
5.3 INTERSPECIFIC RELATIONSHIP

Conflict with Man

The reactions of Indian rhinos to Man depend largely on previous experience of the local population, partly on the individual rhino, but also on the circumstances of the encounter.

On several occasions, during observation for the activities of rhino, when the author approached rhino, it turned its ear towards the author, even when author moved very silently and was still 60 to 80 m away (Fig. 5.10). At a distance of 25-30 m on elephant back, the rhinos were observed watching the author in an alert posture. Then it showed curiosity or even a threatening attitude following this with a symbolic horn push or a step forward in an aggressive posture.

Aggressive behaviour only occurred when the rhino could see the cause of disturbance, and then not in all individuals. Repeatedly bulls and occasionally also mother with calf rushed at the author in a buff attack during observation. The Author was chased several times by bull, even by mother too, when driving motorcycle on one track.

Rhinos have poor eyesight but acute senses of hearing and smell. Mostly they prefer to avoid man, but males particularly bad-tempered during the mating period, and females with calves charge with little

provocation. During few recent years rehabilitated rhinos used to enter the Sugarcane fields, where they come in contact of man. On one occasion a man have been attacked and knocked over by a female rhino (Personal communication to Villagers) in study area.



Fig. 5.10 A female Rhino hidden in the thick patch of grasses on encounter with author

Symbiosis

Symbiotic relationship between rhinos and few species of birds was observed during the study. Often birds sat on a rhino's back (Fig. 5.11). These birds uttered a high-pitched alarm call when observed any predator or even man and thereby reacted the rhino (Fig. 5.12).

Thus, invariably one can see Cattle-egret, *Bubulcus ibis*, Drongo, *Dicrurus leucophaeus*, *D. caerulescens*, and Jungle Myna, *Acridotheres fuscus* riding the rhino, peeping every now and then into ears or folds of the skin, and extracting parasites with their beaks. Ectoparasites have a nasty habit of lodging in the ears or folds of skin, and these cannot be removed by wallowing. The job of ridding such ectoparasites falls on such birds as they act as parasite eliminators.

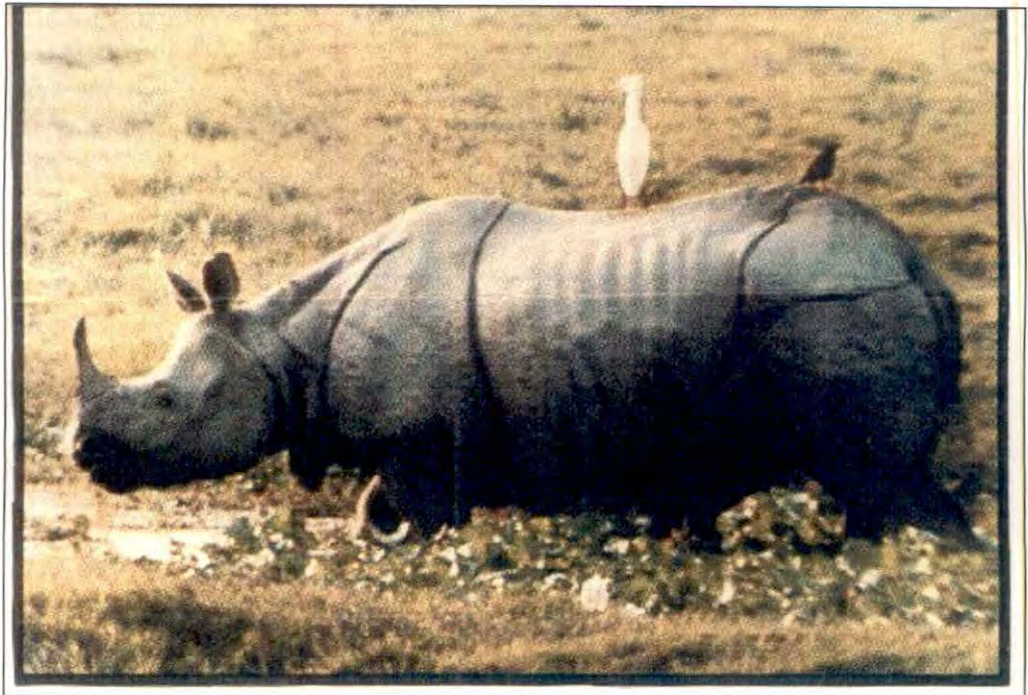


Fig. 5.11 Symbiotic birds riding a Rhinoceros.



Fig. 5.12 A female Rhino responding an alarm call given by a bird

Relationship with other Vertebrates

Indian rhino is a highly specialized creature and well adapted for a swampy tarai habitat. It is terrestrial in nature and can increase in number, provided the habitat with ideal conditions. A solitary nature with occasional brief associations between females and many rodents such as Indian Hare, *Lepus nigricollis*, Hispid Hare, *Caprolagus hispidus*, Indian Porcupines, etc. for procreative purposes were observed. Carnivore like Otter, *Lutra perspicillata* shares the aquatic habitat with rhinos. During summer when water bodies are few with limited water the spotted deer were also found generally close to water bodies where rhinos were present.

5.4 INTRASPECIFIC RELATIONSHIP (CONFLICT)

Conflict between females is rare and never serious. Hostile encounters between males are more frequent, but often bulls deliberately avoid meeting each other. Right from the beginning of the rehabilitation, there has been a serious intraspecific fight between males as well as between males.

After second phase of translocation of rhinos in RRA, started a serious fighting, particularly two males for dominance, though they were translocated from the same habitat. The large male named 'Raju' (25 yr old at the time of release in RRA) asserted its dominance in the beginning. The other male named 'Bankey' (7.8yr old at the time of release in RRA) with the passage of time became more and more aggressive that resulted in frequent fighting between the two. During mid 1988, in one fight Raju broke his horn and therefore Bankey became the dominant male (Personal observation). Raju was chased out of the fence many times by the Bankey. To avoid such fighting, a "mini fence" was created to separate them but the fights continued and in a final fight Raju sustained fatal injuries and died on 11.12.1988. As a consequence of death of Raju, Bankey remained the only breeding male of the founder population or blood stock in RRA.

In 1992 an attempt was made to counter the anticipated problem of inbreeding by introducing a male rhino, Lohit from Kanpur Zoo. It 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 rhino rehabilitated area has two more adult males by they are unable to assert themselves in front of the dominant male 'Bankey'. Bankey has driven one of them named Nakul out from the main fence on several occasions. Therefore, separate contiguous mini fence has been created in north-west part of the RRA to provide save heaven to Nakul. These two males are often seen parading on their respective sides of the common section of the fence. The operation failure of this fence and even functional fence also are unable to restrict the rhinos from fighting. Owing perhaps to this very reason, a female (Narayani) have started straying out of the RRA since last two years. Narayani even gave birth to a calf out side of the RRA.

In 1991, one adult female named Rapti died because of the internal infection and abortion after faught with the Bankey to save her male calf. One another female rhino supposed to belong to the population of Royal Bardia Wildlife Reserve (Nepal) had found her way to RRA. She was also attacked by Bankey and died.

5.5 POPULATION ECOLOGY

Study of population ecology in RRA includes population size & composition, sex ratio, natality & mortality, population growth trend and habitat utilization.

Population Size and Composition

The original target was aimed at releasing 30 rhinos, but due to financial and administrative constraints only 10 could be released between 1984 to 1992, including one captive male (Lohit) from Kanpur Zoo. Three out of these ten rhinos have died and one captive male had been sent back to Zoo. So, the breeding started with one male (Bankey) and Five females (Swayambara, Narayani, Himrani Rapti and Pabitri). About 18 years (1984-2002) duration of breeding, a total of 21 calves were born out of which 13 are surviving. Hence, the vital index (birth-death ratio) will be as under:

$$\begin{aligned}\text{Vital Index} &= 100 \times \text{Birth/Death,} \\ &= 100 \times 21/8 = 262.5\end{aligned}$$

It indicates that population will increase because during 18 years under existing conditions the realized natality is greater than the realized mortality. The population size as of now stands at 18, which composed of

4 males, 11 females and 3 calves. The table no. 5.5 depicts the demographic status of existing population of rhino in RRA.

Table- 5.5: Demographic status of existing population of rhino in RRA, Dudhwa Tiger Reserve (up to July-2002)

	SEX		
	MALE	FEMALE	CALF
AGE	1. 25 Years 2. 11 Years 3. 10 Years 4. 4 Years	1. 23 Years 2. 22 Years 3. 21 Years 4. 19 Years 5. 13 Years 6. 13 Years 7. 10 Years 8. 5 Years 9. 5 Years 10. 5 Years 11. 3 Years	1. 1 Year 2. 1 Year 3. 1 Month
TOTAL	4	11	3

(Source: Deputy Director, Dudhwa National Park)

Sex Ratio

The present sex ratio between male and female is about 1:3 excluding calves whose sex has not been confirmed. After the death of old male Raju in 1988 and a failed attempt to introduce another male rhino (Lohit) from Kanpur Zoo in 1992, Dudhwa Tiger Reserve has not got any other adult male from outside even after a lapse of about 14 years. As a consequence, only one male i.e. Bankey is mating with all the females of the population and single male raises all the calves born in rehabilitated area in Dudhwa Tiger Reserve. This has resulted into:

- I. Slow rate of population build up due to availability of single breeding male.

II. Severe inbreeding and in future possibilities of imbalance in sex ratio.

In future inbreeding can cause sex ratio imbalance that is preferably 1:3 ratio between male and female. There are chances that in newly born calves will be more male or female, which can disturb the sex ratio.

Natality and mortality

The period from 1984 to 1989 may be considered as pre-breeding establishment phase, as all five females were sub-adult. With the death of old male Raju, the entire population was of uniform age structure with high breeding potential. In 1989 four of the five females successfully calved. The Rhino Rehabilitation program very clearly indicates that success in case of sub-adult individuals and failure in case of old aged individuals. There has been no casualty in case of sub-adult females, whereas the adult females died. Further, these sub-adult females only have contributed to breeding.

The first evidence of breeding in the reintroduced population was detected in the form of remains of newly born calf in a patch of tall grasses in August 1987. There was no sign of predation indicating a possibility of premature birth or any such natural circumstances. The first

successful calving occurred in early 1989 on the Park Day (2nd Feb, 1989). Three more calvings in the same year followed this. The table no. 5.6 depicts year-wise calving in RRA, Dudhwa Tiger Reserve.

Table 5.6: Year – Wise Calving Pattern of Rhino in RRA

Year	Calving	Surviving	Died on	Aborted
1984	NIL	-	-	Sa-1
1985	NIL	-	-	-
1986	NIL	-	-	-
1987	NIL	-	-	N-1
1988	NIL	-	-	-
1989	1. R-1 (19.05.89) 2. H-1 (02.02.89) 3. N-2 (01.06.89) 4. S-1 (12.10.89)	- Surviving -do- -	11.12.93 - - 07.01.90	- - - -
1990	NIL	-	-	-
1991	1. S-2 (10.08.91) 2. P-1 (04.08.91)	Surviving -	- 12.01.2000	R-2 -
1992	1. N-3 (31.07.92) 2. H-2 (05.08.92)	Surviving -do-	- -	- -
1993	NIL	-	-	-
1994	1. N-2-1 (11.01.94) 2. S-3 (07.10.94)	- Surviving	17.10.94 -	- -
1995	P-2 (21.09.95)	-	21.01.96	H-1-1
1996	NIL	-	-	-
1997	1. P-3 (02.10.97) 2. H-3 (19.10.97) 3. N-2-2 (17.09.97)	Surviving -do- -do-	- - -	- - -
1998	S-4 (06.08.98)	Surviving	-	-
1999	1. H-1-2 (02.10.99) 2. H-2-1 (12.06.99) 3. N-4 (21.11.99)	- - -	28.10.99 25.02.2000 10.01.2000	- - -
2000	NIL	-	-	-
2001	1. H-1-3 (03.11.2001) 2. N-5 (29.10.2001)	Surviving -do-	- -	- -
2002	S-2-1 (05.07.2002)	Surviving	-	-
TOTAL	21	13	08	04

(Source: Office of the Deputy Director, Dudhwa National Park)

Abbreviations: Sa – Saheli, N – Narayani, R – Rapti, H – Himrani,
S – Swayambara, H-1: 1st progeny of Himrani,
H-1-1: First calf of first progeny of Himrani.

Two females translocated from Assam died in 1984 after their release in RRA. One of them, Saheli (30 yrs old) died on April 12, 1984 of stressful abortion before she could be released. Another female, Asha (16-12 yrs old) died on July 31, 1984 after a bid to tranquilize her to treat a wound. Two more adult rhinos, Raju and Rapti died due to dominant male attack and internal infection.

Following tables depict the causes of adult as well as calf mortality in RRA, Dudhwa Tiger Reserve from April, 1984 to July, 2002.

Table- 5.7(a) : Causes of Adult mortality in RRA (From April 1984 to July 2002)

S. No.	Causes of death	No. of Individuals
1.	Injured by male attack	1 (Raju)
2.	Injured by male attack and abortion	1 (Rapti)
3.	Injured due to accident and paralyzed	1 (Asha)
4.	Stressful abortion and infection	1 (Saheli)
	Total	4

Table- 5.7(b) : Causes of Calf mortality in RRA (From April 1984 to July 2002)

S. No.	Causes of death	No. of Individuals
1.	Premature death / Abortion	6
2.	Tiger Predation	1
3.	Lung congestion / Severe Infection	2
4.	Killed by dominant male	1
5.	Internal Infection / Enteritis	2
	Total	12

(Source: Office of Deputy Director, Dudhwa National Park)

Population growth trend

In 1985, seven surviving individuals of the reintroduced population were included 2 males and 5 females. After the death of Raju in 1988, remained the seed population of rhino and the first successful calving was recorded on 19.05.1989; unfortunately which did not survive and died on 11.12.1993. This was followed by 3 more calvings in the same year. Out of which one calf died on 07.01.1990. No calving recorded in 1990. Four calves were born in the year 1991-1992, out of which one died on 12.01.2002. No birth took place in 1993. Further, in 1994 the third generation was observed dated 11.01.1994, which unfortunately died on 17.10.1994. Overall 21 calves have been born from the year 1989 to the end of study, out of which 8 died in different years. Population growth trend of rhinos in RRA is given in the fig. 5.14.

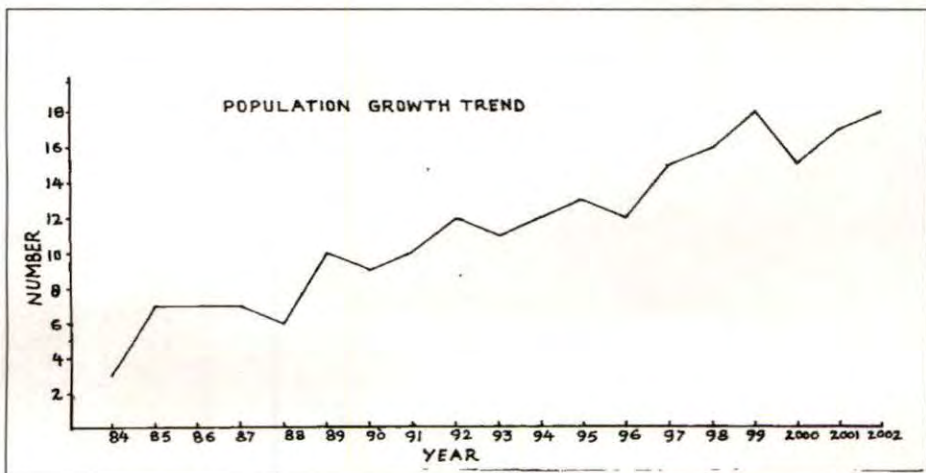


Fig. 5.14 Population growth trend of Rhinoceros in R.R.A. (1984-2002)

Habitat Utilization

For the study of habitat utilization of Rhinos in different seasons, total area of the RRA has been divided in to seven groups viz., Sal forest (SAL), Tall grassland (TG), Short grassland (SG), Marshy land (ML), *Saccharum spontaneum* dominated grassland (SSD), Water bodies (WB) and Scrub forest (SF) (table. 5.8).

The utilization of different habitat varies in different seasons (Fig. 5.15). Rhinos throughout the year use aquatic habitats. Marshy grasslands exhibited similar trends of use. Tall grasslands are equally significant in monsoon and winter. During summer season the best preferred areas are Marshy lands and water bodies.

They utilize scrub forest mostly in summer than other seasons. In rainy season rhinos prefer tall grassland as well as Sal forest, but sometimes they were also seen in water bodies. Rhinos moderately utilize different grasslands in winter. The minimum utilization of *Saccharum spontaneum* dominated grassland is in summer and monsoon.

Table- 5.8: Habitat utilization in different seasons in relation to degree of preference

Habitat Type	Season		
	Summer (%)	Monsoon (%)	Winter (%)
Sal Forest	13.7	23.6	20.4
Tall Grassland	12.0	21.4	19.0
Short Grassland	7.2	8.0	12.7
Marshy Land	25.3	17.3	18.3
SSD Grassland	4.2	4.2	9.6
Water Bodies	28.0	19.7	15.6
Scrub Forest	9.6	3.8	4.4

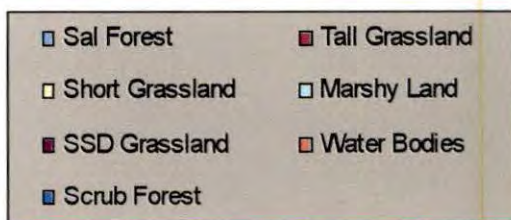
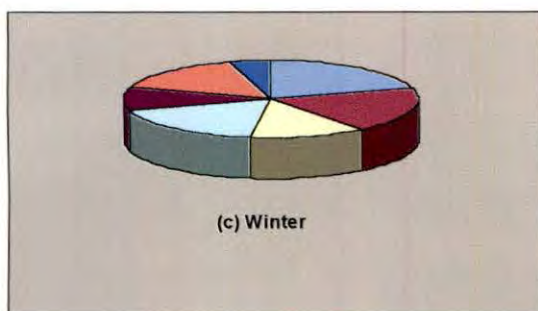
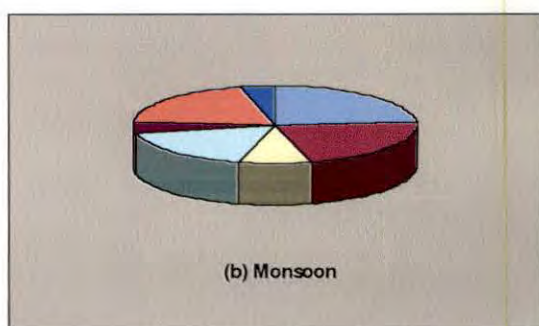
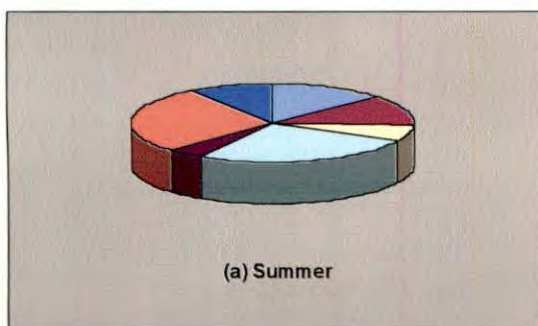


Fig. 5.15 Habitat Utilization in three Seasons (in relation to degree of preference)

5.6 NON-RETUALIZED BEHAVIOUR PATTERN OF DAILY ACTIVITY

The rhinos follow a definite pattern in the daily activities like feeding, drinking, wallowing, resting and moving. They do not roam randomly.

Feeding and drinking

The Indian Rhino, *Rhinoceros unicornis* is mainly grazer, but also browses over tall grasses. While browsing, it holds the grasses with its mouth and pushes them inside the buccal cavity with the help of finger like projection on the upper lip for mastication (Prater, 1971). On the basis of direct observation, it was found that rhinos feed on about 24-26 species of plants in RRA. Grasses comprised 70 to 75% of the total plant species eaten. The highly preferred grass species were *Cynodon dactylon*, *Chrysopogan fulvus*, *Imperata cylindrical*, *Imperata arundinacea*, *Phragmites karka*, *Cymbopogan martini*, *Saccharum spontaneum*, *S. munja*, *Hygrorhiza cristata*, *Typha augustata*, *Arundo donax*, *Vallisnaria spiralis*, *Trappa sp. etc.*



Fig. 5.16 Himrani feeding on *Cynodon dactylon* near the Chhedia Tal

Among the marshy vegetation, the rhino prefers *Eichornia* (Water hyacinth), *Ipomoea reptans*, *Nelumbo nucifera* and *Nymphaea nouchali* the most. Short grasses, which are distributed only around the marshy land, are of high forage value as the majority of them are soft and palatable to rhinos. These grasses start growing from October when water recedes.

Sometimes rhino browse on leave of few shrubs and trees. They seize a small branch or twig with their prehensile upper lip, cut it off with their premolars and then chew it slowly. During the period of grass burning rhinos mostly feed on climbers like *Tiliacora acuminata*, tender leaves of the Shisham, *Dalbergia sissoo*, and Khair, *Accacia catechu*.

They also feed on leaves and twigs of a median sized tree, *Mallotus philippinensis* during the same period. Within 2-3 days following the burn, rhinos start feeding on burned shoots of tall gasses and also lick the ash on the ground. Feeding on bark of *Accacia catechu* was also observed.

According to Dutta, 1990 an adult rhino requires fodder on an average 145-150 kg per day, and spends most of its time feeding on short grasses. During the winter season, food of rhinos in RRA comprised of as follows—

Plant	Percentage
Grasses	45%
Aquatic plants	18%
Rest (woody plants, climbers, and tree species)	37%

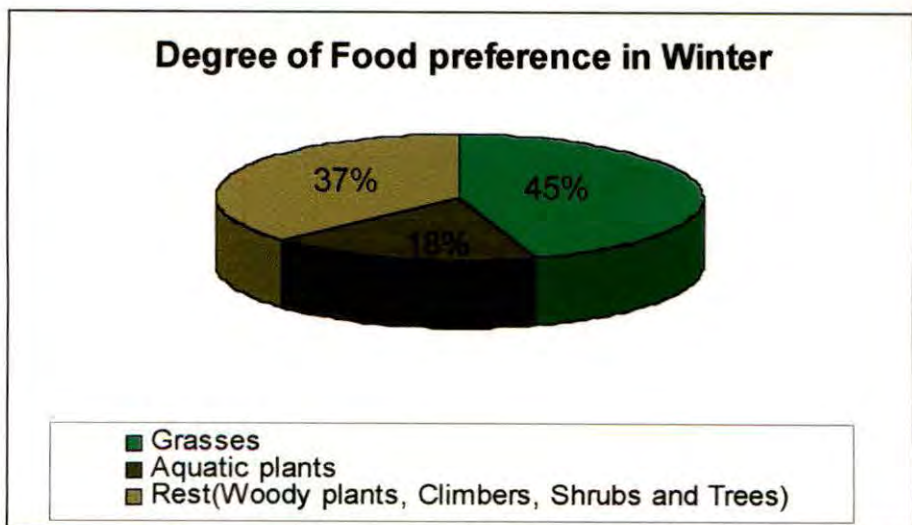


Fig. 5.17 Degree of Food plant preference of Indian rhino in RRA.

Drinking

It was observed that, after feeding rhino moved towards lake or spring nearby feeding area, then normally remains motionless for few seconds at the edge of water body. Then rhino either drinks from the edge or it steps in to water. It was also observed that rhino drinks continuously for 30 sec. to 1.30 min., then lifts it's head for few seconds, surveying the surroundings acoustically, which is followed by second phase of drinking and often a third for few seconds only. Rhinos spend on an average 4-5 min in drinking with two to three short intervals, if undisturbed. After drinking rhino either leaves the water body immediately, or standing motionless and rest for few minutes.

Resting and movement

The resting behaviour of Indian rhino is somewhat different in wallows and other resting places. During very hot days rhinos take rest in water or wallows for minutes or even hours. After feeding they reach the nearest water body to drink as well as to rest.

More frequently rhino were found lying in the thick strands of tall grasses (5-6 meters), but sometimes they lie even on its own track for hours. In sunny days they lie and rest under trees inside the thick shades.

In winter, rhino mostly take rest on the bed of short grasses or the main roads of the RRA.

Their movements were observed in a small area of 1-4 sq km. which is their home range, and meets most of their requirements of food, water and shelter were full filled in the same area. Males may have to wander farther for mates during mating season. In monsoon their movements were restricted to very small area in high level woodland of R.R.A..

Straying out of Rhinos from the R.R.A.

From last two years few rhinos (Narayani, Nakul, Himrani's IInd progeny and Narayani's IInd progeny) have started straying out of the RRA (Fig 5.18). Records at Gulra chawki indicated that there have been 11 cases straying out in Dudhwa National Park. One among such cases is quite interesting and disturbing too that 'Narayani', which lives out side the RRA gave birth to a calf during October ,2001 in a sugarcane field in Bela Kala village about 4 km. away from the RRA in south. The author made rapid survey in the villages located nearby the RRA such as Bela Kalan, Bela Tapar and Gulra Tanda to know the problem of straying out



Fig. 5.18 A Rhino roaming in S.D. Singh Phanta (outside of the R.R.A.)

of these rhinos. Four out of eleven straying out cases of rhinos in RRA were noticed and recorded by the author too, which are shown in figure-5.19.

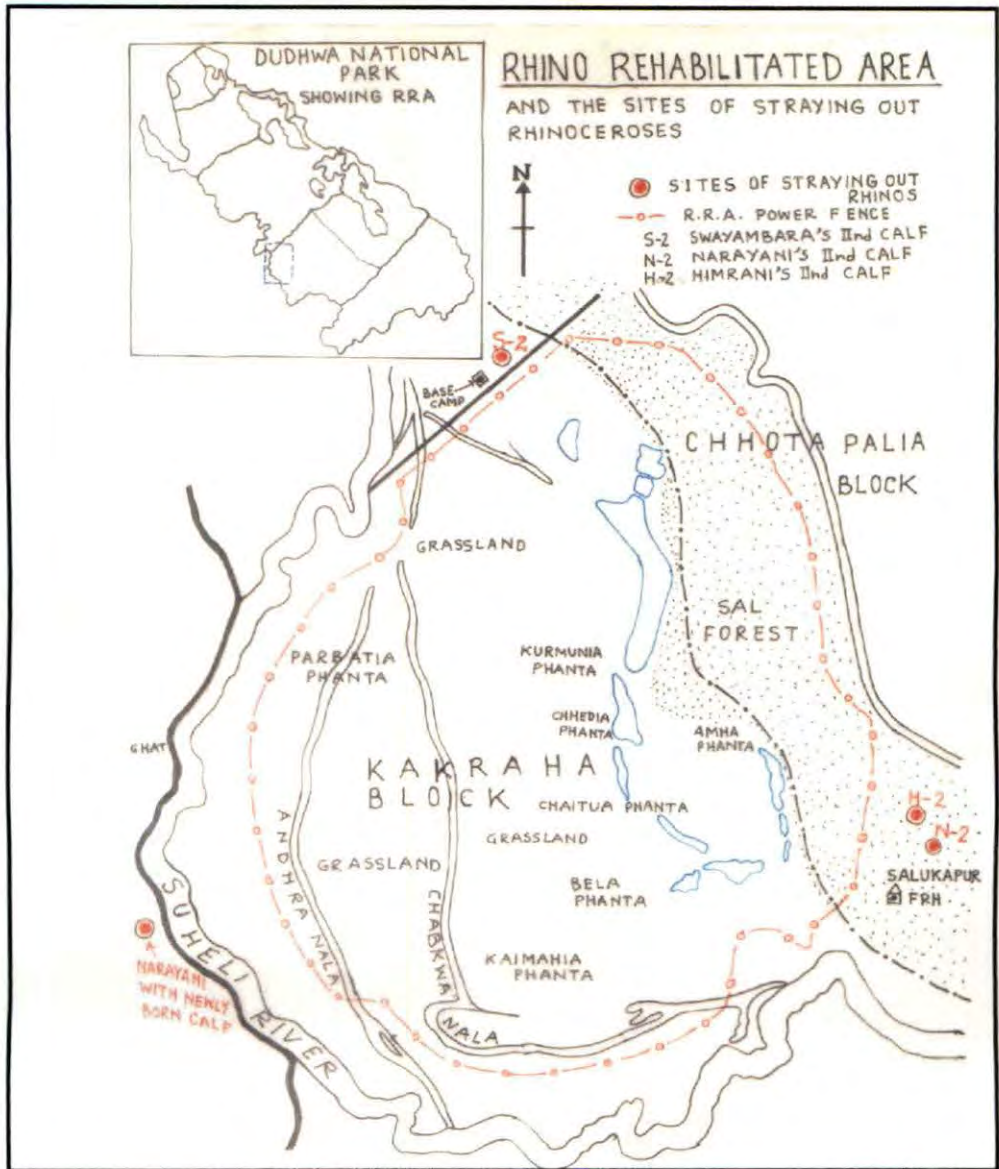


Fig. 5.19 Map showing the sites of straying out of rhinos in D.T.R.

Wallowing

Rhinos are fond of water and spend hours for wallowing, which was always done in the mud or static water bodies never in streams or other running water bodies (Fig. 5.20). In very hot days, during the

summer season, a lot of heat is generated by the rhinos and wallowing helps them to keep body temperature low. Besides, wallowing also protect them from flies (external parasites), which try to lay their eggs in the folds of thick skin. In a wallow, the flies, deprived of air, either perish or are forced to drop off. Hence, wallowing, apart from providing obvious satisfaction to the rhino, also serves physiological function.



Fig. 5.20 Indian Rhinos are fond of water. Himrani with her calf in Chhedia Tal

Early mornings, of course, are the coolest part of the day, so wallowing is not necessary to regulate the temperature, but to remove external parasites. Further, while wallowing, the rhino, if the mud is sufficient, goes right down so that the entire body is covered, and only the snout with horn and the ears stay above the surface. But the ectoparasites

have a nasty habit of lodging in the ears of rhino too, and these cannot be removed by wallowing. The job of ridding of such parasites falls on certain birds who act as parasite eliminators. The mud wallowing habit of rhino in early morning and winter showed that parasite removal is as important as temperature regulation.

In summer they wallow 3-4 times, spending one to two hours a stretch in them. In winter there is a less wallowing than summer. Mud wallowing itself consists of two to three rotation impulses by which rhino rolls on one side until fore legs are well off the ground, those of the other side almost vertically. Rhino rolling over its back on to the other side was not observed during the study. But on several occasions it was observed that after having reached a maximum elevation of the legs, these falls back again. In most cases, it was observed, after wallowing on one side, the rhino rises and then wallows the other side. While wallowing the rhino also drains water by its forelegs. In some cases, during wallowing, rhino suddenly made sneezing as well as snorting noise. It is because of water mixed with mud had entered the rhino's nostrils.

5.7 RITUALIZED BEHAVIOUR PATTERN OF DAILY ACTIVITY

Defecation

Indian rhinoceros has characteristic defecation behaviour. It makes large dung piles in some selected spots and use the same defecation places over and over again. The sight, scent or both, of the previously deposited dung or dung piles stimulates rhino to defecate on the same dung pile. Due to acute sense of smell, the released odour of the dung leads the rhino to move towards the dung pile. This peculiar characteristic



Fig. 5.21 Fresh dung pile of Rhinoceros

of sharing of the same dung pile with selection of defecation spots is thought to have some deep relation for exhibiting self existence to other individuals.

Analysis of the tracks inside the RRA revealed that in most cases rhino dropped their excreta on the track. Usually the rhinos stopped near the old dung or dung pile and defecated either close to the previous one or a few meters away or over the old dung. Sequence and duration of formation of fresh dung piles by individuals were also observed in RRA (Fig.5.22). Probably they were influenced by the scent of previously deposited dung piles lying on widely separated parallel tracks. Generally rhinos walked off immediately after defecation.

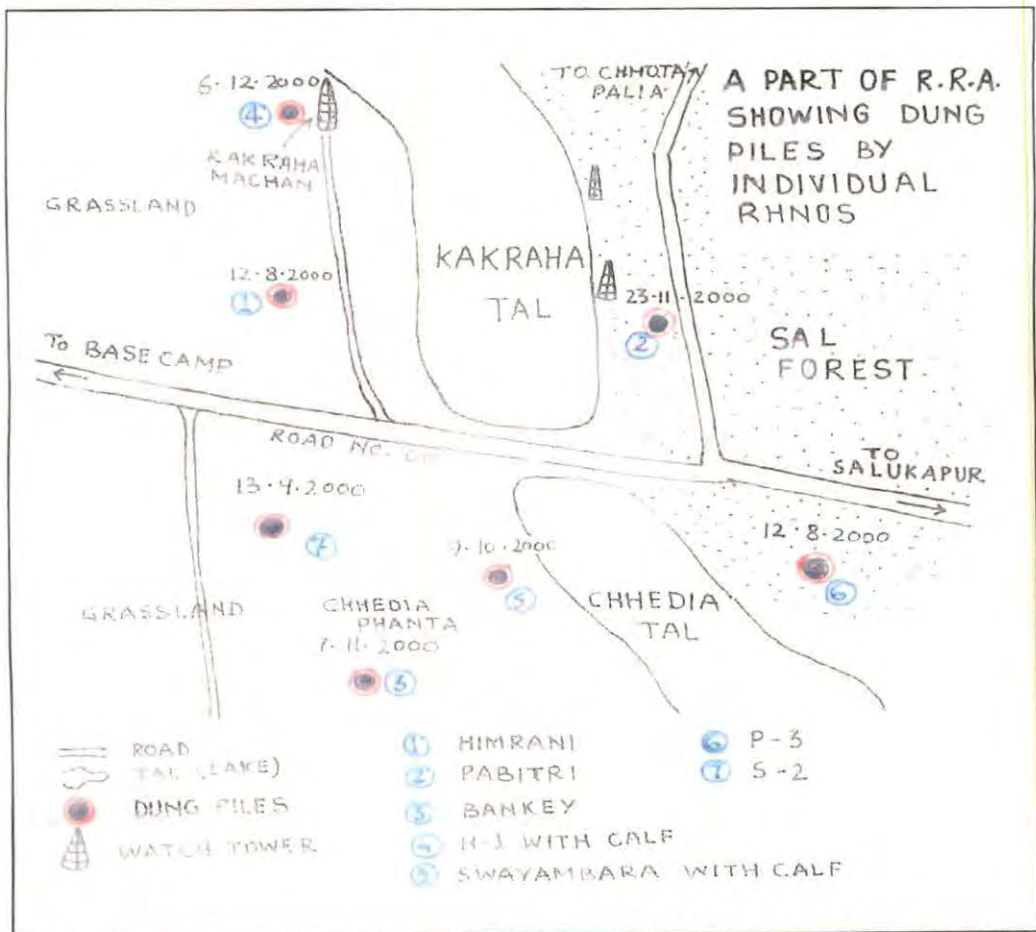


Fig- 5.22 A part of RRA showing the sequence and duration of formation of fresh dung piles by individuals.

Urination

In male as well as female rhinos both retualized and non-retualized urination occur. In urination with retualized manner, the bull ejects 2 to 5 bursts of urine horizontally backwards. When bull stands in thick vegetation, these bursts due to pressure, take the form of a horizontal shower of very fine droplets, which may reach as far as four meters away. In cows, only single squirt consisting of a small quantity of urine with little pressure occurs with retualized manner. In bulls, retualized urination is more or less congruous to retualized defecation, where as in cows it is restricted only in a special phase of oestrous cycle (personal observation). Hence, in cows retualized urination is not considered as a daily activity.

In urination with non-retualized manner, bull first stands motionless then squirts a continuous, downwards and backwards pulsating stream of urine. Non-retualized urination is simple and very common in cows, which was often observed during the study. In this manner, cow squirts urine in a continuous almost vertical stream without pressure, which is interrupted and pulsating towards the end of the process.

Scent marking

The rhinos with their acute sense of smell have developed a complex system of olfactory communication by ritualized defecation and urination. Rhinos, when coming upon dung of their own species, are stimulated to defecate in a characteristic manner.

In Indian rhino dung seems less important for marking the track; it is rather used to maintain special "scent-post" in the form of large dung piles. When lying in a wallow, these rhinos urinate and then the whole body is covered with a sheet of mud mixed with urine. When walking along the tunnel like the tracks in dense vegetation, the smell of urine on the footprints and walls of the tunnel is striking.

The bull produces localized scent marks by frequently squirting urine in the backward shower on to the vegetation. The cows squirt urine often and in small quantities when on heat.

All the type of scent marking produced by the rhinos serve to main function: they convey information between individuals in the same area, especially revealing if a cow is in mating condition, the scent markings give special qualities to the living space of a population and thus contribute to guide the individual in its daily activity and it is typical means of communication among opposite sex.

Earth and dung scrapping

In many occasions, marks of earth scrapping over the dung piles were observed. With scrapping, the soil covered their droppings partially. In the case of a sub-adult male, it was observed that this scrapping behaviour developed at the onset of dry season only after a fight with a large dominant male for occupying the best area for water cover and green grass. In that fight former was the loser. It might be that the particular (loser) tried to hide the odour emitted from his freshly deposited dung as well as himself from that of his dominant counterpart.

5.8 REPRODUCTIVE BEHAVIOUR

Breeding Time

Indian rhinos are reluctant breeders i.e. desire of courtship and mating behaviour in them do not synchronise all time. Observations on zoo rhinos indicate that male undergoes a period of 'heat' as does the females, and these periods must concede before mating takes place. Males come in to heat when they are in rut. It was observed in RRA (study area) that rhinos prefer to breed between the months of March to June and most of the calves were born between the months of July to October.

The period of oestrous cycle was observed is about 46-48 days throughout the year. It was observed in the case of a female cow 'Narayani' that the interval between last calving and the next first service. She delivered her 4th calf on 22.11.99 and took next first service on 06.06.2000, the period being 6 month and 14 days approx. In October, 2001 she delivered her 5th calf. Following table depicts three parturitions in captive female in Kanpur Zoo.

Table 5.9: Three parturitions in a captive female recorded at Kanpur Zoo.

Breeder's Name	Calving		
	1 st calf	2 nd calf	3 rd calf
Lachhit (female)	Oct. 1982	Dec. 1984	June 1987
Mayung (male)	Rashmi (female)	Lohit (male)	Rohit (male)

(Source: personnel communication)

Courtship Behaviour

It was regularly observed in R.R.A. that the female on heat utter a typical rutting call and also released urine at short intervals to attract the bulls. Mating calls of rhinos were heard at several occasions, which were most frequent during the months between March and June. Mating calls of rhinos are low-pitched, often associated with deep sigh and appeared to be of groaning sound devoid of any nasal exhalations. The mating calls were short-lived but occurred in quite intervals; at least 10-12 calls were counted in each bout. The frequent flickering of vocal cord was also associated with each call.

A cow living on her own will attract bull by her scent traces when on heat. Premating contact often involves some aggressiveness vocalization, which is rich in variations. Sometimes the association of a cow and bull lasts for several days and even longer. Thus, a relationship is maintained between cow and bull, which facilitate breeding. In the beginning of courtship, the cow generally rushes at bull and even chases

him. Normally the bull chases the cow at a trot or gallop like horse. From time to time the animal faces each other to fight with horn and teeth. In these animals as in many other vertebrates, the premating behaviour has a complex function; a social and sexual relation is established between the partners. In addition both partners are synchronized in the readiness for mating.

Mating Behaviour

In the last part of pre-mating, mating intention movements occur. The cow stands in front of bull with her hindquarters turned in his direction and even steps backward towards him. The bull put his forelegs on her rump and mounts her. Mating itself lasts from 20 to 80 minutes.

During present study no mating was observed in day time in R.R.A., most probably it took place in dark of the night. Similar observation has been found in zoo. It indicates that how secretive the rhinos are in their mating behaviour.

Post-mating Behaviour

Pregnancy in a female rhino is difficult to detect in her natural habitat. Even in zoo condition it is only possible just two to three months before delivery, which is obvious through development of teats. To observe teats in the natural habitat is very difficult because of thick wild

growth and the nature of the animal always maintains a safe distance from the observer.

The gestation period is about 470 to 490 days recorded in the zoo rhinos. In RRA gestation period was observed in two female viz. Narayani and Himrani. The gestation period of Narayani was recorded before her 4th issue and it was 475 days; while in Himrani before her third issue was 479 days. A fully developed calf is about 120 cm long and 60-70 kg by weight at the time of birth. It was also observed that similar to other ungulates, the newly born calf becomes able to rise within an hour of birth. Then it searches the nipples in the angle between legs and body of its mother and suckles showing innate behaviour.

During most observations in first hour just after the birth, both mother and newly born calf become familiar with each other through imprinting. Within time mother guide and protect her calf from enemies. The observation in R.R.A. showed that approximately 2.6 years old calf is independent and at 3-4 years old females became sexually mature. Normally 4.6 to 5 years old cows give birth to the first calf. Following table depicts the age of three females at first parturition in RRA in three cases.

Table 5.10: Age of three female rhinos at the birth of their first calf in RRA.

S. No.	Name	Born	First calving	Age of mother (y/m/d)
1	N-2	01.06.89	11.01.94	4 / 7 / 10
2	S-2	10.08.91	05.07.02	6 / 10 / 07
3	H-2	05.08.92	12.06.99	10 / 10 / 26

5.9 SOCIAL BEHAVIOUR

Indian Rhino, *Rhinoceros unicornis* is a solitary animal, as a rule but does not resent one another's company. In RRA, occasionally 3 or more rhinos were found near each other in a large lake, and even at the time of grazing. There was no stable (long-lived) group, except mother-calf unit, seen among these rhinos in RRA. Even adult male and female avoid meeting each other except in mating period.

Mother-Calf Bond

The only strong social bond among the rhinos is mother-calf bond, which may last up to two to three years (Fig.5.23). Mother rejects the calf before she gives birth to next offspring. The old calf may later re-join the mother when the new calf is several months old. In this way matriarchal community is formed which are, however, not very stable.

Just after birth, same kind of reciprocal imprinting occurs between mother and calf. They become familiar to each other and from then onwards form an intimate social unit. With time the calf is guided and protected by the mother. On several occasions it was observed that mother was with two young ones of different ages. They must have been her offspring of former years, because the group still had some characteristics of a mother-calf unit.



Fig.5.23 A Mother-calf unit

Association of Bull and Cow

Bull and cow form long-term associations that was observed during mating period, but sometimes a bull may be found with a cow for a short period or even whole day, even when she is not in heat. Bull is equally aggressive during the pre-mating phase.

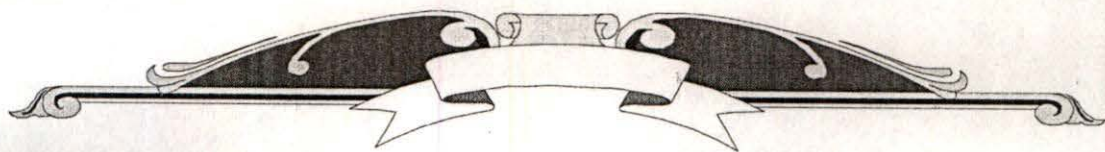
During the study, on several occasions fights were observed between bull and cow especially in the context of pre-mating but these were never serious. No observation was made during whole study regarding long lasting associations between bull and cow in RRA except pre-mating and mating phases.



Fig. 5.24 Bankey (right) and Swayambara (left) in Chhedia phanta

Association between bulls

Intolerance between bulls is somewhat more frequent but also not a predominant feature of rhino sociology. Mostly the bulls do not associate with one another or show marked tension when they meet, but once it was observed that two male rhinos, one very well known 'Nakul' and the other one Narayani's IIIrd progeny, formed a social group for two days; they moved and fed together. Breeding male rhinos are generally territorial and form territory by defecation and urine-scent markings. Their territory ranges may overlap. Adult males are 'hostile' to each other and compete for estrous females. Once, Bankey chased Nakul for about 1.5 km even it was recessive male.



*Inbreeding
Problem*



INBREEDING PROBLEM

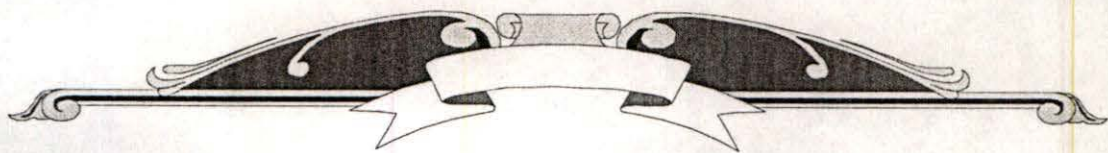
The existing rhino population in the RRA is facing the problem of inbreeding due to only single dominant male Bankey. During 1991 an attempt was made to counter such problem by introducing a captive male (Lohit) from Kanpur zoo. But, it was repeatedly attacked by Bankey and severely injured. Then this animal had to be taken out, treated and returned to the zoo after it had recovered. This existing rhino population in RRA has two more adult males (Swayambara's IInd progeny and Himrani's IIIrd progeny) but they are also unable to assert themselves in front of the dominant male Bankey. Bankey continues to be the dominant male even today. Following table shows the breeding population of the R.R.A.

Table. 6.1 Breeding Male and Females of R.R.A.

Sex	Breeder's Name	Origin	No. of Calf born	Surviving
MALE	Bankey	Assam	-	-
F E M A L E	Pabitri	Assam	3	1
	Narayani	Nepal	4	3
	Swayambara	Nepal	4	3
	Himrani	Nepal	3	3
	Rapti	Nepal	1	0
	H-1	Ist calf of Himrani	2	1
	N-1	Ist calf of Naraynani	2	1
	H-2	IInd calf of Himrani	1	0
	S-2	II calf of Swayambara	1	1
	Total			21

All the calves born till today are the 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 Bankey and if in the future they will mate with the females, same 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 variability. So, there is an urgent need to introduce some other males with different genetic base. Keeping in view the past experiences with Bankey's behaviour, newly translocated male rhinos should be kept in separate enclosure to avoid the chance of fighting among them. Therefore it is needed to enlarge the existing RRA or creating another rhino habitat in Dudhwa Tiger Reserve.



*Other suitable site for
rehabilitation of
Rhinos*



OTHER SUITABLE SITE FOR REHABILITATION OF RHINO IN DUDHWA

Long back in 1991, the Rhino Sub-committee of Indian Board of Wild Life has strongly recommended for the urgency of creating another viable breeding population of rhino in Dudhwa Tiger Reserve and identified Bhadi-Churaila sector in Belrayan Range as one of the possible sites for reintroduction of rhino in their original recommendation. The area about 10.733 sq km. provides water for drinking and wallowing, shade and adequate variety of plants known to be eaten by Indian rhino elsewhere. One of the essential prerequisite for rhino reintroduction is vast grassland with water bodies for drinking and wallowing (Fig. 7.1 & 7.2). The Bhadi-Churaila sector has two permanent water bodies viz., Bhadi tal and Churaila tal. Apart from these permanent water bodies, there are various other smaller water bodies, which are permanent as well as seasonal.

Feasibility study with regard to the habitat availability for the reintroduction of rhino in Dudhwa by the Botanical Survey of India led by Dr Hajra carried out a detailed survey of the vegetation of Dudhwa in relation to the rhino feeding ecology. The detailed study clearly established a number of floral elements common to Dudhwa and

Kaziranga National Park (Assam), both of which are excellent rhino habitats.

The advantage of the area selected is that it is in the central location of Belrayan Range and sufficient buffer is available (Fig 7.3). There is no danger of rhino wandering in the human occupation and cultivation in case of operation failure of power fence. While in the case of existing rhino reintroduction area, it is adjacent to the southern boundary of the park, which lacks a buffer zone and outside of which is an area of dense human occupation and cultivation.



Fig. 7.1 Grassland in Bhadi Block of Belrayan Range



Fig. 7.2 The largest lake, Bhadi Tal in Bhadi Block of Belrayan Range

The three-strand power fence (17 km. long) will cover the entire proposed area of 10.733 sq km. in Bhadi-Churaila sector. Fencing work has already been started and target was to complete this operation by the end of financial year 2001-2002.

The creation of Bhadi-Churaila sector of RRA will reduce the prevailing conflict situation among the males in the existing population. Fresh batch of rhinos from Nepal will be reintroduced in this area to broaden the genetic base.

There exists a viable connectivity between the existing and newly created RRAs through the grasslands of Bankey Tal area. Thus two

populations can also be joined in due course of time when the rhino population increases by extending the fenced areas.

Following table presents the area-wise vegetation types in proposed Bhadi-Churaila Habitat.

Table 7.1 : Bhadi-Churaila Habitat (Belrayan Range)

Block	Compartment	Sal forest (ha.)	Grassland (ha.)	Wetland/ Swamps (ha.)	Total (ha.)
Bhadi Block	Bhadi-2	108.09	-	-	108.09
	Bhadi-3a(Part)	-	30.00	-	30.00
	Bhadi-3c	18.21	354.88	105.00	478.09
	Bhadi-6a	88.63	-	-	88.63
	Bhadi-6b	-	106.43	-	106.43
Laudaria Block	Laudaria-2(Part)	35.39	-	-	35.39
	Laudaria-3b	4.04	96.62	24	124.66
	Laudaria-4(Part)	9.72	20.30	-	30.02
	Grand Total				1073.31

(Source: Proposed plan for Bhadi Tal Rhino Area, Tewari A., 2002)

There are excellent “phantas” (grasslands) and water bodies in other ranges as well. These areas are blessed with vast expanse of grasslands with number of viable swamps. These areas can also be rehabilitated with rhinos in due course of time when the rhino population increases.

Last but not least, the conservationist’s ultimate objective of creating as many separated viable “islands” as possible to reduce the risk

of extinction will be fulfilled when the reintroduced rhinos of Dudhwa once again haunt the entire Tarai area.

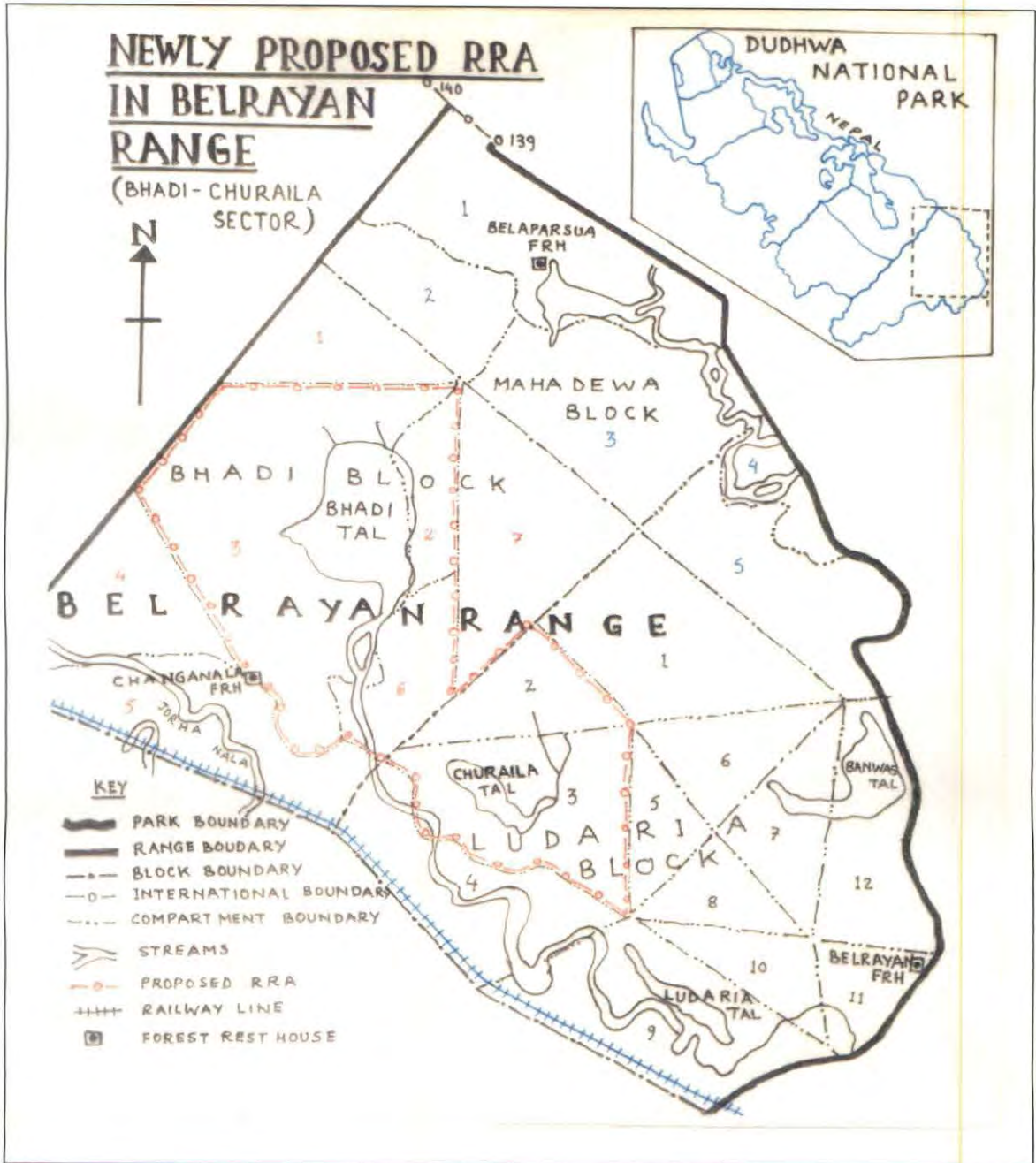
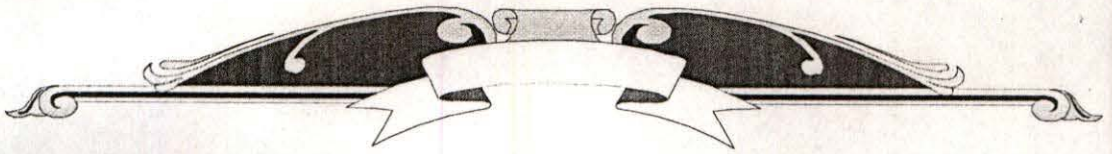


Fig.7.3 Newly proposed area in Belrayan Range for Rhino Rehabilitation.



Discussion



DISCUSSION

The tall grassland once extended across the northern Gangetic plains from U.P. through the Nepalese Tarai to Bengal, North-Western Assam, and South to West Bengal, being concentrated on the flood plains of the Ganges and Brahmaputra rivers and their tributaries (Fig. 8.1). The grassland had suffered a special decline due to conversion of forest land into agriculture land and intense grazing pressure from domestic stock. These grasslands were the natural home of herbivores, including rhinoceros, now grasslands are restricted in isolated pockets. The biotic pressure and the hunting in the last couple of centuries finished off the rhinos in much of this range, which was the mega herbivore of the tarai region. Now, the rhino's natural population is restricted in North-Western Assam and South West Bengal.

The isolated population is now suffering from various abiotic and biotic factors. With the result, this species is moving towards extinction. To revive or to re-establish the population of this species, it is to be reintroduced in the areas where it was found originally in older times. The last rhino was killed in Pilibhit (U.P.) in 1878, which is close to Dudhwa National Park having similar habitat (**Hewitt, 1938**). That is why, the Dudhwa National Park had been selected as a new home for

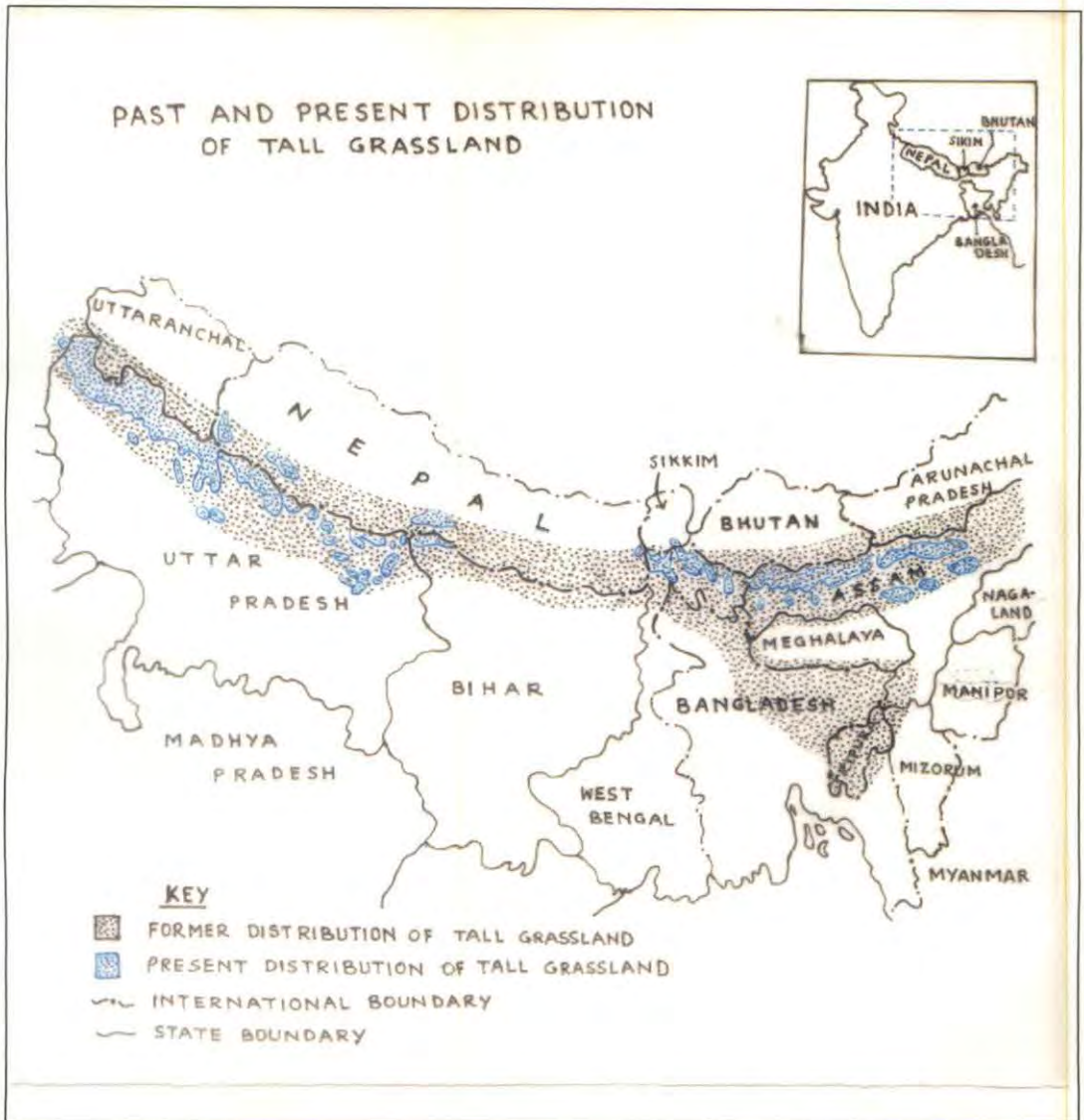


Fig-8.1 Map showing past and present distribution of tall grasslands

rehabilitation of rhinos by Asian Rhino specialist Group of the IUCN in August, 1979 after a detailed survey of the area. It was also found similar during present study.

The reintroduction programme was started in U.P. in middle of the 1950s with Asiatic Lion in Chandraprabha Wildlife Sanctuary. This effort

totally failed, due to unmanaged and unplanned reintroduction. Further, in 1975 the two crocodilians species, Gangetic gharial and Mugger were successfully released in different river systems of U.P. such as Ganges, Ramganga, Sharda, Ghagra, Girwa, Chambal and so on. This programme was successful because it was started planned and gave positive results. The last reintroduction programme in U.P. was done in 1984 and 1985 of Rhinoceros in Dudhwa National Park, which came partly from Assam and Nepal. This programme is also appearing successful. The population reached from seven surviving to 18 individuals till the end of the study.

This large herbivore was well studied by **Stebbing (1908)**, but this study was restricted to distribution, morphology, habitat, feeding behaviour of different species of rhinoceros. This study helped in selecting rehabilitation area. The detailed morphological aspect was later studied by a number of workers such as **Gee (1964)**, **Chaturvedi (1968)**, **Chaudhary (1964)**, **Pathak (1978)** and so on. **Pratar (1971)** has given a detailed description on biology of one-horned rhinoceros. As regards the biology, the author agreed with the opinion of the previous workers as observed during present study, but the old workers neither suggested nor made any study on reintroduction programme.

During last 25 years this species has been well studied in India (Kaziranga) by different workers like **Mary, Solanki, Limboo** and **Upadhaya (1998)**. The reintroduction programme in Dudhwa National Park as well as in Bardia Wildlife Reserve, Nepal is now flourishing well due to the fact that in both the places, these programmes were started in a planned manner by making study of Flora and Fauna of the area, which clearly concede with the present natural habitat. A proper protection is also given in both the places, but biotic pressure should also take into consideration. This task was mainly done by different renowned workers like **Schenkel (1980/81), Sale (1981)** and **Hajra & Shukla (1982)**. The study of these persons was proper and the recommendation was found fully suitable for the reintroduction, which resulted in a fruitful programme. Further study in Dudhwa National Park has continued by other workers such as **Sinha and Sawarkar (1991), Qureshi (1991)**. All these studies were restricted to the management of the reintroduction programme and no future plan was suggested by these previous workers:

As regards the habitat of the RRA, it fulfils all the basic requirements of a rhino in respect to the vegetation cover, food plants and wallows. The wallows RRA is dotted with numerous perennial water bodies, which are regularly flooded annually by the tributaries of the

Sharda, Suheli and other seasonal streams providing excellent habitat for rhino. Whole of the habitat has 67% grassland including both upland and lowland 22% woodland (tree forest area) and the rest is water bodies and fringes and Riparian. Overall combination provides excellent habitat for the rhinoceros. The author's observations totally tally with the previous workers **Sinha** and **Sawarkar (1991)**. During the present study at Dudhwa National Park no controversy was raised by other workers.

The survival of any species not only depends upon food and habitat but the relationship with the other species also plays an important role in the existence of the species, especially interspecific relationship. The symbiotic relationship with few species of the birds observed during the study was found helpful to rhino against predators. The most common birds that were seen by the author are the cattle egrets, Drongos, Jungle Mynas etc. Similar observations were also made by the workers like **Kushwaha, Roy, Azeem, Bouruah** and **Lahan (2000)** in Kaziranga National Park, Assam. As regard the intraspecific relationship, there was no conflict observed among the females, but as concerns the males, a single dominant male, Bankey is able to establish its majesty in RRA. Similar observation was also made in Kaziranga. The reintroduction of captive male, Lohit totally failed and rather it was a blunder during the

total programme. This animal was returned to Zoo only seven months after release in the wild. It has probably given a lesson, that Zoo bred individual should not be reintroduced along with the natural population in rehabilitation.

The break in the programme is also disadvantageous as the basic decision was made to introduce 30 individuals in the RRA, but it was stopped after the rehabilitation of 10 individuals including a captive male. Out of which two mature individuals including one pregnant died during the rehabilitation, which were unable to tolerate exertion as well as adjustment in a restricted area. Besides, it caused infighting among the male individuals, resulted into injury and death of the others. Therefore, on the basis of present observation, in future (more than one) sub-adult male individuals preferably should be introduced, so that they may adjust and live with other male individuals as existing in Assam.

The basic surviving population of reintroduced rhinos included 2 male (Bankey and Raju) and 5 females (Himrani, Narayani, Swayambara, Pabitri and Rapti). Out of which 1 male (Bankey) and first 4 females mentioned above are still surviving. The increase in the population started in 1989, which is continuing till the end of the study. The sub-adult males and females are now trying to adjust into the same area. Being a mega

herbivore it needs larger area for the distribution, therefore a number of individuals (Narayani, Nakul, Himrani's IInd progeny and Narayani's IInd progeny) have crossed the fence and living close to the fenced area. Narayani, even gave birth to her IVth calf outside of the fence in a sugarcane field about 4 km south of RRA. Same type of problem was observed in the reintroduced population of Royal Bardia Wildlife Reserve, Nepal. Four out of the thirteen translocated rhinos have left the reserve and established themselves in agricultural land south of the introduction site (Bauer, 1988). We should take lesson from the above observation. The suitable habitat close to the RRA should be extended to make them able to establish themselves in the same area. This will be also helpful in avoiding conflict with the local population living close to protected area. Another factor regarding mortality was age factor. Out of seven females that have been translocated so far, 3 have died, two of which were rather old females. This clearly indicates that mature females are more susceptible to mortality during translocation.

As regarding the habitat utilization by rehabilitated population it was observed during present study that rhino prefers mainly Tall and *Saccharum spontaneum* dominated grasslands (SSD) in dry season. While in monsoon it prefers short grasslands, in comparison to Tall and

SSD grasslands. Whereas during cool and dry season it moderately prefers Tall grasslands, Short grassland and SSD grasslands. During this period its preference was Scrub Forest (SF) and aquatic habitat. Observation of present study coincide with the study of **Laurie (1978)**, **Dinerstein (1979)**, **Oliver (1980)**, **Mishra (1982)**, **Bell (1987)** and **Dhungel & Gara (1991)**. There is slight variation in the observation of the author as compared to the above mentioned workers, the rhino in RRA area of Dudhwa were observed during hot days in summer and dry season in tree forest area; while feeding and wallowing was seen in aquatic as well as in grassland during dusk and dawn. Observations during the late night were not possible.

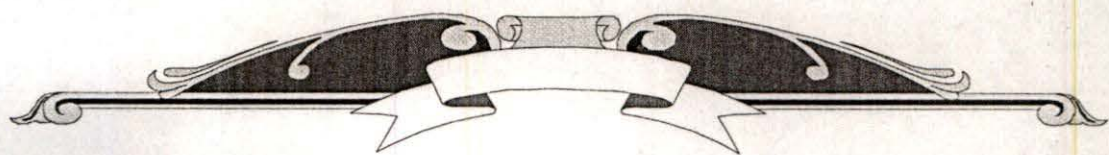
Rhino was observed feeding on young sprouts of tall grasses that appear after burning, and water hyacinths from the swamps. The highly preferred grass species were *Imperata cylindrica*, *Saccharum spontaneum*, *Arundo donax*, *Chrysopogon aciculata*, *Pragmites karka*, *Cynodon dactylon* etc. Among the massy vegetation, the rhino preferred *Eichhornia crasipes* (Water hyacinth), *Nymphaea nouchali*, *Trapa* sp., *Hygroziza aristata* and *Potamogeton crispus* the most similar observations have been made by Mary, Solanki, Limboo and Upadhaya,

1998. During hot period of the summer season, wallowing in the water or muddy pool is common.

During the present study it was also observed that in male rhino especially in Bankey, on several occasions it scrapped its dung to exhibit or mark the territory mainly during breeding periods. But, on the other hand, the other sub-adult males (recessives) scraped the earth to cover their defecations for prevention of releasing the odour thus hiding their presence from stronger opponents. Such type of defecating behaviour of rhinos has already been observed at two Wildlife Sanctuaries (Garumara and Jaldapara) in West Bengal (Bhattachrya, 1994).

Regarding the reproductive behaviour, the peak mating period was observed between the months of March to June in all three successive years. While in the Assam State Zoo and Kaziranga National Park, it was observed that they prefer to breed in the months of April, May and June (**Kakti and Rajkonwar, 1972**). This difference may be due to abiotic factor as it was found in other mammals. The highest dropping of the calf was recorded during present study was between the months of July to October. While in Bardia Wildlife Reserve no description has been mentioned. Inbreeding aspect looks to be a very negative towards the success of the present programme. It should be taken into priority for

long-term success of the programme in author's opinion. Similar suggestion has also given by **Sinha, Akhtar** and **Kalra (2001-2002)** in their report regarding corridor viability.



Recommendation



RECOMMENDATION

1. Till now, there is no special strategy for the management of habitat in R.R.A. Only a special programme prepared by Habitat management can manage the existing or newly created R.R.A.
2. In spite of old individual, only sub-adult individuals should be selected for translocation.
3. For maintenance of fence, special attention should be given. Either wooden fence posts of Sal or cemented poles should be used. The Eucalyptus poles decay quickly.
4. A patrolling road should be from the outside to check the regular maintenance of fence; it will also help in checking the poaching as well as villagers interference.
5. There is immediate need of appointment of a veterinary person to look after the health of Rhinos and the Elephants that used in monitoring.
6. Conflict between local people and Rhinos should be avoided.
7. Selection of new area in D.T.R. for Rhino rehabilitation is right decision for long-term success of the programme but experienced

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- person in the field of the forest staff should be deputed for this programme.
8. In newly created area (Belrayan-Churaila Sector), at least three females and Bankey of the existing RRA should be released to check the inbreeding and conflict of males.
 9. Male from outside should be released in Kakraha area to avoid problem of inbreeding. These Rhinos may be translocated either from Bardia or Assam.
 10. Healthy Elephants and efficient Mahouts are required for proper monitoring. There is also need an increase in the number of monitoring staff.
 11. Monitoring staff should be provided walkie-talkie sets. So that they may remain always in contact while conducting monitoring.
 12. Habitat management should be the first priority. The annual burning is important but all patches of trees and bushes close to water bodies should be protected through control fire.
 13. Grassland should not be burned annually; patches should be identified to burn periodically considering other endangered species like Hispid Hare, Bengal Florican and Swamp Francolin etc.

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14. Burning time and pattern of burning should be with taking into consideration of breeding period of land birds and other species.
 15. Perennial bodies in Rhino area are one of the important considerations. Most of the water bodies of the Park are heavily silted with the result that they start drying in the month of April so silt should be removed to create perennial bodies.
 16. Removal of weeds in aquatic and forest area is also important aspect for habitat management. The major part of Bhadi Tal of new R.R.A. is covered with lotus.
 17. In existing as well as newly proposed R.R.A. there is a need of removal of under story in tree forest area, which provides alternative feeding and resting habitat to Rhinos during summer.
 18. The villagers living close to protected area depend for firewood and grass for hut as well as for other forest product but after the declaration of protected area their rights have been curtailed specially close to R.R.A. Therefore, they should be compensated with other programmes like Eco-development to get their sympathy for the programme.
 19. There is need of construction of watchtowers for monitoring the activities of Rhinos and all the watchtowers should be built in

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- planned way. The old watchtowers also need repair and maintenance.
20. Inbreeding aspects should be taken under priority basis for the long-term success of the programme.
 21. Advisory committee at the Park level for Rhino rehabilitation programme should also be formed for regular improvement and to solve the problem it should include people representative, wildlife expert and forest officials.
 22. Water holes and additional wallows can be create in the southern portions of the RRA to cause more extensive utilization of the habitat and also help to reduce intraspecific competition.
 23. The creation of additional wallows and water holes will require three new borings and two additional pumping sets.