

**CURRENT STATUS AND CORRIDOR SURVEY
BETWEEN THE KATERNIAGHAT WILDLIFE
SANCTUARY, INDIA AND THE ROYAL BARDIA
NATIONAL PARK, NEPAL**

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General Description about the Katernighat WLS and Royal Bardia National Park

Katerniaghat Wildlife Sanctuary

The Katerniaghat Wildlife Sanctuary is situated in the Nanpara Tehsil of district Bahraich on the Indo-Nepal border and is a part of the Katerniaghat Wildlife Division. It lies between 28 06 N and 28 24 N latitudes and 81 02 E and 81 19 E longitudes. After the enactment of Wildlife (Protection) Act 1972. An area of 400.9 sq km area of the division was declared as Wildlife Sanctuary in 1976. However, the control of the forests of the sanctuary continued to remain with the territorial forest division (West Bahraich Forest Division). Finally in April 1997, the West Bahraich Forest Division was converted in to Wildlife Division and named as Katerniaghat Wildlife Division. The total area of the division is 551.64 sq km of which 400.9 sq km is sanctuary and rest are reserved forests.

There are six ranges in Katerniaghat Wildlife Division, of which four, Katerniaghat, Nishangarh, Dharmapur and Murthia are the part of sanctuary and remaining two, Motipur and Kakaraha are outside the sanctuary. The Katerniaghat wildlife sanctuary represents the Terai- Bhabhar biogeographic subdivision of the upper Gangetic Plains.

The Royal Bardia National Park

The Royal Bardia National Park is located 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 (968 sq km). 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, it declared as Royal Kamali Reserve with an area of 348 sq km. It was renamed as Royal Bardia Wildlife Reserve in the year 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 India called it as Kauriala) forms the western boundary of the Park and the crest of the Churia Range (Siwalik Hills) demarcates the northern limits. Physiographically the park has following distinct regions – Siwalik, Bhabar area. The alluvial flat land and the riverine floodplains.

2.4 Katarniaghat Wildlife Sanctuary

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 occurrence of Great Indian one horned Rhinoceros (*Rhinoceros unicornis*).

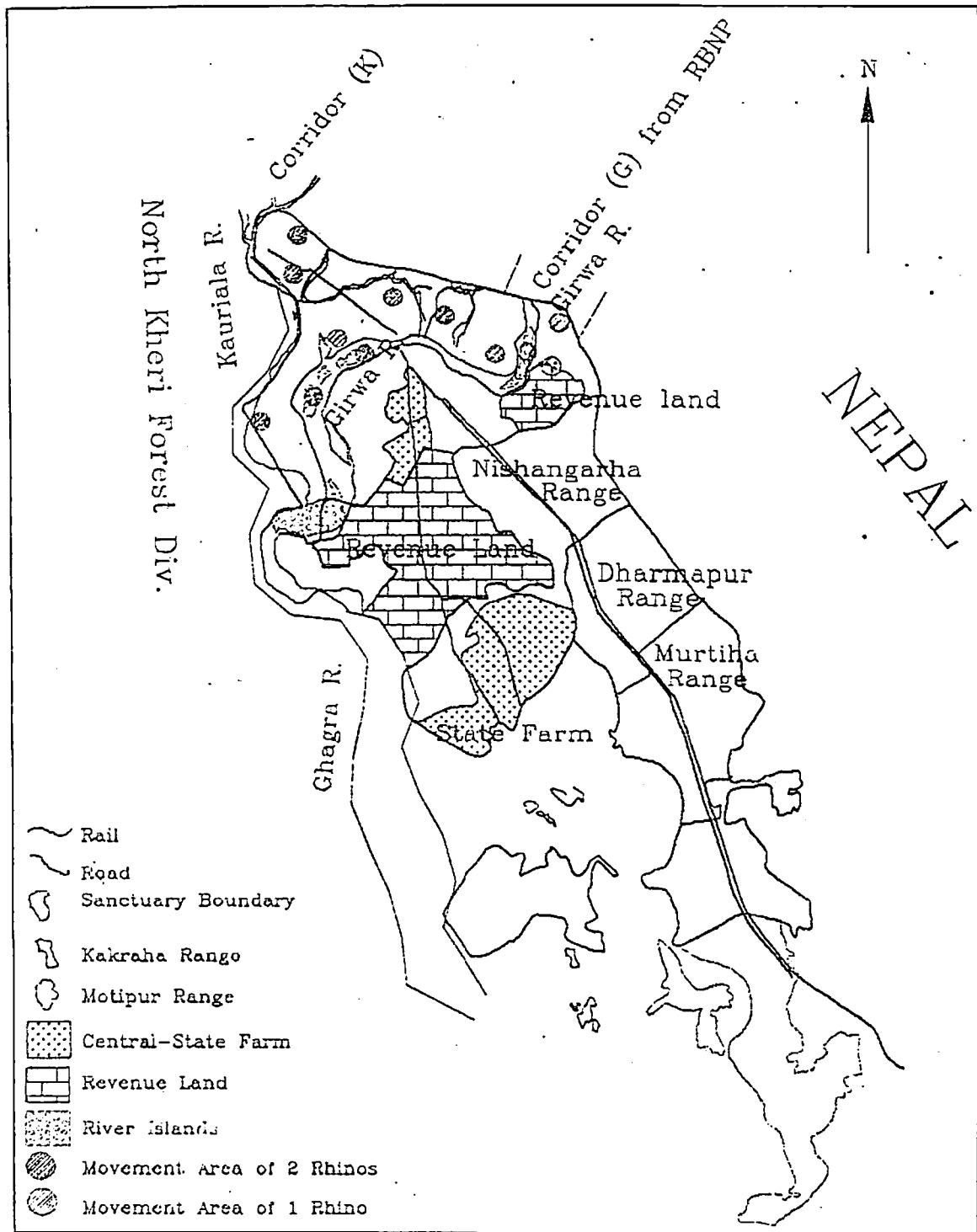
2.4.1 Vegetation

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 characterised 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

- (1) Northern Moist Deciduous Sal Forests
- (2) Northern Dry Plains Sal Forests
- (3) Northern Dry Deciduous Mixed Forests
- (4) Tropical Seasonal Swamp Forest
- (5) Low Alluvial Savannah
- (6) 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*, *Scioichera oleosa*, *Bombex cieba*, *Adina cardifolia*, *Aegle marmelos* etc. The main grass species are *Saccharum spontaneum*, *Saccharum munja*, *Bahrichola intermedia* etc.

Fig.3. Map of Katerniaghat Wildlife Sanctuary, India



2.4.2 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, 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 also.

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 water fowl 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 acqitic members in Katarniaghat.

2.4.3 Hydrology

Kauriyala and Girwa are two major river 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 river of the area.

2.4.4 Landuse

There are two major landuse 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 (Table 2.6). The other major crops are Rai (22.24%), wheat (14.83%), Maize (13.9%) and Turmeric (11.59%) (Table 2.6). Area under sugarcane cultivation is very less and only restricted to few area south western side of the park.

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

2.4.5 Rhino in Katarniaghat

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 movements 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 2.7).

Table 2.7 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 has 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 do 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. River Girwa and forest patches along it from royal Bardia to katarniaghat is used by rhinos, elephants and some times 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 has been recorded.

2.4.6 Potential habitat for Rhino

Approximately 3814.2 ha. area in the heart of sanctuary are under Central State Farm. which was given on lease during 1975-77. Out of this total , 3300 ha. area 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 south western portion of the farm is marshy and have water logged throughout the year. The other area are grassland with large number of palatable species. The portion where the agricultural activity is going on, grasses come out very fastly 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 should now take back the whole area for further habitat development.

2.4.7 Immediate threat

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

2.4.7.1 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 lots of people residing inside or on the fringe of park in the Indian side are also 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.

2.4.7.2 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 become 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. Same day when we were in Katarniaghat, the Range Officer of Katarniaghat captured two full truck of illegal timber from the Nishangarha range.

2.4.7.3 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.

2.4.7.4 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, Nilgai etc (Table 2.6). 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.

2.4.7.5 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 is 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 collection, 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 come under water, which affect the vegetation. It is also a big hurdle in corridor route from KWLS to DNP.

Table 2.6 Agricultural landuse pattern and crop raiding by different wild herbivores in and around KWLS.

(Number of people surveyed through questionnaire =28)

Major crops	Total area under cultivation (in ha.)	% of the area under cultivation	Animals involved in crop raiding
Paddy	12	27.8	Elephant, Chital, Wild Boar, Nilgai, Rhino
Wheat	6.4	14.83	Chital, Wild Boar, Nilgai
Maize	6	13.9	Nilgai, Chital, Wild Boar, Rhino
Rai	9.6	22.24	Nilgai, Chital, Wild Boar
Turmeric	5	11.59	Wild Boar
Others*	4.16	9.64	Chital, Nilgai
Total	43.16	100	

* Others (Mussore, Chilli, Arhar)

2.5 Royal Bardia National Park

Royal Bardia National Park is situated about 585 km west of Kathmandu in the south-western terai of Nepal. It has its unique importance due to presence of the reintroduced population of Rhino.

2.5.1 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.

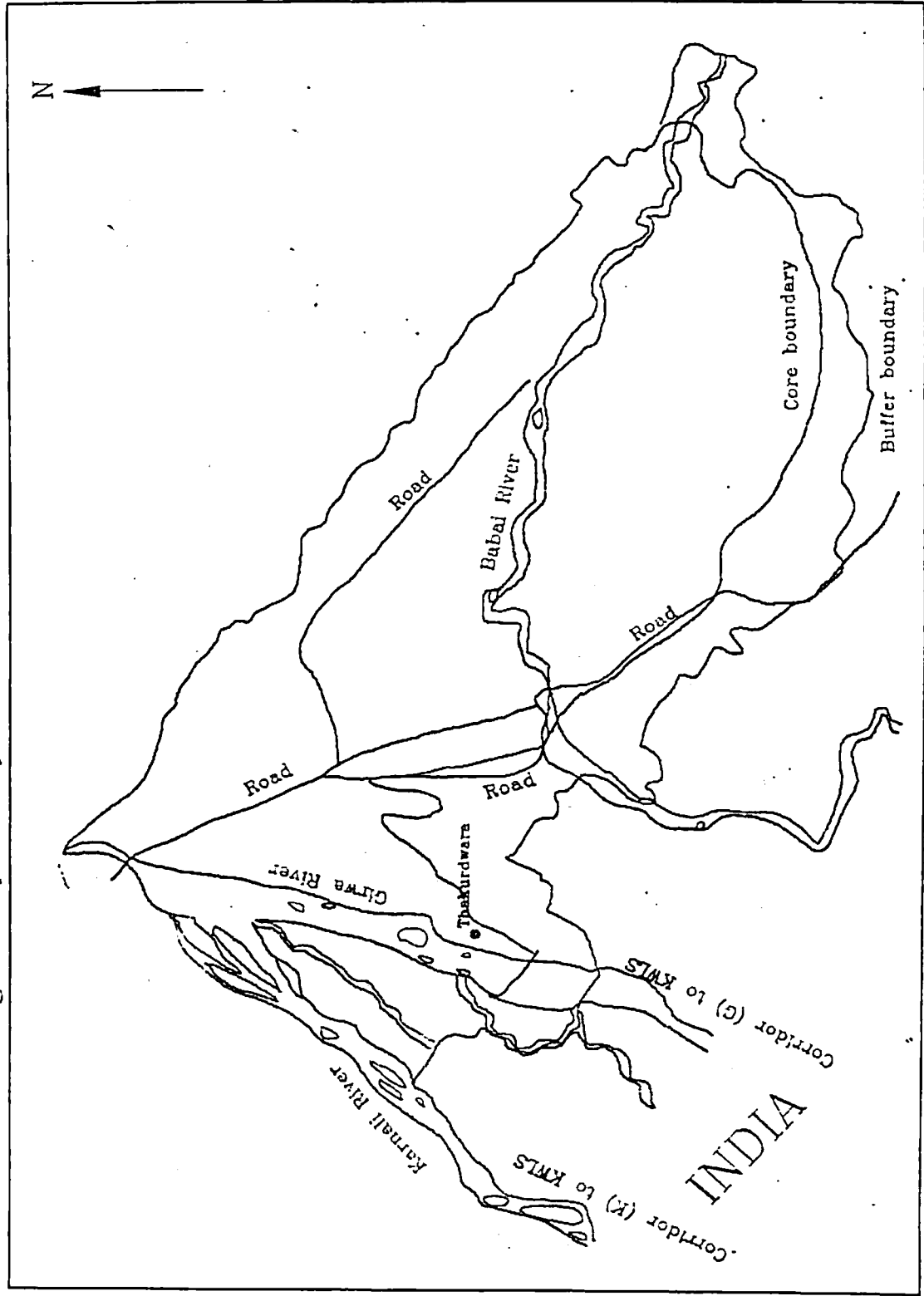
- 1) Sal Forests
- 2) Khair-sissoo Forests
- 3) Moist Riverine Forests
- 4) Mixed hardwood Forests
- 5) Wooded Grassland
- 6) Phanta, and
- 7) Floodplain Grassland

Area under sal forest has higher percentage than the others (Ghimire, 1997) (Table 2.8). The Khaire-sissoo forest is composed of *Dalbergia sissoo* with *Acacia catechu* as associate. Moist riverine forests has species like *Syzigium cumini*, *Ficus racemosa*, *Mallotus phillipinensis*. In mixed hardwood *Garuga pinnata*, *Bombox ceiba*, *Adina cordifolia* and *Mitragyna parviflora* are the main species. Open grassland are called Phanta. *Inperata cylindrica*, *Saccharum spontaneum* and *Vetiveria zizanioides* are common species in these grasslands.

2.5.2 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,

Fig. 4 Map of Royal Bardia National Park, Nepal



Leopard, Sloth bear, Elephant, Rhino, Swamp Deer, Spotted Deer, Hog Deer, Barking Deer, Sambar, Four horned Antelope are the main mammalian species.

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

2.5.3 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 river 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.

2.5.4 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 (only 118 person/sq. Km.) (Ghimire, 1997) and also higher than the whole terai region of Nepal (almost 221 persons/sq. Km.).

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.

2.5.5 Landuse Pattern

A recent study of Central Department of Geology, Tribhuvan University, Kirtipur, Kathmandu (Ghimire, 1997), on the landuse 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 (Table 2.8). 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 landuse. Most of the farmers have small land holding. Large number 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.

2.5.6 Rhino reintroduction 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 calf born in Royal Bardia, out of which only 21 could survived rest 8 died (Table 2.9), hence survival rate of calf is 72.41 %. Since 1986, 13 adult death has 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 (Table 2.9).

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.

2.5.7 Major threat to park and Rhino

2.5.7.1 Poaching

Poaching is a big problem for rhino and for park's other animal also. Since 1986, from the date of introduction of rhino, poachers have killed 9 rhino. Organised way of poaching cases has been recorded from the park. The moment when rhino goes outside of park in open area or in crop land 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 anti-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 game Scot and three field level informer. Nepal army is also helping the park authority in cubing poaching. Since the establishment of anti-poaching group the poaching cases has been came down.

2.5.7.2 Biotic 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. this much of cattle 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.

Table 2.8 Present landuse status of Royal Bardia National Park, Nepal.

Landuse categories	Core area (in Km ²)		Buffer zone (in Km ²)	
	Total area	Percent	Total area	Percent
Total forest	810.59	92.15	161.55	49.42
Sal forest	210.07	23.88	36.02	11.02
Catechu and Sissoo forest	27.39	3.12	19.70	6.03
Chir Pine and Sal forests	2.57	0.29	-	-
Tropical Mixed hardwoods	128.88	14.65	71.86	21.98
Chir Pine and Tropical Mixed Hardwoods	3.43	0.39	-	-
Chir Pine Forests	2.63	0.30	-	-
Protected forests	435.62	49.52	33.97	10.39
Cultivation land	-	-	135.57	41.48
Grassland	13.56	1.54	3.20	0.98
River course	55.50	6.31	26.54	8.12
Total	879.65	100	326.86	100

(Source: Report on Digital data base of RBNP, Central Department of Geography, tribhuvan university, Kirtipur, Kathmandu)

Table 2.9 Demographic status of reintroduced Rhino population in Royal Bardia National Park, Nepal

Year	Rhinos reintroduced			Calf natality and mortality			Adult Mortality					
	Male	Female	Total	Born	Died	Survived	Due to poaching		Natural death			
							Male	Female	Total	Male	Female	Total
1986 & 1991	10	28	38	29	8	21	5	4	9	3	1	4
1999	4	0	4									
Total	14	28	42									

2.6 Corridor between Katarniaghat WLS and Royal Bardia NP

2.6.1 Important Corridors

The main corridor (Corridor-G) between Bardia and Katarniaghat are along the Girwa River (Fig 2 & Fig 4). The rhino entry takes place through this route only. They generally enter in Katarniaghat WLS from this route either near Dhanora Tal area, slightly south-east of river Girwa or near Ambia Bardia village. Some times rhino also enter near Maila nala area, on the north to river Girwa travelling 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 norther 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 need attention for habitat improvement.

2.6.2 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 seltor 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 landuse in the corridor area. Paddy is the major crop of the area. The other crops are wheat, maize, mustered etc.

3.0 Proposed planning a possibilities

3.1 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. The 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 every where, but poaching is the grave problem in this area. The 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.

3.2 Anti poaching steps

Poaching is a serious threats every where 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.

3.3 Habitat improvement

Habitat improvement work is very important to make the programme successful. Search for new suitable habitat within the park and its proper management is essential. Bhadital area in Dudhwa National Park can be a better habitat for next reintroduction or translocation of animal from the RRA, Dudhawa. As the present population in Dudhwa is increasing, which will require more area in future, hence the new suitable habitat is needed. The 3800 ha. area under Central State Farm in Katarnia ghat WLS could be a viable habitat for rhino. Forest Department should take back this area without giving further lease.

3.4 Small population and inbreeding depression

The inbreeding problem in case of rhino in Dudhwa National Park is a serious threat from genetic point of view. In Dudhwa, there is only one adult male, mating with the females and all in new generation are his progeny. The whole new generation share gene, adopted from a common father. If they will interbreed, generation after generation there will be a chance of homogenization and threat for genetic viability. So there is urgent need to introduce few males from different stock to save the future population from genetic disorders. In Katarniaghat the three animals are totally isolated from the mainstreams. As they came in the year 1989, and till today they are not in contact with other rhinos and are isolated sexually (as it is not confirm about the sex of the two rhinos living in the same area). If this situation persists they will die without transferring their genes to the progeny.

3.5 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. So all problems should be dealt with proper care.

Highlights of Conservation issue and current threats

Highlighting the conservation issues and current threats discussed in the WWF-Asian Rhino action planning workshop held in Ho Chi Minh City, Vietnam between Dec. 1-6, 1998. following immediate threats were identified for western Terai:

1. Habitat degradation- prime issue.
2. Small population.
3. Poaching.
4. Habitat conversion and
5. Conflicts.

In case of western terai threats which were categories are not specifically applicable to the all Rhino conservation area eg. Corridor links between DNP and Katarnighat and link between katarnighat and Bardia. Problem and threats and its intensity varies in different places and are of area specific. In case of Dudhwa National Park immediate threat or prime issue is the small population and inbreeding. Since only one adult male met with all the female and now population has increase to 16. Before the implementation of Rhino Reintroduction in DNP experts decided to translocate at least 30 rhinos in five year of interval, but due to number of fact nothing has been done. Unless until a male of fresh gene pole is translocated then in future, genetical disorders, abortion cases can rise, which are not easy to trace out in tall grassland area of DNP and usually undetected. Still in DNP, 90 sq. Km area is of good grassland, a prime rhino area exists with good forest cover. But on the other hand currently rhino population is enclosed in an area of 20 sq. Km. of electric fence. Close to the southern boundary, approximately 3 km. touches the cultivated lands. As Rhino population will increase, electric fence will be a major issue whether area has to be increase or how far rhino will be kept in electric fence. In case of removal of electric fence crop raiding by rhino will be a major conflict. As already crop raiding incidences by elephants exist but due to small elephant problem local cultivators are tolerant. Since poachers are active in tiger poaching carrying in this area can go for rhino poaching also. So these part has to consider.

In case of buffer zone and corridor link between Dudhwa NP and Katarniaghat WLS is concern. In past no effort were made to restore, more over it has degraded and encroached by migrated farmers from Punjab and also by local inhabitants and political buck up. So corridor has an unique problem and restoration of such link has to be done through the rehabilitation and evacuation of the encroach area systematically with the local understanding and is of multi dimensional and multi facultative efforts.

While in case of Katarniaghat WLS, in the past areas was under the territorial division and hardly any effort was made for the improvement of habitat and wildlife concern. In 1991, consultant himself saw 35 swamp deer in this area but now only few are reported. Poaching problem, grazing and excessive use of natural resources, encroachment, settlements around farmland are the major problems in the area. These threats have to be tackle individually. Poaching of Tiger, deer and trapping of migratory ducks were the major threat in the past but newly formed WLS slowly recovered through its past but immediate attention has to be paid for trained staff, proper infrastructure, fund facilities and the changes in staff mentality by deputing proper trained officers with wildlife background and priority to protect both habitat and animal.

In case of Bardia and corridor link situation is similar around Katarniaghat and buffer. Main problem is the human population and livestock population and limited forest in Nepal side. It got clear from the satellite imagery that forest cover towards the Bardia -Katarniaghat is limited except the catchment area of river Girwa. There is immediate need from Nepal side to restore the corridor and improve the habitat and give enough protection so that in future it become regular concern not only for the rhino but also for the other wildlife. In these corridor tiger were sighted number of time but unfortunately one of the tigress and one male Rhino (collared) was poached in the corridor area across Katarniaghat WLS in Nepal side

ASRSG meeting comments

IUCN/SSc-Asian Rhino Specialist Group (ASRSG) Regional meeting for India and Nepal was held in Kaziranga National Park, Assam from 21-27 February 1999. Delegates and members of ASRSG from India, Nepal, USA, Malaysia, Netherland and UK took part in this meeting. In this meeting members agreed that priority should be primarily on the funding of Rhino Conservation for in situ activities reforce 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, ASRSG 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 a viable of minimally 2500 in at least 10 population of minimally 100 each and a metapopulation of 5000 individual. Formations of a Technical management Advisory Group comprising representative from all major Rhino areas in India and Nepal. To get more recognition and support for Rhino conservation, ASRSG recommended that at Government level should establish a Project Rhino similar to other species. To make it further success in the rhino conservation in insitue condition in the Nepal and India, member felt that at Government level in both the country with the help of international funding could make more efforts in this direction.

Behind the success story of rhino conservation in India and Nepal, goes to the effort made by the dedicated staff of rhino areas and their hard work. Individually members expressed great concern to provide proper facilities, their safety and by proper funding. Since staff can efficiently work in the adverse condition to save the rhinos for future generation.

4.0 Role of WWF-India and other agencies in Western Terai Rhino Conservation

4.1 In Dudhwa NP and Katarniaghat WLS

WWF-India has basically supported the Dudhwa National Park and Katarniaghat Wildlife Sanctuary for the purpose to conserve tiger and its habitat. It has provided financial support to these park for the training of the forest staff including officers, help in developing infrastructure capabilities, providing vehicular support, development of telecommunication network, providing fire fighting tools, equipping field staff etc. WWF-India has also carried out awareness generation and ecodevelopment programmes and activities around parks.

Traffic-India, which is a part of WWF-India also playing an important role in conservation by assimilating exhaustive first-hand information on poaching and related illegal activities within the protected areas.

In Katarniaghat WLS, WWF-India is providing a support of Rs. 19.12 Lakhs for strengthening management of the park, under various heads through WWF-Tiger Conservation Programme. They have already given two vehicles, one steamer, some wireless sets and jackets and boots to the staff.

In Dudhwa National Park, they have given support of Rs. 29.20 Lakhs through WWF-Tiger Conservation Programme.

WWF-India's role, plans and programmes include:

- (a) Lobbying and mobilizing support for the tiger reserve area at political and policy making level.
- (b) Generating support at the grassroots level through conservation awareness and education programme for the local communities

(c) Developing support mechanism through information collection, effective communication, education and awareness, networking, legal action against poaching and illegal trade, and promoting international cooperation on trans-boundary and CITES matters.

(d) A branch office of WWF-India located in Lakhimpur kheri is actively organising meeting and awareness programmes in this region with the collaboration of INTECH- New-Delhi.

Other organisations working in the field of wildlife conservation and research in Dudhwa NP :

1). Shri Arjan Singh, well known tiger conservationist actively working in this area from last 50 years and has contributed a lot in the field of tiger conservation and other wildlife. Under him a tiger foundation is operating from last 10 years to carry out work in the field of tiger conservation and research in the field of wildlife conservation as a whole.

2). Wildlife Institute of India , Dehra Dun is involved in Rhino Re-introduction Programme from the very beginning of this project in monitoring and to study the rehabilitation of reintroduced rhinos (1987-91). During this period a study on swamp deer ecology was also conducted. Currently under WII-USFWS, a joint programme, a long term biodiversity study project is ongoing in DNP.

3). Other organisation such Bombay Natural History Society, Aligarh Muslim University and PG college, Lakhimpur conducted research on Bengal Florican, storks, avi-fauna and other wildlife.

4.2 In Royal Bardia National Park

In royal Bardia, WWF-Nepal has playing dual role, primarily supporting in park management as well as working for community development. WWF-Nepal played an important role in providing fund for monitoring and conservation training after rhino introduction in RBNP in 1986. They have also helped in establishment of anti-poaching squared in Royal Bardia National Park to curb rhino poaching. They have given support in infrastructure development also. The new office of the park is constructed through the WWF-Nepal's assistance. Through Bardia Integrated conservation Projects (BICP) funded by DGIS, Netherland, the WWF-Nepal has taken up task of Inventory and Data base preparation.

Among the other organization working in Royal Bardia for conservation are, King Mahendra Trust for Nature Conservation (KMTNC), Women Education (WE), Care Nepal and Park and People. KMTNC had played a key role in reintroduction of rhino and latter in conducting research on rhino monitoring and conservation training. Presently through Bardia Integrated Conservation Projects they have taken up tasks on agroforestry, livestock management, natural forest regeneration, income generation activity and tourism management.

WE, working for women education and its role in conservation. Care Nepal is involved in community development activity in eastern part of park.

Name WESTERN RHINO CONSERVATION UNIT (Dudhwa-Bardia Complex)
 Areas Dudhwa
 Katarniaghat
 Bardia

Size (in Km²)
 604 (884 DTR)
 551.64
 1206.51

Total >600

KNOWN	NEED TO KNOW	BEING DONE	NEED TO DO	WHEN	WHO	COST (\$ 1000)		FUNDER	
						GMNT	EXTERN		
RHINO POPULATION									
Dudhwa	Bardia	Area survey			UP State & FD, Nepal FD		10		
Size= 16 Males= 1 Females=5 Subadults=10	50	Corridor between DNP-KWLS-Bardia	Regular census	4y-census	Soonest		2		
TARGET POPULATION									
>300	Potential sites	Partial translocation	More translocation	20 to 30 yrs Soonest	UP FD, Nepal FD		250		
RHINO POACHING									
Cases reported	Poachers activity & media	Anti-poaching	Market survey	Soonest	International & National body		40		
RHINO PROTECTION									
	Anti-poaching effort	Given protection	Training & Infrastructure	Soonest	National	50			
EQUIPMENT									
Insufficient	Immediate need		Provide soonest	Soonest	International		500		
HABITAT MANAGEMENT									
	Present status	Initial stage	Proper Inventory Research	Soonest	UP FD, Nepal FD		500		
COMMUNITY WORK									
Village around rhino corridor	Cooperation from the people		Activate people for cooperation	Soonest	National & International	50	50		
TRANSLOCATION									
All rhino were translocated	Availability of area	Estimate done	Translocate 60 rhinos	Within 10 years	National & International	50	100		
Proposed budget in ASRSQ meeting 1999 Assam						Total Costs	150	1452	

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POPULATION	THREATS & ISSUES	ACTIVITIES	TIMEFRAME	BUDGET ESTIMATE	RESPONSIBILITY	WWF NOW	OTHER NGOS DONORS	OTHER KEY SPECIES
Western Terai RCU (Bardia-Dudhwa-Katerniaghat-Suklaphanta) Nepal-India <i>Greater One-horned Rhino</i>	1) Habitat fragmentation / degradation	*Support establishment of legal buffer zone for Suklaphanta	3 years	??	WWF Nepal / WWF India	All activities as detailed now underway except Bardia popn census	* KMFNC * UNDP * NORAD * World Bank (Dudhwa)	* Tiger * Swamp Deer * Gharial * Asian Elephant * Gangetic Dolphin
		* All 37 village user groups to prepare 10-year management plans	3 years	??				
		* Complete feasibility studies for other translocation sites in Nepal	3 years	??				
	2) Poaching for horn	*Create endowment fund for anti-poaching in Bardia	3 years	??	WWF Nepal / WWF India	As above		
		* India-Nepal trans-boundary co-operation for wildlife trade control	3 years	??				
	3) Small population sizes	* Increase Bardia popn to 75	3 years	??	WWF Nepal / WWF India	As above		
		* Increase Dudhwa popn to 20	3 years	??				
		* Establish founder popn in Katerniaghat	3 years	??				
		* Popn census in Bardia	3 years	??				
		* Bardia popn > 100 * Dudhwa popn > 50	10 years 10 years	?? ??				
4) Development projects	* Generate benefits for local communities	3 years	??	WWF Nepal / WWF India	As above			

Reference

- Anon 1997. Study on the Management of Rhinoceros; Final Report of West Bengal World Bank aided Forestry Project; Wildlife Institute of India, Dehradun. 201p.
- Anstey, D. 1991. Report on stage two of the reintroduction of the greater one horned rhinoceros to the Royal Bardia Wildlife Reserve, Nepal. Report, DNPWC/KMTNC. 12pp.
- Bauer, J.J. 1988. A preliminary assessment of the reintroduction success of the Asian one-horned rhinoceros (*Rhinoceros unicornis*) in Bardia wildlife reserve, Nepal. Tiger Paper, October-December: 26-32.
- Caughley, G. 1969. Wildlife and recreation in the Trisuli Watershed and other areas in Nepal. HMG/FAO/UNDP Trisuli Watershed and Development Project. Project Report No. 6. Kathmandu. 54pp.
- Champion, H.G. and Seth, S.K. 1968. A revised survey of the forests type in India. Government of India Publication, New Delhi.
- Dinerstein, E. 1979a. An ecological survey of the Royal Karnali-Bardia Wildlife Reserve, Nepal. Part I: Vegetation, modifying factors, and successional relationships. Biol. Conserv. 15: 127-149.
- Dutta, A.K. 1991. Unicornis. The Great Indian One-horned Rhinoceros. Konark Publ. New Delhi.
- Forest Report. 1998. Wildlife Protection in katarniaghat Wildlife Division, Uttar Pradesh.
- Gee, E.P. 1959. Report on survey of the rhinoceros area in Nepal. IUCN. Publ., 1-25.
- Ghimire, P.K. 1997. Digital data base of Royal Bardia National Park & Buffer zone. A Final report submitted to WWF Nepal Program. Central Department of Geography. Tribhuvan University, Kirtipur, Kathmandu.
- Gurung, K.K. 1989. The Indian rhinoceros. Pp 87-89. In: Indian wildlife (Israel and Sinclair, eds.). APA Publ.. Singapur. 380pp.
- Harris, L.D. 1984. The Fragmented Forest: Island Biogeographic Theory and the Presentation of Biotic Diversity. University of Chicago Press. Chicago, Illinois.
- Hewett, J. 1938. Jungle Trails in Northern India. London.

- Jhonsingh, A.J.T., Sathyakumar, S. & F.W. Sunderrj. 1991. Ariankavn pass. a lost elephant corridor in south India. *Biol. Conserv.* 18: 368.
- Jnawali, S.R. 1995. Ranging behavior and habitat preference by a translocated population of greater one-horned rhinoceros (*Rhinoceros unicornis*) in lowland, Nepal. In: Ph.D. Dissertation, Department of Biology and Nature Conservation, Agricultural University of Norway. 129pp.
- Jnawali, S.R., and Wegge, P. 1991. Is there room for endangered large mammals in a developing country? Preliminary results from a field study on the conservation of greater one-horned rhinoceros (*Rhinoceros unicornis*) in Royal Bardia National Park in Nepal. *Faginfo* 123: 145-160.
- Jnawali, S.R. and Wegge, P. 1993. Space and habitat use by a small-reintroduced population of greater one horned Rhinoceros (*Rhinoceros unicornis*) in Royal Bardia National Park, Nepal. In: Ph. D. Dissertation. Agricultural university of Norway, Norway.
- Jnawali, S.R. and Wegge, P. 1995. Performance of a translocated population of greater one-horned rhinoceros in Nepal. In: Ph.D. Dissertation, Department of Biology and Nature Conservation, Agricultural University of Norway. 129pp.
- Johnsingh, A.J.T., Narendra, S.N. Prasad & S.P. Goyal. 1990. Conservation status of Chilla-Motichur corridor for elephant movement in Rajaji-Corbett national Park area, India. *Biol. Conserv.* 51: 125-138.
- Khan, M.K. bin., and Foose, J. 1994. Chairman's report: Asian rhino specialist group. *Pachyderm* 18: 3-8.
- Laurie, W.A. 1987. The ecology and behavior of the Greater One-horned rhinoceros. Ph.D. Dissertation. University of Cambridge. Cambridge. 449pp.
- Mishra, H.R. and Dinerstein, E. 1987. New zipcodes for resident rhinos in Nepal. *Smithsonian Magazine* 18: 67-73.
- Pelinck, E. and Upreti. B.N. 1972. A census of rhinoceros in Chitwan National Park and Tamaspur forest. Nepal. HMG/FAO/UNDP National Park and Wildlife Conservation Project, Kathmandu. 10pp.
- Sale, J.B. 1986. Re-introduction in Indian wildlife management. *Ind. For.* 112: 867-873.
- Sale, J.B., and Singh, S. 1987. Reintroduction of greater Indian rhinoceros in to Dudhwa National Park. *Oryx* 21: 81-84.

- Sinha, S.P., and Sawarkar, V.B. 1993. Management of the reintroduction greater one-horned rhinoceros (*Rhinoceros unicornis*) in Dudhwa National Park Uttar Pradesh, India. Pp. 218-227. In: *Rhinoceros Biology and Conservation* (O.A. Ryder, ed.). Proceeding of an International Conference, Zool. Society, San Diego, USA.
- Stracey, P.D. 1963. *Wildlife in India, Its Conservation and Control*. Government of India.
- Vigne, L., and Martin, E.B. 1994. The greater one-horned rhino of Assam threatened by poachers. *Pachyderm* 18: 28-43.
- Wegge, P., Jnawali, S.R., and Moe, S.R. 1990. Bardia Conservation Research Program: Progress report 1990. Department of Biology and Nature Conservation, Agricultural University of Norway, King Mahendra Trust for Nature Conservation, Nepal, and Department of National Parks and Wildlife Conservation, Nepal. 37pp.
- Working Plan. 1994-2004. North Khiri Forest Division, Uttar Pradesh.