Jaldapara WLS and Gorumara NP, rhinos were historically found in the Sunderbans and the district of Malda (Banerjee, 1966: Ghosh, 1991 and Gupta, 1958). The rhino population between Sankosh and Rydak moved freely between Assam and West Bengal with two overlapping sub-population. The Buxa sub-population in the forest of Bholka Reserve in the current Buxa Tiger Reserve and another in the Garodhat area in the Cooch Behar district were confined to the forests and grasslands.

Similarly, during the early 1900s rhino population existed in the Torsa flood plains in the neighbouring areas of Chilapata Reserve and Jaldapara, currently known as the Jaldapara WLS. The rhinos of these areas from time to time ranged to the neighbouring areas of Bhutri forest of Buxa and Cooch Behar. It is also reported that Patlakhawa rhino sub-population ranged further upto Pundibari near Cooch Behar.

The existing rhino in Gorumara NP is a nucleus population. In the past, rhinos were distributed across the forest of upper Tondu, lower Tondu and between Diana- Jaldaka Rivers. Rhinos further moved upto Indo-Bhutan border in the North and Myanaguri area in the East.

During the last 150 years, due to drastic change in the land use pattern consequent to the phenomenal rise in the human, livestock and expansion of agricultural field and tea gardens. The rhino population was fragmented and confined to small habitat pockets, later declared as Protected Areas. It is estimated that the original area of rhino distribution was reduced one eighth of its range (Banerjee, 1966).

Between 1871 to 1905, the Maharaja of Cooch Behar recorded presence of rhinos between rivers Sankosh and Rydak including the forests of Rydak and Bholka. Currently there are no forests left in this area. Once this region was the main rhino hunting ground for the Maharaja of Cooch Behar. The Garohat rhinoceros population in Cooch Behar district and the population between Rivers Sankosh and Rydak appears to have been extirpated due to hunting and land use change during the 1930s and 1970s, respectively (Bist,1994). Between 1877 to 1897, the Maharaja of Cooch Behar is supposed to have killed more than one hundred rhinos in these areas. In 1886 alone a total of 18 rhinos were hunted and during the period 1977 to 1904, in a single hunting expedition of the Maharaja, 28 rhinos were killed, atleast 13 injured and another 14 rhinos were seen. While the rhino disappeared from this area by 1970s, none was recorded in the recent years in the forest of Buxa. The trend over the years is presented in the table.

Table. 9. Rhino population in Buxa Area

S.No	Year	Population Trend
1	1948-49	Few Rhinos
2	1949-50	"
3	1952-53	Presence found
4	1953-54	"
5	1954-55	"
6	1956-57	"
7	1957-58	"
8	1958	"
9	1958-59	10
10	1966-67	Presence found
11	1967-68	"
12	1968 & After	No Rhinos reported

(Source: Bist, 1994)

The Torsa rhino population was mainly distributed along the Torsa River flood plain in the tract of high grasslands up to the foot hills of Bhutan including the Patlakhava Reserve. In the area now the Jaldapara WLS and its neighbouring areas a total of 14 rhinos were sighted between 1892-1904 and one rhino was killed by Maharaja of Cooch Behar around the Chilapata forest. Fawcus (1943) reported nearly 200 rhinos in the Jaldapara and Patlakhava areas. It is also reported that rhinos from Jaldapara ranged as far to the forest of Patlakhava till late 1985. Rao (1959) recorded the presence of rhinos in the Khairbari, Bhutri, Sal Kumar, Basti and Moiradanga till 1954. Records indicate that till the year 1982 rhinos were being sighted in the forest of Nimati in Buxa Tiger Reserve. Table presents the trend of rhino population in the Jaldapara area.

Table. 10. Rhino population in Jaldapra WLS and in near by area

S.NO	Year	Population Trend
1	1920	Approx 200 including Patakhova
2	1930	80
3	1932	40-50
4	1935-36	In good number
5	1936-37	56 including Panabari
6	1940-41	Increasing
7	1947-48	"
8	1949-50	"
9	1950-51	"
10	1951-52	"
11	1952-53	"
12	1953-54	30-56
13	1954-55	"
14	1957	50
15	1958-59	65
16	1964	72

17	1965-66	72
18	1966-67	76
19	1968-69	75
20	1973-74	21
21	1975	23
22	1978	19
23	1980	22
24	1986	14
25	1988	24
26	1989	27
27	1993	33
28	1996	42
29	1997	42
30	1999	55
31	2000	54
32	2002	74
33	2010	125

In the Gorumara area rhino population in 1920 was reported to be around 12, Fawcus (1943). Gorumara WLS (now a National Park) was set up in 1949 covering an area of 9 sq km, although rhinos were sighted in the lower Tondu, Upper Tondu, Nagarakanta and in the flood plains of River Jaldaka and Diana. Rhinos were also sighted outside the reserve area in the grasslands, and in the Hiljhora forest till 1950s and in Chapramari and Diana ranges till 1980s. In March 1989, one female rhino strayed up to the Bangla Desh border and was later brought back. Another female rhino strayed out to the Mahananda Sanctuary and died in 1992. The rhino population trend in the Gorumara NP area given in the table.

Table. 11. Rhino population in Gorumara NP

S.NO	Year	Population Trend
1	1920	12
2	1936-37	4-5
3	1940	12
4	1950-51	Increasing
5	1951-52	“
6	1952-53	Seen
7	1954	3
8	1954-55	Few
9	1955-56	3
10	1956-57	5
12	1958	4
13	1958-59	7
14	1965	8
15	1965-66	14
16	1967-68	10
17	1968-69	Present
18	1971-72	12
19	1972-73	13
20	1973-74	7
21	1978	7
22	1986	8
23	1989	8
24	1993	12
25	1996	14
26	1997	14
27	1999	19
28	2000	19
29	2002	22
30	2010	35

(Rhino census source: Chief Wildlife Warden Office, Department of Forest, West Bengal)

Rhino and other wildlife population estimation in Jaldapara WLS and Gorumara NP also followed in other Protected Areas

Population estimation was conducted in a systematic manner between 1964 to 1966 and during one of the operations in 1966 Juan Spillet had also participated. The entire sanctuary was divided into small segments or blocks and each was assigned to one party consisting of an elephant, 'Mahout', enumerator and a forest guard who helped in conducting direct counts on sighting animals. Different landmark such as river boundary, fire lines and any other prominent features were used to divide the sanctuary in small blocks and also to track locations. A party moved systematically in a zigzag manner across their assigned blocks to count the animals by direct sighting. Although there were chances of missing some of the animals the method was consistent and provided a relatively reliable index of abundance of animals in a particular area. A large size animals like the rhino had a much smaller chance of missing detection. In 1966, the census method was slightly modified. A party in its assigned block started its survey from the southern block boundary and worked between 6 AM to 12 Noon. Spillet (1966) observed that a prior to the 1966 census, only the number of each species were recorded. But in 1966 census attempts were made to classify the tally into sex and age classes like adult male, adult female, and young/ calf. If sex of any rhino could not be identified for certain then it was classified as un-sexed or sex unidentified individual.

Same procedure is followed during wildlife including rhino population estimation exercise in West Bengal, Assam in India and Nepal.

Rhino population trend in Jaldapara WLS and Gorumara NP

The mammalian population dynamics is directly related to the habitat conditions which include availability of forage, forage quality, presence of competitors, presence of predators, poaching pressure and other factors which affect the population growth. It is important to know the population trend in terms of number, sex and age classes. For comparison such parameters are necessary

across all past census operations to assess how and for what reasons a population behaved in particular manner.

In the earlier census operation reflected only the rhino numbers. Similarly in some years the census operation was not carried out. In Jaldapara WLS, the year 1975 onwards a regular exercise for population estimation has been carried out while in Gorumara NP from the year 1954 onwards, classified census figures are available (Table.10 and 11).

The published records of the rhino population in Jaldapara WLS and Gorumara NP were used to calculate the overall population trend of rhinos during the last 68 years from 1930 to 1996. To ascertain the more recent population trend the period between 1980 to 1996, was chosen and separate calculations were made. This was considered necessary since in the earlier population estimates the procedure was not clear, raising the possibility of adding inconsistency to the data.

While calculating the rhino population trend the year of 1930 was not included since the estimation in this particular year included three different rhino sub-populations of neighbouring areas.

From 1930 to 1996, rhino population trend in Jaldapara WLS shows marked variations in different years and in some years population figures are not clearly mentioned which forms a discontinuity. In 1930, around 80 rhinos (Shebbeere and Ray, 1950) were reported from this area which later on fluctuated between 30 to 75 rhinos between 1932 to 1969. There was a sharp decline in the rhino population from 1973 onwards and in 1986 only 14 rhinos were left in the Jaldapara WLS. From 1968 to 1986 around 63 rhinos died which caused a sharp decline in the rhino population. In the last 10 years rhino population in Jaldapara has increased to 42 rhinos.

The population of the Jaldapara rhinos from 1930 to 1969, showed an annual growth rate of 0.0030 (95 % CI+₋ 0.0015). Between 1973 to 1996 rhino population was growing at the rate of 0.0260 per year (95 % CI+ 0.0067). Rhino population figures are not available from 1970 to 1972. Rhino population has declined from 75 individuals in 1968-69 to 21 individuals in 1973-74. Rhino population growth rate was separately calculated for the period 1980 to 1996, a span of 16 years to even out inconsistencies. It was found that the population was growing at the rate of 0.042 (95 % CI + 0.031). The overall rhino population growth rate from 1930 to 1996 shows -0.0222(95 % CI + 0.039).

The rise in rhino population to 42 rhinos in recent years in the Jaldapara WLS is mainly due to rigorous vigil, patrolling and protective measures undertaken by the hard working and dedicated team of officers and staff, who risked life and limb in line of duty. The number of poaching cases has significantly been reduced.

In Gorumara NP, rhino population from 1920 to 1996 fluctuated between 12-15 rhinos. During 1952-54 only 3 rhinos were reported in this area indicating a marked decline in the population. **Table. 13** gives the over all rhino population trend in the Goumara NP and adjacent areas.

Between 1920 to 1968 there appear have been to be some procedural inconsistencies. For the purpose of calculation the inconsistent data was excluded. Records from 1968 to 1996 were taken into consideration. During the period of 1971 to 1974 there was a sharp decline in the rhino population which reportedly had gone down to 7 and the mortality was 11 rhino because of various reasons. The population growth rate in Gorumara NP in the years from 1968 to 1996 was 0.0079(95 %+ 0.012).

Table. 12 and **Table. 13** present an overall picture of the rhino population structure, sex and age class details respectively for Jaldapara WLS and Gorumara NP. In Gorumara NP, the sex ratio of the rhino population from 1954 to 1996 was

estimated using the data set under table. Unsexed animals were not included in the analysis. The sex ratio was found to be 0.395(95 % CI+0.077) male per female in Gorumara NP for the period 1968 to 1996, while in the Jaldapara WLS the sex ratio for the period of 1975 to 1996 was 0.694(95 % CI+0.133) male per female. Based on the data available for Jaldapara during 1980 to 1996 it was found that sex ratio for adult rhinos worked to 0.402(95 % CI+0.36) male per female and the calf to adult female ratio was 0.441 (95 % CI+0.058). The data of 1992 was left out of the calculation.

Table.12. Rhino Population structure in Jaldapara WLS (1975-2004)

Year	Male	Female	Unsexed	Calves	Total
1975	7	7	4	5	23
1978	5	7	4	3	19
1980	5	7	6	4	22
1988	9	11	-	4	24
1989	9	13	-	5	27
1992	8	12	-	13	33
1993	4	7	2	11	26
1996	9	18	2	8	42*
1999					53
2002					74
2010					125

* Including one female sub-adult and four unknown sex excluding male rhino translocated from Guwahati Zoo, Assam.

Population of Rhino in West Bengal during 2002 Census

A. JALDAPARA WILD LIFE SANCTUARY (COOCHBEHAR DIVISION)

Adult Male	17 Nos.
Adult Female	11 Nos.
Adult sex unknown	2 Nos.
Sub Adult Male	6 Nos.
Sub Adult Female	2 Nos.
Sub Adult sex unknown	2 Nos.
Female with Male Calf	16 Nos.
Female with Female Calf	4 Nos.
Unknown Calf	14 Nos.

Total **74 Nos.**

Table. 13. Rhino population structure in Gorumara NP (1954 - 2004)

Year	Male	Female	Unsexed	Calves	Total
1954	1	1	-	1	3
1965-66	-	-	8	2	10
1968-69	-	-	8	2	10
1978	1	3	3	1	8
1989	4	7	-	1	12
1993	4	7	-	4	15
1996	2	6	-	7	15
1999					19
2002	6	11	-	5	23
2010					35

Birth and Mortality

Based on the data available from 1986 to 1996 on the birth of rhino calves in Gorumara and Jaldapara the birth rate was calculated. The calculation for the

rhino population in Gorumara is based on some inconsistent data. The calf to female ratio was 0.349(95 % CI+ 0.111) and calf to female ratio was 0.509 (95% CI+0.078).

In the wild it is always difficult to timely locate a newly calf. In a study conducted in Dudhwa NP, UP the reintroduced population in 1984-85. Rhinos are confined to an area of 27 sq km which is power fenced. Regular monitoring is done till today and to located individual rhino on daily basis. Currently rhino population is total 18 rhino in the year 2004 from a founder population of 5 rhino comprise of one male and four adult females. The over all birth rate was one calf per female per 2.4 years. Official record of mortality is presented in **Tables.18 and 19.**

Laurie (1978) reported death of seven rhino calves below one year age and one calve below 2 years, during his study period of 3 years in The Royal Chitwan NP. He also found that the main cause of death was poaching (calf accompanying cow), other causes includes tiger predation and intra specific fight between sub-dominant male and dominating male. In case of Dudhwa 3 cases of abortion and 12 cases of calf mortality were recorded from 1987 to 2004 (Sinha et.al.).

Table. 14. Birth and Mortality in Rhino calves in Jaldapara WLS

Year	Birth	Death
1988	3	-
1989	2	-
1990	2	-
1991	3	-
1992	2	-
1993	3	1

Table.15. Rhino calves birth and mortality in Gorumara NP

Year	Birth	Death
1988	1	-
1989	-	-
1990	1	-
1991	1	-
1992	1	-
1993	1	-
1994	NA	
1995	NA	

Adult mortality is mainly due to poaching, old age, disease, intraspecific fight or by accidents. **Table.16** and **Table.17**. show the mortality in rhinos in Jaldapara WLS and Gorumara NP. In Jaldapara WLS, reportedly poachers used guns for killing rhinos. Since 1993 the poachers have switched over to poisoning the rhinos as has been reported by Martin (1992) in Royal Chitwan NP, Nepal. Two such cases (one sub adult male and one female) of death due to poisoning were detected in December 1992 and March 1996 in Jaldapara WLS.

Table. 16. Mortality cases of rhinos in Jaldapara WLS

Year	Number of cases
1930-31	50
1932	40-50
1935-36	1
1936-37	1
1940-41	2
1948-49	2
1949-50	4
1950-51	1
1954	3

1955-56	4
1957-58	2
1967-68	1
1968-72	30
1972-73	6
1973-80	9
1981	2
1982	3
1983	4
1984	6
1985	2
1986	1
1987	1
1991	1
1992	2
1993	1
1994	2
1995	3
1996	3
1997	2
1998	2
1999	2
2000	2
2001	3
2002	5
2003	2
2004 (July 2004)	2

Table. 17. Mortality cases of rhinos in Gorumara NP

Year	Number of cases
1950-51	3
1952	2
1954-55	1
1968-72	4
1981	1
1983	2
1984	1
1989	1
1990	1
1992	1
1993	NA

(West Bengal Section Source: Shri A.K.Raha IFS, Former Conservator of forests Wildlife, Forest Department, West Bengal, presented in AsRSG meeting in Kaziranga NP,1999)

Rhino Mortality in Jaldapara WLS and Gorumara NP, West Bengal (1999 -2004)

Date	No of Cases	Place of occurrence	Description	Cause of death	Remarks
23.01.1999	1	Jaldapara-5 Comptt., Jaldapara WLS	Female	Attacked by Rhino, Natural Death	
18.05.1999	2	MB-6 Comptt., Kodal Busty, Jaldapara WLS	Male, adult	Poaching	
02.08.2000	3	Torsa River, Jaldapara WLS	Male	Natural Death	
24.09.2000	4	MB-5 Comptt., Jaldapara WLS	Male	Poaching	
06.09.2001	5	Siltorsa Comptt., Jaldapara WLS	Male, adult	Natural Death	
25.09.2001	6	Baradabri Comptt.-6, Jaldapara WLS	Male, adult	Poaching	

06.11.2001	7	Chilapata, Jaldapara(East) Range, Jaldapara WLS	Male, adult	Disease, Natural Death	
17.03.2002	8	Malangi-3, Jaldapara(East) Range, Jaldapara WLS	Male, adult	Disease, Natural Death	Captive Rhino Madhu
08.04.2002	9	Sissamara, Chilapata-1, Jaldapara (East) Range, Jaldapara WLS	Female, adult	Disease, Natural Death	
28.06.2002	10	Sissamara, Chilapata-1, Jaldapara (East) Range, Jaldapara WLS	Sub-adult	Disease, Natural Death	
17.07.2002	11	Sissamara, Chilapata-2, Jaldapara (East) Range, Jaldapara WLS	Female, sub-adult	Fighting with other animal, Natural Death	
15.12.2002	12	Malangi, Jaldapara (East) Range, Jaldapara WLS	Male, calf	Natural Death	
08.03.2003	13	Jaldapara-3 Comptt., East Range, Jaldapara WLS	Female, adult	Disease, Natural Death	
04.10.2003	14	Torsa-3 Comptt., Jaldapara WLS	Male, adult	Inter- fighting, Natural Death	
04.03.2004	15	Dhupjhora-I, Gorumara NP	Female, adult	Disease, Natural Death	
15.06.2004	16	Gorumara NP 16	Female	Disease, Natural Death	

(Source: Chief Wildlife Warden Office, Department of Forest, West Bengal)

DUDHWA NATIONAL PARK AND TIGER RESERVE, UTTAR PRADESH

The Dudhwa NP is located in the Eastern Uttar Pradesh. Its Northern boundary is the International border between India and Nepal. Historically, the North Kheri Forest lies between 28 18 N and 28 42 N latitudes and 80 28 E and 80 57 E longitudes. The Mohana River flowing along the Indo-Nepal border constitutes the Northern boundary of the Park while the Southern Boundary of the Park is demarked by River Suheli.

Historically, forest areas which constitute today's Dudhwa NP and Tiger Reserve was brought an area of 303 sq km under the control of the State Government in 1861 after the visit of Sir D. Brandis in 1860. In Kheri district all the Sal and miscellaneous forests and grasslands in Khairigarh Pargana, between Mohana and Suheli Rivers were included in the North Kheri Forest Division.

This area is well known for tiger and other game species and equally well known for timber of Sal *Shorea robusta*. During the post independence period encroachment on forest lands and poaching continued and alarming degradation of forest and viable decline of wildlife, the Sonaripur Wildlife Sanctuary comprising 15.7 sq km was created in 1955 to specifically protect the Swamp deer *Cervus duvaceli duvaceli*. The area was too small and later enlarged to 212 sq km and renamed as the Dudhwa Wildlife Sanctuary in 1968. In 1977, by including further additional areas the Dudhwa National Park was created over 490 sq km. The nearby Kishanpur Sanctuary of 200 sq km extent along with the Dudhwa NP was brought under control of the Management of Project Tiger in 1988 as the Dudhwa Tiger Reserve. Currently in 2003, Katerniaghat Wildlife Sanctuary is also included in the Dudhwa Tiger Reserve. The total area of 884.90 sq km of the Dudhwa Tiger Reserve is distributed as:

1. Core Zone: 490.29 Sq km
2. Buffer Zone: 190.03 sq km

3. Kishanpur Sanctuary: 203.41 sq km (Satellite core area) Currently included in Dudhwa NP/TR

4. Katerniaghat Wildlife Sanctuary: 551. 64 sq km (Satellite core area)

The main objective of creation of National and Tiger Reserve was to preserve and conserve one of the rarest deer species, the Swamp deer (*Cervus duvaecli duvaceli*). Swamp deer are endemic to the Indian Sub-continent and probably is the last home of this sub-species. It is worth to mention here that Swamp deer is the state animal of Uttar Pradesh.

Dudhwa NP/TR is rich in its biodiversity in terms of Floral and Faunal Diversity and shows presence of 77 species of grass and grass like plants, 179 species of aquatic plants, 75 species of Trees, 21 species of shrubs and 17 species of Climbers. Based on the structure and composition, the major communities are: (1) Northern Tropical Semi-Evergreen Forest (2). North Indian Moist deciduous Forests (3). Alluvial Plain Sal Forest (4). Western Light Alluvial Forest (5). Riparian Forest (6). Moist Sal Forest (7). Moist Savannah (8). Tall Wet grasslands (9). Intermediate level grasslands (10). Short grasslands (11). Plantations of eucalyptus species, Teak, *Tectona grandis*, Semal, *Bombax ceiba*, Khair, *Acacia catechu*, Shisham, *Dalbergia latifolia*, Eucalyptus and teak are an exotic and not native of this area. There are atleast 24 species of plants are of conservation importance.

Funal Diversity is rich in this area comprise of 40 species of mammals, 292 species of Birds, 25 species of reptiles, 3 species of amphibians, and 20 species fishes were recorded. Of these, 11 species of mammals, 6 species of Birds and 5 species of reptiles are in endangered list. During the last hundred odd years, the Wild buffalo *Bubalus bubalis* and the one horned rhinoceros *Rhinoceros unicornis* have disappeared from the Uttar Pradesh terai. Rhinoceros was reintroduced in Dudhwa NP in 1984-85. These animals were translocated from Assam and Nepal.

Rhino Re-Introduction Area (RRA) in Dudhwa NP/Tiger Reserve

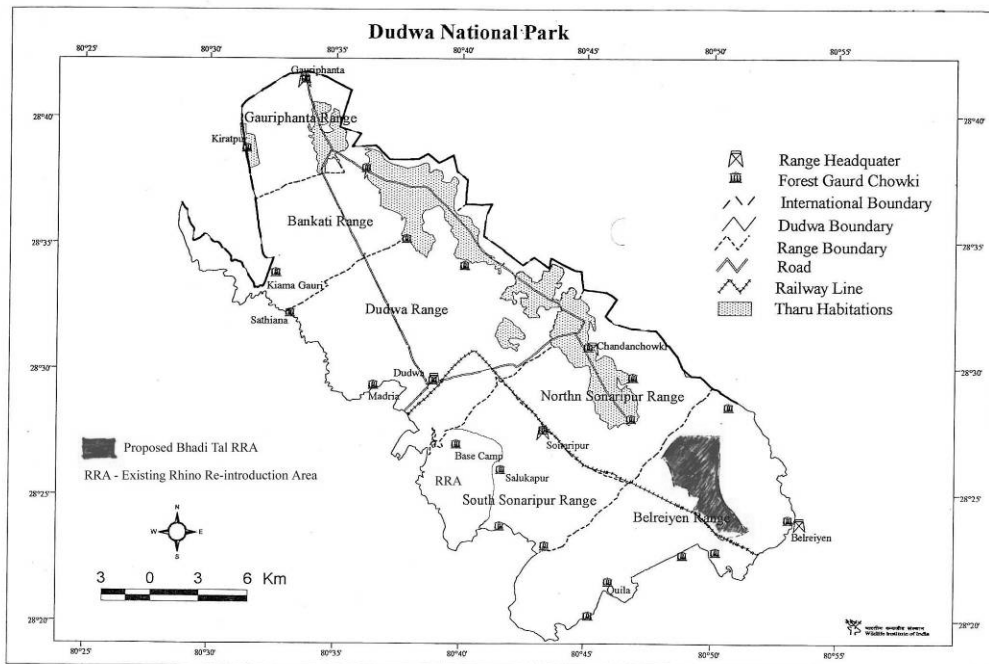
Approximately 90 sq. km of grassland area under Dudhwa Tiger reserve is located on its South – West portion along river Suheli. It is a 15 km long tract, which is suitable as rhino habitat. About 50 percent of this area is subject to seasonal flooding and an area of about 560 ha is permanently swampy and water logged. The Rhino Sub-Committee of the Wildlife Status Evaluation Committee of the IBWL felt that the area was highly suitable. A small area of about 25 sq. km. was enclosed by energized fencing called as Rhino Re-introduction Area (RRA) was selected for re-introducing rhinos. This comprised the entire Kakraha Block and a part of Chhota Palia Block falling under the jurisdiction of South Sonaripur Range. The RRA has a total of eleven water-bodies (taals) namely Kakraha Taal, Bara Puraina, Chhota Puraina, Bhandar, Bar Godha, Chhedia, Chaitua, Amha, Bela, Kurmunia and Kaimahia. First seven are permanent whereas the last four get dried during summers and water is augmented by pumping water from wells. The chain of water bodies lay along the Damar Sal and grassland ecotone. The lakes and streams, Andhra and Chabakwa represent remnant flows of the old courses of river Suheli. During monsoon, major portion of the grassland inside RRA remains flooded and water currents can be seen in the two streams and across the chain of swamps while the other areas have up to four feet of standing water. The area of 25 sq. km comprises Damar Sal forest – 20 percent and grasslands - 80 percent with fringe forest. Initially entire area was enclosed with a three strand energized fence. A 9 km stretch of the RRA forming park boundary along river Suheli was additionally protected against accidental escapes by construction of an elephant proof trench (3.0mX 2.0mX 1.5m) equally effective for rhinos.

The RRA habitat is a mix of tall grassland, short grassland, marshy grassland and woodland. The extent of each type is presented in the following table.18:

SL. No.	Vegetation Type	Area (in ha)
1	Tall grassland	343
2	Short grassland	807
3	Marshy grassland	563
4	Water-bodies (Aquatic vegetation)	107
5	Fringe and Riparian	107
6	Woodland	584

The floral diversity in this area and in the park is immense. Current documentation indicates presence of 75 species of trees, 21 species of shrubs, 17 species of climbers, 77 species of grasses and 179 species of aquatic plants. There are atleast 24 species of plants of conservation importance.

Map of Dudhwa Tiger Reserve



The main tree species are Sal (*Shorea robusta*), Asna (*Terminalia tomentosa*), Shisham (*Delbergia sissoo*), Bahera (*Terminalia belerica*), Teak (*Tectona grandis*), Eucalyptus spp, Khair (*Accacia catechu*), Jamun (*Syzygium cumini*), *Kydia calicyna*, *Mitrangyna parviflora*, *Emblica officinalis*, *Phyllanthus reticulates*, *Aegle marmelos*, Kusum (*Schleichera oleosa*), Ficus spp, Semul (*Bombex cieba*) ect. The main grass species occurring in this area are Ulla (*Bothrichloa intermedia*), Meyari (*Imperata cylindrica*), Kaans (*Saccharum spontaneum*), Munja (*Saccharum munja*), Retwa (*Sclerostachya fusca*), *Cymbopogon flexuosus*, *Desmostachya bippinata*, *Themeda spp*, *Vetiveria zizanioides*, *Narenga porphyrocoma* etc. Reed grasses such as *Arundo donax* and Narkul (*Phragmites karka*) are distributed around water bodies and swamps.

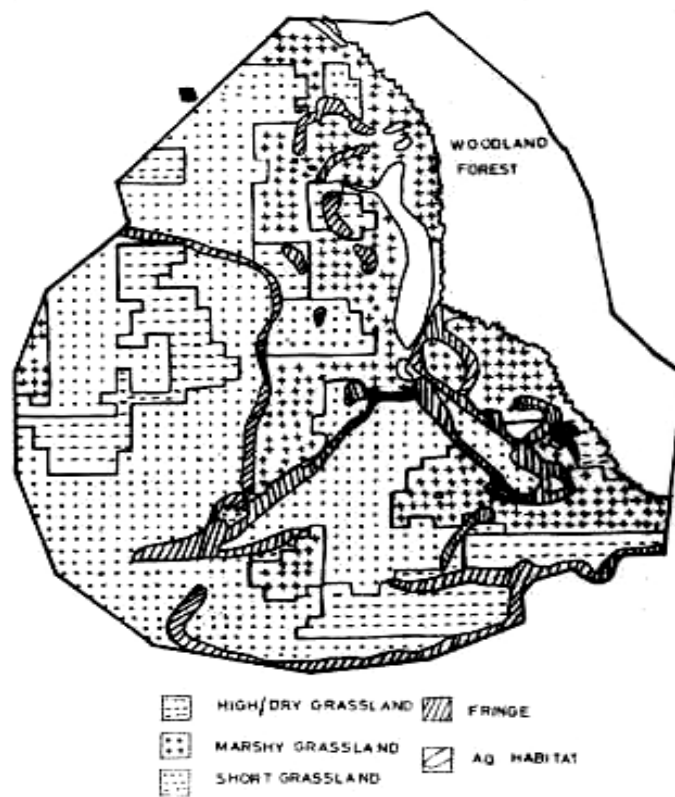
Some of the aquatic plants like *Hydrilla verticillata*, *Vallisneria spirolis*, *Hygroryza aristata*, *Nymph spp*, Water lily spp and *Potamogeton spp* are commonly found in the water bodies.

The RRA has a network of roads and can be approached from outside from 3 sides, namely Base Camp, Chhota Palia and Salukapur where gates have been provided in the power fence. There are two main roads inside the fence-while one travels straight from Salukapur to Base Camp, the other run along the Southern perimeter fence joining the main road at either end. As these roads remain unserviceable for long period during and after monsoon, an additional road from Salukapur to Kakraha was made in 1997-98. A feeder road links the central main road and the peripheral road. At Salukapur the staff is housed in conventional quarters. At Base Camp log huts have been built on top of high piles for housing the staff. This is a special requirement as the area remains under water for prolonged periods during monsoon. There are four watchtowers inside the RRA. While three are located around Kakraha swamp, one is at Kaimahia. All are wooden structures. These serve as animal observation posts and fire watchtowers. After opening up of the area for tourism, these towers are being used by tourists. But the condition of these towers is very bad and need immediate repair.

The RRA provides a good habitat for a range of animals like Tiger, Leopard, Elephant, Swamp Deer, Sambar, Spotted Deer, Hog Deer, Barking Deer, Hispid Hare, Bengal Florican, and Swamp Partridge. During field visits hispid hare pellets and tiger pug marks were observed. A pair of Bengal Florican was also sighted during this visit inside the RRA and in other grassland areas in Dudhwa.

RHINO REINTRODUCTION AREA

(This figure shows different habitat types inside RRA)



Habitat types inside Rhino Reintroduction Area



KATERNIAGHAT WILDLIFE SANCTUARY, UTTAR PRADESH

The Katarniaghat Wildlife Sanctuary is situated on the Indo-Nepal border in Bahraich district of Uttar Pradesh. It represents the Terai-Bhabhar Bio-Geographic Sub-Division of Upper Gangetic Plains. Owing to great vegetation diversity the area is a mosaic of diverse habitat. The most interesting feature of the Sanctuary is the regular movement of Great Indian one horned Rhinoceros (*Rhinoceros unicornis*) reintroduced in Royal Bardia NP, Nepal.

Forest areas which constitute the Katarniaghat Wildlife Sanctuary Division were brought under the control of British Government in 1856 and their management was initiated in 1861 under Avadh Forest Rules. Between 1883 and 1908 these forests were declared as reserve forests and their area was 462.65 sq km. After Zamindari abolition some more forests were added on to the forests of the division. Thus, between 1967 and 1994 a total 88.99 sq km of forests were added to the division and these were called new reserves. The scientific management of the forests was started in 1893 when the first working plan was prepared by B.A.Rebbs.

The importance of the area from the view point of wildlife was well recognized and it had many famous shooting blocks which attracted Tiger hunters from far off places. After the Wildlife (Protection) Act, 1972 came into force, the hunting was banned and in 1976 and 400.09 sq km area of the division was declared as wildlife Sanctuary. However, the territorial forest division (West Bahraich forest Division). Finally in April 1997, the west Bahraich Forest Division was converted into Wildlife Division and aptly named as Katarniaghat Wildlife Division. The area of the division is 551.64 sq km of which 400.09 sq km is sanctuary and rest is reserved forests. The reserved forests are contiguous to the sanctuary and along it form one ecological unit.

The Katarniaghat Wildlife Division is located in the Nanpara Tehsil of district Bahraich and most of its area is situated on the Indo-Nepal border. It lies between

27 55 N and 28 24 N latitudes and 81 02 E and 81 25 E longitudes. The Katarniaghat Sanctuary is situated between 28 06 N and 28 24 N latitude and 81 02 E and 81 19 longitudes.

The total area of 55164.13 hac of the Wildlife Division is distributed as follows:

1. Sanctuary - 40009.35 ha
2. Reserved Forests - 15154.78 ha

For management and administrative purpose the area is divided into six ranges as in the Table 19.

S. No.	Name of Range	Area(in ha)
1	Katarniaghat	20987.37
2	Nishangarha	10791.07
3	Dharpur	4922.64
4	Murtiha	4963.41
5	Kakraha	7219.22
6	Motipur	6280.42
	Total	

The area of Katarniaghat, Nishangarha, Dharpur and Murtiha ranges which constitutes the Girijapuri sub-division is 41664.49 ha, out of which 40009.35 ha is the sanctuary. The Motipur and Kakraha ranges are outside the Sanctuary. The Katarniaghat Wildlife Sanctuary represents the Terai-Bhabhar Bio-geographic Sub division of Upper Gangetic plains.

Vegetation

The vegetation of the Katarniaghat Sanctuary varies from dense moist terai Sal forests to large open grassland. The vegetation close to Girwa River and its tributaries is characterized by the presence of very dense cane brakes. According

to the Champion and Seth's classification the forest of this area belong to the following forest types:

Northern Moist Deciduous Sal Forests
Northern Dry Plains Sal Forests
Northern Dry Deciduous Mixed Forests
Tropical Seasonal Swamp Forest
Low Alluvial Savannah
Moist Sal Savannah Forests

There are 95 species of trees, 57 shrubs and small trees, 28 species of grasses in Katarniaghat WLS. The main tree species are *Shorea robusta*, *Terminalia tomentosa*, *Dalbergia sissoo*, *Acacia catachu*, *Syzigium cumini*, *Sclioichera oleosa*, *Bombex cieba*, *Adina cardifolia*, *Aegle marmelos* etc. The main grass species are *Saccharum spontaneum*, *Saccharum munja*, *Bahrichola intermedia* etc.

Fauna

The faunal diversity of sanctuary is very high. The Girwa River, being a large snow fed river adds greatly to the faunal diversity of the area. About 40 species of mammals are found in this sanctuary. Tiger and Leopard are the important carnivores of the area. The other carnivores are Jungle Cat, Fishing Cat, Leopard Cat, Ratel, Jackal, Indian Fox, and Palm Civet. Area has five species of Deer namely Chital, Hog Deer, Sambar, Barking deer and the highly endangered, Swamp Deer. There may be strong possibility of existence of endangered *Caprolagus hispidus* and *Huberopsis bengalensis*. The area has a small population of black buck and Nilgai.

According to the wildlife census held in May 1997 there are 37 Tiger, 6 Leopard, 5341 chital, 77 Swamp Deer, 185 Sambar, 212 Hog deer, 281 Barking Deer, 12 Black Buck.

Due to reservoir and joining places of several rivers many areas remains water logged throughout the year and attracts large number of migratory waterfowl and other water birds. There are approximately 300 birds species in this area. There are at least 100 species of fishes found in river Girwa. Gangatic Dolphins, Ghariyal, Muggar and smooth Indian Otter are the other aquatic members in Katarniaghat.

Hydrology

Kauriyala and Girwa are two major rivers, which flow through the sanctuary area. The river Kauriyala flow on the northern boundary of Katarniaghat range. River Girwa flows through the Katarniaghat range from east to west and split it in to two equal parts. The two rivers join at a point outside the park about 2 kms upstream of Girjapur Barrage. Thereafter the river is known as the Ghaghara. The Barrage has a great impact on the surrounding vegetation in KWLS. Mailanala and Gandhela nala are two tributaries of river Girwa. There are few other nalas, which finally joins to either one of the two major rivers of the area.

Land use Pattern in this area

There are two major land use in and around Katarniaghat WLS, Forestry and agriculture. Agriculture is the main occupation but people are also dependent on forest for their various needs. The average land holding is very small (0.66 ha.). Many people are landless, either cultivate the land of other farmers or work as agricultural labourers.

The agricultural pattern in the area close to Kheri district is very similar to the agricultural pattern around DNP and Corridors forests. But agricultural pattern inside the park and towards the Nepal border is slightly different. Here area under paddy (27.8%) cultivation is higher than the others. The other major crops are Rai (22.24%), wheat (14.83%), Maize (13.9%) and Turmeric (11.59%). Area under sugarcane cultivation is very less and only restricted in few area

southwestern side of the park. The time for sowing and harvesting of different crop is similar to the area around corridors between DNP and KWLS.

Movement of Rhinos from the Royal Bardia NP, Nepal to Katarniaghat WLS, India

Katarniaghat WLS has three rhinos, dispersed from the Royal Bardia National Park, Nepal in 1989. These rhino inhabit the island on the river Girwa and also the swampy areas close to it. Their movement is only restricted to Katarniaghat range of Katarniaghat WLS. Out of these three rhinos two moves in the northern half of the Katarniaghat range, areas north to the river Girwa. They moves in Bharthapur beli and adjoining area under compartment No. 1C and 1A of beat No. 1, Badi beli and chotti beli under compartment 4A of Sadar beat and compartment No 1 B of beat No 1. From compartment No 1A they goes to compartment No 2A and to compartment No 2B. They some times even go to Bharthapur village and do crop raiding during rainy season. The movement's records collected from forest department, of the period between Sep 97 to Feb 99, reveals that the movement of these two rhino is more in Compartment No 1C, 1A and 4A (53 % of locations) of beat No 1 and sadar beat than the compartment No 2A and 2B (44.7% of locations) of beat No 2 .

Table.20. Movement of Rhino in Katarniaghat range of Katarniaghat WLS.

Location of 2 Rhinos staying north to river Girwa			Location of 1 Rhino south staying south to river Girwa	
Compartment	Locations	%	Compartment	Locations
1C+1A+4C	117	53.92	6B+6A	72
2A+2B	97	44.20		
5B	3	1.38		
Total	217	100		

The major portion of 1A, 1B, 1C and 4A compartments are covered by grasslands and swampy with woodlands very few. 2A and 2B compartments of beat No2 have dense mixed forests with dense cane breaks.

Another one rhino stay in Sissam beli (compartment 6B), an island in the river Girwa in the eastern portion of Katarniaghat range close to Indo-Nepal border. His movement is confined to the southern side of the river Girwa. Sissam beli is situated in block 6B of Bichia beat of Katarniaghat range. This rhino moves in the area of compartment 6B and 6A of katarniaghat and the adjoining area of Nepal near Dhanora Tal. During paddy and wheat crop season he also does crop raiding in Amba bardia and other nearby villages of Katarniaghat range close to sissam beli. Sissam beli has mixed forest dominated by *Dalbergia sissoo*.

The area near 6B and 6A is on the corridor route of rhino from Nepal. River Girwa enters the parks near Compartment No 6B. Rhinos, elephants and some times use river Girwa and forest patches along it from royal Bardia to katarniaghat by tigers as corridor while movement from one park to other. During rainy season both elephants and rhinos from Bardia use to come to Katarniaghat or nearby areas and do crop raiding in Amba Bardia or other villages. Some stray movements of rhino from Bardia to Dharmapur range through Nishangarha range have been recorded.

Potential habitat for Rhinos in and around Katarniaghat WLS, UP

Approximately 3814.2 ha area in the heart of sanctuary is under Central State Farm, which was given on lease during 1975-77. Out of this total, 3300 ha, areas are of compartment No 1B and 2B of Dharmapur block under Nishangarha range and rest other are part of compartment No 5A and 4A of Bichia and Sadar beat under Katarniaghat range. The area close to state form in Katarniaghat range is grassland and swampy. The area of central state farm, falling under Dharmapur block of Nishangarha range could be a unique habitat for the rhino. The southwestern portions of the farm are marshy and have water logged throughout

the year. The other area is grassland with large number of palatable species. The portion where the agricultural activity is going on, grasses growing very fast even after exposure of more than 25 years of continuous cultivation. The whole area is basically a grassland and very fertile and a good habitat for rhino.

The area under Central State Farm was given for 25 years of lease, going to end in the year 2000-2004. Forest department is trying to take back the whole area for further habitat development.

Immediate threat

There are many human induced threats for Rhino and other wildlife including flora and fauna. These are as follows:

Poaching

Approximately 30 km of eastern and northern boundary of park share boundary with Nepal, across which free movement is permitted. Several people across the border are involved in gang poaching of various wild animals. They even penetrate the area and come inside the park for poaching. On the other side of the border there is no forest and due to involvement of the Nepal's army in to forest management, now people has concentrated themselves for illegal activity on Indian side. As there is no restriction on movement they are taking advantage of it.

Except these people residing inside or on the fringe of park in the Indian side are suspected to be involved in poaching activity. Few records of poaching by farm staffs have been also recorded. Though, poaching cases is now going down due to effort taken by park staffs, it is essential to curb it completely.

Timber felling

Large number of people from Nepal is involved in felling of trees from park. These people take advantage of the International border and free mobility across

it and extract timber from sanctuary area. As these people are totally dependent on Indian forest for their requirements this becomes a grave problem for the park. Large-scale unemployment and poverty are major drawbacks, which is fuelling these activities.

People inside the park are also involved in large scale of timber extraction. It has been observed during our study period in Katarniaghat area, the Range Officer of Katarniaghat captured two trucks full of illegal timber from the Nishangarha Range Forest.

Cattle grazing

There are 9 villages inside the park and many more on the fringe from both Indian and Nepal side. The cattle from these villages graze inside the park area and are fully dependent on it. The most important thing is that the cattle density in the area is very high and most of them are either dry or non-working. Grazing was officially permitted inside park up to 1991 on nominal payment basis. Even though grazing was banned subsequently; it has continued, as the staff of the P.A. has made no particular effort to stop it.

Crop depredation

Crop damage in and around the park area is general problem for people. The animals involved in crop depredation are Elephants, Rhinos, Chital, Wild Boar and Nilgai. Crop depredation cases by elephants, Chital and Wild Boar is very high as compares to others. Elephants are responsible for paddy crop damage during rainy season. Elephants enter from Royal Bardia during rainy season. At present there are three elephants in the park area. Rhino from park and from Royal Bardia are also involved in crop depredation but in very small scale.

Pressure due to Central State Farm

Large amount of pesticide and fertilizer use in farm is a great threat to the park. These are also going to the water system through runoff and can badly affect the

aquatic animals and water birds for which park are famous. Except these the use of large amount of crackers to deter the wild herbivores from crop raiding is also dangerous practice.

There are lots of other problems in the park. Fuel wood collections, grass cutting from park area are the other biotic problems and a threat to the park. The Dam on river Ghaghara has also severely damaged the park and still a big threat for it. During monsoon large area of forests comes under water, which affects the vegetation. It is also a big hurdle in corridor route from KWLS to DNP.

Militancy Problem

In our neighbouring friendly country in the current situation particularly in Bordering areas of Dudhwa NP and Katerniaghat WLS problem of this kind has recently developed. Numbers of paramilitary forces agencies are regularly monitoring the entire area to check infiltration in Indian side. On many occasion people from other side take shelter in forest area and local people are worst affected as well as the forest staff. Expecting that in near future this problem will be solved at Government level talks. Now a day the problem has changed and situation has been calm down in 2011.

RHINO AREAS IN NEPAL

Currently Rhinos are found in the three Protected Areas in Nepal. Rhino were tranlocated to Royal Bardia NP and Royal Suklaphanta Wildlife Reserve from the Royal Chitwan National Park under Reintroduction Programme from 1986 to 2001. The Royal Chitwan NP is the main strong hold for rhinos in Nepal and found before the reintroduction took place in two protected areas.

THE ROYAL CHITWAN NATIONAL PARK, NEPAL

The rapid and spread in human population has meant the gradual elimination of many large mammals from their historical range in the pat, the principal reason being loss of habitat. Wildlife habitat deteriorated so rapidly in the last few

decades that Nepal witnessed a colossal loss in its wildlife especially large mammals such as elephants, tigers, Gangetic dolphin and snow leopards. The conservation of forests for agriculture, hydroelectric projects, and encroachment from human-related developments have constricted and fragmented wildlife habitat, and threatened the life support systems of many species.

The rhinos are of special conservation interest because of their role in the maintenance of Terai biodiversity as their phylogeny, ecology, and nutritional energetic have evolved around the grassland ecosystem. The one-horned rhinoceros is the second largest of the five extinct species which was once widespread on the Indian sub-continent. As a result of habitat destruction and hunting for the much valued horn, there are fewer than 2000 individuals, restricted almost entirely to eight small protected areas in Assam and West Bengal of India, Nepal and Bhutan. Nepal has by far the second largest remaining population of the one-horned rhino. Therefore, the long-term future of the rhino in Nepal lies within protected areas but these protected areas are increasingly interrupted by human activities and development programs.

Status of rhino population in Royal Chitwan NP, Nepal

The Chitwan rhino population declined from an estimated 1000 animals in 1950 to 60-80 animals by 1962 when land clearing was followed by malaria eradication and heavy poaching. Strict protection reversed this decline. Investigations revealed that the population had increased to 270-310 individuals by 1975 with 73 (32.3%) adult females, 45(19.9%) adult males, 48(21.2%) sub-adult and 60(26.6%) calves. After 25 years of protection, the Royal Chitwan National Park now supports a viable population of 500-600 rhinos at a growth rate of 3.7 %. The increase in rhino number since the late 1960s demonstrates that populations can rebound vigorously when provided with sufficient habitat and protection.

Unfortunately due to insurgency and mass poaching rhino population in all the rhino areas drastically came down. In Chitwan NP rhino population estimated

recently was 408 and in Bardiya NP around 20 rhinos and in Sukhlaphanta WLS is 7 left are reintroduced rhino population.

Chitwan rhinos provide an example of a population that almost went extinct while still carrying high genetic diversity. Eric Dinerstein and Gary Mc Cracken suggest that high heterozygosity is a consequence of the large population size prior to 1950 and long generation time on average. The genetic bottle neck occurred only recently. The present rhinos have retained 90% of the heterozygosity of the original population going back 1400 A.D. Given the accelerating rate of extinction, threatened species like *R. unicornis*, which were, until recently, common and widespread, may yet retain a substantial proportion of their original heterozygosity.

Studies in the past have suggested that the Chitwan rhino population will continue to grow to a size exceeding 600 rhinos. Several large tracts of grasslands, suitable to maintain high densities of rhinos, are currently under utilized which could have been the result of harassment by cattle herders occupying these areas. The north-east population in Chitwan is indicative of a large herbivore population still in the expansion phase as the population has increased by 86 animals (48.9%) between 1975-88 with an average annual rate of increase of 3.76% /Year. In contrast, the West population has increase by only 22% since 1975 for a mean annual rate of increase of 1.7%/year. In the eastern part of the park, poaching may have artificially reduced rhino densities. However, some of these grasslands are bordered by Sal forest, a habitat offering little forage for rhinos and other large ungulates. It is doubtful if these areas will support increase number of dispersing sub-adults and non-breeding adults.

HABITAT CONDITION

Increased number of rhinos is apparent within blocks of the suitable rhino habitats in Chitwan. Rhinos occurred in highest densities along the flood plain grasslands and riverine forests bordering the Rapti, Narayani, Reu, Dhungre and

Icharni Rivers suggesting riverine grasslands as the single most critical habitat dominated by 6 meter high *Saccharum spontaneum*. These grasslands are interspersed with patches of riverine forest which together account only 30% of the Parks 932 sq km. In contrast, the vast Sal forest (*Shorea robusta*), an evergreen association on well-drained slopes, covering 70% of the Park, are rarely used. Rhino densities were positively correlated with the present of the block covered by *Saccharum spontaneum* grassland, along stream banks. *Saccharum* is fundamental as it exceeds 50% of the rhino diet each month. *Saccharum spontaneum* is unique among the common tall perennial grasses because a plant sprouts soon after cutting, grazing or inundation by floods whereas other does not sprout again after manipulations. Such dominance depends on annual habitat disturbance by monsoon floods. Monsoon floods deposits silt on the *S.spontaneum* grasslands bordering major rivers and, after receding, create favorable germination sites for seeds of this tall grass. Floods have probably always frequent phenomenon in this ecosystem because of the steep mountain chain to the north and heavy precipitation concentrated in a 4 month wet season. Large herbivores which feed heavily in these dense near monotypic stands would be expected to reach high local densities.

Avoidance of heat stress, nutritional requirements, and predator densities constrain habitat selection in large ungulates. Rhinos average 8 hrs/d wallows or streams during August and September, the period of peak daily relative humidity. Wallowing occur for at least one hour /day in everyday in wallows except in the months of December and January.

Thus, open water is crucial for rhinos most of the year.

Agriculture in former rhino habitat has resulted in serious crop depredation. However, past studies suggest that high densities were not related to the proximity of agriculture fields as densities in grasslands away from croplands exceeds or equaled to those densities in blocks bordered by croplands. However, densities in the eastern block, where rhino habitat are comparatively small,

fluctuated seasonally with the ripening of rice, corn, wheat, and lentils grown in the adjacent fields.

THE ROYAL BARDIYA NATIONAL PARK, NEPAL

Royal Bardia National Park is situated about 585 km west of Kathmandu in the southwestern terai of Nepal between 28 15 to 28 40 N and 80 10 to 80 50 E. The park contains almost half of the Bardia District of about 968 sq kms. It has a core area of 968 sq km and buffer area of 327 sq km. It was established in 1969 as a Royal Hunting Reserve. Later in 1976 declared as Royal Karnali Reserve within an area of 348 sq km. It was renamed as The Royal Bardia Wildlife Reserve in the year of 1982 and was extended to include the Babai River Valley in 1984. It was declared as National Park in 1989.

The River Girwa, a branch of River Karnali (In Indian side this River named as Kauiala) forms the western boundary of the Park and the crest of the Churian Range Siwalik Hills demarcates the Northern limits. Physiographically the park has following distinct regions- Siwalik and Bhabar area. The alluvial flat lands the riverine flood plains. It has its unique importance due to presence of the reintroduced population of Rhino.

Vegetation

According to Champion and Seth's (1968) classification forest of Bardia belong to "Moist Semi-deciduous Forests" in the Bhabar. Dinerstein (1979a) classified the vegetation in to six major vegetation type, which latter modified to seven by Jnawali and Wegge (1993). These include four main forest types along with three type of grassland.

Sal Forests

Khair-sissoo Forests

Moist Riverine Forests

Mixed hardwood Forests

Wooded Grassland
Phanta, and
Floodplain Grassland

Area under Sal forest has higher percentage than the others (Ghimire, 1997). The Khaire-sissoo forest is composed of *Dalbergia sissoo* with *Acacia catechu* as associate. A moist riverine forest has species like *Syzigium cumini*, *Ficus racemosa*, *Mallotus philippinensis*. In mixed hardwood *Garuga pinnata*, *Bombox ceiba*, *Adina cordifolia* and *Mitragyna parviflora* are the main species. Open grassland is called Phanta. *Imperata cylindrica*, *Saccharum spontaneum* and *Vetiveria zizanioides* are common species in these grasslands.

Fauna

The park shelters some of the world's most endangered species. There are at least 39 mammalian species and approximately 400 bird species. Tiger, Leopard, Sloth bear, Elephant, Rhino, Swamp Deer, Spotted Deer, Hog Deer, Barking Deer, Sambar, Wild boar and Nilgai are the main large mammalian species.

Among aquatic fauna Mugger (*Crocodylus palustris*), River Dolphin, Gharial crocodile (*Gavialis gangeticus*), Otter (*Lutra perspicillata*), turtles etc. are important species.

Climate and Hydrology

The climate is sub-tropical. The area has three distinct seasons, Dry (from Feb to mid June), Monsoon (mid June to late September) and winter (from late September to January). The mean annual precipitation is 1200mm to 1800 (Ghimire, 1997). The dry season is hot and temperature reaches up to 40°c and during winter season the temperature drops down to 4-5°c.

There are two major rivers namely, Karnali and Babai which form the water system of the area. The river Girwa, an eastern branch of river Karnali forms the

western boundary of the park. It is the habitat of the last possible viable population of Gangetic dolphin (*Platanista gangetica*) in Nepal.

The Local People

There are 17 villages in the buffer zone of park. The total human populations of these villages are more than 90 thousand. The population density of buffer zone is 249.86 person/sq. Km., higher than the population density in the terai region of mid far Western region (118 person/sq. km) and also higher than the whole terai region of Nepal (221 persons/sq. km) reported by Ghimire, 1997.

Tharu is the main tribe of the area. Economy of the area is totally agriculture based and 90 percent people are dependent on it. Rest 10 percent people work as labourer in sector other than agriculture or are involved in trade.

Current Land Use Pattern

A recent study of Central Department of Geology, Tribhuvan University, Kirtipur, Kathmandu (Ghimire, 1997), on the land use pattern of the Royal Bardia National park through remote sensing shows that, the area under forest in core zone is more than 92 %, though it is only 49.42 % in the buffer zone . There is no agricultural land in the core zone but in buffer zone 41.48 % area are under cultivation.

Forest and agriculture is the main land use. Most of the farmers have small land holding. Large numbers of people are land less, work as labourers.

Paddy is the major crop of the area. Wheat, maize, mussoore, mustered and sugar cane are the other important crop of the area.

The Rhino reintroduction Programme in Royal Bardia National Park

To safe guard the species against natural calamities and to establish a new viable breeding population, a small sub-population based on individuals translocated

from Chitwan was established in the Royal Bardia National Park (Jnawali and Wegge, 1993). The first batch of 13 rhinos was introduced in the year 1986 (Mishra and Dinerstein, 1987). After a gap of few years again in 1991, 25 rhinos were reintroduced in the same area. The rhino were introduced in the flood plains of river Karnali and in Babai river valley. So total 38 rhino were introduced in park among them 10 were male and 28 adult female. Today the total population of rhino in Bardia is 50 animals. The mean annual rate of increment is 2.43 %.

Till today 29 calves born in Royal Bardia, out of which only 21 could survive rest 8 died, hence survival rate of calf is 72.41 %. Since 1986, 13 adult deaths have been recorded, out of which 9 or 69.23 % (5 male and 4 female) occurred due to poaching and rest 4 or 30.77 (3 male and 1 female) due to natural death.

Between 1986 to March 2001, a total of 63 rhinos were translocated from Chitwan NP to Bardia WLS and 6 rhinos to Sukhla Phanta WLS.

This year again 4 adult males are introduced in the park. In 1989 three rhinos from Royal Bardia dispersed to the Katarniaghat Wildlife sanctuary, India and became permanent member of this park. They never return to Bardia.

The rhino in Bardia moves in flood plain of River Karnali and in Babai River Valley area. But during rainy season they some time comes near Katarniaghat WLS along River Girwa and also enter the park area or cultivation land close to it. Such crop raiding cases in Ambia Bardia village of Katarniaghat has been recorded several times.

Major threat to Park and Rhino

Poaching Problem

Poaching is a big problem for Rhino and for park's other animal also. Since 1986, from the date of introduction of 63 rhinos, poachers have killed 9 rhino.

Organized way of poaching cases has been recorded from the park. The moment when rhino goes outside of park in open area or in cropland they are in the high risk of being poached, particularly when they go towards the Indo-Nepal border.

Now the park authority has established two ant-poaching groups with the help of WWF. The anti-poaching group is headed by a Park Ranger and comprises of one senior game Scot along with four games Scot and three field level informer. Nepal army is also helping the park authority in curbing poaching. Since the establishment of anti-poaching group the poaching cases has been came down.

Anthropogenic Pressures

The buffer zone of park and other area around park has large number of human population. Particularly in the buffer zone there are more than 90 thousand people are residing. The people are fully dependent on park for their fuel wood requirement, cattle grazing and for other purposes. The total livestock population in the buffer zone is 142825 and its population density is 265.60 cattle/sq. Km. Cattle's are dependent on grazing inside the park, which is exerting large amount of pressure.

Except this many people are also involved in illegal felling of timber. There are many more other management problems related to the human dimension around park.

Corridor between Katarniaghat WLS and Royal Bardia NP

Important Corridors

The main corridor (Corridor-G) between Bardia and Katarniaghat are along the Girwa River. The rhino entry takes place through this route only. They generally enter in Katarniaghat WLS from this route either near Dhanora Tal area, slightly southeast of river Girwa or near Ambia Bardia village. Some times rhino also enter near Maila nala area, on the north to river Girwa traveling through this route only. Elephants and tiger also use the same route while coming from Royal

Bardia. From this route entry takes place in block 2B, 6B and 6A area of Katarniaghat range on the eastern boundary.

The second corridor (Corridor-K) link is through Kauriala River on the northern tip of the sanctuary. But this corridor is not in use by Rhino. Even elephant does not use it frequently. This corridor is completely open at several places and is under encroachment.

The corridor along the Girwa River is still a viable corridor and it needs attention for habitat improvement.

Status of Corridor

The forest along this corridor (corridor-G) is very narrow sometimes only 1.5 to 2 km wide. The vegetation in this corridor is of Sal, mixed forest and riverine forest. As this corridor forest is linked with Bardia and KWLS, it is a shelter of various types of ungulates. There are various types of human pressure along the corridor. The forest towards the Nepal side has been cleared by the people and converted in to the cultivation land. The settlers in the transborder are mainly retired army personals of Nepal, who has completely destroyed the forest at almost all places along the border. Large number of human habitations is there in corridor areas. Livestock grazing, encroachments are the major threat to the corridor. Among the other threats, illegal timber cutting, firewood collection, fodder extraction are important.

The second corridor (Corridor-K) along the Kauriala River is in more degraded condition. The other problem with this corridor is that to follow this route the rhino has to cross the Girwa River in the Royal Bardia and they have to also cross the open croplands. That's why they do not take risk and they do not come easily.

The agriculture is the main land use in the corridor area. Paddy is the major crop of the area. The other crops are wheat, maize, mustered etc.

Proposed planning possibilities

Corridors linking

Western terai currently having two isolated reintroduced rhino population and three members dispersed from one of them. Their future survival depends on various co-related aspects. It is essential to have accessibility to more area and a free movement across these parks. This is only possible when corridors will be viable and will provide fearless, smooth passage to wild animals. Linking these populations will play an important role in future rhino conservation.

As today corridors between these parks are in highly degraded states and even abandoned by the wild animals, it became essential to reduce the pressure and make it viable. The corridors between Dudhwa National Park and Katarniaghat Wildlife Sanctuary are under grave problem of encroachment and various biotic pressures. Most of the area has been encroached for agriculture and settlements. The recovery of encroached forestland and rehabilitation within a time frame is essential to make these corridors viable. It has to handle very carefully and with the involvement of local people and all concern authority. Ecodevelopment activity will help in easing the various biotic pressures. At the same time protection of forest and habitat improvement through community involvement will be a great help.

Though Corridor No.1 between DNP and KWLS is highly degraded and have large area under encroachment, then also it will be easier to make it viable than the Corridor No.2. Corridor No.2 has complete gap at one place, an area of 6-7 km filled with agriculture land and settlements. Another problem in this corridor is of water logging in an area of 7 km width, due to backwater of dam and river Ghaghara, which separate it from Katarnighat WLS.

Corridor between Katarniaghat and Royal Bardia is almost in the same condition. The only viable link, along the river Girwa is also under various human induced threats. Encroachments, habitat degradation, cattle grazing are the common

problem like everywhere, but poaching is the grave problem in this area. Another link through river Kauriala has its large number of difficulties and is not being used. So attention should be given on the corridor along river Girwa for habitat improvement and for protection to forest and for a safer passage.

There is still option to save the Basanta forest patch in the Nepal side and to fill a gap of 500 meter between Basanta forest and Dudhwa NP forest. This can be a effective viable corridor and wild animals can easily move through this stretch. Regular monitoring and protection this stretch should on first the priority.

Anti poaching steps

Poaching is a serious threat everywhere in park area and in corridors. But in corridor, particularly between Katarniaghat and Royal Bardia the chances of animal being poached are very high. To curb the poaching Royal Bardia has already established an anti-poaching squared, which has shown fruitful result in recent years. On the same line the Katarniaghat WLS and DNP authority should also develop strategies to curb the poaching in and around the park. To reduce the poaching pressure on international border and in corridor, the Katarniaghat and RBNP authority should work in co-ordination.

Monitoring

Monitoring of animal for various purposes is very important task for future. Animal should be monitor for their movement pattern, habitat utilization, breeding status and general health. A proper census should be conducted every year to know the actual situation of demography. Information should also gather on adult and calf mortality and the reason behind it. The other problems in all these area are almost common, except few. All the problems should be dealt with proper care.

(Source of Bardia NP Section: Dr Satya Priya Sinha and Dr A.K.Singh, 1999, Report submitted to WWF-India)

RHINO REINTRODUCTION PROGRAMME

BASIC NORMS OF THE IUCN'S SPECIES SURVIVAL COMMISSION AND RE-INTRODUCTION SPECIALIST GROUP, & ASIAN RHINO SPECIALIST GROUP ACTION PLAN ON RE-INTRODUCTION OF RHINOCEROS INTO ITS FORMER RANGE OF DISTRIBUTION

INTRODUCTION

In WWF-Asian Rhino Action Planning Workshop held at Ho Chi Minh City, Vietnam held on 1-6 December 1998, five major threats are habitat degradation-prime issue; small population, poaching, habitat conservation and conflict were identified for western terai region. Later during IUCN/SSC-Asian Rhino Specialist Group regional meeting for India and Nepal, held between 21-27, February 1999 at Kaziranga NP, Assam. Delegates and members of ASRSG from India, Nepal, USA, Malaysia, Indonesia, Netherlands, and UK took part in this meeting and finally agreed that priority should be on the funding of the rhino conservation for the in Financial Aspects In in-situ conservation activities reinforce to anti-poaching, habitat management, Its improvement and buffer zone management with proper planning to encourage ecodevelopment activities. To get more support at state level Government, ASRGS should have more interfaces. To strengthen the current inelegance system adequate funding should be arranged and provided to most of the rhino areas. Group reaffirms that rhino population should be viable of minimally 2500 in at least 10 populations of minimally 100 each and a Meta population of 500 individual. Formations of a technical advisory group comprising representative from all major rhino areas in India and Nepal. To get more recognition and support for rhino conservation, ARSG recommended that at Government level should establish a **“PROJECT RHINO”** similar to other species. To make it further successful in the rhino conservation in in-situ conditions in India and Nepal, members felt that at Government level in both the countries with the help of International funding could make more efforts in this direction.

A Conservation Action Plan on Asian Rhinos by IUCN/SSC Asian Rhino Specialist Group (1997), the emphasis of this action plan is to consider what needs to be done to preserve the species in perpetuity. Thus, the main objectives that should govern immediate conservation actions are detailed along with specific recommendations derived from these objectives. Application of these recommendations is considered separately for India and Nepal.

With the objectives are as follows:

1. To develop and maintain a total wild population of at least 3,000 rhinos.
2. To maintain these rhinos in the following major protected areas in the current range of the species: Kaziranga, Manas, Rajiv Gandhi Wildlife Sanctuary (Orang WLS), Pobitora, Jaldapara and Dudhwa in India; Chitwan and Bardia in Nepal.
3. To expand the number of rhinos in other protected areas also when and where possible.
4. To respond to threats to viable populations in the wild adequately.
5. To maintain a captive of long-term viability to guard against any unforeseen extinction of the wild population.
6. To continue efforts to close down the trade in rhino products.
7. To develop public support for conservation through eco-development and awareness programme.

Action Plan of IUCN/SSC/RSG on Indian (Great One-Horned) Rhinoceros in India and Nepal, recommends following:

1. Concentrate efforts on areas in which reasonably viable wild populations (100 rhinos) in the wild can be developed and maintained:
Kaziranga, Manas, Orang WL (RGWLS), Pobitora, Jaldapara, Dudhwa in India; Chitwan and Bardia in Nepal.
Such efforts should include habitat improvement, area extension, anti-poaching measures, training of staff, public education campaigns, research and eco-development.

2. Calculate the financial resources currently available and those additionally required providing adequate protection for these populations. Develop project proposals for submission to donors for additional financial support.
3. Assess the value to the conservation of the species of the small remnant population of rhinos, e.g. Gorumara NP, North Bengal through better information on current status and cost-benefit analysis of increased protection and management in such areas.
4. Continue efforts to establish other wild populations elsewhere in India and Nepal through translocations. But such translocations should be limited to Sanctuaries where the carrying capacity exceeds 100 rhinos. It is recommended that there be follow-up surveillance to measure the success of the translocations.
5. Expand the captive population mainly through propagation of rhinos already in Zoos by transfer of animals, where required, from western Zoos.
6. Encourage wildlife officials and their governments in India and Nepal to participate more fully in the activities of the IUCN/SSC Asian Rhino Specialist Group (AsRSG).
7. Continue measures to prevent illegal trade in rhino products from leaving India and Nepal for markets abroad.

The Norms of the IUCN'S Species Survival Commission (SSC) and Rhino Re-Introduction Specialist Group (RSG) & Asian Rhino Specialist Group (AsRSG), on Re-Introduction of Rhinoceros into its former range of distribution are as Follows:

The re-introduction of a species in its former range of distribution, with all factors in favor, is an accepted practice in the wildlife management, especially relevant in context to species like the rhino which is habitat specific and have a restricted range of distribution at present.

According to IUCN Species Survival Commission and Re-Introduction Specialist Group (SSC/RSG) defines “Re-Introduction as the International movement of an organism into a part of its native range from which it has disappeared or become extinct in historic times as a result of human activities.”

Five criteria are to be followed before starting rhino reintroduction programme:

- (1) Reintroduction is the release of animals or plant of a species into an area in which it was indigenous before extermination by human activities. Reintroductions are particularly useful where a species has become extinct due to human persecution, over-collection, over harvesting or habitat deterioration.
- (2) Reintroduction should only take place where the original causes of extinction have been removed or are in the process of being dealt with.
- (3) Reintroduction should only take place where the habitat requirements of the species are satisfied. This means that that where species to be reintroduced become extinct in an area because of habitat change or where significant deterioration has occurred in the habitat since the extinction, the species should not be reintroduced unless measures have been taken to reconstitute the habitat to state suitable for the species.
- (4) The Basic Programme for Re-Introduction Consists of:
 - (i) A Feasibility Study
 - (ii) A Preparation Phase
 - (iii) Release Phase
 - (iv) Follow Up Phase: Study and Monitoring of Re-Introduced Animals on regular basis which includes,
 - (a) Study of the ecology of the species should reassess the relationship, the species had with the habitat into which reintroduction is to take place, and assess the extent that the habitat has changed since the extinction of the species. The change in the species should also taken into account, they have been captive bred or cultivated, and

allowance made for any change liable to affect the ability of the animal or plant to re-adapt to its traditional Habit/habitat.

(b) The attitude of local people must take into account. The reintroduction of a species that was persecuted by over hunted or over collected is propose, an education and interpretative programme or other inducement should be used to improve their attitude to the introduction, if it is unfavorable, before reintroduction take place.

(5) The animals or plant involved in the reintroduction must be of the close available race or type to the original stock and preferably be the same race as that previously occurring in the area.

RHINO REINTRODUCTION PROGRAMME IN DUDHWA NP/ TIGER RESERVE, UTTAR PRADESH

INRODUCTION

Rhino Reintroduction Programme in Dudhwa National Park /Tiger Reserve, in 2010, is going to celebrate its 25 years of successful reintroduction in the field of wildlife conservation and more appropriate species reintroduction, its conservation & protection. For the first time in India reintroduction of rhinos from Pabitora Wildlife Sanctuary, Assam and The Royal Chitwan National Park, Nepal, rhinos reintroduced into former range of its distribution in Dudhwa NP took place in two phases in 1984 and 1985. Last rhino in terai area in Pilibhit district which close to Dudhwa NP was killed in 1878.

Once Indian One-horned rhinoceros (*Rhinoceros unicornis*) roamed over the Indus, Gangetic to Brahmaputra 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 the invading Emperor Timor hunted and killed many rhinos on the frontier of Kashmir in AD 1398 and there are evidences that rhino existed in parts of the west of subcontinent as far northwest as Peshawar till 16th Century. Babur, the founder of

Mughal Empire in India in his famous memoirs – the Baburnamah described how he hunted rhino in bush country near the Indus as late as 1519 AD.

Out of three species of rhino that roamed over the Indo-Gangetic and Brahmaputra 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 in about 1935.

The only species of Asiatic Rhinoceros that exists in Indian subcontinent is the Great Indian One-Horned Rhinoceros (*Rhinoceros unicornis*). The *Rhinoceros unicornis* were 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 will be interesting to note that in Assam Col. Pollock a Military Engineer engaged in lying 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 fires 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 undoubtedly 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. Being roughly 50 to 60 in Assam and 40-50 in West Bengal. At present the Great Indian One Horned Rhinoceros has total population of about 2500 animals in the world, that too only in India and Nepal. In India, currently its population is restricted to four natural populations in Assam viz Kaziranga, Manas, Orang (Rajiv Gandhi WLS) and Pabitora, two natural populations in West Bengal viz Jaldapara and Gorumara and one re-introduced population in Dudhwa NP and one migratory population in Katarniaghat in Uttar Pradesh. There are 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 Sulkhaphanta WLS. The Rhino of Royal Chitwan N.P. is a natural population while Royal Bardia NP and Sukhlaphanta WLS have the re-introduced population. The Kaziranga National Park in Assam (India) has the highest population of Rhino (about 1800+) and Pabitora WLS (85 rhinos in 16 sq km area) followed by Royal Chitwan N.P, Nepal with approximately 408 rhinos.

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 and then in 1985 in two batches.

Selection of Dudhwa Tiger Reserve 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 (U.P.), Jaldapara (W.B.), Champaran (Bihar), Intaki in Nagaland and Lalighabri Sanctuary of Arunachal Pradesh. Among these various areas considered by this 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 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 close to the Dudhwa National Park.

Prof. Schenkel confirmed the suitability; the then chairperson of Asian Rhino Specialist Group and Prof. Schenkel observed, “*Dudhwa is the area most suitable for establishing a new local population of Indian rhinoceros. The area is protected, large enough and contain suitable habitat*” and this was further supported by the vegetation survey conducted by Dr. Hazra and his team of Botanist from Botanical Survey of India and 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

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*, *Phragmites karka*, etc.

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.

They also prefer **aquatic plants** like *Hydrilla verticillata*, *Vallisneria spirolis*, *Hygroryza aristata*, *Potamogeton sp.* and *Trapa 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 90km² in the southwest part of the park (South Sonaripur and Bellarian ranges). It was estimated an area of 90 sq. km. could support an ultimate maximum number of 90 rhinos considering one rhino per sq. km. (*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 sq. km. 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 another in 1985. The 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.

Airport and headed into Aeroflot 1176 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 Guwahti 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 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 the 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 vigor. 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 translocate 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 fought with another dominant male. Again in 1991, a female, from Nepal died due

internal infection and abortion. She also lost her male calf in 1993 killed by the dominating male. The present rhino population of total 30 rhino comprise of 25 calves of different age and 5 rhinos of founder population (2010).

The first evidence of breeding in the re-introduced population was detected in the form of remains of a newly born calf in 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 5 has increased to 30, November, 2010.

PROBLEMS

In-breeding

As discussed earlier, all individuals of the Dudhwa bred population are sired by single male rhino. There is no other unrelated male currently and all the mating of Dudhwa bred population is taking place between close relatives. This is certainly a very discouraging reality.

The original target was aimed at releasing 30 rhinos, but due to financial and administrative constraints only 10 could be released from 1984 to 1992. Four out of these ten have died and another one from the Kanpur Zoo had been sent back to its origin. So, breeding started with one male and four females. In the past 20 years of breeding, a total of 28 calves were born out of which 16 are surviving. There had been 4-recorded cases of abortions and a total of 12 calves died because of various reasons. It clearly shows that mortality among calves found to be 42.85 percent while 57.15 percent in case of calf survival. The population size as of now stands at 30 (November, 2010). It is also expected that within 6 months at least 4 -6 calves are going to born and add to the current population.

The problems of in-breeding as well as desired response to the stochastic eventuality need be addressed. These are rooted in genetic variability as well as in

numbers. These need to be overcome with further restocking from large populations. The original number of 30, though not a magic number needs to be considered. These could be from Nepal or Assam and all need to be from the wild that are not 'nuisance' animals habituated to crop raiding.

Intra Specific Fight

Right from the beginning, there has been a serious intra-specific fight between males as well as between male and female. As a consequence of such fights, one of the two males of the first group got killed. Another male from Kanpur Zoo was seriously injured by the dominant male from Assam and finally had to be sent back. Owing perhaps to this very reason, 'Narayani' a female from Nepal is presently staying outside the fenced area. 'Narayani' even gave birth to her last calf in a sugarcane field in Bela Kalan village about 4 km from the RRA.

As suggested by experts, it is necessary to enhance the fenced area to include more of swamps, wallowing grounds, grasslands and upland forest habitats to prevent intra-specific fights. Sinha and Sawarkar have suggested extending the area to include Gupti Phanta area including Road No 60 leading towards Belraiyan. They have further suggested creation of artificial wallows to cause more extensive utilization of the habitat and also to help reduce intra-specific competition.

Straying Out of Rhinos

From last two years, some rhinos, especially Narayani have started straying out of the park. A rapid survey in the villages Bela Kalan, Bela Tapar and Gulra Tanda and an interaction with forest staff of Gulra Chowki indicated that there have been 11-recorded cases of straying out of rhinos. There had been crop damage but no other damage has been reported. It is quite interesting and disturbing too that 'Narayani', that lives outside the fenced area gave birth to a calf during October 2001 in a sugarcane field in Bela Kalan village about 4 km away from the RRA.

Although, the problem now is not of very serious dimension from depredation point of view, trend is not very good for the rhino re-introduction programme. Since in most cases, only one individual is straying out, that too during her pregnancy, chances are that it is a part of her strategy to avoid Bankey. But it has to be seen as the calf grows. Till now as reported five rhinos were seen straying out of the fence area. But they also come back after some weeks.

Whatever may be the reason, the fact that the PA management is not in a position to maintain the 9 km elephant proof trench is disheartening. The trench has to be maintained at all costs if the programme has to be a success.

Alternative site at Bhadi Tal in Belraiyeen range has been selected and fencing work is expected to start. This new site may prove helpful in providing home to such animals.

Resource Crunch

The park management faces a lot of difficulties in procuring money for taking up the following activities on a regular manner:

- Fence maintenance
- Wages to fence watchers
- Maintaining elephants for rhino monitoring and recent need for tourism.

Apart from ongoing activities, large sums are needed to create and maintain a 9 km long elephant proof trench as prescribed by the Rhino Sub Committee at the beginning of the project. Such a trench is extremely important to check straying out of rhinos that may even lead to poaching. Additional money would be required to procure elephants for monitoring and for tourism purposes. This again is a vicious circle, as it would require recurring expenditure on maintenance of elephants. Such recurring expenditure is to be anticipated in advance and sources ensured.

Tourism inside the Rhino Area

Park authorities have opened the RRA for tourism from December 2001. Earlier this area was supposed to be a **restricted zone** and no body was allowed to enter the RRA. When the RRA was opened for tourism, there were four elephants engaged for monitoring duties. Unfortunately, because of bad health one female elephant died in February 2002 and another is too weak to stand. These monitoring elephants are kept on long duty hours in locating rhinos. The same elephants are used to make number of trips for the tourist in rhino shows. This practice should be discontinued or reduced to three days per week. There is also a need of regular checking of amount of prescribed food provided to individual elephants and health care measures by the veterinary officer and other officer concern.

Poaching Threat

At present the park management in very much alert, patrolling duty is being done religiously and rhinos stray out in rare cases only, so poaching does not seem to be a problem. But, its possibility remains as other animals are being poached.

Biotic Pressure

Villages like Bela Kalan, Bela Tapar, Gulra Tanda etc. are located near Southern fringe of the power fence. People from these villages, at times, venture into the RRA for collection of thatch grass, fodder and at times fuel wood and for fishing in the swamps. The addition of the southern buffer has helped in reducing the problem to some extent. It has been observed that in the past the theft of fence wire was directed at preparing snares by local poachers to snare deer found in the RRA. Daily monitoring of entire length of fence and monitoring rhinos with the help of riding elephants has contained to a low level but it remains a constant threat.

Lack of Veterinary Facility

There is a sanctioned post of a veterinarian in Dudhwa Tiger Reserve, but no one has joined considering the current salary scale and bleak promotional prospects. Veterinary doctors are called from Chandan Chowki or sometimes from Palia when required. From time to time Veterinary officer and Veterinary scientist from Lucknow Zoo and Indian Veterinary Institute, Izzatnagar, Bareilly visit this area. Due to these reasons it is difficult to get timely medication. On many occasions doctors are not available or not well versed with the wild animal in providing the correct doses. It is very difficult to ensure appropriate health care of the camp elephants and rhinos without having proper veterinary care facilities in the existing conditions.

CONCLUSIONS

- Procure a few (in the ratio 1 male to 3 females) males and females from the wild or wild captive rhinos.
- In all future re-introductions, only sub-adult individuals in the same age group should be brought, as there are lesser chances of casualty and they adopt better in new conditions. Moreover, by having males of same age group there may be lesser possibility of over dominance by one individual.
- **Development Bhadhital Area as alternative rhino area in Dudhwa N.P.**
- Maintain 'Rhino Proof Trench' on the Southern side of the RRA.
- Restricted Rhino watch to 4 days per week within the RRA until necessary infrastructure facilities are properly developed
- Procure additional riding elephants (4 for daily monitoring and 2 elephants for tourists).
- Long-term studies on Grassland Management, habitat use by different large and small mammals and regular monitoring of population of highly endangered species like Tiger, Swamp deer, Bengal Florican and Hispid hare. This is only possible by creating a permanent research and monitoring station at Salukapur funded by National and International Funding as an independent body. This will attract not only Indian Scientist

and from abroad to work in this area. Such long-term studies and monitoring will not only help in the future management of rhinos but in the habitat management as a whole.

- State Forest Department must allow the revenue generated from tourism activities should be re-cycled in the developmental activities and maintenance of infrastructures of the park and welfare of the forest staff. This will also help in generating more revenue.
- Since getting funds is one of the major concerns, Park authority with the consent of State Forest Department can create a registered Wildlife Welfare Society or Foundation to be looked after by Deputy Director of the Park. This society/foundation should be allowed to accept donation and funds from different funding individuals and agencies for different conservation activities and welfare of the staff of the Tiger Reserve. Currently Gir Welfare Society in Gir National Park, Gujarat and Tiger foundation Society in Madhya Pradesh are running successfully.

Table.2. Calving pattern in founder female rhinos of Dudhwa.NP (1987-2010)

No	Rhino Name	Age in 2010	Age at 1 st calf	Age at 2 nd calf	Age at 3 rd calf	Age at 4 th calf	Age at 5 th calf	Age at 6 th
1.	Swambara Born (1980)	30year	9 12.10.89, died on 7.1.90	11 10.8.91 Male	14 7.10.94 Female	18 6.8.98 died on 28.8.02	24 29.7.04	
2.	Hemrani Born (1981)	29 year	8 2.2.89 Female	11 5.8.92 Female	16 19.10.97 Female	21 6.8.02 Male	26 13.9.07 Male	
3.	Naraini Born(1980)	30 year	7 1987 died	9 1.6.89 Female	12 31.7.92 Male	19 21.11.9 9 died on 10.1.20 00	21 27.8.01 Died on 12.1.06	24 31.9.04
4.	Pabitri Born (1980)	30 year	11 4.8.91 died on 11.1.2000	15 21.9.95 died on 21.1.96	17 2.10.97 Male Kartik	27 14.9.07 Male		

5.	Rapti (1980 (died in 1991)	----	9 Male calf died on 1993					
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Table.3 .Calving pattern in female rhinos born in Dudhwa.NP (1989-2010)

No	Rhino Name	Age in 2010	Age at 1 st calf	Age at 2 nd calf	Age at 3 rd calf	Age at 4 th calf	Age at 5 th calf	Age at 6 th
1.	Rajshree H-2 (1992 Born)	18 year	7.8 mo 12.6.99 killed by tiger on 29.2.2000	12.9 14.9.07 Male	15 yr Calf born in 2010			
2.	Suheli N-2 (1989 Born)	21 year	5.5 11.1.94 died on 17.1.94	8.3 17.9.97 Female	13.5 1.11.02 Male	16.7 14.3.05		
3.	Hemvati H-1-1 (2001 born)	9 year	-					
4.	Rajrani H-1 (1989 Born)	21	10.9 2.1.99 died on 28.10.99	12.9 1.11.01 Female Hemvati	15.5 30.7.04 died on 4.2.200 5	17.8 7.10. 2006		
5.	Vijayshree H-3 (1997 born)	13 year	9.5 21.5.06 Male	12.9 Mated with Banke on 10-12 April 2009	13 yrs Calf born in 2010			
6.	Rajeswari S-3 (1994 Born)	16	8.9 7.9.2002 died on 24.12.2002	11.3 9.3.2005	13.9 16.9.07			

Table.4. Adult male rhinos in Dudhwa NP/TR

S. No.	Rhino Name	Probable birth year	Age on 2010 (in years)
1	Banke (Founder male)	1977	33
2	Bheemsen	1991	19
3	Kartik	1997	13
4	Nakul	1992	17
5	Sahdev	2002	7

In Nutshell:

1. Total males: 9 males born in Dudhwa NP and one male of founder population Banke age 33 years still mating with his own offspring of third generation.

2. Total females: 16

3. 4 calves of different age sex yet to be determine

In 2010 total rhino population of Dudhwa NP is 30 rhinos.

4. In 1984-86 total rhino reintroduced: 7 females and 2 males out of this on different year 3 females and one male died because of number of reasons and in 1988 total rhino population was 4 females and one male. After 25 year rhino born in Dudhwa reached to 25 calves and 5 rhinos of founder population. In all total rhino population reached to 30 rhinos.

**PART-II. PROPOSAL FOR THE CREATION OF A VIABLE BREEDING
SATELLITE POPULATION OF GREAT INDIAN ONE-HORNED
RHINOCEROS (*Rhinoceros unicornis*) IN BHADHI - CHURELLA TAAL
SECTOR OF DUDHWA NATIONAL PARK & TIGER RESERVE**



View of Bhadhi Taal area - Proposed New Rhino Area inside Dudhwa NP/TR

1. BACKGROUND

The Great Indian One-horned Rhinoceros (*Rhinoceros unicornis*) was once widely distributed from Hindukush Mountain Range (Pakistan) to Myanmar and also all along the flood plains of Ganges River. In the last 200 years over-hunting, fragmentation of habitat by clearing forest for cultivation, desperate land use for agriculture, extension of tea gardens, reclamation of grasslands and swamps for fulfilling the basic needs of expanding livestock and human population and uncontrolled fires are the major causes of elimination of Indian Rhinoceros from most of its former range of distribution. The last Rhino in Uttar Pradesh was shot in the Pilibhit district adjacent to the Dudhwa National Park in 1878. At present the Indian Rhinoceros population of around 2200 is restricted to protected areas in Assam, West Bengal and Nepal. The Kaziranga National Park in Assam has 2084 Rhinos and the Royal Chitwan NP in Nepal has 408. By considering the highly restricted distribution with poaching pressure, habitat specificity and considering the scattered small population, it becomes 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 this species. The IUCN Rhino Specialist Group and the Rhino Sub-committee of the Indian Board of Wildlife (IBWL) recommended the establishment of an additional Rhino population in India.

2. RHINO REINTRODUCTION IN DUDHWA NATIONAL PARK

Of the various areas considered by the sub-committee, Dudhwa National Park was thought to be the most promising because similarities of the habitat to that of Kaziranga National Park, the fact that the Rhinos have been recorded in this area till the last century and the adequacy of the protection available. The suitability was confirmed by Prof. Schenkel, Chairperson of Asian Rhino Specialist Group and was further supported by the vegetation studies by the Botanical Survey of India, which revealed the presence of various preferred species of rhino.

The reintroduction of Rhino in Dudhwa took place in two phases. The first phase in 1984, in which five Rhinos comprising 2 males and 3 females were captured,

and translocated to Dudhwa from Pobitora WLS, Assam. These animals were released in Rhino Reintroduction Area (RRA) in specially constructed stockades for health care and for experiencing electric fence before final release into the main fenced area of RRA. Of these five animals, one female died of stressful abortion before she could be released. The first batch of animals was released in Dudhwa on 20.04.1984. The large male was held back until the others had settled and released after radio-collaring a few days later. Another female died on July 31, 1984 after a bid to tranquilize her to treat a wound. With only one female and two males left, an urgent need was felt to translocate some more Rhinos. The collaboration of the Govt. of Nepal was obtained in the exchange of four young female rhinos for sixteen elephants. The rhinos captured from near Royal Chitwan National Park arrived in Dudhwa in April 1985. Thus these seven rhinos, two males and five females made up the seed population of rhinos.

The first evidence of breeding in the reintroduced population was detected under unfortunate circumstances when remains of a newly born calf were discovered in a patch of tall grass in August 1987. The first successful calving occurred in 1989. Four more calves followed this in the same year. Unfortunately, in 1991, out of five female rhino one adult female died of stressful abortion after fighting and chasing by Male rhino Banke to save her male calf. Later her calf was also killed in 1992. The breeding success followed then and the seed population of 5 has since increased to 23 with total number of rhinos to 28 which also includes one male and four females of founder members. In the current rhino population there are total 10 adult females in an age group of 8-29 years and among adult males total number is 5 males in an age group of 6 to 32 years. Rest of 17 calves' falls in an age group of couple of months to 5 years.

All the rhinos are kept in an area of 25 sq. km. encircled by a power fence. The five stranded outer fence, the inner partitioning three-stranded mini fence of 1993-94 and the additional fence created in 1997 are serviced by staff and labour. Main rhino monitoring centre is based at Salukapur and staff with elephants at Base-

camp to carry out rhino monitoring from other side. Two energizers based at these places for power of the fence. In 2009, location of fence in Salukapur side to earlier entrance gate has been slightly shifted right in the middle of the un-asphalted road. Now patrolling elephants directly enter into the rhino fence area from Salukapur. Every day, four riding elephants were used to locate all the rhinos, seldom were all the rhinos sighted everyday due to poor sighting in the tall grassland condition. Except for a short period after the burning of grasslands when most of the rhinos were located. Rhinos were also sighted on foot, using a motorcycle and from machan tops. All the adult rhinos are identified individually by recording different physical traits and name has been given to individual rhino.

3. Need to Establish a Separate Rhino Population inside Dudhwa NP

(i). Genetic Variability and to check Inbreeding

Initially, the original objective was aimed at releasing 30 rhinos in Dudhwa National Park. The precise reason why this was not carried out after release of two batches is both financial and administrative. However, due to breeding the number has increased from six to twenty two with total number of 28 rhinos which includes the 6 rhinos of founder population.

In the beginning 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 dominant 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, 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 – Bankey. Because all these calves surviving now are born after

1989, there is little chance of mating with Raju who died in 1988. 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 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 translocate male rhinos should be kept in the rhino area of Bhadhi Taal - Churella Sector to avoid the chance of fighting among them. And hence, there is an urgent need of enlarging rhino habitat (*Sinha, 1991 and 1999*).

(ii). To Reduce conflict amongst males in existing RRA

Earlier in 1986, Bankey has driven one of the two adult males in existing population out from the main fence on several occasions and finally another male lost its horn and became submissive. Therefore, separate contiguous mini fence 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 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, 1991*).

Male calves born in rhino area are now mature enough to breed but are driven out by the founder male Banke. Although the founder male is losing its dominance but it is still active in breeding and from time to time drive the young males out of the fence. But due to lack of escape space inside the existing rhino area male rhinos usually go out of the fence area or shifting the area frequently to avoid any direct conflict. It is therefore possible that some of the fully mature male rhino are straying out side the rhino area in nearby areas.

(iii). Use of the Rhino Reintroduction Area (RRA) by migratory elephants

Another problem, which is going to be a major problem unless until precautionary measures are taken in maintaining the fence intact, is the presence and movement of migratory herd of wild elephants in Dudhwa National Park. Till 1992, usually elephants of 4-35 in a group used to migrate from Pilibhit forest to Kishapur WLS to Sathiana Forest Range and then to Banke Taal. These elephants till the sugar cane was available in fringe cultivation adjacent to rhino area, used to raid during late evening hours then come back to Salukapur and shared the sugar cane provided to riding elephants and go back to Banke Taal grassland or Bhadhi Taal area. Occasionally, they tried to go inside the rhino area due to inactive fence. These elephants make two groups one with females and calves and another is exclusively males of different age. In the recent past group size has also increased in number over 60 elephants in single herd. Usually males of different ages are daring enough to bend the fence pole and come inside the rhino area and stay for days and go out. During this period they can be a threat to riding elephants with visitors or Patrolling team..

These herds also visit the Bhadhi Taal and Churella area and precaution should be taken because after completion of fence these herds will try to push poles from different side to enter the area. There is need to erect latest designed electric fence made against the elephant's attacks by pushing and bending of fence poles. Another important factor is for the safety of the people working in around fences area patrolling party and protection staffs along with riding elephant have to stay near by should be given protection by erecting a separate fenced area to avoid any unwanted incidences. Usually elephants go in search of food and salt to such camps and raid during late nights.

(iv). Increasing Population in the existing RRA

Increasing population of rhino in the existing area is also a major problem. The current rhino population is 28 rhinos in 25 sq km of RRA which is a fenced area. Either a new area can be selected for rhino translocation in Dudhwa Tiger Reserve

or the enclosure should 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). Recently four rhinos went outside the RRA and are regularly raiding the croplands. The rhinos also killed two villagers. In response to these situations, it is better to keep the rhinos in enclosure. And hence, there is a need to select some new area inside the Dudhwa National Park. In the light of above facts, in 1991, there was a recommendation for the urgency of creating another viable breeding population of rhino in Dudhwa National Park and proposed Bhadhi-Churella Taal sector in Belraya Range of Dudhwa National Park.

4. PROPOSAL

I. Priorities in the selection of rhinos for introduction in the New Rhino Area- Bhadhi Taal - Churella Sector in Belraya Range of Dudhwa NP

Priority Options:

(i) Rhinos straying outside the existing Rhino Reintroduction Area

It has been observed that from time to time rhinos stray out of the rhino area. These rhinos cause crop damage in the neighbouring cultivation. During daytime they take shelter in the buffer forests. Efforts have been made to push these rhinos inside the fence with the help of riding elephants but efforts were futile. On many occasion female with calf tried to attack the elephants and people on foot. Earlier the female rhino has been killed a villager in the buffer forested area. Therefore it is essential to translocate these animals as early as possible after the installation of fencing around Bhadhi Taal area. Migratory herd of elephants enter the rhino area by pushing fence pole which damages the fence and makes escape routes for rhinos. There are possibility that some of the rhinos can go out of rhino area when fence is open and unnoticed in those areas where approach is not easy especially during the monsoon months and for some days fence is non-functional.

(ii) Rhinos from Existing Population in Dudhwa NP

Translocation of young males and females from the existing population to a newly fenced satellite area so as to provide immediate relief from infighting between the dominant and young males and inbreeding. The area identified is well drained out suitable grassland for Rhinos and is physically separated from the existing RRA so as to minimize the operational difficulties and intra specific conflict situations arising out of operational failures of the fence.

(iii) Translocation of rhinos from Katerniaghat WLS

Since 1989, 3 to 5 rhinos from Bardia NP regularly move to Katerniaghat WLS and also breed. In view of their security and safety these rhinos can be translocated to Bhadhital area along with few rhino from existing rhino area of Dudhwa NP to maintain genetic vigour. This should be done with consent of Nepal authorities and common understanding.

(iv) Wild rhinos from other population with in the country or from Nepal

Wild rhinos can be procured from Jaldapara WLS and Gorumara NP, West Bengal. Other alternative is to procure rhinos from Royal Bardia NP or Royal Chitwan NP, Nepal. Matter can be pursued at the Government level and such a effort would incur more time and expenses.

II. Hiring Experts for Rhino Immobilization, Translocation Operation of Rhinos into the New Rhino Area

In the case of mega herbivore immobilization, its translocation and shifting of animal in to the new area needs special skill and expertise. Total cost of the entire translocation operation has been included in the proposed budget of the project. The amount will cover all the operation cost which includes hiring charges of experts, travel cost, per diem, transportation, Immobilization, labour involved and building of stockade or mini fence before release of the rhinos into the main fence.

5. Policy Statement about Future Plans for Rhinos in Dudhwa NP

As per the final recommendations of the Rhino Sub-committee of the Wildlife Status Evaluation Committee of IBWL (1980) in the Translocation of Great India Rhinoceros in Dudhwa National Park:

1. The U.P. Forest Department had proposed an area of approximately 90 sq kms in the southwest part of the park (South Sonaripur and South Bellarian Ranges): as providing most suitable rhino habitat. It includes a 15 km long tract of grassland on the southern boundary of the park bordering the Suheli River. Fifty percent of the area is subject to seasonal floods and an area of 560 hectares is permanently swampy and water logged. The Committee felt that area was highly suitable. A disadvantage of the area proposed is that an adjacent to the southern boundary of the park (Suheli River), which lack of buffer zone and outside of which is an area of dense human occupation and cultivation. There is thus a danger of rhinos wandering across the river and causing damage to cultivation and possibly to human life.
2. In order to prevent rhinos from wandering across the park boundary from the proposed release area, a rhino-proof barrier should be erected parallel to the right bank of the Suheli river from the point where the Dudhwa/South Sonaripur inter-range bordering joins the southern park boundary to a point on the park boundary south of Salukapur FRH. The distance is approximately 11 km. The type of barrier erected initially as experimental. Size of the trench will be 2X2X1 m the outer slope being brick lined to prevent scouring. 60 m sections of the trench will be alternated with 15 m sections of iron fencing so as to avoid water flow in these trenches turning it into 'Nullah'. Regular maintenance of the trench will be necessary.
3. An initial release should consist of six young adult animals (2 males: 4 females).
4. Further release in Dudhwa should be planned based on the experience with the initial six animals. A total release of up to 30 about over 5 years, in the South Sonaripur /South Bellarain Range is recommended. The area of 90 sq km proposed as suitable for rhinos are able to accommodate a maximum 90

animals but clearly rhinos must leave space for future population growth by reproduction. A limiting factor might prove to be the availability of funds for further fencing of the southern boundary depending on which type barrier eventually proves to be most suitable.

5. IUCN, Species Survival Commission, Asian Rhino Specialist Group in their, February, 1999, conference at Kaziranga National Park considered rhino population to be viable if their minimum number is 2500 in the wild in atleast 10 population, each of minimum 100 rhinos in each sites. With the present pace of growth in the population this figure will be achieved in 25 years. Till that period present electric fence is to be expended and maintained.
6. As the boundary of the park conjoins agriculture and human habitation almost all over, man animal conflict with respect to the rhino is invariable, the moment electric fence is removed. In order to avoid such conflict it is advisable to construct trench cum fence this will prevent not only rhino but also almost all the wild animals straying out side Dudhwa National Park. Resources for this purpose will be gathered either internal funding or with the help of other funding agencies in the field conservation particularly wildlife.

6. AREA SELECTION FOR CREATING SATELLITE POPULATION

In early 1980's , The Rhino Subcommittee of Indian Board for Wildlife (IBWL) had identified the Bhadhi - Churella sector in Belraya 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 was carried out by the Botanical Survey of India (Hajra, 1980), and Sinha and Sawarkar (1991), Sinha et.al, (2003). Detailed survey of the vegetation of Dudhwa special reference to Bhadhi Taal area in relation to the rhinos feeding ecology. The detailed study clearly established a number of floral elements common to Dudhwa National Park and Kaziranga both of which are excellent rhino habitats.

The Bhadhi - Churella Taal area identified by Sawarkar and Sinha (1991) was also recommended in the management plan of Dudhwa NP by Dey (2001) and Mishra and Tewari (2002), for the creation of a satellite rhino population. In 2003 and again in 2009, the area was surveyed for its habitat suitability and found fit for rehabilitation of Rhinos. A detailed vegetation study in proposed rhino area in Bhadhi - Churella Sector was carried out by Sinha et.al (2003). In 2002-2003 erection of power fence and poles was started around Bhadhi Taal - Churella sector but due to some reasons could not be completed. The area to be power fenced in the Bhadhi Taal -Churella Taal sector was on the basis of number of animals in the population to be translocated. Currently the area supports migratory herd of elephant, swamp deer, sambar, spotted deer, hog deer, barking deer, otters and large number of migratory and resident birds along with tigers.

The advantage of the area selected is that it is in the central location of Belraya Range. There is no danger of rhino wandering in the human habitation and cultivation in case of failure of power fence. While in case of existing rhino re-introduced area, it is adjacent to the southern boundary of the park, with dense human settlements and cultivation. Bhadhi-Churella sector is centrally located and sufficient forested area is available in northern part and demarcated by Mohana River as the international boundary with Nepal.

The habitat requirement of Rhinos, the Bhadhi -Churella Taal sector fulfills the basic need like adequate forage availability, wallowing, shade of woodland for resting and calving and for free movement. The area comprises of Sal and Mixed forests (2,416.36 ha), Grassland (1,203.68 ha) and Wetland/ Swamp (129.00 ha), which fulfill the need of rhino, and is one of the prime rhino area in Dudhwa.NP.The proposed rhino area of Bhadhi-Churella sector will comprise of 25 kms long fencing enclosing an area of 3036.72 hac as rhino area.The location map of Bhadi-Churaila sector is enclosed (Map.1.)

THE DETAILS OF THE AREA TO BE FENCED ARE AS FOLLOWS:

Block/ Comp.	Sal Forest (ha)	Grassland (ha)	Wetland/Swamps (Ha)
Bhadhi -1a,b	189.39	-	-
Bhadhi-2	180.09	-	-
Bhadhi-3a,b (part)	369.47	300.00	-
Bhadhi-3c	4.86	354.88	105.00
Bhadhi-6a	88.63	9.31	-
Bhadhi-6b	-	53.83	-
Bhadhi-7 a,b	346.81	4.36	
Laudaria-1 a,b	466.61	40.06	-
Laudaria-2 (part)	35.39	15.0	-
Laudaria-3a,b	294.21	346.00	24.00
Laudaria-4 (part)	9.72	20.30	-
Laudaria-5	128.69	25.4	-
Laudaria-6	182.51	40.42	-
<i>TOTAL</i>	2,416.38	1,203.68	129.00

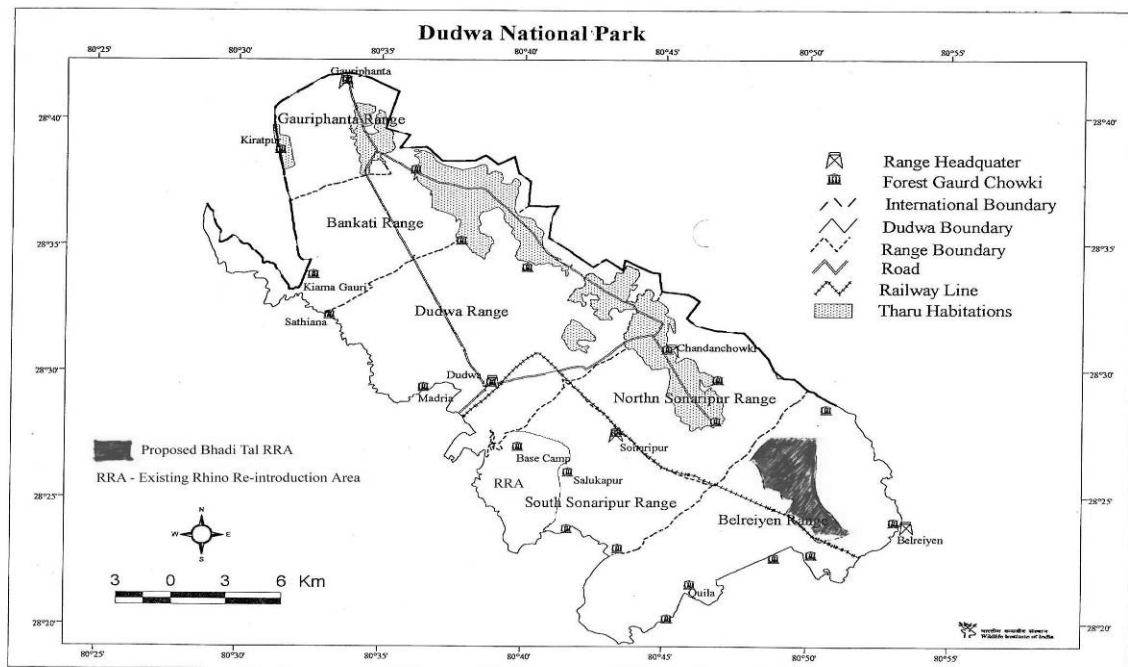
(Source: Management Plan of Dudwa TR by Rupak Dey (2001))

Total Fenced Area - Approx 3036.72 hac or 30.367 sqkms. Total length of the fence - Approx 25 Kms

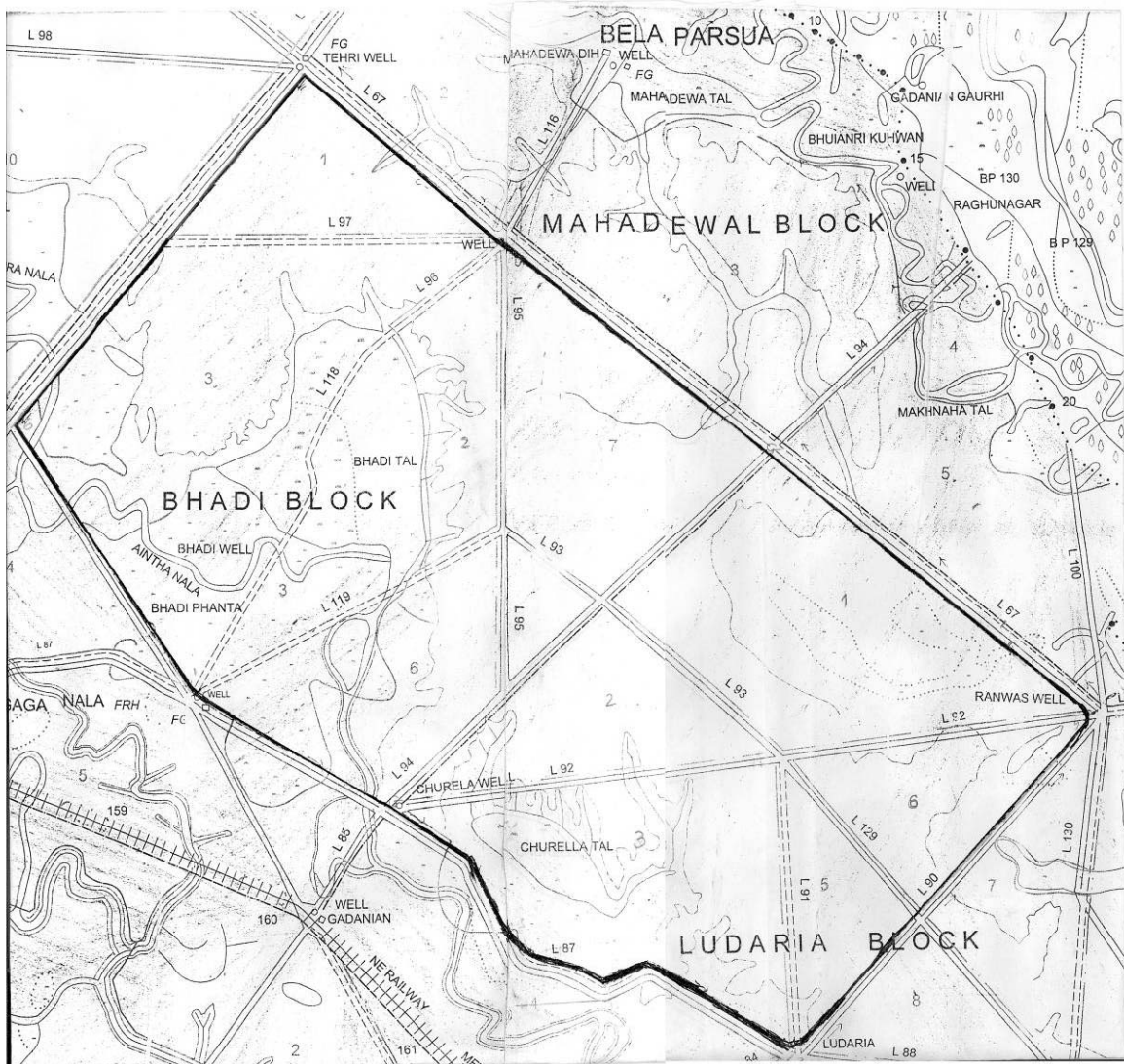
7. Construction of Heavy duty Stockade

Before releasing the translocated animals into the main fence, Animals are kept in stockade for at least for 2-3 weeks till the animal gets acclimatized with number of factors provided with least human disturbances. Total area inside the individual stockade unit should be 54 sq m, female with calf then area should be increased. Details are given in the figures. In this particular period animal cool down after a stress period and get established.

The big confined wooden cage / enclosure on the ground should be provided with small water ditch and container with fresh water. Regularly locally available fodder grass, sugar cane and bersene should be provided. Since animal do not have prior experiences of electric shock of a fence or might have forgotten the earlier experience. It is advisable have to have an electric fence around stockade. So when animal is released from stockade it should experience the shock. Otherwise direct release into the main fence will not be effective and animal will break the fence and go away repeating the same story.



Map.1. Dudhwa NP & Proposed Rhino area (in Red Color)



(Scale 1 cm: 250 m)

Map.2. Showing demarcation of proposed Rhino Area in Bhadhi - Churella Taal Sector in Belraya Range of Dudhwa National Park

8. COSTING:

Besides fencing the area by erecting rhino and elephant proof fence, maintenance of existing roads, elephant shed; check post & barracks needs to be constructed for the monitoring staff. The Rhino Monitoring Station is proposed at Chhanganala. After the translocation of Rhinos monitoring of individual animal will be carried out till the translocated animals get established in the proposed RRA in Bhadhi - Churella Taal area. The total Costing of the current project is given in the Table.1.

9. EXPECTED OUTCOME

The creation of the Bhadhi satellite area for the Rhinos will reduce the prevailing conflict situation among the males and severe inbreeding in the existing population. Moreover, 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. The all round increase in the status of protection of the area will help to proliferate other endangered wildlife such as Hispid Hare and Bengal Florican. These expectations are based on the observations recorded in the main RRA. This area will also ready to receive fresh batch of Rhinos. Moreover, there exists a viable connectivity between the existing and proposed RRAs through the grasslands of Bankey Taal and Rehta sector. Thus the two populations can also be joined in due course of time when the Rhino population increases by extending the fenced areas and only possible if the railway line is dismantled in near future which is the major barrier between two potential rhino areas.

Table.5. Proposed Budget (Five year project to be regularize with Rhino Project of Dudhwa NP for further funding)

No	ITEM OF WORK	UNITS	RATE (In Rs.)	COST (In Rs.) 1& 2 year budget	3 year
1.	Installation of the rhino & elephant proof fence (Includes GI poles, heavy coated GI wires, Energizers, Solar panel, Batteries, Installation charge etc.)**	25 km (Five strand)	Approx 3 to 4 lac per Km	75,00,000.00 (Calculated @ 3 lac per Km)	-
2.	Ground leveling and clearing of ground for fence installation	L.S.	-	2,00,000.00	-
3.	Construction of Gates to enter the fenced area	06	20,000.00 per gate	1,20,000.00	-

4.	Construction of Elephant shed	02	4,00,000.00 per shed	8,00,000.00	-
5	Construction of Forest Guard chowkies, Barrack, Kitchen etc. for forest guards, Mahouts, Chara-cutters and Fence watchers.	LS	-	15,00,000.00	-
6.	Salary/wages of Mahouts for 24 months*	04	5000.00 per month	4,80,000.00	2,40,000
7.	Salary/wages of Chara-cutters for 24 months *	04	3000.00 per month	2,80,000.00	1,40,000
8.	Salary/wages of fence watchers for 24 months*	10	3000.00 per month	7,20,000.00	3,60,000
9.	Cost of translocation of Rhinos from different locations including hiring experts	L.S	-	15,50,000.00	-
10.	Purchase of Arms and ammunitions	L.S	-	3,00,000.00	-
11.	Purchase of four departmental elephants	LS	5 lac per elephant	20,00,000.00	-
12.	Alignment of roads for patrolling inside and outside the rhino fence area	L.S	2.5 lac per year for 2 years	5,00,000.00	2,50,000
13.	Trench inside & outside the fence	L.S	-	10.50,000.00	-
14.	Deepings of water bodies	L.S	-	10,00,000.00	-
15.	Construction of heavy duty Stockade	L.S	5 Unit fenced/ partition	8,00,000.00	-
16	Habitat and grassland management	L.S	Inside the fenced area	6,00,000.00	3,00,000
17.	Research project on Monitoring of	3 year	Rs 19,70,000	29,90,000.00	10,20,000

	rehabilitated rhinos : 1. Project Coordinator (1) 2. Field Biologist (1) 3. Field Assistant (1)		for first year, for second and third year Rs 10,20,000 for each year		
TOTAL RUPEES			(Two crore and twenty three lac and ninety thousands only)	2,23,90,000.00	23,10,000

* Later inducted as per the official rules and scale

Table.6. Year-wise proposed budget

S.No.	First & Second year(In Rs)	Third year	Fourth year	Fifth Year
1	2,26,,00,000.00	23,10,000	12,90,000*	12,90,000

**PART- III. PLAN OF ACTION FOR TRANSLOCATION OF RHINOS IN
DUDHWA NATIONAL PARK, UTTAR PRADESH**



INTRODUCTION

Reintroduction of mega herbivore from existing population into its former range of distribution is being practiced long back in African countries. In India, for the first time Indian one horned rhinos were brought from Pobitora Wildlife Sanctuary, Assam and The Royal Chitwan National Park, Nepal in two batches in 1984 & 1985 in Dudhwa National Park. A total of nine rhinos were translocated. The current rhino population is twenty one from a five founder populations comprise of one male and four females. In last couple of years due to various reasons five rhino are strayed out of the main rhino fence. This has been already mentioned in our report on twenty years of rhino reintroduction in Dudhwa National Park. Main task is to recapture the straying rhinos back into newly erected fence adjacent to main Rhino area in Dudhwa National Park. Considering the problems of crop raiding by rhinos and more severe problem is the number of cases of human death due to rhino attack and injuries. This may increase in future and is an urgent need to translocate back these rhinos. Otherwise in retaliation villager can take an unwanted step which is against the conservation plans of rhinos. Till the Bhadhital new rhino area is ready the captured rhino will be kept in the erected fenced area.

Before any translocation operation needs a phase manner preparations for a successful operation are as follows:

- 1. Planning & Preparatory Phase**
- 2. Training Phase**
- 3. Operational Phase**

1. PLANNING AND PREPARATORY PHASE

In this phase a detail action has to be discussed and planned, its requirements and how to proceed. A detailed ground work has be completed depending on the resource availability and current need.

(I). Formation of Teams with designated Task

- A. First team which comprise of team leader operate the entire operation, Darting person, veterinary person, People help to restrict the animal in the field along with elephants and Mahouts during capturing of the animal
- B. Second team will comprise of atleast 15-20 people to assist during down loading of tranquilized rhino into the crate and safe transport to the site. Since it is a team work and during such operation number of people is needed.
- C. Third team will be ready at the site of release of animal in the Stockade inside the fenced area.

(II). Availability of Darting Equipments

1. For a safer side keeping ready two to three set of darting equipments along with the doses. This will help during darting of rhino in the field. Keeping 2-3 set of darting guns always increases the probability of darting of animal than keeping a single gun and takes longer period with uncertainty. For this exercise 4 persons have of be trained under an expert and possibly experts should be involved in this operation.

(III). Drug Used for Immobilization

The drug combination was Immobilon L.A. (Reckitts and Colman Pharmaceutical Division, Hull, England). This consists of Etorphine hydrochloride 2.45 mg and Acepromazine maleate B, Vet C 10 mg in each ml. The drug was delivered by the syringe projectile intramuscular as far as possible. The effects of Immobilon were reversed by the intravenous injection of an equal quantity of Revivon L.A containing Diprenorphine hydrochloride 3 mg per ml.

One advantage of Etorphine is that being extremely potent (10,000 times the potency of Morphine) only small quantities are required. This makes particularly suitable for delivery by a syringe projectile system, where a lighter dart has more stable flight characteristic than a heavier one, assisting accurate placement at the target site. The case with which the effect of Etorphine can be reversed using

Diprenorphine is another reason for the choice of this drug. A further feature is that it has a wide safety margin, reducing the possibility of over dose.

Precautions:

Immobilon L.A. is extremely dangerous if accidentally injected into humans or even absorbed through skin and great care must be exercised in its use. **The best antidote in cases of accidental administration to man is NARCAN** (Winthrop Lab, Surbiton, UK) which is a naloxone hydrochloride 0.4 mg/ml. A human kit containing vials of this drug and a suitable syringe for injection was carried at all times in the field. One serious problem with the use of etorphine in India is that neither of the human antidotes is available in the country (the second choice antidote is Lethidrone). It is therefore vitally important the Narcan or Lethidrone be imported along with the immobilon, the use of which should be not be contemplated under any circumstances unless one of the human antidotes is to hand.

(IV). Prior Preparations at the site of release

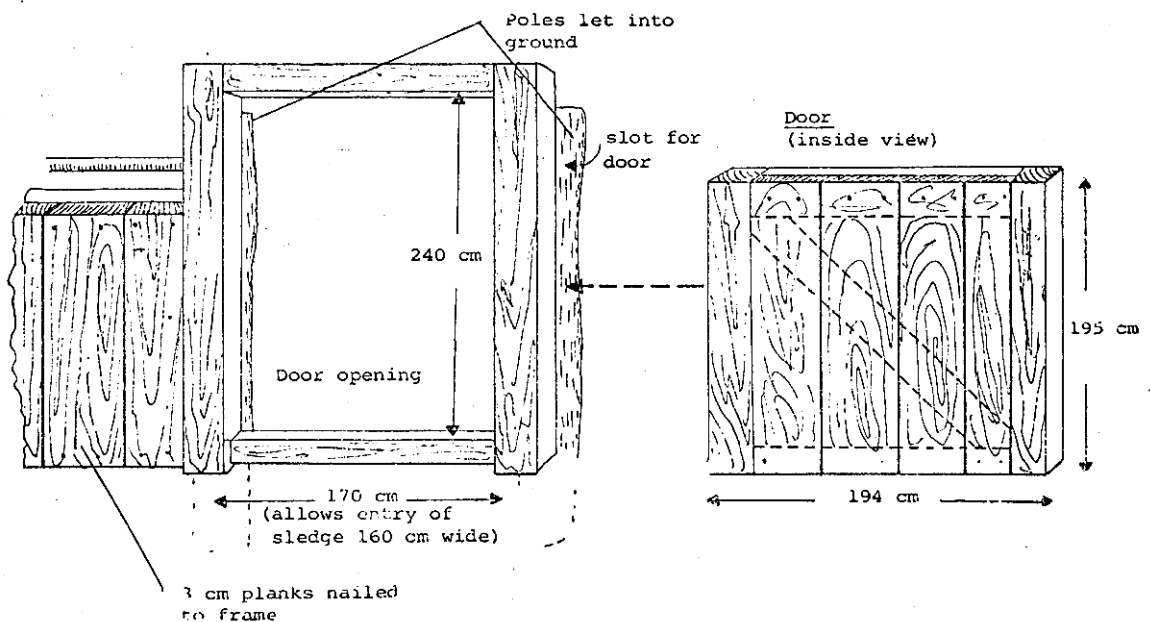
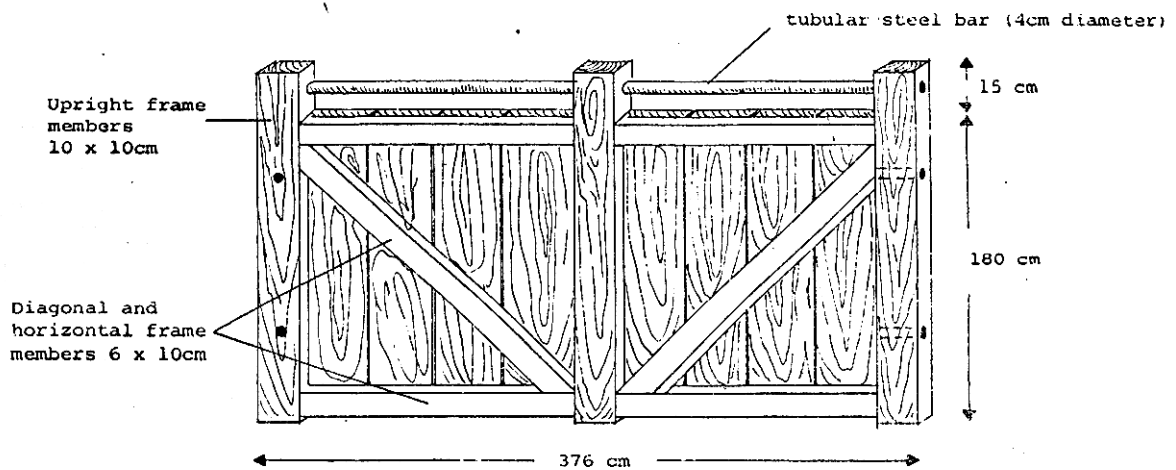
a. Fencing of release site

Proper fencing around selected area by considering the availability of fodder grass, Woodland as shade and water body depend on the number of animals translocated area span must be considered.

b. Construction of Heavy duty Stockade

Before releasing the translocated animals into the main fence. Animals are kept in wooden made stockade for atleast for 2-3 weeks till animal get acclimated with number of factors provided with least human disturbances. Total area inside the individual stockade unit should be 54 sq m. If female with calf than area should be increased. Details are given in the figures. In this particular period animal cool down after a stress period and get established. The big confined wooden cage / enclosure on the ground should be provided with small water ditch and container with fresh water. Regularly locally available fodder grass, sugar cane and bersene

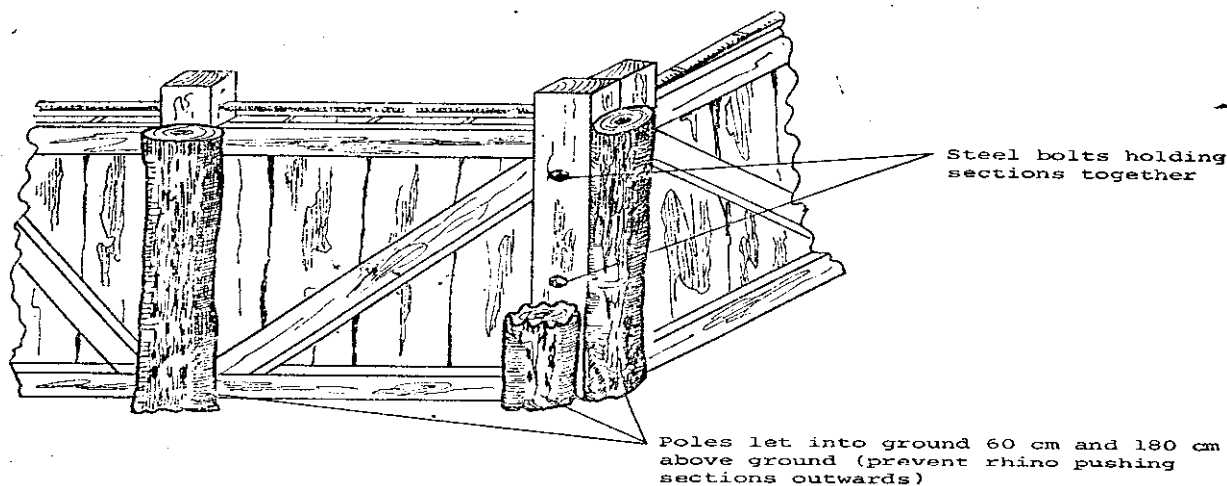
should be provided. Since animal do not have prior experiences of electric shock of a fence or might have forgotten the earlier experience if animal is too long was way from such situation is advisable have a electric fence around stockade. So when animal is released from stockade should experience the shock. Otherwise direct release into the main fence will not be effective and animal will break the fence and go away repeating the same story. Main reason is that since the stray animal repeatedly harassed by the people in the crop fields and animal has to shift one place to another to hide itself. Due to all these reasons animal behaviorally changes towards the human presence and severely distressed.



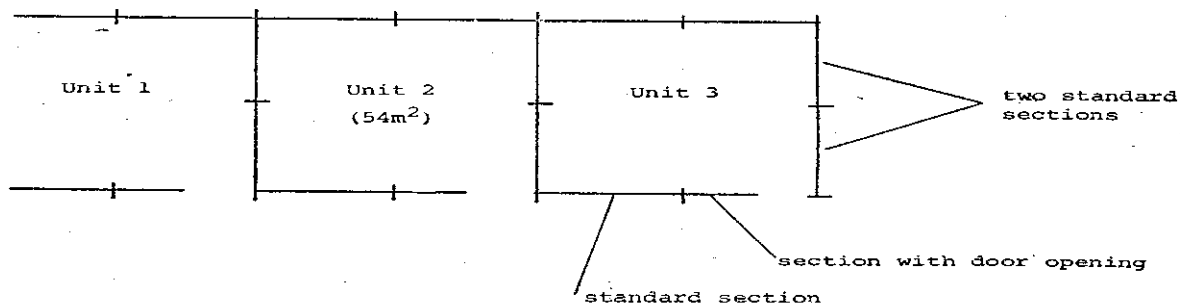
c. Construction of Sledge

It is often impossible to get a truck to the immobilization site due to steep slopes, uneven or swampy ground, thick ground cover in sugar cane field and in thick jungle. In such cases an interim transport phase is necessary wherein the still immobilized rhino is moved from its resting place to the waiting crate and truck from 50 m to few km away. For this initial journey the rhino is placed on a sledge (King, 1969) which is then pulled by elephants or a vehicle to the site where the animal will be transferred to a Crate.

The sledge should be very strongly constructed as the weight of a over 1 to 2.4 tons of rhino places enormous strains on the structure as it is dragged over rough terrain. It should have sufficient clearance to avoid smaller boulders, vegetation cover and stumps to facilitate loading of the rhino onto it. Length should be slightly longer than a large rhino and 360 cm was found to satisfactory. Width of the sledge should be such as to comfortably accommodate a rhino lying on its side (an also be capable of being inserted into the crate to facilitate loading) and 160 cm was found satisfactory. Strong towing hooks should be fixed at both ends of the sledge to enable it to be pulled in either direction, which is important when maneuvering it into position. Runners should likewise be tapered at both ends and steel shod to reduce drag and damage by stones. Handle of both sides of the sledge facilitate shifting it into position alongside the rhino by hand and also provide anchorages for ropes used to secure the rhino to the sledge when loaded. Nylon ropes should not be used for this purpose as they may cause burns on the skin.



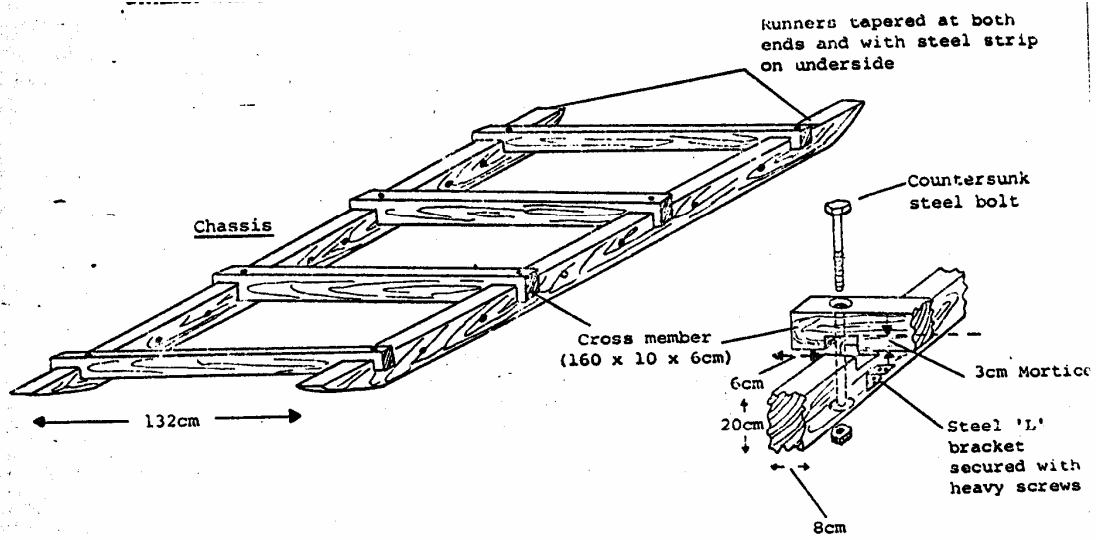
Formation of sections into units



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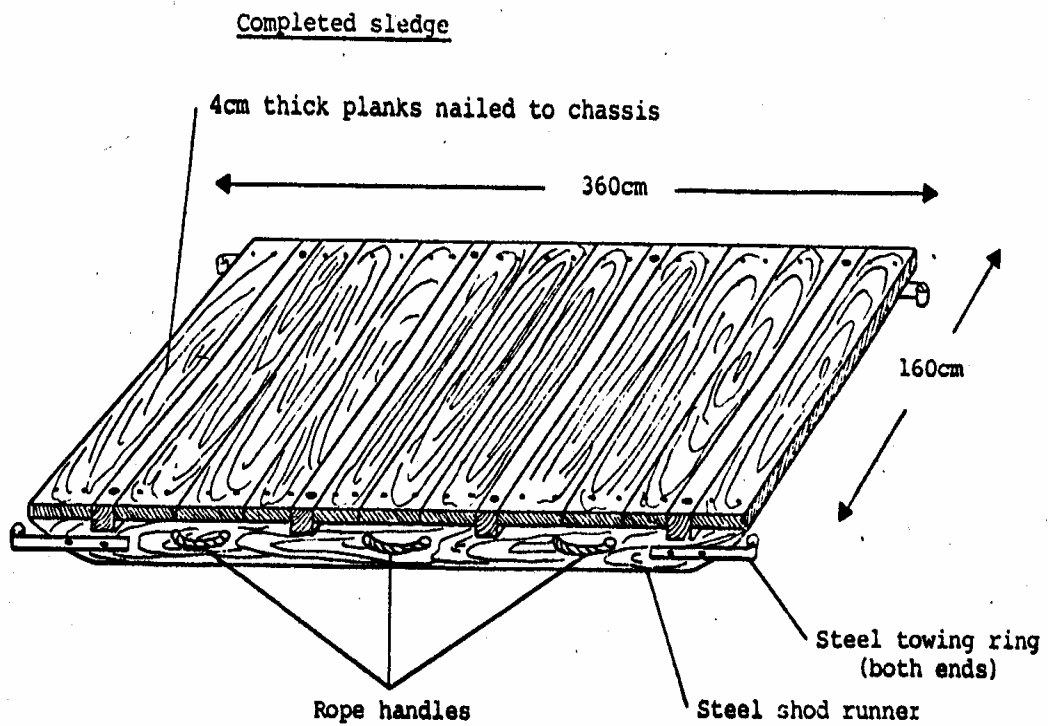
Loading of Sledge

Elephants are the best source for dragging the sledge in dense jungles or over extremely uneven ground. On flat, fairly even tractor, jeep and in adverse condition people can drag the sledge but not advisable because needs large number people and time is the limiting factor on this moment.



Timber for sledge, crate and stockade - sal

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d. Construction of Cage / Crate

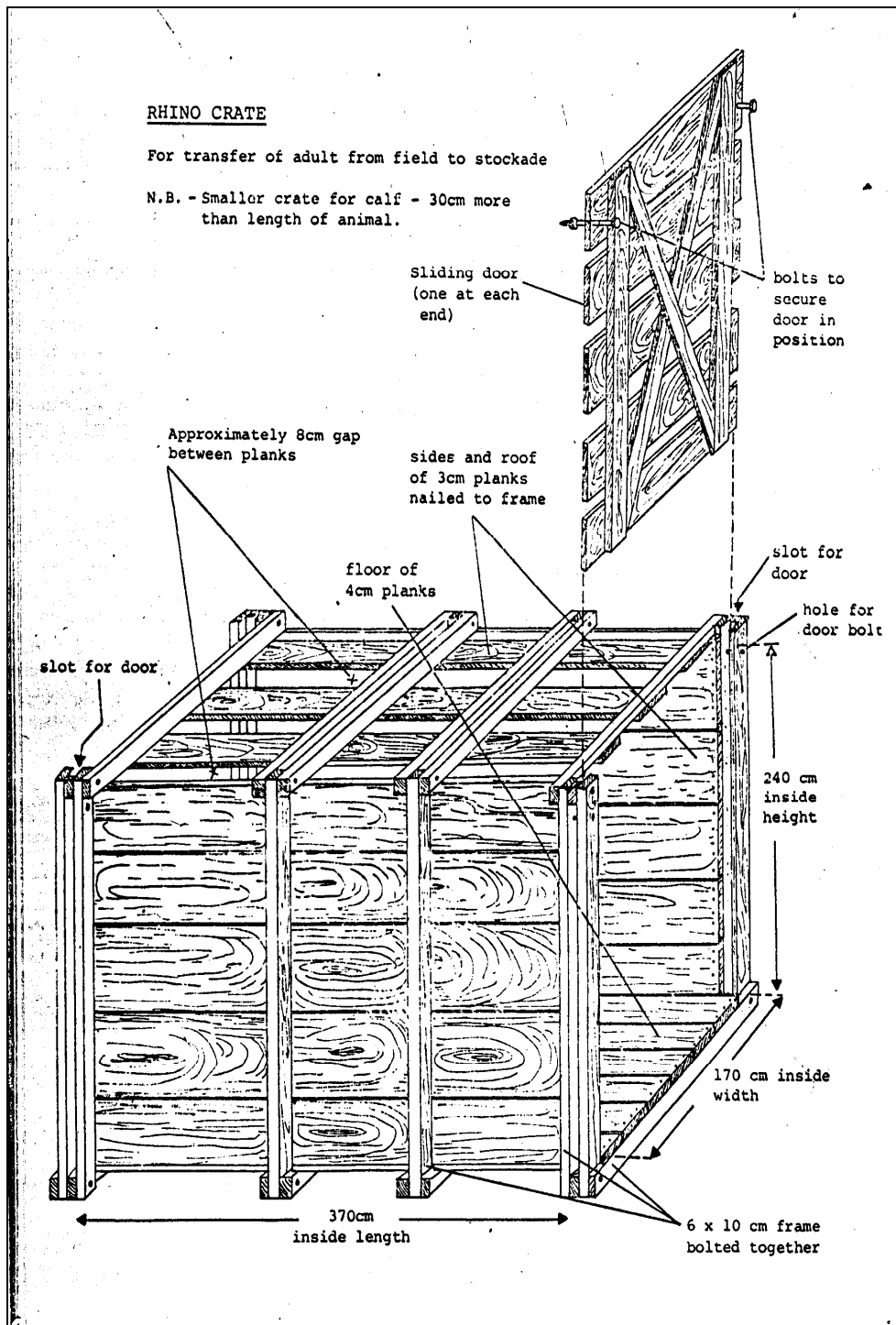
The crate should be extremely robust construction as a rhino makes persistent attempts to destroy it after revival. Internal dimensions recommended are 370 cm long, 170 cm wide and 240 cm high. Side timber should be planed smooth to

prevent them from scratching the rhino, as it is jolted around during travel. It should have a drop door in runners at ends, allowing manipulation of the rhino in the crate from the front or back and enabling it to exit from the crate forwards, on arrival at its destination. Details are given in the diagrams.

e. Loading of Crate

Because of the impossibility of lifting a loaded crate onto a truck in the field, it is necessary to load the rhino into the crate while it is roped to the truck. In order to facilitate this difficult operation it is desirable to lower the rear of the truck into the ground to bring the floor of the crate to a level near that of the sledge.

If it is impossible to dig a ramp into the ground, it is necessary to have a short wooded ramp available to bridge the gap between the sledge and the crate. As nearly as possible, sledge and crate should be horizontal and the sledge should be correctly aligned with the crate to facilitate loading of the rhino.



Once the rhino is safely in the crate, its legs should be untied and the Revivon injection administered. The crate door(s) should then be quickly closed and the secured with bolts in anticipation of the animal reviving with couple of minutes of the Revivon injection.

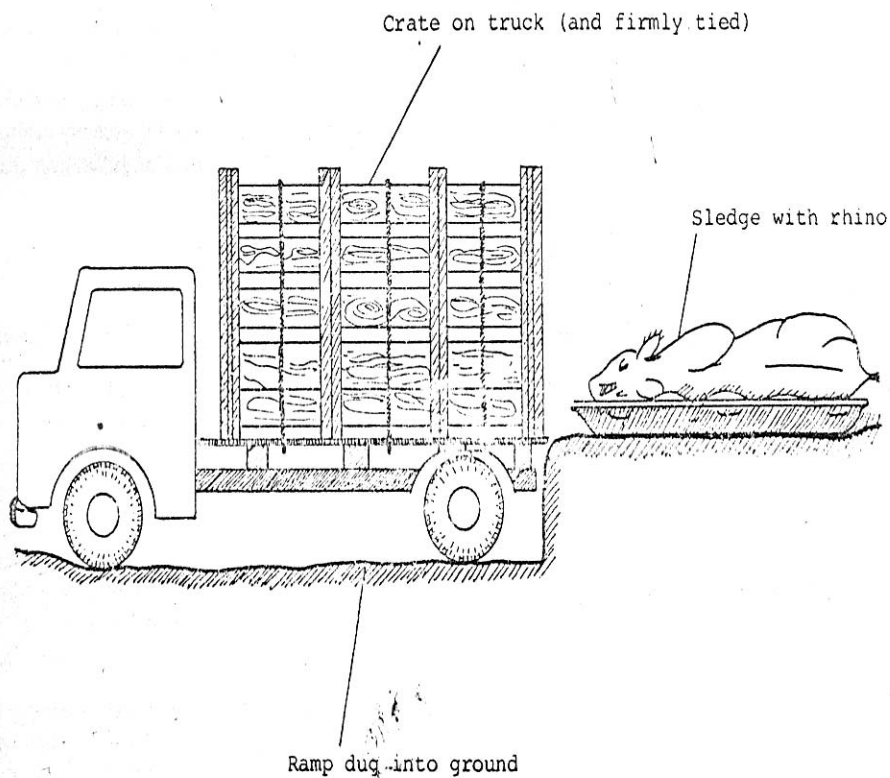
Precaution should be taken if sledge is kept inside the crate because during transportation period by jerk and use of break sledge can push back ward. This can be fatal and break the crate door or damage it. In view of this to intact the sledge into crate. Sledge should be tied firmly from trucks driver side properly with help of strong thick wire. So during transportation sledge become intact inside the crate. Otherwise removal of sledge during transferring animal with the help of conveyor belt is the only alternative to avoid any mishapening. This has been already tried during our current rhino operation near Sitapur area.

Gap between planks in all the four side should be least as possible and all the four side should be covered by gunny bag cloth. So animal should not see the surrounding specially the people around.

f. Unloading of Crate to destination site

The crate containing the rhino is best removed from the truck by using a crane. If a crane is not available, a ramp may be dug into the ground near to the door of the holding accommodation. After the truck has been reversed into the ramp, men or elephants may be used to push the crate from the truck to the door of the holding pen using poles as rollers.

Once the front door of the crate is aligned to the door of the pen, both these doors should be opened and the rhino allowed walking out of the crate of its own, even if this takes time. As soon as the rhino is in the pen, the pen should be closed and crate is removed or reloaded onto truck for a further operation.



2. Training Phase

This one the important part before going to the operational site.

Designated team member should practice in the field in a scheduled period of time. Since after immobilization is completed the animal has to be revived within 45 minutes to one hour depend on the reflections of animal. In this short span of time available animal has to be locating first and shift the animal with help of sledge to load into the crate before its revival. Here time and swift action is the major factor to be completed within the prescribed time.

3. Operational Phase

Before reaching the operation site a list of equipments and other items should be check properly and again checked after reaching there and briefing to different teams. If possible at-least four to six mobile hand set should be distributed to individual team leader. This can be used during the immobilization operation over elephants and keep regular contact with the individual persons on the elephant as well as the loading team which stays away from the site.

4. Monitoring of translocated animals

Just after the translocation of fresh batch of rhinos into the new area animals are supposed to monitor on daily basis to monitor its activities closely. The main reason is to observe the reaction of rehabilitated rhinos translocated in a new area. Earlier in Rhino Reintroduction Area in Dudhwa NP when rhinos were translocated rhino were monitored on daily basis to study the habitat use, behavior studies and health conditions. It provides regular data collected on different aspect on daily basis and have 25 years of regular data which usually not available elsewhere. Once the animals get acclimatized it start breeding which is healthy sign because animal do not breed under stress condition if not properly get settled into a new year. In such circumstances management input is needed and also to find out the reason.

Observations on the immobilization of rhino in Sitapur area on 2nd November, 2004 (Team Members : Mr.S.P.Chowdhury and Dilip Chakraborty, West Bengal Forest Department, Dr SP Sinha and Mr PP Singh, IFS, Deputy Director Dudhwa NP/TR 2004)

1. Sex of Rhino : Male
2. Approx Age : +12
3. Length 1.15 meter
4. Horn Size: 5.5 Inch
5. Height of rhino: 5 feet
6. Horn Base Circumference: 16 inches

Physiological Parameters noted in different time:

1. 12.34 noon: Male rhino was darted by using 2.5 ml of Immobilon
2. 12.38 noon : Immobilized Rhino was located
3. 12.49 noon

Respiration Rate: 6 per minute

Pulse Rate: 56 per minute

Body Temperature: 100 F

4. 1.05 noon:

Pulse rate: 56 per minute

Respiration rate: 8 per minute

5. 1.09 pm:

Pulse rate: 56 per minute

Respiration rate: 6 per minute

7. 1.20 pm:

Pulse rate: 56 per minute

Respiration rate: 3 per minute

Body Temperature: 102 F

8. 1.35 pm: Same as Above

Cardiac Stimulant injected (Decdem-8ml)

8. 2.06 pm :

Revivon Injected

9. 2.09: Rhino Stand on feet dashed back the door and ran out of the crate

On 11 Jan, 2005

Same rhino reached near Moradabad-Kashipur road in Abdullah Village.

Around 4:25 rhino was sighted and immobilised and within 10 minutes it was on the ground. Immediately with help of sledge and conveyer belt drag to the loading site. At 6:15pm it was finally loaded into the truck safely. Revivon was given to interveniously and water spread over head and animal immediately responded. Since animal was badly injured and need proper treatment was send to Kanpur zoo on the same night. It covered nearly 500 km from Lakhmipur Kheri near Dudhwa NP.Uttar Pradesh to Sitapur- Shajhanpur- Bareilly- Kashipur-Rampur and finally reached Moradabad.

Citation and Source:

Preliminary Report on Drug Immobilization and Transport of the Great India Rhinoceros by Dr.J.B.Sale, FAO Consultant & Technical Adviser to Govt of India: In India's Rhino Reintroduction Programme, Department of Environment Govt of India.

RHINO CONSERVATION AND ACTION PLAN FOR WEST BENGAL

1. Zonation and zone plans

The entire sanctuary is divided into 3 management zones namely.,

A. Wilderness Zone,

B.Habitat improvement Zone,

C.Eco-tourism Zone

This is necessary in order to ensure that some of the strategies of management, which are mutually exclusive, are well separated in the spatial frame and other strategies which are mutually compatible may be implemented in the overlapping zones. Clear identification of such zones in the sanctuary help in simplifying operations by the field level staff and reducing possibility of skewed achievement of certain objectives at the cost of other.

2. Conservation of Biodiversity

The wilderness zone, with no habitat manipulation activities and no outside interference, will be maintained primarily for the conservation of biodiversity, and to represent all the bio-geographic sub-zones of this sanctuary. Both the PA's lie in the bio-geographical zone (7b Lower Gangetic plain).

3. Control of Poaching of Rhino and other species and illicit felling of Timber

To achieve the above objectives, the strategy will be mainly building up protection network, developing infrastructure for better implementation of the rules and regulations, building up information network and building other State plan schemes. However, there is problem of procurement of cartridges as these

are normally supplied from ammunition factory at Khadki, Pune and such supplies are not forthcoming.

4. Strengthen wireless network

The erstwhile Jaldapara Wildlife Sanctuary, comprising an area of 116 sq km is having a well connected wireless network of frequencies. All the range headquarters, beat and most of the camps are provided with either fixed stations or mobile phones or walkie talkies.

5. Establishment of intelligence network for collecting information and provision of secret fund

The success of any protection job depends on the quality of information gathered by the management. At present the Assistant Wildlife Warden, the range officers and beat officers collect information through their personal level networks and informers. Since there is no such mechanism in the forest department for collection of information professionally, in most of the cases the information collection system becomes highly personalized and its effectiveness depends upon the initiative taken by the official concerned.

The mechanism of information gathering can become effective only when there is a specific provision for the same under the rules and when there is provision to buy information. Like in the police, customs, BSF and other enforcement agencies. Forest department should also have provision for operating a secret fund by the divisional forest officer to facilitate purchasing information regularly from the informers. The secret fund will be operated by the divisional forest officer from this fund will not be sent to AG, West Bengal along with the amount disbursed will accompany the accounts. This is required in order to maintain the secrecy of the source of information and to safe guard the lives of the persons supplying information. The power of divisional forest officer to operate such secret fund may be kept restricted to Rs 50,000 per year and the original vouchers will be

retained by the divisional forest officer confidentially which may be subject to audit verification on specific request.

Similarly, the system of paying rewards to informers for providing valuable information which has led to seizure/ confiscation of illegal wildlife products and arrested of persons involved in such illegal activities, will facilitate the flow of valuable information from the field / villages and other sources to the sanctuary managers.

6. Coordination amongst various law enforcement agencies

Since poaching is always associated with the inter-state and or International smuggling of the poached product, a regular coordination between various enforcement agencies like BSF, Railway police, Customs, Director of revenue, Intelligence, Police etc. For this purpose a coordinating body comprising the divisional forest officer, Asstt wildlife warden and representative of various enforcement agencies should be constituted. The divisional forest officer will be the convener of such coordinating body and the coordination meeting will be held at least once in every six months for sharing of vital information and to ensure further coordination amongst the field level staff working in the field level.

7. Incentive and rewards to staff

At present there is a provision for reward under the existing forest manual but the same is not sufficient to tackle the menace of poaching in the present day context. A proposal had been submitted by the Chief Wildlife Warden, West Bengal for approval. An immediate sanction of the scheme is required to ensure speedy flow of information on poaching / poachers and also to motivate the staff in taking risk while apprehending offenders.

8. Publicity, nature education and awareness generation

Dissemination of information on the objectives of management of the sanctuary to the local people as well as to all others is extremely important towards the efforts

of conservation of biodiversity and prevention of poaching. Such publicity and awareness can be generated by various ways and means.

9. Strategy for conservation and sustainable growth of rhino and other wild animal population

A. Habitat Improvement

Jaldpara Wildlife Sanctuary and Gorumara NP are the only two rhino habitats of the State and the Great Indian One-Horned Rhinoceros is the key-stone species of these Pas. The other associated species of the Pas are elephants, Gaur, Tiger, different species of deer, wild boar and a large number of species of birds, reptiles, amphibians and insects. Hence any habitat development activity should primarily aim at developing the habitat for rhino while, at the same time, preserving the habitat and the food base of other species as well. Since the food chain in any ecosystem is highly complicated and any large scale manipulation of the ecosystem may set in an irreversible process of degradation. One has to be extremely careful while carrying out habitat manipulation activities for the purpose of development.

10. Over wood removal and fodder plantation

Since rhino prefers riverine grassland and savannah grassland for food and shelter, controlling the invasion of grassland by the pioneer tree species is an important strategy for development of rhino habitat. Since the sanctuary has a comparatively small area as ideal rhino habitat and since the rhinos have to be kept restricted within the sanctuary areas, the process of over wood removal followed by artificial regeneration for maintaining grassland habitat is an extremely important component of management.

11. Plantation of Indigenous Grasses

Some of the prescribed important guidelines are:

1. Plantation areas include the over wood removal areas as well as forest blanks/degraded grassland.
2. Cleaning of weeds/climbers and control burning of the same should be done during December and January.
3. Eradication of weeds and burning of the debris should be done immediately before starting of soil work in the month of May.
4. Local and indigenous fodder species like *Saccharum* species, Nal, Khagra, Bhutagrass, Banspati, and Purundi should be planted. No exotic grass species will be planted anywhere.
5. No fodder plantation should be raised in forest areas which are close to the periphery/boundary of the sanctuary.

12. Weed eradication and climber cutting

Weeds and climbers are acute problems in Jaldapara Wildlife Sanctuary and Gorumara NP. The most common and proliferating weeds are *Leea* spp., *Cassia tora*, *Mikania* spp., *Eupatorium* spp., *Lantana camera* and *Clerodendron bengalensis*. Prolific growth of fern is also a special feature in Jaldapara as it assumes the form of weed and sometimes surprises the growth of grass. However, fern is not considered as weed since it plays an extremely important role in maintenance of swampy habitat. Among the fern spp like *Christella dentate*, *Diplazium esculentum* and *ampilopteris* proliferers are common. Removal of fern spp should not be taken up in the sanctuary under weed eradication programme.

13. Control burning of old grass plantation for natural regeneration of grassland

The fodder grass plantation, which were earlier raised in Jaldapara Wildlife Sanctuary, as well as the coarse fodder grass areas also start losing their importance as foraging areas since the rhinos do not prefer coarse and old

Dhadda grasses as fodder. All such older plantation and natural grassland with good stem density should be gradually taken up for cut back operations to be followed by control burning to facilitate regeneration of young shoots.

14. Control of wildfire

Accidental and man-made wild fire is common in Jaldapara WLS and Gorumara NP. Some of the strategies proposed are follows:

1. Existing fire line should be maintained and works completed by January and before the dry season set in.
2. During the dry period extensive patrolling should be taken up especially around the fringe areas where fires are set in by the graziers.
3. Efforts should be made through the eco-development committees to impress upon the fringe villagers the fringe villagers against creation of man-made fires.

15. Control of grazing by livestock of fringe villages

Grazing poses great threat to the habitat. A total of 32 fringe villages and 4 forest villages around Jaldapara Wildlife Sanctuary contain around 70,000 cattle. More over, nine tea gardens situated in the fringe area contain large number of cattle ranging between 12000 to 15000 belongs to local inhabitants. Domestic livestock from the fringe villages not only competes with the wild herbivores for food, they also spread diseases like Anthrax and foot and mouth disease among wild animals which can cause death.

Strategies planned to curb the problems by:

1. Extensive patrolling along the boundary and fringe including the prone areas.
2. Regular immunization of domestic cattle in the fringe villages against FMD, Anthrax and other deadly diseases.
3. Replacement of low yield variety of breed by high yield variety.
4. Involvement of local to check the illegal grazing inside the WLS.
5. Formation of milk producer cooperative in the fringe villages.

16. Construction of water harvesting/ recharging structures

Four cement concrete rectangular weir structures constructed on two perennial streams flowing through Harindangar Char under JP-5 compartment during 1995-96, have yielded excellent result in creating shallow stretches of wetlands and perennially inundating appreciable quantum of dry lands of Haridanger Char. Such inundation has been effective in suppressing thatch and lemon grasses colonizing in these areas and has facilitated regeneration of Typha, Dhadda and other palatable grass species.

Since such measures are most cost effective methods to improve soil moisture regime in the drier uplands of Harindangear Char, 20 such structures should be constructed in series, after proper contour survey of Harindangar Char. So as to create long stretches of shallow water pools along the existing perennial streams. Two such structures should be constructed per year and it should start from southern part of Harindangar Char and then proceed upstream towards northern part.

17. Proposal to Reduce Man-Animal Conflict

1. The entire forest boundary having interface with the villages. In the Jaldapara East, Jaldapara West and North ranges will be erected with power fence and these should be regularly maintained. Such fencing is required for Gorumara also without blocking the elephant movement route.
2. The local EDCs should be involved in maintenance of the fencings.
3. The villages in the other forest fringe areas may be encouraged to go for cultivation of Non-edible cash crops.
4. Awareness generation programme should be carried out with the help of EDCs for conservation of wild animals which occasionally stray out of the sanctuary.

18. Irregular shape of the sanctuary leading to large interface

The following strategies are proposed to resolve the problems:

1. By erecting power fence all along the exposed boundary of the sanctuary, barring through which elephants move in and out of the sanctuary during their normal migration.
2. Encourage social fencing around the sanctuary through the eco-development committees.
3. Generate awareness amongst the fringe villagers with regards to wildlife conservation and importance of the sanctuary.
4. Step up family welfare measures in the villages adjoining the sanctuary.
5. Take up literacy drive amongst the fringe villagers.

19. Transboundary Problems

The problem is concentrated mostly in Titi-1 and Joygaon-1, 2 Blocks of the Sanctuary adjoining the Bhutan Border.

20. Reintroduction Programme

Due to intra- species fighting will force some of the rhinos to move out of the sanctuary boundary. Since Chilapata Range of Cooch Behar Division and Nimati Range of Buxa Tiger Reserve are separated by a narrow corridor, it will be worthwhile to consider reintroduction of rhino in Buxa Tiger Reserve as third sub-population similar to rhino reintroduction programme of Dudhwa National Park. Uttar Pradesh

Rhino Action Plan for Royal Chitwan National Park, Nepal

The strategies of rhino conservation in Nepal are to ensure long-term viability of the one-horned rhino throughout its range, while minimizing conflict with people. Such objectives have to be achieved while continued increase in human population, economic influence of development on natural areas, and the need for land for agriculture and settlement.

It will not be possible to save Nepal's every rhino in terms of physical protection, but losses can be kept to a minimum if economic development plans take into account the needs of threatened wildlife species, and planning for conservation takes into consideration the needs of local people. Conservation of the rhino depends on the political will and concerted action of the government and people. Without political will and commitment, application of the conservation recommendations outlined here will be difficult although they are based on sound ecological, economic, and cultural arguments.

1. Habitat Improvement

a. Considering the rate of increasing in the rhino population in the Royal Chitwan National Park, it is apparent that the rhino population is likely to increase with the availability of the suitable rhino habitats and protection. Various studies suggest that at present, the rhino habitat in the RCNP is under utilized. However, the grazing pressure from the livestock's has rendered many ideal habitats literally unsuitable for rhinos.

b. Habitat improvement through weed elimination and plantation with indigenous grass species preferred by rhinos.

c. Uprooting of the weed and trees species or regular grass cutting so as to suppress their growth is likely to improve the rhino habitat.

Maintenance of fire line to avoid wild and man made forest and grassland fires.

d. Improvement of wetlands through desolation, control on invasion by undesirable aquatic plants and regular removal of water hyacinth are important.

2. Rehabilitation of villages and development of rhino Habitat

1. Relocation of Padampur village elsewhere and development of a suitable habitat for rhinos

2. Rhinos also inhabit forest area outside the RCNP, particularly, the Tikauli forest. This forest area also needs to be managed and protected for the rhino conservation. It is preferable that this forest area is included in the park with the gazettelement rather than just making this as buffer zone.

3. Translocation and Reintroduction of rhinos

A. Thirty eight rhinos were translocated from the Royal Chitwan National Park to the Royal Bardia National Park in 1986-88 and 1991. It will be too early to infer that the translocated rhinos in the RBNP have adapted to the new environment, however, there are some indication that he population is doing well. Considering the historical range of rhino (all throughout Gangetic plain) possibility of translocating some individuals to other protected area need to be explored. However, there are only two protected areas, namely Royal Bardia National Park (RBNP) and Royal Suklaphanta Wildlife Reserve (RSWLR) that can sustain the reintroduced rhino population. There is need to study in detail in the above mentioned protected areas and to find out the solution of crop damage problem.

B. Most of the rhino are located in the northern part of RCNP and considering the habitat in the southern part rhino can be translocated in this part. But for that people around should take into confidence to know the consequences of such translocation. Considering the closeness of Madi with Indian boundary. There is need of regular surveillance and monitoring is required.

4. Strengthening anti- poaching capability

A. Considering the spurting poaching activity, an anti-poaching unit has been constituted with the support from WWF and International Trust for Nature Conservation. The strategy of the unit is to work in close collaboration with local people who work as secret informants to the park management in order to apprehend the poachers. Arrest of a number poacher arrested indicates that this system is working very well in curbing the poaching.

B. The Park awards to the villages informants up to the amount of RS 50,000 and the penalties rhino poaching are 5 to 15 years of imprisonment with a fine of Rs 50,000 to 1, 00,000. Despite of such severe penalties and efforts occasional poaching are still reported. This indicates that only law alone is not sufficient in curbing the poaching of endangered wildlife species. Cooperation of local people living adjacent to the protected areas is the key to achieving success in such

issues. The recent amendment of Buffer Zone Act to channel 30 to 50 % of the park revenue in the local development may develop some positive attitude in the local community.

It is also necessary to explore the possibility of imposing trade restriction and surveillance at the major custom post in Nepal. CITES implementation workshops should be held frequently to make various agencies such as police, customs, forest, local administration, journalist, local inhabitant to help in implementing the effective trade as per the CITES regulations. Transboundary collaboration to implement CITES regulation with neighbouring countries will provide additional opportunity to curb poaching activities and the illegal trade of endangered wildlife.

5. Loan to International agencies for scientific studies

Rhino has always been in high demand in zoos and research stations of several countries. A number of rhino were provided agencies in the past.

CITES regulations should be followed. Funding support, if any, arising from such exchange should be strictly applied to the rhino conservation efforts. The recovery process of such loan should be clearly defined before the exchange is ever made. This is still a very sensitive issue and therefore, every precaution should be observed so as to avoid controversy.

6. Population Monitoring

To transpire a scientific basis for rhino conservation and management a long term monitoring program should be initiated to assess numbers, population trend, ecological requirements, carrying capacity, and people/ rhino conflicts. Rhino census similar to count rhino 94 is suggested in every 5 years to assess the population trend and status.

7. Carrying Capacity

A study to assess the rhino carrying capacity of the park should be conducted. Since the establishment of the RCNP, 109 rhino death have been reported. Natural death constituted about 80 % of the total death and 20% from poaching in last 18 years (1973-1991). Recently frequency of injured and rate of crop damage are on the rise. This is possibly because the present rhino population is beyond the carrying capacity. Some studies suggest that the rhino habitat in the RCNP at present is under utilized. It is argued that the high injury rate and crop damage at present is as a result of displacement of rhino by the livestock. Livestock grazing in the rhino habitat in the park has become widespread.

8. Conservation Education

Conservation awareness programme needs to be actively launched in the area in cooperation with the local NGOs and institutions and various other relevant organizations. Conservation education through radio, TV, Audio-visual arrangement at the local level, poster, papers, bill-boards, visitor's center etc., needs to be activated. CITES status of rhino, fines and punishment, rewards to the informer and other relevant information's should be furnished simultaneously to the local people.

9. Income generation activities

Cooperation from the local can be realized only when they see the direct benefit from the existence of the park and protection of wildlife. Most of the local people in the surrounding areas are subsistence farmers. They can not think of conservation of wildlife if their life sustaining system is disrupted. At local people are realizing very little benefit directly from the tourism in the parks. They should be trained in hotel/lodge management, tour operators, and nature guide to accrue the benefit from tourism to them. If this can happen, they will put all their efforts in sustaining the income source i.e. protection of wildlife.

Increase in living slandered of the local people will lead to reduction in pressure in the parks from several means. For example, fire wood consumption will be reduced, number of livestock's will be reduced, and more over, they will be conscious about nature conservation.

10. Funds for Orphanage Center

It has been noticed that on an average every year the park has been raising one or two rescued orphan rhino calf from the wild. Such calves are either abandoned by the mother or injured by the predators. Although, this is incidental, regular fund needed to be for necessary care and raising of such orphans in an orphanage center.

11. Training

To increase the efficiency of the park personnel in rhino conservation, specific training such as habitat improvement, population monitoring, anti-poaching, conservation education and extension, orphan rearing etc are necessary.

12. National and International Corridors

As it is not realistic now to establish new, sufficiently large protected areas, exploration to determine existing habitat corridors should be investigated between protected areas. Existing habitat corridors may facilities range extension and migration later between protected areas. Land use planning should recognize such vital corridors and routes, and protect them from incompatible forms of development and settlement. Maintenance of critical habitats in such areas will minimize conflicts between rhinos and people. It will also prevent the isolation of groups and improve the genetic viability of the overall population.

International cooperation is required where corridors and routes cross frontiers. It is particular that such areas not disrupted, or very serious conflict between rhinos and people may result. The frequent movement of rhinos from Royal Bardia National Park, Nepal to India and rhinos from Dudhwa National Park, India into Nepal corroborates such conservation action.

RECOMMENDED ACTIONS

1. The integrity of the present reserves containing one-horned rhinos should be maintained and their areas extended where possible to cover seasonal movements. This will require a net work of well managed flood plain grasslands and carefully designed multi-use zones, aimed at meeting the needs of local people without jeopardizing wildlife resources.
2. The ecological relationship between river flows, ground water level and grassland maintenance with a specific focus that will increase landscape diversity and grassland biomass production, shall be determined with development of a detailed long term program to monitor the ecological system of the Park. The grassland areas bordering the Rapti River and the water required to maintain its diversity are vital for rhino conservation. This plan should also identify the pesticides used in the area and elaborate on their potential toxicity.
3. Resources should be provided to strengthen anti-poaching measure. This is especially important as slaughter of rhinos will damage the genetic composition of the rhino population.
4. Core rhino habitats should be given both legal and long term physical protection. Enlargement of existing protected, and the creation of buffer zones should be employed where possible.
5. Eco-development projects to meet the needs of the human population around key rhino areas are highly desirable to relieve the pressure on forests. Emphasis in Project design should be place on passive rhino management features. These can include minor modification in infrastructure, either to facilitate or block rhino movements, and the creation of buffer zones to separate production areas and pastures refuges.

6. It is highly desirable that both India and Nepal cooperate in protecting and managing rhinos that move across their common frontier. Establishment of a link will not only safeguard transient rhinos but also has a potential to monitoring poaching activities.

7. A long term monitoring program to asses' numbers, population trends, ecological requirements, movements, and people/rhino conflict should be put into effect to provide a scientific basis to evaluate the nature and extent of habitat encroachment and poaching in the protected areas. The result be the basis for recommendations for improving the management of these reserves and the rhinos in them.

Conclusions

The Royal Chitwan National Park was established in 1973 primarily to protect the rhino population in Nepal. Until recently this park was last strong hold of rhino in Nepal. With the adequate protection and conservation measures, the rhino population has rebounded to about 500 individuals in the park. The park is likely to loose its fame in the world if the rhino population dwindles. Habitat improvement and rehabilitation, conservation education campaign, strengthening the anti-poaching unit, population monitoring are urgently needed to support the increasing rhino population. Strong conservation commitment (both political and technical) is required for the long term survival of the rhino in the RCNP.

Estimated Budget for rhino conservation (in US\$, 000)

Habitat improvement: 200

Translocation/ Reintroduction studies: 20

Translocation of 40 rhino: 100

Strengthening anti-poaching unit: 500

Population monitoring and census: 50

Conservation education: 50

Income generation activities: 55

Funds for orphanage center: 25

Training: 100

Total funding needed: 1,050,000 USD

Rehabilitation of prime rhino habitats

Relocation of Padampur and Ram-Mauri Bhata Village: 1,000,000 USD

(Source: DR.T.M.Maskey, Director General, Department of National Parks & Wildlife Conservation (DNPWC), HMG, Kathmandu, Nepal. Conservation action plan presented and distribute to members, in IUCN- AsRSG Meeting held in 1999 in Kaziranga NP, Assam)

Recommendations of IUCN - Asian Rhino Specialist Group (AsRSG/SSC) on Rhino Conservation in India and Nepal, Meeting held in Kaziranga NP, Assam, 1999

1. The primary priority of funding of rhino conservation is in - situ activities, especially anti-poaching and habitat management combined with eco-development.
2. The AsRSG should have more interfaces with the rhino range state Government at appropriate level, so that rhino conservation receives continuing and increasing support.
3. The intelligence gathering system for rhino conservation is inadequate. External funds should be used to support the intelligence gathering till an effective Government system is developed.
4. The AsRSG will sponsor a technical management Advisory Group comprising representatives from all major rhino areas in India and Nepal.
5. The group reaffirmed that there should be a viable population of rhinoceros unicornis of minimally 2500 in at least 10 populations of minimally 100 each, with an ultimate objective of Meta population of 5000 individuals.

6. To develop more recognition and support for rhino conservation the AsRSG recommends that the Government of India establishes A **PROJECT RHINO**, similar to those develop for tiger and elephant.

7. The Governments of India and Nepal are already providing considerable funds to conserve the rhino and their habitats have been successful in in-situ conservation. Because of demographic pressure, to carry this success into the next millennium the efforts of the Governments of India and Nepal should be augmented with International Funds.

8. Conservation success achieved in India and Nepal in case of the rhino has been possible due to extraordinary dedication and commitment of the field staff. The service conditions of these field staff who are the guardians of the worlds heritage requires to be adequately upgraded commensurate with their selfless struggle.

(Source: Proceeding of IUCN/SSC, Asian Rhino Specialist Group meeting, Kaziranga NP, Assam, 1999)

Conclusion of Asian Rhino Specialist Group (AsRSG/SSC) on Rhino Conservation in India and Nepal, Meeting held in Kaziranga NP, Assam, March 5-7, 2007

The Asian Rhino Specialist Group (AsRSG) organized a 3 day workshop in Kaziranga NP, Assam, India, 5-7 March, 2007. The aim of the meeting was to:

- * Share ideas and discuss the present status of Asiatic one-horned rhinoceros as well as trans-boundary rhino conservation strategies,
- * Share experiences on the Rhinoceros Translocation Programme in Nepal and India,
- * share information on the successful rhino conservation programme in Kaziranga National Park, Assam, India, and
- * Prioritize issues to prepare regional Rhino Action Plan for South Asia.

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