

**ASSESSMENT OF CORRIDOR VIABILITY AND HABITAT
RESTORATION BETWEEN DUDHWA NATIONAL PARK AND
KATERNIAGHAT WILDLIFE SANCTUARY AND ITS
MANAGEMENT IN WESTERN TERAI RHINO CONSERVATION
UNIT, KHERI DISTRICT, UTTAR PRADESH, INDIA**

**(PROJECT FUNDED BY RHINO AND TIGER CONSERVATION
FUND OF US FISH & WILDLIFE SERVICES)**

PROJECT TEAM

Dr. Satya Priya Sinha, Project Coordinator

Naim Akhtar, Field Biologist

Mohit Kalra, Field Biologist

Radhey Shyam, Field Assistant

Vijay Pal, Field Assistant

PROGRESS REPORT

(DECEMBER, 2001 TO MAY, 2002)

SUBMITTED TO

BOMBAY NATURAL HISTORY SOCIETY

US FISH & WILDLIFE SERVICES

2002

CONTENTS

Acknowledgement

Work Profile

1. INTRODUCTION (1)
2. OBJECTIVE OF THE PROJECT (3)
3. METHODOLOGY OF THE PROJECT (4)
4. STUDY AREA (6)
5. WORK CARRIED OUT (7)
(Dec 2001 to May 2002)

ASSUMPTIONS AND METHODS (8)

Corridor viability & Identification (8)

- A. Vegetation Quantification (9)
- B. Estimation of Biotic Pressure (10)
- C. Assessment of Animal Movement (11)
- D. Assessment of Socio - Economic Status (11)
- E. Assessment of Birds Abundance (11)
- F. Land Use and Encroachment (12)
Map of Proposed Corridors – I & II (14)

G. ASSESSMENT OF CURRENT STATUS OF THE REINTRODUCED RHINO

POPULATION AND REVIEW OF THE RHINO REINTRODUCTION PROGRAMME IN
DUDHWA NP (15-64)

- I. Introduction
- II. Objectives
- III. Study Area
- IV. Methodology
- V. Scope of study
- VI. Analysis and evaluation of measures of success
- VII. Breeding & Population Dynamics
- VIII. Fence Maintenance
- IX. Monitoring
- X. Captive Elephant Management
- XI. Habitat Management
- XII. Problems
6. NEED OF ENLARGING RHINO ARE AND A SEPARATE RHINO POPULATION (65)
7. PROPOSED ACTION PLAN (69)
8. EXPECTED RESULTS (74)
9. CONCLUSION (75)
10. FUTURE PLAN OF WORK FOR NEXT SIX MONTH (78)
BIBLIOGRPHY ON DUDHWA.NP (79-85)
APPENDIX – I (86)

ACKNOWLEDGEMENT

Firstly, I am thankful to Mr. Fred Bagley, Department of Interior, US Fish & Wildlife Services, USA, for his encouragement, Cooperation and calling me on many occasion to discuss the plans. I am also thankful to him for extending his help in many ways and funding.

I am equally grateful to Dr. Asad. R. Rahmani, Director, Bombay Natural History Society, kindly accepted this project and arrangement made for funding which only made possible to us to work smoothly and to carryout this study. His guidance, keen observations, valuable suggestions and comments always helped us to improve our work.

I am thankful to Dr.R.L.Singh, IFS, Chief Wildlife Warden, Uttar Pradesh State, for giving his approval for funding this project and finally given permission to carryout study in and around Dudhwa Tiger Reserve, North Kheri Forest Division and Katerniaghat WLS.

My gratitude is also extended to Shri.G.C.Mishra, IFS, Director, Dudhwa Tiger Reserve for his valuable suggestions, by providing all possible help and permitting us to work in and around Dudhwa NP and Katernighat WLS area.

I am personally thankful to Shri Ashish Tiwari, IFS, Deputy Director, Dudhwa Tiger Reserve, for his kind cooperation, help and providing all possible help in many ways. On many occasion accompanying in the field in rhino area and Bhadhi Tall Area. We are also thankful to Shri P.Singh, IFS, Deputy Director, Dudhwa NP recently took the charge in place of Shri Ashish Tewari.

I am also thankful to Shri Sanjay Singh, IFS, Divisional Forest Officer, North Kheri Forest Division for giving all possible help and access to all the documents available at his place.

Our team is also thankful to Shri Shukla and Shri Panday, Assistant Conservator of Forests and all the Range Forest officers and staff members of Dudhwa Tiger Reserve and North Kheri Forest Division for extending their help.

I am personally grateful to Prof. V.B.Sawarkar, IFS, Director & Dean, Wildlife Institute of India Dehra Dun, helped me from the very beginning and worked under him in Rhino Monitoring Project in late 80s. His kindness, words of encouragement, valuable suggestions always helped to learn, improve and work systematically.

I am also thankful to Shri Quamar Quareshi, GIS expert, Wildlife Institute of India, for helping me in digitizing the maps, designing, finalizing the formats, interpreting satellite imageries and accompanied during field survey. Finally, helping in analysis of data by using different computer software's.

I am thankful to two officers Trainee of 21st Diploma Course of Wildlife Institute of India; Shri Vimal Kumar of West Bengal Cadre and Shri Satya Prakash of Jharkhand Cadre submitted their desertion under my guidance on different aspect on reintroduced rhinos in Dudhwa NP. Some of their suggestions are also considered in the rhino section in the current progress report. I am also thankful to Sh. Kuldeep Chauhan for word processing and layout of the document.

I am thankful to my wife Bitapi Chhaya and my daughter Juhi for spending many days with me in the field without considering winter cold, heat of summer and rains during monsoon months in terai climate in and around Dudhwa NP/Tiger Reserve and other parts of India. I am also thankful to her for going through all my reports and suggesting changes to give a final shape.

Dr. Satya Priya Sinha

WORK PROFILE

The project envisages the viability assessment of corridor between Dudhwa National Park/ Tiger Reserve and Katerniaghat Wildlife Sanctuary. It is evident that currently in corridor area, forest area is fragmented and interspersed with agriculture lands, encroachments and habitations. In the month of December 2001, areas on the north eastern side of the Dudhwa National Park, adjacent to Mohana River on the Indo-Nepal boundary surveyed up to Katerniaghat Wildlife Sanctuary. But due to heavy rain routine was disrupted partially for 15 days and our movement restricted. We had to wait till the areas were approachable. Similarly it happened in January 2002. But we continued to work on the southern side of the Dudhwa National Park in the second corridor and collected other related data. These two reconnaissance of the area assessment of the current field condition before beginning the fieldwork in detail and following the methodology regarding data collection. In the meantime permission to work in these areas was approved by the Chief Wildlife Warden, Uttar Pradesh and information to the concerning authorities. In December two research biologist and two fields assistant were selected and a field station was set up at Palia Town. Formats for data collection was developed and designed for the recording of vegetation, faunal distribution and its diversity, animal movements, bird abundance and socio-economic data.

The Project officer visited Dudhwa National Park in November and met Park Official and discussed about the project. Study areas were visited and data on reintroduced rhinos was updated.

Arrangements were made for hiring of vehicle and a house for field station for team members. From December 2001 to April 2001 total of 41 days were spent to supervise the fieldwork. Project officer is looking after the digitizing of the maps. The field biologists and two-field assistant are working regularly in the field. In the same period field biologist visited Lakhimpur Kheri, HQ of Dudhwa Tiger Reserve to interact with the Field Director, Dudhwa Tiger Reserve and Divisional Forest officer of North Kheri to collect information and map of Northern Kheri area and other related documents. Project officer also met the Field Director and Divisional Forest officer. During this visit documents related to the project was given to Field Director Dudhwa Tiger Reserve and other forest officers concern.

Till May 2002, we have covered the entire Northern boundaries along Mohana River to Katerniaghat Wildlife Sanctuary and southern side of the Dudhwa National Park from Gulra Forest, which is included as buffer Zone. In these areas we have fixed GPS Transect location points and at such points permanent objects are painted as a prominent site for observations and data collection for summer season. During monsoon months it is not possible to visit any of the two corridor areas because of flooding and road conditions.

From April 15 to 24,2002, Dr.Asad.R.Rahmani, Director, BNHS, organized a workshop on Bird census methods for Forest Department and researchers. During this time Dr. Rahmani interacted with the field researchers and field assistant of project team and also visited the field station based in Palia. Since we have completed the winter observations in two proposed corridor routes. Summer season data

collection is in progress and will be carried out till end of the project period.

INTRODUCTION

Corridor plays an important role in management of landscape, by linking fragmented forest patches and provides accessibility to alternative habitat for long ranging animals. It also helps in maintaining gene flow as it is required to prevent inbreeding depression thus causing extinction (Harris, 1984). In recent years a number of wildlife habitat have under gone or are threatened with fragmentation due to various anthropogenic factors and this has actually affected large mammal population residing in them (Johnsingh et al 1990, 91).

Dudhwa National Park and Katerniaghat Wildlife Sanctuary are important habitat for large mammals like rhino, elephant, tiger, swamp deer and other wild animals found in the terai and bhabar range. Once these areas had abundant population of rhinoceros (Laurie, 1978), linked with each other, now has reintroduced and isolated populations. A number of rhinoceros have been reintroduced in recent past from Pobitara Wildlife Sanctuary, Assam and The Royal Chitwan National Park, Nepal to Dudhwa in India (Sale and Singh, 1987, Sinha and Sawarkar, 1993) and from the Royal Chitwan National Park to Royal Bardia National Park in Nepal (Barner, 1988, Mishra and Dinertein, 1987, Jnawali and Wegge, 1993) to establish new viable breeding populations and safeguard this species from various threats. The Katerniaghat Wildlife Sanctuary has three rhinos dispersed from Royal Bardia National Park to Katerniaghat Wildlife Sanctuary.

The corridor between Dudhwa National Park and Katerniaghat Wildlife Sanctuary has been disrupted due to continuous biotic pressure and human settlements. The situation of corridor between Katerniaghat Wildlife Sanctuary and Royal Bardia National Park is more or less similar. In the past corridors were safer passages for

animals while movement from one place to other. Records on the regular movements of tiger, elephant and rhino from Katerniaghat Wildlife Sanctuary to Dudhwa National Park are limited. But movement of elephants and rhinos takes place between Royal Bardia National Park and Katerniaghat Wildlife Sanctuary, which is restricted to certain areas. In such situation, revival of corridors is very important for survival of these three isolated wild animal population including rhinos, tiger and elephant.

In the past entire terai area had rhino, elephant and tiger population. In due course of time due to rapid growth of human and livestock population, establishment and growth of cultivation and rehabilitation of displaced population during partition of India brought to bear immense pressure on the land and gradually link between Dudhwa National Park and Katerniaghat Wildlife Sanctuary lost its integrity and identity. Currently wildlife population is restricted to two different PA. In both the areas rhino, tiger and elephant occur with other sympatric larger mammals. If the habitat of the corridor is restored the connectivity will promote genetic exchange not only between Dudhwa National Park and Katerniaghat Wildlife Sanctuary but also with the Royal Bardia wildlife Sanctuary, Nepal. This possibly may reduce the Man-Animal conflict. Currently number of tigers, wild pigs and seasonally elephants and rhinos are seen in the cultivated areas between Dudhwa National and Katerniaghat Wildlife Sanctuary. Keeping these problems in mind this study is justified in carrying out the assessment of corridor viability and habitat restoration between Dudhwa National Park and Katerniaghat Wildlife Sanctuary and its management in Western Terai Rhino conservation Unit.

OBJECTIVES OF THE PROJECT

1. To assess the current status of the reintroduced rhino population and conduct a review of the Rhino Reintroduction Programme in Dudhwa National Park / Tiger Reserve.
2. To assess the current state of faunal and floral diversity in the corridor habitats between DNP – Katerniaghat.WLS.
3. To assess the extent of the wild animal movement in the corridor.
4. To study the socio-economic status of people living in and around the corridor areas and their dependency on the resources of the areas.
5. Using the information demarcate the possible corridor link between Dudhwa National Park - Katerniaghat Wildlife Sanctuary and to prepare a plan for habitat restoration that includes cost analysis and other management inputs needed.

METHODOLOGY OF THE PROJECT

1. Data collected on all aspect of the Rhino Reintroduction Programme, including the dynamics of the founder rhino population, management inputs and their measures of success between 1984-99 updated to May 2002, are analyzed and a future action plan is prepared.
2. Transects are established for habitat stratification. From fixed transects data collected on the following:
 - (I) Direct sightings of wild animals
 - (II) Indirect evidences such as hoof marks, pugmarks, pellets, dung and feeding signs, at fixed intervals in predetermined size circular plots.
 - (III) Secondary information's like the frequency of sighting of various species reported by local people.
 - (IV) Local peoples reaction about the status of the corridor, its restoration and their contribution in such work.
3. Current status of forest patches in the corridor are assessed for habitat quality:
 - (I) Transects were laid down randomly in recognized habitat strata. Plots of 10 m X 10 m were laid on the transects at regular fixed intervals to record:
 - (a) Lopping and wood cutting pressure
 - (b) Livestock grazing pressure
 - (c) Status of plant species / classes & regeneration
 - (d) Succession stage of vegetation, distribution and amounts
 - (e) Plant and animal species richness and diversity
4. A detailed survey is already completed in the corridor area to collect data on:

- (I) Current land use practices in and around the corridor.
 - (II) Number of villages, human and livestock population
 - (III) Dependency of such people on the natural resources, type of material collected from the forested area of corridor, and its place in the local economy.
 - (IV) Social status of the locals and their economic conditions.
 - (V) Predation by tigers on livestock, cropland depredation by wild herbivores eating and injuries inflicted by wildlife on people.
 - (VI) Natural mortality of wild animals, illegal capture and poaching incidence.
5. Information related to status and distribution of large mammals, habitat conditions, movement patterns, population demography, main threats and management issues in two PA and in the corridor are collected from research work documentation, interaction with forest officials, staff and other people active in the field of conservation. A questionnaire survey in different villages is in progress.
6. Degraded areas in the potential corridor link are marked on the graded and thematic maps of the corridor link mark on the map for DNP and Katerniaghat WLS. ARC/INFO and Auto Cad software is used for the purpose.
7. In consultation with the forest officials a restoration plan for corridor habitat will be developed including modalities, responsibilities and partner. Forested area under encroachment by local villagers is to be delineated to institute procedures and processes for recovery. Forest department is a major stakeholder in this context.

STUDY AREA

The forest patches in possible corridors between Dudhwa National park and Katerniaghat Wildlife Sanctuary are a part of North Kheri forest division, which lies between $27^{\circ} 42'$ to $28^{\circ} 46'$ N and $80^{\circ} 12'$ to $81^{\circ} 16''$ E. North Kheri Forest Division was created in the year 1916 with vide G.O.No 313/xiv-31, dated April 8,1916 with the forests in Trans-Sarda areas. In 1977, the division was reorganized after the creation of Dudhwa National Park. Most of the old reserve forests of the division were transferred to the Dudhwa National Park, which forms the buffer. Forests of North forest division are fragmented and in small patches which are situated on the banks of rivers Mohana and Suheli. The Northern boundary of the forest division forms international border between India and Nepal extending from Pillar No. 98 to 139 and 195 to 211. There are six forest ranges in the North Kheri forest division namely, Sampurnanagar, Palia, Manjhghae, North Nighasan, South Nighasan and Dharohara. The forest patches of two possible corridors falls mainly under North Nighasan, South Nighasan and Manjhghae ranges. The corridor No.1 links the North Eastern corner of Dudhwa NP to North Western part of Katerniaghat WLS and corridor No.2, the South Eastern portion of Dudhwa NP to North Western part of Katerniaghat WLS below the first corridor.

**Current work carried out on the following aspects
(December 2001 to May 2002)**

1. Assessment of current status of the reintroduced rhino population and review of the reintroduction Programme in Dudhwa NP
2. Identification assessment and viability of the two possible potential corridors for wild animal movement.
3. Vegetation sampling for floral diversity in forest and grassland of following areas:
Bela Persua, Takiya, Banglaha, Chakra, Dhramapur, Singhai Kalan, Raghunagar, Deepnagar, Kharitya, Bilora, Lathore, Kauria, Murthia, Lathuua, Mohammadpur, Norangabad, Bathua, Behria, Majjhra, Icchanagar, Sisiya and Roopnagar.
4. Data for animal abundance in terms of direct and indirect evidences have been collected from the above-mentioned areas.
5. Data on Biotic pressure was collected from the cited areas.
6. More then 100 GPS location of the various land use categories from the cited areas are recorded.
7. Socio-economic survey and study carried out in villages of Bela Pursua, Keoria, Danga, Banbirpur, Ramnagar, Suratnagar of Corridor – I

ASSUMPTIONS AND METHODS

Corridor viability and identification

The area between Dudhwa National Park and Katerniaghat Wildlife Sanctuary is interspersed by agriculture field and human habitation hence identification of the possible corridor for wildlife movement including large mammals started to link these two potential protected areas. Two potential corridors were identified for animal movement on the basis of our preliminary survey and secondary information available from forest department, by consulting maps of forest survey of India, Survey of India maps and satellite imagery. Although all the required maps of Survey of India are not available specially the North Kheri area as it is restricted area and disputed boundary along Mohan River between India and Nepal. Along with this, working plan map of North Kheri Forest Division, Dudhwa NP and Katerniaghat WLS, satellite data were consulted and reconnaissance of the area to ascertain ground facts was also conducted. Criteria adopted for the identification of corridors were the route followed by elephants, tiger. During 1996, one adult female rhino from Katerniaghat, reintroduced in Bardia NP reached Dudhwa National Park. Later this rhino was put into Rhino Re-Introduction Area (RRA). Unfortunately it was chased, attacked and finally killed by the male bull. The corridor should be feasible, forested and the distance between the rhino area of Katerniaghat WLS and Dudhwa NP should be minimum.

The area between Dudhwa NP and Katerniaghat WLS comes under the jurisdiction of North Nighasan, Majghai and South Nighasan Ranges of North Kheri Forest Division. Location of Corridors between the Dudhwa National Park to Katerniaghat Wildlife Sanctuary is given

hereunder:

Corridor - 1: The area of this corridor lies along the River Mohana, which originates in Nepal and is a tributary of Sarju river in the past. This river frequently changes its course and pushed into Indian Boundary, which causes dispute in demarcating the actual international boundary between India and Nepal. In the past one rhino from Katerniaghat area crossed Kuryala Ghat and reached in the forested area of Belrayan Range of Dudhwa NP via Banbirpur Village. Local villagers and farmers had seen rhino in the cultivated field on a number of occasions during this period. The villages and forested area along the corridor-1 is given hereunder:

Belrayan Range Forest (Dudhwa.NP) – Bela Pusua- Keoria, Gulara Pathar Shah, Kishunagar, Deep Nagar, - Banbir Nagar, Ganga Nagar, Rann Nagar, Khairatya – Katerniaghat.WLS

Corridor - 2: The area of this corridor is interspersed with forest patches, agriculture land and human habitation. River Suheli and its tributaries pass through the corridor-2. The villages and forest area along this corridor is given hereunder:

Kila Range (Dudhwa.NP) – Sisya- Roop Nagar - Nunia-Dharmapur, Kauria- Singhai Kalan, Banglaha, Chkraha- Lathua, Bathua, Mohamadpur – Majhra East –Katerniaghat.WLS

A. Vegetation Quantification:

The present existing forest cover between Dudhwa NP and Katerniaghat WLS is fragmented and patchy. Most of the forest patches and grasslands are in small sizes and interspersed with agriculture and human settlements. Transect sampling for vegetation quantification in a continuous manner is not possible. Hence sampling

was done covering random sampling points in each patch of the forest and grasslands in the corridors. Sampling for trees was done in circular plots of 20 m radius at various points, picked randomly in each existing forest cover in both the corridors identified. From the same sampling points, data were also collected for shrub and herb species using circular plot of 5m and 1m respectively. Woody species exceeding 20 cm GBH (Girth size) were considered as trees whereas less than 20 cm in GBH were counted as shrub. At each sampling plots, plant species and their number, GBH, tree height, terrain, vegetation type and canopy cover was measured. Canopy cover was measured with the help of GRS densiometer. Similarly for shrubs quantification, shrubs number, height and cover were recorded. Since grass were supposed to be highly significant for large herbivores like rhino and elephants. Hence grass was quantified using a cross of 5m length from the centre. Species and their height were recorded at distance of 20 cm interval of the 5 m rope of cross in all four directions. In total, 100 points were taken in a quarter for grass abundance.

B. Estimation of Biotic Pressure

The information on cutting and lopping of trees and grazing cases were recorded in the circular plots of 10 m diameter. Density of cutting and lopping of trees will be estimated per hectare whereas grazing will be assessed in terms of dung density per hectare in both the corridors. Besides this, information on location of habitation and road from such patches was also taken to assess and know that how close is habitation and road from the sampling patch of forest and its impact. It is quite natural that closeness of human habitation and road will reflect the extent of biotic pressure.

C. Assessment of Animal Movement

To find out the current status of people living in the identified areas, surveys were done. Information on cropping pattern, livestock population, human density, land holding pattern, source of income, profession, educational status, living conditions and availability of basic amenities are being taken in the redesign formats. Besides this, information's on crop damage by wild animals and man-animal conflict is being collected. The following villages were covered during current study and will include other villages:

1. Bela Parsua 2. Keoria 3. Danga 4. Banbirpur 6. Suratnagar

D. Assessment of Socio Economic Status

None given

Forest patches in both the corridors were visited and information on animal movement was recorded in the circular plots of 10 m in terms of indirect evidences such as pellets, pugmarks and scats. Direct sighting of wild animals were also done and one tigress with two cubs were sighted in the Gulra forest in the buffer zone. Same tigress later attacked three local graziers when they went too close to watch the cubs and tigress. Earlier a tigress was found dead near Bhadhital and the incident was reported to Deputy Director, Dudhwa National Park by the researchers. In addition to that local villagers around and graziers were interviewed and information's on wild animal movement was recorded. Information about the past situation was also gathered around the corridor villages.

E. Assessment of Birds abundance

Data on Bird abundance is being taken in terms of number of bird species in each sampling points and in different vegetation types in both the corridors and will be collected season wise.

F. Land Use Pattern and Encroachment in and around Proposed Corridors (I&II)

To assess the land use practices, intensive surveys are being done in both the corridors and GPS location of villages and crop fields in the identified corridors are being taken to validate the land use cover shown in the imageries of Satellite data, topo sheets and range maps of forest department of North Kheri Forest Division.

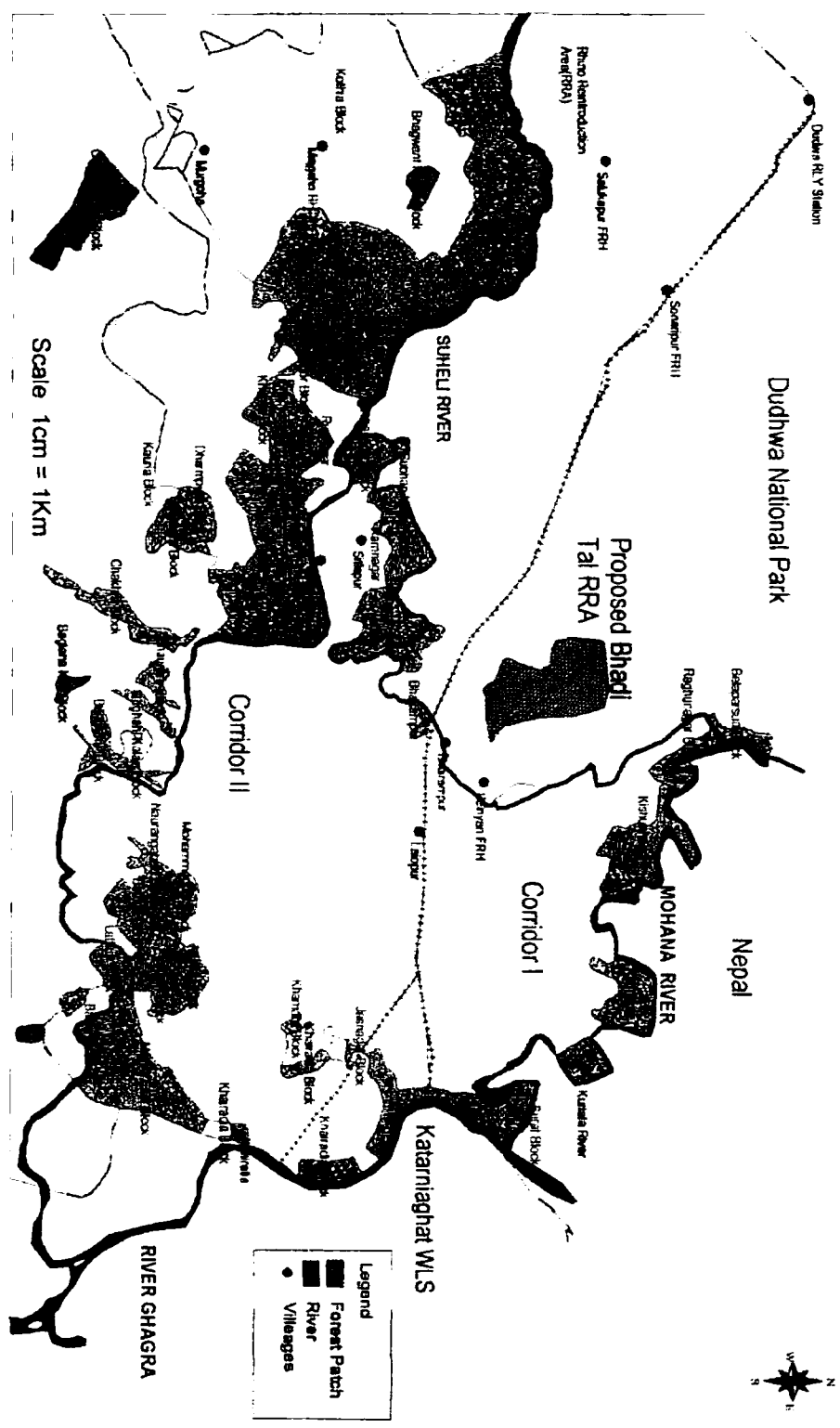
Agriculture is the prime occupation and main source of livelihood in this area. Above 70% human population is dependent on agriculture and allied activities. According to our study, the average land holding is 1.27 ha and more than 46% farmers are marginal, whose land holding ranges between 0.2 to 1 ha. Although exceptions are there in case of some of the farmers like Bhalla Estate have more than 100 acre of land in Kisannagar owned by a single farmer.

The main crops are sugar cane, paddy, wheat, pulse and mustered. Sugar cane has largest share in cultivation (35.82%), followed by Paddy (26.87%) and Wheat (20.90%). In the last 20 years the agriculture land use of the region has changed towards sugar cane cultivation. Before that paddy was the major crop of the area. Shift in agriculture pattern or cropping pattern is related to monetary gain, less investment and care. Sugar cane is sown in March and harvested in the months of December/January. Among kharif crops paddy is sown during July/August and harvested in October/November. The wheat, pulse and mustard are the Rabi crop, whose sowing period is in the month of December and harvested in March/April. The irrigation during dry period is totally dependent on diesel driven pump sets. Kharif crops are dependent on monsoon for irrigation. After agriculture the second major land use is forestry in the region.

Encroachment is one of the major threats in this area. Large number of forested area in the corridors are encroached and being converted into agricultural field. The growth of human population particularly due to migration and settlements of Sikh community had severely impact on forestland.

Corridor No. I have percentage 57.60 percent of the land under encroachment more than the Corridor No. II (2.5 %). Out of 1847.59 ha in Corridor No. I. 1064.21 ha area is under such encroachment. Mostly in all the forest block except few in this corridor have encroachment problem. Raghunagar, Suratnagar, Ganganagar and Rannagar forest blocks are badly affected by encroachment. Raghunagar forest block is completely converted in to crop fields. Indernagar and Deepnagar are among the other forest blocks where almost half of the area is under encroachments. The Corridor No. I have less problem of encroachment than the Corridor No. I. Since most of the area comes under marsh and watershed of River Suheli and other tributaries. Out of approximately 5964.99 ha area, total area under encroachment are only 149.03 ha. But in future the forest of this area will definitely face the problem of encroachments. Changing land use and demand for more land to cater to human and livestock, forest management in terms of improper demarcation and reclamation of the peripheral forest and its protection are the major reasons behind the encroachment and degradation of corridor peripheral forest.

Proposed Corridor and Forest Patches between Dudhwa National Park and Katarniaghat WLS



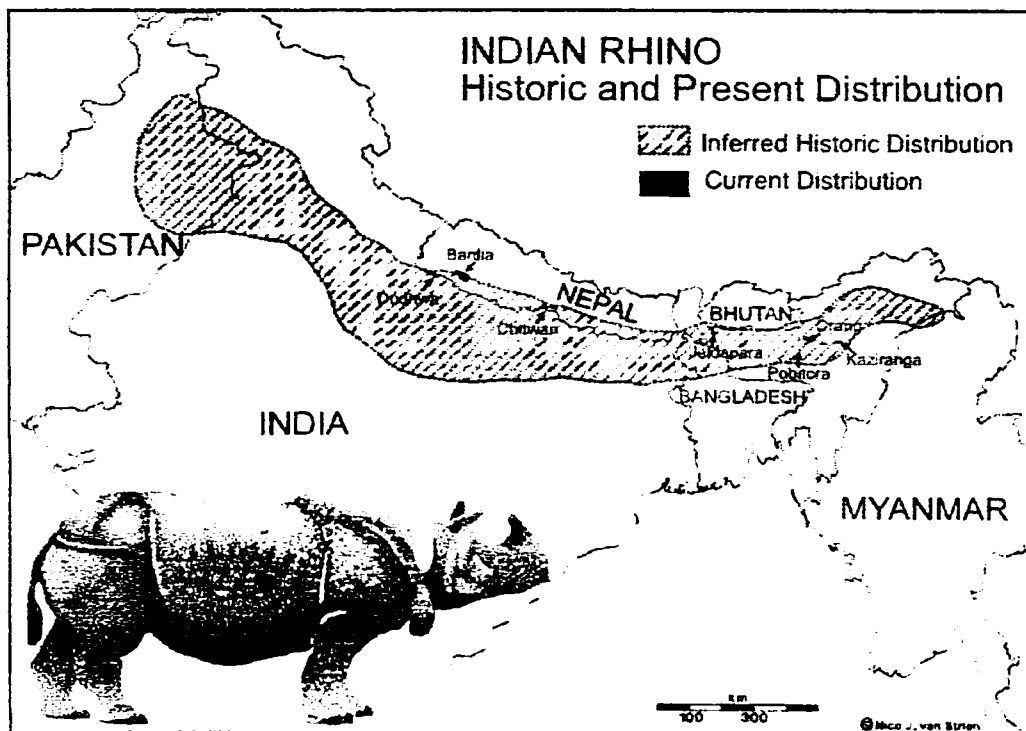
**G. Assessment of Current Status of the Re-Introduced Rhino
Population and Review of the
Rhino Re-Introduction Programme (*Objective No.1*)**

By 1984, only 1500 individuals of the species were left all over the world (Singh and Rao, 1984) of which 1200 existed in India and another 300 in Nepal. In India, almost the entire population was found in Assam, Kaziranga National Park being the stronghold with about 1000 individuals. Rhino population in Nepal at that time was restricted to one location i.e. Royal Chitwan National Park.

Being concerned with the alarming situation the world community led by the IUCN looked into the problem at great length. The Asian Rhino Specialist Group of the IUCN's Species Survival Commission studied the causes of decline in the population of the species and concluded that some of the rhinos from Assam may be trans located to a place within its past distributional range. Current threats and criteria for translocation, referred to as re-introduction hereafter, were hammered out. A Sub-Committee of the Indian Board of Wild Life was constituted to select and recommend a site for Re-introduction Programme. The sub-Committee visited seven sites in India and sought the services of the Botanical Survey of India to assess the habitat suitability of different alternative sites. A team led by Dr.Hazra, Botanical Survey of India studied the vegetation of Kaziranga and Dudhwa, concluded that Dudhwa National Park had 45 common floral components similar to that of Kaziranga NP, Assam. Later on, based on expert committee report, it was decided to translocate 30 rhinos from Assam to Dudhwa as it was thought that it would help assure survival of the species in case of any stochastic eventuality of local extinction. A team led by Dr Sale, FAO Expert, recommended techniques for capture, transport and conducted training to the forest personnel and veterinarian. Later on the same team led the capture

INTRODUCTION

The Great Indian One – Horned Rhinoceros roamed all along the foothills of Himalayas. Its distribution range formed a northern border fringe of the erstwhile-undivided Hindustan. It extended from Afghanistan to include Bangladesh and up to Arunachal Pradesh. Babar mentions its presence up to Peshawar. This magnificent mega-herbivore was distributed in the valleys of Indus, the Ganges and Brahmaputra. Its southern limit seems somewhat uncertain but presumably, it did not extend into drier parts (Sale, J.B.). Hunting and poaching for sport, horn or hide as well large scale conversion of the terai grasslands to agriculture and tea plantations during last two hundred years or so has led to the persecution of this species from its past distribution range. This has converted the past continuous range from Peshawar to Assam into isolated pockets of grasslands.



By 1984, only 1500 individuals of the species were left all over the world (Singh and Rao, 1984) of which 1200 existed in India and another 300 in Nepal. In India, almost the entire population was found in Assam, Kaziranga National Park being the stronghold with about 1000 individuals. Rhino population in Nepal at that time was restricted to one location i.e. Royal Chitwan National Park.

Being concerned with the alarming situation the world community led by the IUCN looked into the problem at great length. The Asian Rhino Specialist Group of the IUCN's Species Survival Commission studied the causes of decline in the population of the species and concluded that some of the rhinos from Assam may be trans located to a place within its past distributional range. Current threats and criteria for translocation, referred to as re-introduction hereafter, were hammered out. A Sub-Committee of the Indian Board of Wild Life was constituted to select and recommend a site for Re-introduction Programme. The sub-Committee visited seven sites in India and sought the services of the Botanical Survey of India to assess the habitat suitability of different alternative sites. A team led by Dr.Hazra, Botanical Survey of India studied the vegetation of Kaziranga and Dudhwa, concluded that Dudhwa National Park had 45 common floral components similar to that of Kaziranga NP, Assam. Later on, based on expert committee report, it was decided to translocate 30 rhinos from Assam to Dudhwa as it was thought that it would help assure survival of the species in case of any stochastic eventuality of local extinction. A team led by Dr Sale, FAO Expert, recommended techniques for capture, transport and conducted training to the forest personnel and veterinarian. Later on the same team led the capture

and transport operations.

In March 1984, six animals were captured from Pabitara Wildlife Sanctuary, Assam out of which one large male escaped from stockade during night. Remaining five was transported via air and road to Dudhwa National Park. At Dudhwa, these animals were initially kept in stockades for intensive care. One female from the group died after 11 days. Of the remaining four, three animals were released on the 20th April 1984 and the large male was released on the 9th May 1984.

During 1985, With an object of establishing a vigorous founder population of Rhinos, four young adult female Rhinos were obtained from Royal Chitwan National Park, Nepal in Exchange for 16 domesticated Indian elephants. It was thought that by selecting only females, the reproductive potential in Dudhwa would be more than doubled and eventual mating of these animals with the totally unrelated Assam males would ensure genetic vigor (Sale. and Singh, 1986).

There were several setbacks faced by the Re- introduced rhino population. The single major cause was intra-specific fight among male and between male and females. There was one individual dominant male from Assam, named Bankey that has dominated the entire re-introduced population. During 1988, one of the males was died leaving behind only male in the population. Realizing the threats of in breeding, one male was brought from Kanpur Zoo, but it was seriously injured by Bankey, and was sent back.

Eighteen years after the re-introduction, rhino population has increased to 18 (Last calf born on 11 th, July 002) and has well adapted in its former range. It shows by a number of birth took place in Rhino Re-Introduction Area (RRA) in Dudhwa NP/Tiger Reserve which is quite encouraging and a successful reintroduction Programme.

Objectives of the study

- 1.To assess the measures adopted for managing re-introduced population of rhinoceros at Dudhwa Tiger Reserve,
- 2.To analyze the problems realized in managing the population,
- 3.To develop strategy for sustained success of the programme.
- 4.To examine the possibilities of enlarging the habitats for the re-introduced rhinos,
5. To identify the potential rhino habitats for enlarging the habitats,
- 6.To identify the strengths and weaknesses and prepare an action plan

STUDY AREA

Approximately 90 sq. km of grassland area under Dudhwa Tiger reserve is located on its south – west portion along river Suheli. It is a 15 km long tract, which is suitable as rhino habitat. About 50 percent of this area is subject to seasonal flooding and an area of about 560 ha is permanently swampy and water logged. The Rhino Sub-Committee of the Wildlife Status Evaluation Committee of the IBWL felt that the area was highly suitable. Energized fencing called as Rhino Re-introduction Area (RRA) was selected for re-introducing rhinos enclosed a small area of about 27 sq. km. This comprised the entire Kakraha Block and a part of Chhota Palia Block falling under the jurisdiction of South Sonaripur Range. The RRA has a total of eleven water-bodies (Tals) namely Kakraha Tal, Bara Puraina, Chhota Puraina, Bandara, Bar Godha, Chhedia, Chaitua, Amah, Bela, Kurmunia and Kamiah. First seven are permanent whereas the last four get dried during summers and water is augmented by pumping water from wells. The chain of water bodies' lie along the Damar Sal and grassland ecotone.

The lakes and streams, Andhra and Chabakwa represent remnant flows of the old courses of river Suheli. During monsoon, major portion of the grassland inside RRA remains flooded and water currents can be seen in the two streams and across the chain of swamps while the other areas have up to four feet of standing water. The area of 27 sq. km comprises Damar Sal forest – 20 percent and grasslands - 80 percent with fringe forest. Initially entire area was enclosed with a three strand energized fence. A 9 km stretch of the RRA forming park boundary along river Suheli was additionally protected against

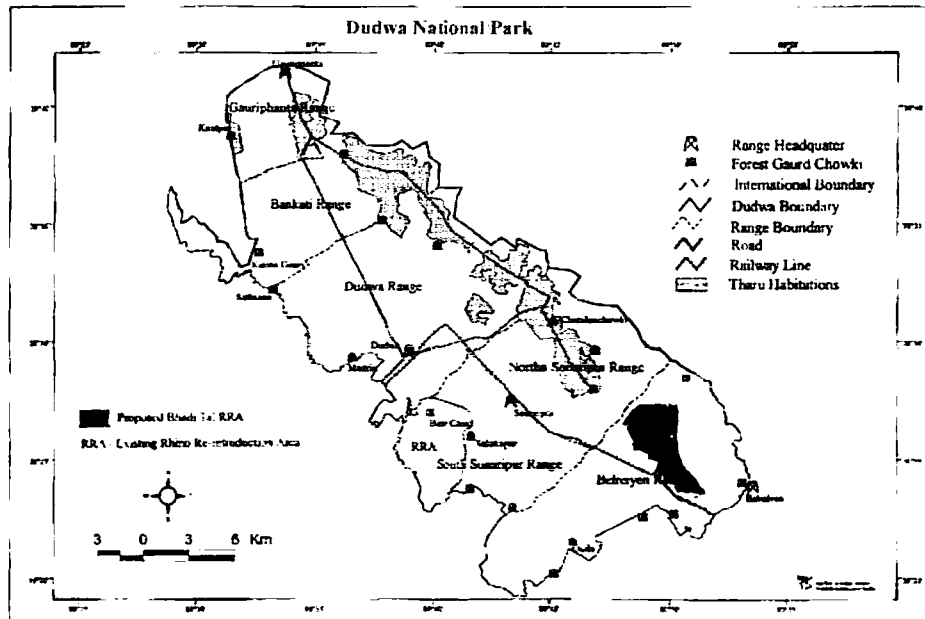
accidental escapes by construction of an elephant proof trench (3.0mX 2.0mX 1.5m) equally effective for rhinos.

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

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

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

Map of Dudhwa National Park Showing Proposed Area



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

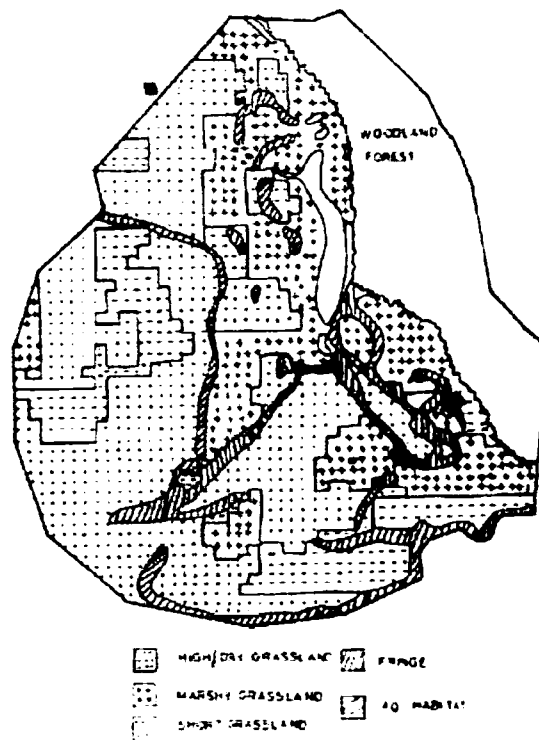
Some of the aquatic plants like *Hydrilla verticillata*, *Vallisneria spiralis*, *Hygroryza aristata*, *Nymph* spp, *Water lily* spp and *Potamogeton* spp are commonly found in the water bodies.

The RRA has a network of roads and can be approached from outside from 3 sides, namely Base Camp, Chhota Palia and Salukapur where gates have been provided in the power fence. There are two main roads inside the fence-while one travels straight from Salukapur to Base Camp, the other run along the Southern perimeter fence joining the main road at either end. As these roads remain unserviceable for long period during and after monsoon, an additional road from Salukapur to Kakraha was made in 1997-98. A feeder road links the central main road and the peripheral road. At Salukapur the staff is housed in conventional quarters. At Base Camp log huts have been built on top of high piles for housing the staff. This is a special requirement as the area remains under water for prolonged periods during monsoon. There are four watchtowers inside the RRA. While three are located around Kakraha swamp, one is at Kaimahia. All are wooden structures. These serve as animal observation posts and fire watchtowers. After opening up of the area for tourism, these towers are being used by tourists. But the condition of these towers is very bad and need immediate repair. The RRA provides a good habitat for a range of animals like Tiger, Leopard, Elephant, Swamp Deer, Sambar, Spotted Deer, Hog Deer, Barking Deer, Hispid Hare, Bengal Florican, and Swamp Partridge. During field visits hispid hare pellets and tiger pugmarks were observed. A pair of Bengal Florican was also sighted during this visit inside the RRA and in other grassland areas in Dudhwa.

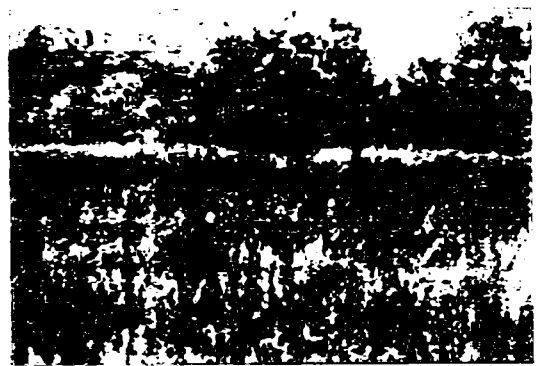
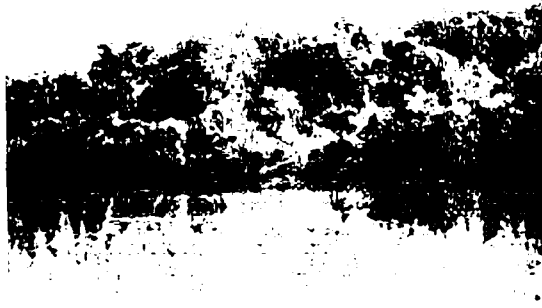
The area identified for creation of a satellite population falls in the Bhadi- Churaila sector of the Reserve, which fulfils all habitat requirements for the Rhino rehabilitation. The area has already been surveyed for its habitat suitability and found fit for rehabilitation of Rhinos. The extent of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

RHINO REINTRODUCTION AREA

(Figure shows different habitat types inside RRA)



Habitat types inside Rhino Reintroduction Area



Habitat Types inside Rhino Re-Introduction Area (RRA)

METHODOLOGY

Methods used for the study included primary and secondary studies. Whereas primary study consisted site visits, observation made on the rhinos in the field, management inputs provided, problems dealing with maintenance of electric fence, interaction with PA management authorities, local staff and local villagers in the southern boundary of RRA. Secondary study included study of a series of observations and assessments made by several scientists in the past years.

Methods applied for the study included:

- i) Literature Survey,
- ii) Interaction with PA management,
- iii) Field observations and
- iv) Village Survey

A. Literature available at the WII library was studied to develop a firsthand concept of the area and activities. It also gave the details of planning, operation. Data on births and mortality in the re-introduced population collected from past publications and from Range Forest Office Sonaripur, Dudhwa Tiger Reserve. PA management including Range Officer, Section Officers, Forest Guards, Mahouts and Fence watchers were interviewed for collecting information on different aspects of management and related problems. Records maintained at camp level, Range level and at Division level were studied to analyze monitoring mechanism. Detailed field visits were conducted for assessing monitoring efforts, status and maintenance of the fence and studying the habitat. Three Villages near the RRA were visited to

METHODOLOGY

Methods used for the study included primary and secondary studies. Whereas primary study consisted site visits, observation made on the rhinos in the field, management inputs provided, problems dealing with maintenance of electric fence, interaction with PA management authorities, local staff and local villagers in the southern boundary of RRA. Secondary study included study of a series of observations and assessments made by several scientists in the past years.

Methods applied for the study included:

- i) Literature Survey,
- ii) Interaction with PA management,
- iii) Field observations and
- iv) Village Survey

A. Literature available at the WII library was studied to develop a firsthand concept of the area and activities. It also gave the details of planning, operation. Data on births and mortality in the re-introduced population collected from past publications and from Range Forest Office Sonaripur, Dudhwa Tiger Reserve. PA management including Range Officer, Section Officers, Forest Guards, Mahouts and Fence watchers were interviewed for collecting information on different aspects of management and related problems. Records maintained at camp level, Range level and at Division level were studied to analyze monitoring mechanism. Detailed field visits were conducted for assessing monitoring efforts, status and maintenance of the fence and studying the habitat. Three Villages near the RRA were visited to

assess the extent of straying out problem of rhinos.

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

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

SCOPE OF STUDY

A comparison of the objectives of the Programme viz a viz achievements indicates success and setbacks of the Programme. Such comparison necessitates evaluation on the following aspects,

Planning and execution,

Breeding success,

Management and monitoring on a daily basis, and

Ecological aspects,

As far as planning for the re-introduction Programme is considered, it was done elaborately and this process involved experts from the Indian Board of Wild Life, Asian Rhino Specialist Group and officials from the Department of Environment and Forests at Union and State levels. An expert group led operations of capture and transport. As the success of the Programme at Dudhwa is closely related with the success of the capture and release Programme, it is felt necessary to analyze the performance of these operations too. Breeding success or

otherwise and management and monitoring on a daily basis needs detailed analysis and an effort has been made. A very important component of the evaluation of the Programme would be to look into ecological implications. It would have been interesting to study the impact of the presence of the species in the Eco-system after a gap of about 100 years in Dudhwa grasslands on:

Composition and maintenance of grasslands,

Facilitation by the re-introduced population for other herbivores,

Any change taking place after the Re-Introduction.

Since the current study was for a very limited period it was not possible to look into such details. However, mentioned topic needs a long term ecological monitoring and a detailed research on individual topics.

ANALYSIS AND EVALUATION OF MEASURES OF SUCCESS

As there were different phases of this programme's implementation, its performance has to be evaluated for these different phases separately. For this exercise, the rhino re-introduction Programme has to be analyzed for the following phases:

1. Planning Phase,
2. Preparatory Phase
3. Operational Phase, and
4. Establishment Phase & Monitoring of Animals

Large-scale hunting as sports, later poaching and habitat destruction leading to fast dwindling population of this magnificent mega-herbivore attracted the attention of conservationists round the globe during mid 70's. This followed studies, surveys and discussions on international forums like International Union for Conservation of Nature and Natural Resources (IUCN). It was during late 70's that the Asian Rhino Specialist Group and Indian Board for Wild Life considered re-introducing the Great Indian One-Horned Rhinoceros at suitable sites within its past distributional range from where it had disappeared or was disappearing. This would, in their opinion, reduce the chances of the species becoming extinct. This Programme started with planning during late 70's, followed by capture and release of rhinos from Assam during 1984, from Nepal in 1985 and translocation of a male rhino from Kanpur Zoo during 1992. The current rhino population has increased to eighteen. On July 11th 2002, a calf born belong to Swayamvara.

Planning Phase

For the present exercise analysis of planning phase is not required as it is out of purview of the study, subsequent phases are analyzed in the following paragraphs.

Preparatory Phase

After having decided to re-introduce rhinos from Assam to Dudhwa, the most challenging job was to capture them from the wild without causing injury to the animals, transport them safely and release them in a smooth manner. All these operations needed in-depth knowledge of biology and behaviour of animal and suitable technique. There was no experience of capturing Great Indian One-Horned Rhinoceros by chemical immobilization at that time, so, the noted specialist in wildlife management with specialization in drug immobilization of large animals Dr.. Sale was vested with the responsibility of suggesting technique for capture, handling and transportation, training to field staff and leading the entire operation.

Dr. Sale and Dr. Wood ford (consultant wildlife veterinarian) conducted capture trials in Assam between 7th January and 12th February 1980. The team captured five animals (all males) out of which four were transported to holding sites specially set up for this purpose. Capture and transport techniques were developed by the team and training was imparted to field personnel and veterinarians. A full report on this trial operation was published on the 5th March 1980. The report gave detailed procedures recommended for the capture and release operation. The report gave details of five successful immobilizations

but did not mention any attempt of immobilization that might have failed or of any casualty. Moreover, all the five animals captured were males. Had a few females also been captured, a better know-how in special cares to be taken while capturing female rhinos might have been developed.

Operational Phase (Capture and Transport and release operation)

The Wildlife Status Evaluation Committee of the IBWL suggested that a minimum number of ten rhinos might be translocate to Dudhwa National Park on an experimental basis. A capture team led by Dr. J.B. Sale conducted the capture operation between 15th and 21st March 1984 in Pobitara Wildlife Sanctuary, Assam. All were captured by darting, using doses of between 1.0 to 2.0 ml Immobilon (etorphine and acepromazine mixture, Reckettes, U.K.) that was reversed by Revivon (diprenorphine). Three of the rhinos were walked directly into crates placed immediately in front of them, by administering small doses of Revivon and guiding them forwards with ropes as resultant recovery from immobilization took place. The other two had to be transported about 1.5 km from capture site to crates on sledges. They were revived after the sledge bearing them had been inserted into the crates. All animals except one female quickly settled in the stockades and were eating well after a few days. During this capture operation, six animals were captured of which one died at Guwahati Zoo (Sinha, Sawarkar and Tiwari; Singh & Rao, 1986). Remaining five animals comprise of one adult male, one sub-adult male, two adult females and one sub-adult female were kept in the stockades.

These five animals were transported to Dudhwa having been airlifted from Guwahati to Delhi and then onwards carted by trucks. Three of

the animals were given pre-flight sedation (between 10 and 20 ml azaperon) and all behaved well during the 150-minute flight to Delhi. After food and water at Delhi's Palam airport, the crated animals embarked on an 18-hour truck journey to Dudhwa National Park. Immediately on arrival, they were released into individual stockades. Rhinos were monitored round the clock basis under the supervision of Dr.R.L.Singh, Director, Dudhwa NP. All the animals were kept in holding stockades for a minimum of about three weeks to recover from the shock of tranquillization and get an experience of energized fence. One female died following a stressful abortion after eleven days at Dudhwa (Singh and Rao, 1986). Three of the remaining four was released on the 20th April 1984 and the remaining one, which was a dominant male, was released in the main fenced area after radio collaring on the 9th May 1984.

Another translocation of rhino to Dudhwa was taken up from Nepal during March- April 1985. Four females estimated to be between 5 and 7 years were captured by immobilizing from Royal Chitwan National Park. These animals were sledged into crates in which they were revived. They were driven 720 km to Dudhwa and all withstood the 24 hr journey well and with the exception of the first arrival, which broke out during the first night, quickly settled in the wild after a week.

In the two operations a total of ten animals were captured (six from Assam and four from Nepal) by drug immobilization. Out of six animals captured from Assam in 1984, two died within a fortnight after being captured. One of the animals died at Guwahati Zoo and the other at Dudhwa. Both these animals were the elder ones of the group; the

female that died at Dudhwa was presumably in advanced stage of pregnancy. Another adult female was in good condition when released on 20th April 1984, but developed a limp shortly after and also had a troublesome open sore on her back. In order to investigate and treat both ailments, the rhino was immobilized on the 7th May 1984. On rising after revival her right forelimb was seen paralyzed, apparently due to nerve damage while recumbent (Sale. and Singh, 1986). In spite of intensive veterinary care the animal finally died on the 31st May 1984.

These three deaths out of a total of six animals captured were due to failure of the capture team and hence the capture and training operation was a definite failure. On the other hand it also justified that this type of incidence happens due to long distance to cover for release site and especially when large bodied animals are transported.

Capture operation of 1985 handled by the Nepalese forest authority, on the other hand was much better in various ways. First, only sub-adult animals were captured, thus minimizing the possibility of any pregnant animal being captured as had happened in the case of Assam capture. Secondly, there was no casualty after the translocation operation and all animals settled well in Dudhwa. But in 1991, one adult female of this group died because of the internal infection and abortion after fought with the dominating male to save her male calf.

Establishment Phase

A total of 10 rhinos were translocate to Dudhwa from 1984 to 1992. However, the last arrival to Dudhwa, a male from Kanpur Zoo returned back and it could not contribute in breeding. Out of the remaining 9

animals, one could not even be released in the wild and died in the holding stockade, two females died in 1984, one more male died in 1988 of injuries inflicted during its fight with another male and adult female died in 1991 and lost her male calf in 1992 killed by the dominating male. So, the founder population for the Programme is five. This founder population of five has only one male and four females, which has increased to a total of 17 rhinos, which includes the founder individual (5 Rhino) by May 2002.

One wild female rhino had found her way into the RRA. She definitely must have belonged to the population in the Royal Bardia National Park in Nepal. She died when attacked by Bankey.

Before the breeding of the re-introduced population could start off several setbacks were faced. By the end of 1984, the year of translocation of rhinos, Dudhwa had only three individuals (two males and one female). After receiving four females from Nepal in March-April 1984, Dudhwa population had two males and five females. But, at this point of time started a serious fighting, particularly between the two males for dominance. The larger male named 'Raju' asserted its dominance in the beginning. The other male named 'Bankey', 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 thereafter Bankey became the dominant male. Raju was chased out of the fence time and again. A 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 population.

The females re-introduced at early ages of about 5 years (in case of the animals from Nepal) adopted better in the RRA. There had been no casualty during or after capture and release operations. Performance with respect to breeding success has been better in case of animals re-introduced in sub-adult stage.

Re-introduction from Assam as compared to that from Nepal had a basic difference of distance of the destination from the origin. Nepal being nearer to the re-introduction site involved ease and economy in operation. This may also be a reason of the re-introduction from Nepal being more successful as compared to that from Assam.

Out of the three females brought from Assam, the two elder ones died within three months and consequently the Dudhwa population had only one 4 year old female and two males (one 7 year old and another 25 year old). In 1985, four females, all below 6 years of age were brought. 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 in 1988, the entire population was of uniform age structure with high breeding potential. In 1989 four of the five females successfully calved. The experiment 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. Furthermore, these sub adult females only have contributed to breeding.

Table 5.1: Causes of Adult Mortality in Dudhwa from April 1984 to February 2002

Cause of death	Number
Internal Infection and hemorrhagic septicemia	1
Injured by male attack and abortion	2
Injured due to accident and paralyzed	1
Stressful abortion and infection	1
TOTAL	5

Causes of Adult mortality

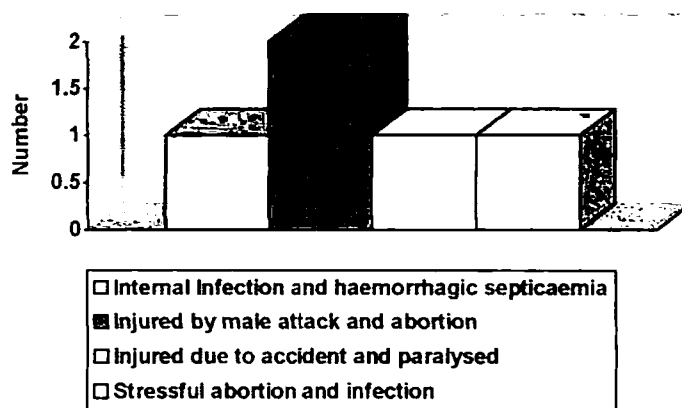
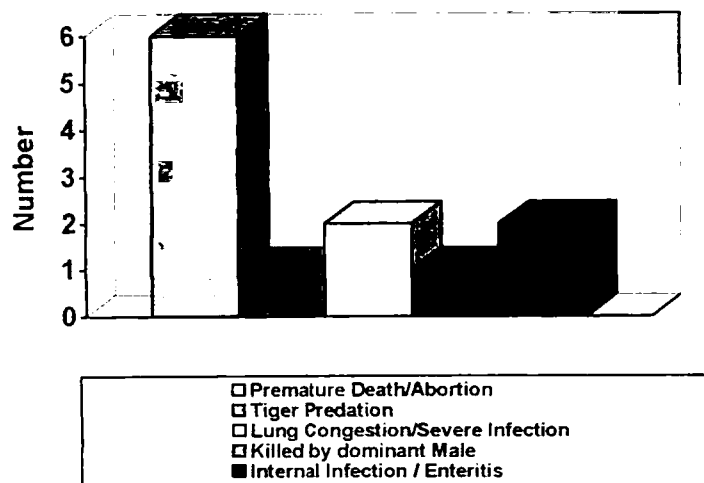


Table 5.2: Causes of Calf Mortality in Dudhwa from April 1984 to February 2002

Cause of death	Number
Premature Death/Abortion	6
Tiger Predation	1
Lung Congestion/Severe Infection	2
Killed by dominant Male	1
Internal Infection / Enteritis	2

Causes of Calf Mortality



Breeding & Population Dynamics

The first evidence of breeding in the re-introduced population was detected in the form of remains of a newly born calf in a patch of tall 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 February 1989). Three more calving in the same year followed this.

Table 5.3: Year-Wise Calving Pattern in RRA

Year	Calving	Total No.	Abortion	No. of abortion
1984	Nil	0	Sa-1	1
1985	Nil	0		0
1986	Nil	0		0
1987	Nil	0	N-1	1
1988	Nil	0		0

Year	Calving	Total No.	Abortion	No. of abortion
1989	1. R-1 (19.05.89, Died on 11.12.93), 2. H-1 (02.02.89, Surviving), 3. N-2 (01.06.89, Surviving), 4. S-1 (12.10.89, died)	4		0
1990	Nil	0		0
1991	1. S-2 (10.08.91, Surviving) 2. P-1 (4.08.91 Died on 12.01.2000)	2	R-2 (1991)	1
1992	1. N-3, (31.07.92, Surviving), 2. H-2 (0508.92, Surviving	2		0
1993	Nil	0		0
1994	1. N 1-1(11.01.94, Died on 17.10.94), 2. S-3 (07.10.94 Surviving)	2		0
1995	1 P-2 (2109.95, died on 21.01.96)	1	H-1-1 (1995)	0
1996	Nil	0		0
1997	1. P-3 (02.10.97, Surviving), 2. H-3 (19.10.97, Surviving), 3. N-1-2 (17.09.97, Surviving)	3		0
1998	1. S-4 (06.08.98, Surviving)	1		0

done
y-4

y < 1

A-9

y < 1

y-1

Year	Calving	Total No.	Abortion	No. of abortion
1999	1. H-1-2 (02.10.99, Died on 28.10.99), 2. H-2-1 (12.06.99, Died on 25.02.2000) 3. N-4	3		0
2000	Nil	0		0
2001	1. H-1-3 2. N-5 (29.10.2001)	2		0
2002 (Up to July)	1. S - 5 (11.7.2002)	1		0
TOTAL		21		4

y-1
y-1

(Source: Office of the Deputy Director, Dudhwa.NP, Forest

Department, Uttar Pradesh) Abbreviations: P-Pabitri, Sa-Saheli, S-

Swayamvara, H-Himrani, R-Rapti, H-1: 1st progeny of Himrani, H-1-1-

1st calf of first progeny of Himrani.

4 Abortion
2/20/02

25 born 21 survive

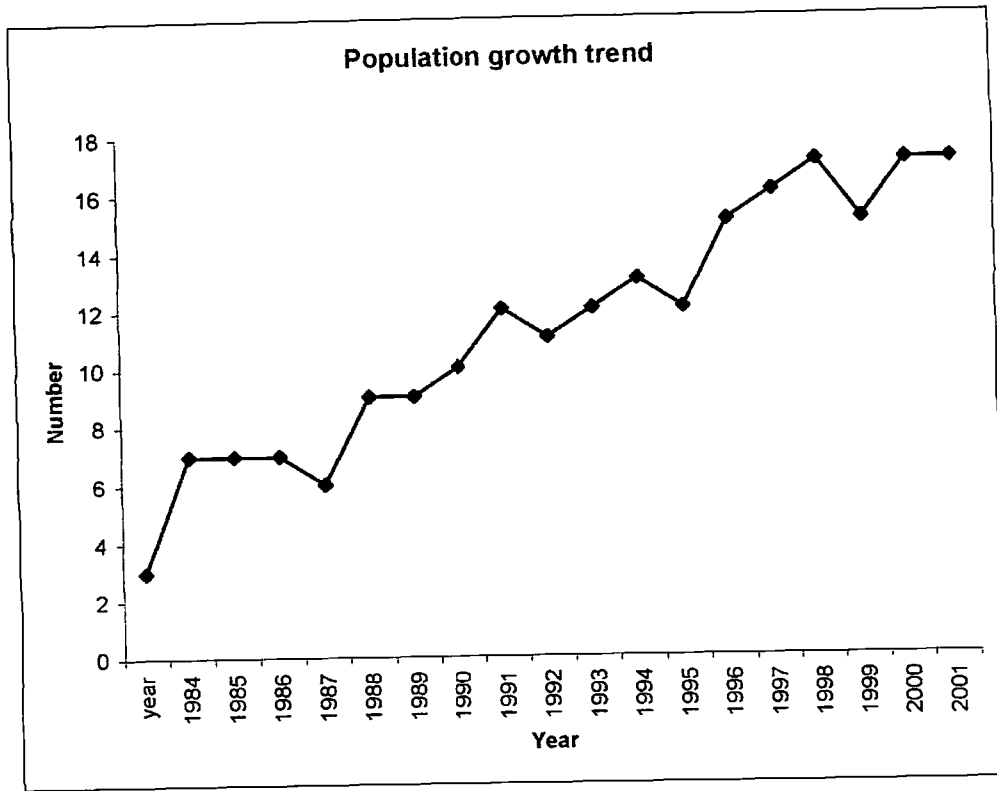


Table 5.4: Population dynamics of Reintroduced rhino population in Dudhwa

Year	Introduced	Withdrawn	Abortion	Born	Calves died	Adult died	Mortality	Recruitment	Population
1984	5	0	1	0	0	2	2	-2	3
1985	4	0	0	0	0	0	0	0	7
1986	0	0	0	0	0	0	0	0	7
1987	0	0	1	0	0	0	0	0	7
1988	0	0	0	0	0	1	1	-1	6
1989	0	0	0	4	0	0	1	3	9
1990	0	0	0	0	1	0	0	0	9
1991	0	0	1	2	0	1	1	1	10
1992	1	1	0	2	0	0	0	2	12
1993	0	0	0	0	1	0	1	-1	11
1994	0	0	0	2	1	0	1	1	12
1995	0	0	1	1	0	0	0	1	13
1996	0	0	0	0	1	0	1	-1	12
1997	0	0	0	3	0	0	0	3	15
1998	0	0	0	1	0	0	0	1	16
1999	0	0	0	3	1	0	1	2	17
2000	0	0	0	0	3	0	2	-2	15
2001	0	0	0	2	0	0	0	2	17
2002	0	0	0	1	0	0	0	0	18
	10	1	4	21	8	4	12	12	

Table 5.5: Calving by different females

Name of the mother	Origin	Total (Calving+Abortion)	Surviving
Saheli	Assam	0+1	0
Narayani	Nepal	4+1	3
Swayamvara	Nepal	5+0	3
Pabitri	Assam	3+0	1
Himrani	Nepal	3+0	3
Rapti	Nepal	1+1	0
H-1	First calf of Himrani	2+1	1
N-1	First calf of Naraya ni	2+0	1
H-2	Second calf of Himrani	1+0	0
	Total	20+4	12

After the death of 'Raju' in 1988 and a failed attempt to introduce a male from Kanpur Zoo, Dudhwa has not got any other adult male from outside even after a lapse of about 14 years. As a consequence, only one male is mating with all the females of the population and single

male sires all the calves born in RRA in Dudhwa TR. This has resulted into:

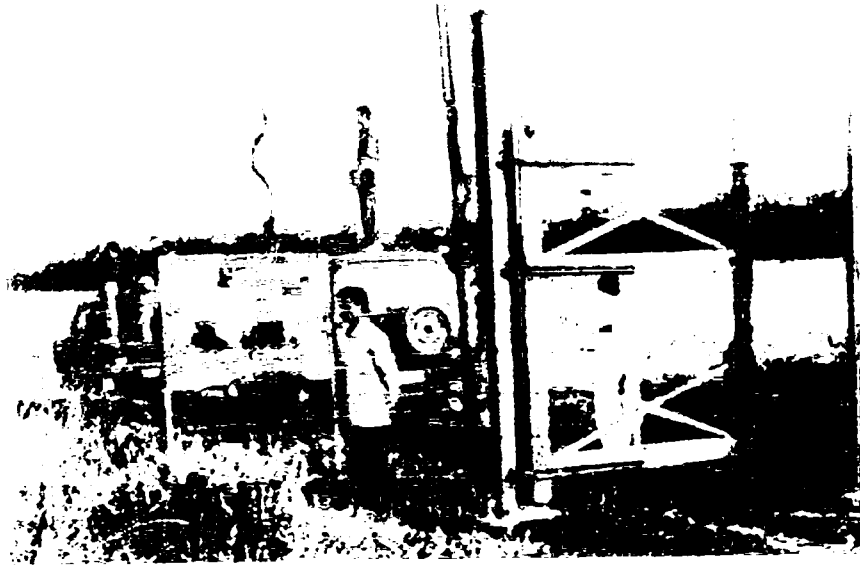
- A. Slow rate of population build up due to availability of single breeding male. Since female rhino initiate male for mating and is a time consuming process in which male rhino exhaust.**
- B. Severe inbreeding and in future possibilities of imbalance in Sex Ratio.**

Had there been few more males capable of participating in breeding, birth rate in the population might have been much higher. At the same time there might have been a genetically healthy population. As the same male sires all the calves, and that male continues to dominate, the females of the progeny are mating with their sire. The population as of now is heavily inbred and this trend should not be allowed to continue. This can reflect how small populations face various setbacks. Nobody knew that out of two males, one is going to be totally ineffective for the breeding programme and only one will participate in all breeding. An attempt to tide over this problem was made by bringing one male 'Lohit' from Kanpur Zoo in 1992, but Bankey did not allow 'Lohit' even to settle down at Dudhwa. Lohit was seriously injured by Bankey and was sent back to Kanpur Zoo after treatment. Now, we are faced with a situation in which even if Dudhwa born males establish them, they will be mating with close relatives only, which is genetically totally undesired proposition and in future of possibilities of imbalance in the sex ratio.



Fence Maintenance

The re-introduced rhino population is enclosed within an area of 28.11 sq.km fenced by a four strand energized fence. Two energizers power this fence, one each at Salukapur and Base Camp. There is facility of solar power run chargers for charging the batteries. This system is effective and useful in open weather but during rainy season arrangements are made to get them charged from Dudhwa or Palia.



Visitors watching Rhino and Bengal florican inside RRA



Fence around Rhino reintroduction Area (RRA)

Proper maintenance of this fence is very important for the success of the rhino re-introduction programme. If the fence goes ineffective and rhinos start straying out in all directions, it will not be within managing proportion for the park authorities. That is precisely why the management lays due emphasis on maintenance of the fence. A total of eight fence watchers are engaged on daily basis for maintenance of this fence. Apart from fence watchers, other departmental personnel

are given responsibility for the maintenance of the fence. There is well laid out system for the purpose. Duties assigned for each of functionary are as follows:

- **Fence Watcher:** is supposed to walk along the entire length of the fence under his jurisdiction from 9.00 A.M. to 5.00 P.M. While walking, he is supposed to check the fence and clean all vegetation, tighten strands, insulator and poles if needed. In case of any breakage, the fence watcher is supposed to report to the Beat Officer.
- **Beat Officer/Fence Supervisor:** to ensure proper duties of all the fence watchers within his jurisdiction and act immediately on reports of fence watchers. Five fence supervisors are deputed for maintenance of the entire length of the fence. Five different fence sectors have been identified and five fence supervisors are made responsible for the entire length.
- **Section Officer (Forester):**
 - Surprise checking of the duties of fence watchers and Beat officer
 - If any rhino is not seen for a long period, scan the entire area and locate it
 - To check voltage of fencing
 - Walk on foot and check fence at least twice a week
 - Maintain store for fence upkeep
- **Range Officer:** is supposed to ensure proper duties of Fence Watchers, Fence Supervisors and Section Officers and proper maintenance of the fence and ration provided to

elephants. He is required to walk and check full fence twice a month.

- **Wildlife warden, Belrayan:** is supposed to co-ordinate fence monitoring by surprised inspection of batteries, energizers and other fence materials. He is supposed to check the entire length of fence once a month.

In the given circumstances, it is very much obvious that the management is trying its every bit for better management of the fence and it is satisfactory. But there are problems in arranging fund for proper upkeep of the fence that will be discussed later on.

Monitoring

Due emphasis is laid on regular and thorough monitoring of rhino population at Dudhwa. This monitoring is based on scanning the area by riding elephants, from watchtowers and on foot and on motorbike. There are four elephants deployed for this purpose. Two elephants are camped at Salukapur and an equal number at Base Camp. Four teams monitor different area within the RRA. They try to locate rhinos, identify them and observe their activity. Each of the adult rhinos is well identified by all of the monitoring staff. Daily observation of sighting location, activity while sighted and any unusual behaviour are recorded in registers maintained at the two camps. A consolidated monitoring report is taken by the Range Officer and submitted to the Deputy Director every fortnight. This fortnightly rhino monitoring report is forwarded to the Director, Dudhwa Tiger Reserve and upto the Chief Wild Life Warden, U.P. This is a very effective monitoring system and any problem arising at any point of time is likely to be detected at an early stage. It is sad on the part of the park and a set

back for the monitoring effort that one of the monitoring elephants has died recently. At present, monitoring is done using three elephants. Right now, the grasses are short and problem may not be readily realized, but once the monsoon sets in, it will be very difficult to ensure effective scanning if additional elephants are not deployed.

Every day, rhinos located are thoroughly scrutinized for wounds or scars. If any fresh wounds are noticed, usually prescribed medicines are sprayed with the help of pumps. Dung samples are collected in all seasons to estimate parasitic load. The parasitic load, however, has never been a problem. Professional veterinarians at Chandan Chowki and Palia are consulted as and when necessary. Veterinary scientist from IVRI Izatnagar, Bareilly help in post mortem and monitoring of health of elephants from time to time and whenever required not on regular basis.

Identification of individual rhinos by their prominent physical features and deformities



Shape and size of the horn



Shape & size of ear pinna



Variation in hip folding & tail length



Size and shape of collar folding



Wound Mark



Pigmentation between upper & lower lips

Captive Elephant Management

As monitoring depends to a great extent on number and proper management of captive elephants, it becomes essential for the present exercise to get a stock of the manner in which elephants are being managed and kept at Dudhwa Tiger Reserve. The observations made during the study are as follows:

General health of most of the animals is poor. Hygiene at the elephant camps to be improved. Proper control over quality and quantity of ration and fodder fed is lacking. Ration Register, Medical Register and Service Book should accompany each elephant wherever it is deployed. But, unfortunately these essential documents are not available at the camps. Ration Register for one elephant was found at South Sonaripur Range Office. There is no utility if the register if it is not kept at the elephant camp.

Weight of Gaddi – is a very important consideration in captive elephant use. Whereas in other parts of the country this weight is well below 100 kg, that in Dudhwa is 200 kg. This is supposed to have a deleterious bearing on the health of the animals. Whereas in Jaldapara, there is a different lightweight 'gaddi' for patrolling purpose suited for long duty periods, in Dudhwa the same one is being used for both purposes. A fair load for an average elephant is about 1000 lbs as per Evans (as sighted by A.J.W. Milroy's Management of Elephants in Captivity, Edited by Bist S.S. 2002).

Duty hours – With the opening up of the RRA for tourism, animals are used for long a period that is deleterious for elephant's health. Elephants should not be worked for more than 5 hours and during mid days as prescribed in the 'Management Plan for Jaldapara Wild Life Sanctuary for the period 1997-98 to 2006-07.

Tourism Inside the RRA

From December 2001, this area has been opened for tourism. After the formation of Uttaranchal, U.P. is left with only one National Park, that is Dudhwa and tourism pressure has increased. Another fact that Dudhwa is the site of first ever reintroduction Programme of the

country, makes tourists even more curious to see rhinos at Dudhwa. Amount of tourist pressure on PA authorities to open up the RRA is understandable. But, it is very important to assess the infrastructure facilities.

Allowing tourism inside the RRA may have some other impacts due to overcrowding in a small area of 28.11 sq.km that will need detailed study. This is the prime area of the park that apparently has very high concentration several species other than rhino. A rapid survey could reveal that highly endangered species like Swamp Deer, Bengal Florican and Hispid Hare use this area regularly. A very high concentration of hispid hare pellets was found in the area where tourists are being allowed. Leaving apart ecological considerations that would need a detailed study, from management point of view it was necessary first to procure additional elephants and manpower and only then tourism should have been allowed inside the RRA. Although with individual visitor group guide is provided but it has been observed that out of curiosity visitor get down from the vehicle to take photographs and make noise, which forced the animals to flee from the scene and get disturb. There are chances when unnoticed rhino in tall grassland area specially dominating male can charge which can prove fatal. Before leaving for the field trip all the visitors should be brief properly by the accompanying guide.

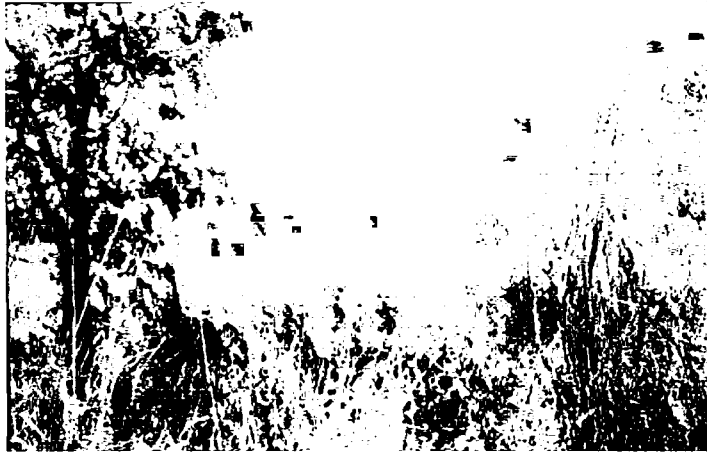
Habitat Management

Grassland management strategy adopted in the RRA is the same as followed in the other parts of the park. Management interventions here can be categorized into two broad categories:

Cool season burning, and harrowing followed by burning is done once immediately before onset of monsoon and once after monsoon

whereas the first one is one time intervention, the second one is done twice each year. The park management considers monsoon as the pinch period from fodder availability point of view. In order to provide more of palatable grasses for the herbivores during rainy season, portions of grasslands are first harrowed and then burnt immediately before monsoon and also after monsoon. This certainly gives new shoot cherished by all herbivores. But, it seems important to study the effects of this practice on the overall health of the grassland eco-system. One thing is for sure that if this practice is continued in area adjacent to water-bodies, their siltation is bound to accelerate.

As far as cool season burning is considered, the entire grassland is burnt every year in mosaic pattern. On the areas used by Bengal Florican, grass is cut first prior to burning in patches in a mosaic manner to provide a mosaic of tall and short grasslands. The areas used by hispid hare are supposed to be protected from fire. Whereas burning as a tool seems to be a British legacy as it has been used for more than 100 years to check fire in woodlands, its long term impact on grassland eco-systems need to be studied in detail.



Cool burning



Water augmentation during summer months

PROBLEMS

Man Management of rhino monitoring staff

Currently rhino monitoring unit is located in Salukapur and rhino monitoring is done from two locations. Living conditions by considering the housing facilities is not at all hygienic. Since entire area is a malaria zone and comes under high rain falls. All the occupied buildings at Salukapur and range head quarter based in Sonaripur are currently in a very bad shape needs proper maintenance including the Salukapur FRH. Since most of the staff is not only involved in the regular monitoring of rhinos but are also in regular patrolling of their respective beats. Southern boundary of the Rhino fence is quite close to the notorious villages involved in number of illegal activities and staffs have to look after these problems. Considering the period when entire staff gets cut off during the rainy months. Provision of extra allowance should be made which is applicable in other Tiger Reserves.

In-breeding

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

The following table gives the details of potential breeding population:

Sex	Name	Origin/Born on	Age in March 2002
Male	Bankey	From Assam	25 years
	N-3	31.07.92	9 year 8 months
	S-2	10.08.91	10 year 7 months
	P-3	02.10.97	4 year 5 months
Female	Pabitri	From Assam	22 years
	Swayamvara	From Nepal	22 years
	Narayani	From Nepal	22 years
	Himrani	From Nepal	21 years
	H-1	02.02.89	13 years
	N-2	01.06.89	13 years
	H-2	05.08.92	9 year 7 months
	S-3	07.10.94	7 year 5 months

The original target was aimed at releasing 30 rhinos, but due to financial and administrative constraints only 10 could be released including a captive male from Kanpur Zoo between 1984 to 1992. Four out of these ten have died and another one from the Kanpur Zoo had been sent back to its origin. So, breeding started with one male and

five females. During about 18 years of breeding, a total of 19 calves were born out of which 12 are surviving. There had been 4-recorded cases of abortions. The population size as of now stands at 20 (Oct, 2002).

The problems of in-breeding as well as desired response to the stochastic eventuality need be addressed. These are rooted in genetic variability as well as in numbers. These need to be overcome with further restocking from large populations. The original number of 30, though not a magic number needs to be considered. These could be from Nepal or Assam and all need to be from the wild, that are not 'nuisance' animals habituated to crop raiding.

Table 2: Demographic Status of existing Rhinoceros in RRA, Dudhwa TR (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. 8 years 9. 5 years 10. 5 years 11. 3 years	1. 1 year 2. 1 year 3. Three month 4. Two month 5. Two month
TOTAL	4	11	5

In future Inbreeding can cause sex-ratio imbalance that is preferably 1: 3 ratio between male and female. **If inbreeding continues than there are chances of imbalance in sex ratio and possibilities of more number males or females in the rhino population.**

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

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

Straying Out of Rhinos

From last two years, some rhinos, especially Narayani have started straying out of the park. A rapid survey in the villages Bela Kalan, Bela Tapar and Gulra Tanda and an interaction with forest staff of Gulra Chowki indicated that there have been 11-recorded cases of straying out of rhinos. There had been crop damage but no other damage has

been reported. It is quite interesting and disturbing too that 'Narayani', that lives outside the fenced area gave birth to a calf during October 2001 in a sugarcane field in Bela Kalan village about 4 km away from the RRA. Unfortunately on 13th July 2002, Narayani accompanying her calf attacked a 35-year-old villager in a sugarcane field. Later man died on the spot with multiple fractures. Since this female rhino has the habit of attacking riding elephant and people. It may be problematic in future and become a threat to local villagers.

Although, the problem now is not of very serious dimension from depredation point of view, trend is not very good for the rhino re-introduction Programme. Since in most cases, only one individual is straying out, that too during her pregnancy, chances are that it is a part of her strategy to avoid Bankey. But it has to be seen as the calf grows.

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

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

Resource Crunch

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

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

Apart from ongoing activities, large sums are needed to create and maintain a 9 km long elephant proof trench as prescribed by the Rhino Sub Committee at the beginning of the project. Such a trench is extremely important to check straying out of rhinos that may even lead to poaching. Additional money would be required to procure elephants for monitoring and for tourism purposes. This again is a vicious circle, as it would require recurring expenditure on maintenance of elephants. Such recurring expenditure is to be anticipated in advance and sources ensured. Another important of this programme is maintenance of fence, which need at regular intervals replacement of rusted wires, energizers and regular monitoring of fence and removal of under growth of plants touching wires. Currently only two energizers are used to flow current in the entire 27 long perimeter length and according to prescription and effectiveness of the capacity of a energizer is 7 kms. Considering the total perimeter length of RRA of 27 kms it needs four energizer. One more factor that it has been a regular problem in getting funds to cover the payment of daily wages labourers involve in the maintenance of fence. There is immediate need of one generator at Salukapur that will be used in recharging the batteries used in the rhino fence. Currently batteries are brought to Dudhwa or Palia for recharging and it takes days, which depend on the power availability. During monsoon months of six months when road are not accessible elephant is only means to reach Dudhwa FRH. During this one monitoring elephant along with a staff will have to accompany batteries. This leads to loss of at least three to four days in this exercise hamper the regular monitoring and patrolling of the area when other illegal activities like timber theft, poaching, fishing and removal of fence wire used in animal traps by the notorious

groups operates from neighboring villages of southern boundary of the RRA.

Tourism inside RRA

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

Poaching

At present the park management in very much alert, patrolling duty is being done religiously and rhinos stray out in rare cases only, so rhino poaching does not seem to be a problem. But, its possibility remains as other animals are being poached. Currently due to affective measures like regular patrolling and arrest of notorious elements by Mr. Ashish Tewari, Deputy Director Dudhwa Tiger Reserve and his staff has made possible to check such illegal activities. Despite of the different pressures from local politicians and influential people patrolling staff have high moral and support to tackle with any odd situation and protecting the wildlife of Dudhwa Tiger Reserve.

Biotic Pressure

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

Veterinary and Research Officer

There are sanctioned post of one veterinarian and one Research officer in Dudhwa Tiger Reserve, but no one has joined on permanent basis. Veterinary doctors are called from Chandan Chowki or sometimes from Palia as and when required. From time to time- Veterinary officer and Veterinary scientist from Lucknow Zoo and Indian Veterinary Institute, Izatnagar, Bareilly visits this area. Due to these reasons it is difficult to get timely medication. On many occasions doctors are not available or are not well versed with the wild animal in providing the correct doses. It is very difficult to ensure appropriate health care of the camp elephants and rhinos without having proper veterinary care facilities in the existing conditions. Similarly there is also need for a research officer to look after the monitoring of rhino and habitat management aspect as a whole on full time basis.

6. Need of enlarging Rhino Area and establish a separate rhino population inside Dudhwa NP

1. Genetic Variability and check Inbreeding

The original objective was aimed at releasing 30 rhinos in Dudhwa National Park. The Precise reason why this was not carried out after release of two batches is both financial and administrative. However, due to breeding the number has increased from seven to seventeen. Out of the seven seed population, only two were male named Raju and Bankey. Initially, Raju had asserted his dominance but with passage of time Bankey became dominate and killed Raju in one of their regular fights in October 1988. During 1991 an attempt was made to counter the anticipated problem of inbreeding by introducing a male, named Rohit, in captivity from Kanpur Zoo. He was repeatedly attacked by Bankey and severely injured. This animal had to be taken out, treated and returned to the zoo after it had recovered. The existing rhino population in RRA has two more adult males but they are unable to asset themselves in front of the dominant male Bankey. Bankey continues to be the dominant male even today. All the calves born till today are progeny of this dominant male – Bankey. Because all these calves surviving now are born after 1989, there is little chance of mating with Raju who died in 1988. In absence of any other male even the sexually mature daughters are mating with their father. The two adult males, though unable to assert are also the progenies of same rhino Bankey and if in the future they will mate with the females, same type of genes will be transmitted to the next generation. If this situation prevails for few successive generations, it may cause inbreeding depression, which is a threat for genetic

viability. So, there is an urgent need to introduce some other male with different genetic base. And keeping in view the past experiences with Bankey's behaviour newly translocate male rhinos should be kept in separate enclosure to avoid the chance fighting among them. And hence, there is an urgent need of enlarging rhino habitat (*Sinha, 1999*).

2. To Reduce conflict amongst males in existing RRA

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

3. Increasing Population in the existing RRA

Increasing population of rhino in the existing area is also a major problem. In this case, either new area can be selected for rhino translocation in Dudhwa Tiger Reserve or the enclosure will be removed. In case of the removal of the enclosures, there are chances of crop depredation by rhinos in the adjoining areas, which is very close to the southern boundary of the Rhino Re-introduction Area (RRA). In response to these situation, it is better to keep the rhino under enclosure for few more years, at least till the people accept them as their neighbours. And hence, there is a need to select some new area inside the Dudhwa National Park. In the light of above facts, long back in 1991, strongly recommended for the urgency of creating another viable breeding population of rhino in

Dudhwa Tiger Reserve and proposed Bhadi-Churaila area in Belrayan Range of Dudhwa Tiger Reserve.

The area selected for enlarging Rhino habitat

In 2002, the work is in progress and proposed area is to be enclosed in power fence for the creation of another viable population of rhino inside the Dudhwa Tiger Reserve. The area falls in Bhadi-Churaila sector of Belrayan Range. This area provides water for drinking and wallowing, shade and an adequate variety of plants known to be eaten by rhino elsewhere. One of the essential prerequisite for rhino re-introduction is vast grassland with water for drinking and wallowing. This Bhadi-Churaila sector has two permanent water bodies known as Bhadi Tal and Churaila Tal respectively. Apart from these two permanent and large water bodies, there are various other smaller water bodies, which are permanent as well as, seasonal. The Rhino Subcommittee of Indian Board for Wildlife (IBWL) has identified this Bhadi-Churaila sector in Belrayan Range as one of the possible sites for re-introduction of rhino in their original recommendation. Feasibility study with regard to the habitat availability for the re-introduction of rhino in Dudhwa by the Botanical Survey of India led by Dr.Hajra carried out a detailed survey of the vegetation of Dudhwa in relation to the rhino feeding ecology. The detailed study clearly established a number of floral elements common to Dudhwa National Park (U.P.) and Kaziranga (Assam), both of which are excellent rhino habitats. The advantage of the area selected is that it is in the central location of Belrayan Range. There is no danger of rhino wandering in the human occupation and cultivation in case of operation failure of power fence. While in case of existing rhino re-introduced area, it is adjacent

to the southern boundary of the park, which lacks a buffer zone and outside of which is an area of dense human occupation and cultivation. Bhadi-Churaila sector is centrally located and sufficient buffer is available.

This Bhadi-Churaila sector comprises an area of 10.74 sq.km and the 17 kms long fencing work has already been started and target was to complete the fencing operation by the end of this financial year. The work was in progress when the study was carried out.

Table 3: The Bhadi-Churaila Habitat

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

(Source: Proposed Plan for Bhadhital Rhino Area, Tewari.A. 2002)

Total Area = 1,073.31 ha = 10.733 sq. km

Total length of the fence = 17 km

THE OTHER POSSIBLE SITES FOR ENLARGING IN THE FUTURE:

There are excellent “phantas” (grassland) 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. Although due to road network and railway lines direct connectivity by means of construction of enclosure between the

existing rhino area no more exist with different grasslands. In due course of time with the increase in rhino population and the fenced areas be extended in the southern boundaries of the park to check the rhino movement in the cultivation.

7. PROPOSED ACTION PLAN

1. **Fencing the newly identified RRA:** As per the plans, the fencing of newly identified RRA i.e. Bhadi-Churaila sector of RRA will be completed by the end of the financial year 2001-2002 i.e. by end of March 2002. Work is in progress when the study was carried out. The erection of fencing posts were in progress and about 3000 posts were required for this purpose. The three-strand power fence will cover entire proposed area of 17 km long stretch of perimeter before releasing the rhinos.
2. **Releasing rhinos in the newly created RRA from the existing RRA:** After the completion of power fencing, three females and one male from the existing RRA will be released in this newly created Bhadi-Churaila sector of RRA. This will provide immediate relief to the conflict situation in the existing RRA and enhance breeding in the newly created RRA.
3. **Releasing fresh batch of rhinos to augment the genetic variability:** Since all the rhinos born in the existing re-introduction area are progenies of single bull Bankey, the problem of inbreeding depression needs to be addressed timely. In order to overcome this problem, there is a proposal to introduce fresh batch of rhinos – one male and three females, either from Royal Bardia NP in Nepal or Assam to broaden the genetic base.
4. **Monitoring:** Presently four elephants are engaged in the

monitoring work. Mahouts and staff scan the area and send the report to the headquarter and office of the Deputy Director. Monitoring is an important activity to see their health condition, movement pattern and other behavioural aspects. With the creation of new RRA, more number of elephants and Mahouts as well as monitoring staff is required.

5. **Infrastructure support:**

- A road will be built along the inner side of the entire fence to familiarize patrolling and fire management
- The monitoring parties are provided with walkie-talkie sets so that they are always in contact while conducting monitoring.

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

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

- (ii) **Wetland management:** Water is the lifeline of rhino thought here are permanent swamps in the newly created RRA, creation of additional wallowing grounds and waterholes as well as supplementing in the existing taals (water bodies), new borings and pumping sets are required.
- (iii) **Weed Removal:** Removal of weeds from the “phantas” (grasslands) and water bodies also is an important aspect of habitat management.
- (iv) **Woodland manipulation:** The newly created RRA contains predominantly of Sal trees and other species as well. Though felling and removal of tree from PA is totally banned, the problem needs to be addressed to check the invasion of trees into grasslands. The removal of trees is required from the point of view of extension of rhino habitat.

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

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

9. Local Awareness: Villages located at the fringes are already facing the problem of elephants and other herbivores straying into their agricultural field. Re-introduction of rhino is another added burden to their problem. Due to proper power fencing and constant monitoring, rhinos generally do not stray into agricultural fields and there is no

monitoring work. Mahouts and staff scan the area and send the report to the headquarter and office of the Deputy Director. Monitoring is an important activity to see their health condition, movement pattern and other behavioural aspects. With the creation of new RRA, more number of elephants and Mahouts as well as monitoring staff is required.

5. **Infrastructure support:**

- A road will be built along the inner side of the entire fence to familiarize patrolling and fire management
- The monitoring parties are provided with walkie-talkie sets so that they are always in contact while conducting monitoring.

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

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

- (ii) **Wetland management:** Water is the lifeline of rhino thought here are permanent swamps in the newly created RRA, creation of additional wallowing grounds and waterholes as well as supplementing in the existing taals (water bodies), new borings and pumping sets are required.
- (iii) **Weed Removal:** Removal of weeds from the “phantas” (grasslands) and water bodies also is an important aspect of habitat management.
- (iv) **Woodland manipulation:** The newly created RRA contains predominantly of Sal trees and other species as well. Though felling and removal of tree from PA is totally banned, the problem needs to be addressed to check the invasion of trees into grasslands. The removal of trees is required from the point of view of extension of rhino habitat.

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

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

9. Local Awareness: Villages located at the fringes are already facing the problem of elephants and other herbivores straying into their agricultural field. Re-introduction of rhino is another added burden to their problem. Due to proper power fencing and constant monitoring, rhinos generally do not stray into agricultural fields and there is no

such report till date from the existing RRA. But with the creation of new RRA, these rhino population is bound to increase. Therefore, to make the conservation programme more successful, participation of fringe villagers is of utmost importance, so that they may compromise with the situation, at least their hostility can be reduced.

10. Ecotourism: The last rhino disappeared in this area was around 1878. Re-introduction of rhinos in this area has fascinated the tourists. Now every tourist who visits the National Park wants to have a glimpse of this mighty animal. More elephants and mahouts are required for this purpose.

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

12. Anti-poaching measure: Protection is the *sine qua non* for any PA. Some conservationists give importance to the protection to the extent that PA doesn't require any input except protection. This is true to the great extent. The success story of increased rhino population in Kaziranga National Park, Assam, Royal Chitwan.NP, Nepal and other rhino bearing PAs is primarily due to effective anti-poaching network built up in these areas. Dudhwa Tiger Reserve shares 56 kms of international boundary with Nepal. With the re-introduction of rhinos, the determined poachers may be attracted in their venture as the rhino horns fetch good revenue in the international market. Moreover, Tharu

villages located in the Northern fringe of the park have relation in Nepal. For them, it can be new and wonderful avenue for getting fast and handsome revenue. The facilities provided presently are not at all adequate. Sophisticated arms and training of anti-poaching personnel is of utmost importance to make the Rhino Re-introduction Programme successful.

13. Setting up of Field Head Quarter in the RRA: There is a requirement of setting up of head quarter, possibly in Chhanga Nala FRH after its renovation for better monitoring of newly re-introduced rhinos. But will require appropriate funding.

14. Construction and Maintenance of watchtowers / Machan: Watch towers need to construct in this new area for monitoring activities. Currently all the watch tower need proper repair and maintenance inside the RRA and outside as well in BhadhiTal area.

15. Requirement of more elephants: More elephants are required for monitoring the rhinos in the newly re-introduced rhino area for monitoring purpose as well as for the tourists. At present the elephants are less in number and to fulfil the requirements of tourists and monitoring activities they are put in to overworking which badly affects their health.

16. Financial Aspect: All the above mentioned points in Proposed Action Plan will be light of the day only if adequate financial provision is available. Initially, the Government of India has provided financial support for the translocation and conservation of the rhino in newly reintroduced area. But with the passage of time, no funding is available from the Central Government for the conservation of rhino in Dudhwa. At present, the entire effort for conservation of rhino in

Dudhwa is being born by the State Government as a part of the Forestry budget. Thus, the financial input is obviously very small. With the increase of rhino population in this protected area i.e. Dudhwa National Park and gradual change of management strategies, the requirement of financial support is very essential

8. EXPECTED RESULTS

1. The creation of the Bhadi-Churaila sector of RRA will reduce the prevailing conflict situation among the males in the existing population. Fresh batch of rhinos either from Nepal or Wild captive rhinos will also be reintroduced in this area to broaden the genetic base.
2. The intensive management efforts to be applied for Rhinos are bound to benefit the existing take off population of the highly endangered swamp deer in the area. These expectations are based on the observations recorded in the existing RRA. The existing RRA is located on the south Sonaripur Range and this Range has recorded the highest number of all the five deer's found including swamp deer and hog deer amongst the nine ranges of Dudhwa Tiger Reserve. (UP Forest Department, 2001)
3. There exists a viable connectivity between the existing and newly created RRAs through the grasslands of Bankey Tal area. Thus two populations can also be joined in due course of time when the Rhino population increases by extending the fenced areas.
4. Last but not the least, the conservationists' ultimate objective of creating as many separated viable "islands" as possible to reduce the risk of extinction will be fulfilled when the re-introduced rhinos of Dudhwa once again haunts the entire Terai area.

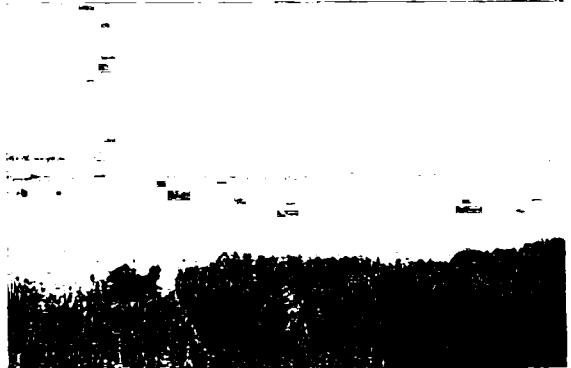
9. CONCLUSION

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

habitat management as a whole.

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

71605



Fencing around Bhadhi Tal RRA & its Habitat - A Prime area for Rhinos

10. FUTURE PLAN OF WORK FOR NEXT SIX MONTHS

1.Larger part of villages which fall in the Corridor – I has been covered in the current study period still few villages are left which is going to be covered in the next six month along with the villages which comes in the proposed Corridor –II.

2.Fresh observation & data collection on summer season on wild animal movement in both the corridors is in progress.

3.Season wise data on bird abundance and richness already collected from both the corridors.

4.After finishing the data collection, analysis of vegetation, socio-economic, animal movement, bird abundance, land use practice, encroachment of forest land, forestry practice on forest patches and degraded area in the corridors, inputs needed and interaction with officers concerned will be carried out.

5.Finally, results and recommendations on the viability assessment of corridor between Dudhwa National Park and Katerniaghat WLS will be prepared on the basis of our observation and analyzed data.

BIBLIOGRAPHY ON DUDHWA NATIONAL PARK

- Aitkin, B. 1988.** A Dudhwa diary. Cub 5(4): 18-22
- Anonymous.** Some observations on habitat of the Dudhwa National Park. 1-7 (Unpublished)
- Bakhsh, N. 1995.** Checklist of Birds of Dudhwa National Park. Unpublished.
- Berkmuller, K., and Mukherjee, S.K. 1987.** Buffer zones in the service of ecodevelopment. Symposium on Tropical Ecology. December 1987: 1-18
- Chaturvedi, A.N., Mishra, C.M. 1985.** Ecological survey of grasslands at Dudhwa National Park. Indian Foresters. 111 (8): 579-582
- Coe, Malcolm. 1979.** A look at wildlife management in India. Oryx 15(1): 60-65
- Harris, L.D. 1984. The fragmented forest. Biogeographic theory and the presentation of biotic diversity. University of Chicago Press, Illinois.
- Hajra, P.K., Shukla, U. 1982.** Dudhwa National Park. Botanical Survey of India. (Some botanical aspects of the proposed new habitat for rhino). Howrah. April 1982:1-12 (1): 41-48
- Holloway, C. (1973).** Swamp deer in Uttar Pradesh. Oryx. 12 (1): 41-48
- Jain, S.K., Sastry, A.R.K. 1983.** Botany of some tiger habitats in India. Botanical Survey of India. 70pp
- Javed, S. 1996.** Elephants in Dudhwa. Garjah. (16): 17-22.

- Singh, A.N. and Singh, A. 1985.** A checklist of birds of Dudhwa national Park. A Report - UP Forest Department, Luck now.
- Singh, L. 1991.** Present status of Barasingha (*Cervus duvauceli duvauceli*) in India and its conservation. Paper presented at the International Seminar on Veterinary medicine in wild and captive animals. 8-10 November 1991. Bangalore.
- Singh, R.L. 1994.** Dudhwa Rashtriya Udhyan. In: Van Vanyajeev aur Vanvasi. Pub: Bishen Singh Mahendra Pal Singh, Dehra Dun.
- Singh, R.L. 1983.** Management Plan of Dudhwa National Park. Uttar Pradesh Forest Department (Unpublished).
- Singh, R. L.1986.** Conflict in the Wild. India Today.
- Singh, V.B. 1978.** The elephants in UP - a resurvey of its status after 10 years. Journal of Bombay Natural History Society. 75(1): 71-82
- Singh, V.P. 1982.** Bio-ecological studies on *Cervus duvauceli duvauceli*, Swamp deer (Barasingha) in Dudhwa near Indo-Nepal border. PhD thesis, Kanpur University (unpublished) Singh, V.P. 1987. Dudhwa National Park. Animal Citizen Vol. 26(1): 46
- Sinha, S.P. and Sawarkar, V.B. 1994.** Ten years of the Asian Rhino Reintroduction Programme in Dudhwa National Park, India. IUCN reintroduction Specialist Group Newsletter. No.9
- Sinha, S.P and Sawarkar. V.B. 1991.** Management of the reintroduced Indian One-homed rhinoceros in Dudhwa National Park. - A report Wildlife Institute of India.
- Sinha, S.P. and Sawarkar, V.B. 1991.** Management of the reintroduced Great one-homed rhinoceros (*Rhinoceros unicornis*) in

Sinha, S.P., Sawarkar, V.B. and Tiwari, A 2001. Management of Re-Introduced Greater One-horned Rhinoceros (*Rhinoceros unicornis*) in Dudhwa National Park and Tiger Reserve, Utter Pradesh, India. Paper presented in International Conference on Elephant and Rhino Conservation, Vienna, Austria, 2001

Tilak, R. and Ray, P. 1990. Range extension and notes on *Rana erythraea* from Dudhwa National Park, Uttar Pradesh. Journal of Bombay Natural History Society. 87(3): 380-384.

- **1982.** Report of the committee to study the problems of man-eating tigers in Kheri district of Uttar Pradesh. Ministry of Agriculture and Irrigation. Govt Of India. New Delhi.

- **1981.** Final recommendations on the translocation of Great Indian One Horned Rhinoceros, by the rhino sub committee. Wildlife status evaluation of IBWL. Govt of India. New Delhi

Tiwari, A. 2002. Creation of viable breeding satellite population of Great India One-horned Rhinoceros (*Rhinoceros unicornis*) in Badhital sector of Dudhwa National Park .UP Forest Department Project Plan

Bist, S.S., 2002(Ed). A.J.W. Milroy's: Management of Elephants in Captivity, pp-74. West Bengal Forest Department Publication / Report

Dey, R. 2000. Management Plan of Dudhwa National Park for the period 2000-01 to 2010-11

Wildlife Institute of India Project Report, 2002: Management of forests for biological diversity and productivity, WII-USDA Forest Service Project (1996 –2002)

Pandit. P.K. 1996. Management Plan of Jaldapara Wild Life Sanctuary for the period 1997-98 to 2006-07

THE TIMES OF INDIA, NEW DELHI

A new home for rhinos at Dudhwa sanctuary

By Mohit Dubey
Times News Network

LUCKNOW: Hostility between two male rhinos and fear of vendetta from a calf on an elder — the lone reproducing male rhino at the Dudhwa national park — has jolted the state forest department into action.

The outcome: A sprawling new 20-square km home, dotted by swamps and grasslands, for the 17 Indian Rhinoceros housed here.

Confirming that the second phase of the 'Rhino rehabilitation project' had begun after it was undertaken in 1984, chief wildlife warden R. L. Singh said on Monday that electric fencing of the new area had begun.

Back from a two-day visit of Dudhwa, Singh said that they had decided to "get going" after reports that the hostility among male members was posing a major safety hazard for the regionally extinct race of Indian rhinos. The new area being carved out in the thickets of Dudhwa involves two swamp areas of Bhadi and Churaila Taal. The second phase entails an expenditure of Rs 15 lakh that involves the setting up of a field headquarters in the area, some watch towers and the construction of the electric fencing.

The department has cleared renovation of a dilapidated and abandoned rest house at *Changa Nala* which would serve as the field headquarters. Dudhwa houses 17 rhinos which is the largest concentration in India except for the Brahmaputra valley in North-East.

The second phase of the "Rhino rehabilitation" project has also been hurried through since the incidence of tiger preying have increased manifold in the area. Fears of inbreeding have also forced foresters hands. Six animals have fallen to the wild cat in the last two decades.



BIBLIOGRAPHY ON DUDHWA NATIONAL PARK

- Aitkin, B. 1988.** A Dudhwa diary. Cub 5(4): 18-22
- Anonymous.** Some observations on habitat of the Dudhwa National Park. 1-7 (Unpublished)
- Bakhsh, N. 1995.** Checklist of Birds of Dudhwa National Park. Unpublished.
- Berkmuller, K., and Mukherjee, S.K. 1987.** Buffer zones in the service of ecocodevelopment. Symposium on Tropical Ecology. December 1987: 1-18
- Chaturvedi, A.N., Mishra, C.M. 1985.** Ecological survey of grasslands at Dudhwa National Park. Indian Foresters.111 (8): 579-582
- Coe, Malcolm. 1979.** A look at wildlife management in India. Oryx 15(1): 60-65
- Harris, L.D. 1984. The fragmented forest. Biogeographic theory and the presentation of biotic diversity. University of Chicago Press, Illinois.
- Hajra, P.K., Shukla, U. 1982.** Dudhwa National Park. Botanical Survey of India. (Some botanical aspects of the proposed new habitat for rhino). Howrah. April 1982:1-12 (1): 41-48
- Holloway, C. (1973).** Swamp deer in Uttar Pradesh. Oryx. 12 (1): 41-48
- Jain, S.K., Sastry, A.R.K. 1983.** Botany of some tiger habitats in India. Botanical Survey of India.70pp
- Javed, S. 1996.** Elephants in Dudhwa. Garjah. (16): 17-22.

Jnawali, S.R. and Wegge, P.1995. Performance of a translocated population of greater one-horned rhinoceros in Nepal.Ph.D dissertation. Agriculture university of Norway.129pp.

Kotwal, P.C. and Parihar, A.S. 1990. Management of hard ground Barasingha in Kanha national park. Paper presented in National seminar on management of Barasingha in Dudhwa national park, Lakhimpur- Kheri.

Kumar, A. 1996. Forest type mapping of Dudhwa National Park using remote sensing and GIS. P. G. Diploma in Forest Ecology. IIRS, Dehradun

Leith, H.1975. Primary production of major vegetation units of the world. 203-215.In: Leith.H & R.H. Whittaker. Eds. Primary productivity of the Biosphere. Springer-Verlag, New York.

Martin, E and Vigne, L. 1996. Numbers of Greater one-homed rhino continue to rise. News and views. Oryx 30: (3)

Mishra, G.C. 1989. Rhino rehabilitation in Dudhwa National Park. Van Vigyan Vol. 27(1): 60- 64

Mishra, C.M. and Chaturvedi, A.N. 1985. Ecological survey of grasslands at Dudhwa National Park. Indian Forester Vol. 111(8): 579-582

Martin, C. (1975). Status and Ecology of the Barasingha (*Cervus duvauceli branderi*) in Kanha National Park, India. Organ. Kolb.Zwich.134 pp.

Qureshi, Q. and Sawarkar, V.B. 1991. Protected area design and conservation: Dudhwa national park. A case study. National Symposium of Environment and wildlife. Indian Soc. of Environment.

Bangalore.

Qureshi, Q., Sawarkar, V.B. and Mathur, P.K. 1990. Status and management of swamp deer in Dudhwa National Park. Seminar on management of Swamp deer in Dudhwa Tiger Reserve. INT ACH and WWF - India.

Qureshi, Q., Sawarkar, V.B. and Mathur, P.K. 1990. Ecology and management of Swamp deer *Cervus devaueceli devaueceli* in Dudhwa Tiger Reserve. Project report of Wildlife Institute of India.

Qureshi, Q., Sawarkar, V.B. and, Mathur, P.K. Dudhwa National Park - The ark must be kept afloat. Unpublished Paper

Raj, T. and Sinha, N.K. 1988. Some of the problems of management of Dudhwa National Park. Cheetal 28(3): 41-44

Rahmani, A. 1996. Present status of the Bengal Florican *Houbaropsis bengalensis* in Dudhwa Tiger reserve. A Report.

Rizvi, S.H.A. 1979. Working plan for the South Kheri Forest Division. Vol 1 (part 1 & 2)

Rizvi, S.H.A. 1979. Working plan for the South Kheri Forest Division. Vol 2.

Rodger, W.A. 1988. The wild grazing ungulates of India: An ecological review. Proceedings of the second International rangeland congress, New Delhi.

Sale, J.B. and Singh, S. 1987. Reintroduction of Greater Indian rhinoceros into Dudhwa National Park. Oryx Vol. 21(2): 81-84

Sale, J.B. 1986. Rhinos re-established in Uttar Pradesh. Indian Forester .112 (10): 945-48

Sale, J.B. 1986. Reintroduction in Indian wildlife management. Indian Forester. 112(10): 867-73

Sankaran, R. 1988. The Bengal florican at Dudhwa national Park. The floricans. Bombay Natural History Society. Annual Report No.4: 25-32

Sankaran, R. 1988. Studies of the Swamp deer in Dudhwa national Park (1988-1989). Endangered species project. Bombay Natural History Society. Technical report No.14

Sankaran, R. 1989. Status of the swamp deer in Dudhwa National Park 1988-1989. Bombay Natural History Society. Technical Report No. 14:25

Sankaran, R. 1990. The Bengal florican in Dudhwa National Park. In: Status and Ecology of Lesser Bengal Florican with report on Jerdon Courser and Mountain Quail. Bombay Natural History Society: 45-54.

Sawarkar, V.B. 1988. Status of the northern Swamp deer *Cervus duvauceli duvauceli* in the Dudhwa National Park. A report Wildlife Institute of India.

Schaaf, D. and Singh, A. 1977. Barasingha in the Dudhwa sanctuary. Oryx Vol. 13(5): 495-498

Schaller, G.B. 1967. The deer and the Tiger. Chicago Urn Press, Chicago. 370 pp.

Schenkel, S. 1981. Report on the suitability of Dudhwa National Park as potential site for reintroduction of the Indian rhinoceros. 21-24.

Singh, A. 1978. The status of the Swamp deer (*Cervus duvauceli duvauceli*) in the Dudhwa National Park. In: Peter Scott Chairman, Threatened Deer. International Union Conservation of Nature & Natural Resource (IUCN) , Morges, Switzerland.: 132-142.

Singh, A.N. and Singh, A. 1985. A checklist of birds of Dudhwa national Park. A Report - UP Forest Department, Luck now.

Singh, L. 1991. Present status of Barasingha (*Cervus duvauceli duvauceli*) in India and its conservation. Paper presented at the International Seminar on Veterinary medicine in wild and captive animals. 8-10 November 1991. Bangalore.

Singh, R.L. 1994. Dudhwa Rashtriya Udhyan. In: Van Vanyajeev aur Vanvasi. Pub: Bishen Singh Mahendra Pal Singh, Dehra Dun.

Singh, R.L. 1983. Management Plan of Dudhwa National Park. Uttar Pradesh Forest Department (Unpublished).

Singh, R. L.1986. Conflict in the Wild. India Today.

Singh, V.B. 1978. The elephants in UP - a resurvey of its status after 10 years. Journal of Bombay Natural History Society. 75(1): 71-82

Singh, V.P. 1982. Bio-ecological studies on *Cervus duvauceli duvauceli*, Swamp deer (Barasingha) in Dudhwa near Indo-Nepal border. PhD thesis, Kanpur University (unpublished) Singh, V.P. 1987. Dudhwa National Park. Animal Citizen Vol. 26(1): 46

Sinha, S.P. and Sawarkar, V.B. 1994. Ten years of the Asian Rhino Reintroduction Programme in Dudhwa National Park, India. IUCN reintroduction Specialist Group Newsletter. No.9

Sinha, S.P and Sawarkar. V.B. 1991. Management of the reintroduced Indian One-homed rhinoceros in Dudhwa National Park. - A report Wildlife Institute of India.

Sinha, S.P. and Sawarkar, V.B. 1991. Management of the reintroduced Great one-homed rhinoceros (*Rhinoceros unicornis*) in

Dudhwa National Park, UP, India. International Rhino Conference, Rhinoceros Biology and Conservation, San Diego, California, USA: 9-11 May 1991.

Sinha, S.P. and Sawarkar, V.B. 1991. Habitat and dietary selection by the population of reintroduced Great Indian one homed rhinoceros (*Rhinoceros unicornis*) in Dudhwa National Park. International Rhino Conference, Rhinoceros Biology and Conservation, San Diego, California, USA: 9-11 May 1991.

Sinha, S.P. and Sawarkar, V. B. 1992. Management of the reintroduced Indian Great one-homed rhinoceros (*Rhinoceros unicornis*) in Dudhwa National Park. IV World Congress of National Parks and protected areas, Caracas, Venezuela. 10-21 February 1992.

Sinha, S.P., Sawarkar, V.B. and Mukherjee, S.K. 1996. Bibliography of Indian One-homed Rhinoceros (*Rhinoceros unicornis*). Wildlife Institute of India, Dehra dun

Sinha, S.P. and Sawarkar, V.B. 1996. Monitoring and Management of reintroduced rhinoceros in Dudhwa national Park. International Conference on Sustainable Use of Natural resources, Budapest, Hungary. 26-29 August 1996.

Sinha, S.P. 1991. Rhino reintroduction Programme in Dudhwa National Park: an update. IUCN reintroduction Specialist Group Newsletter No.(2).Nov 1991.

Sinha, S.P. 1991. Hispid hare *Caprologus hispid* rediscovered in Dudhwa National Park. Zoo Print. 4(4), Nov 21.

Sinha, S.P., Sawarkar, V.B. and Tiwari, A 2001. Management of Re-Introduced Greater One-horned Rhinoceros (*Rhinoceros unicornis*) in Dudhwa National Park and Tiger Reserve, Uttar Pradesh, India. Paper presented in International Conference on Elephant and Rhino Conservation, Vienna, Austria, 2001

Tilak, R. and Ray, P. 1990. Range extension and notes on *Rana erythraea* from Dudhwa National Park, Uttar Pradesh. Journal of Bombay Natural History Society. 87(3): 380-384.

- **1982.** Report of the committee to study the problems of man-eating tigers in Kheri district of Uttar Pradesh. Ministry of Agriculture and Irrigation. Govt Of India. New Delhi.

- **1981.** Final recommendations on the translocation of Great Indian One Horned Rhinoceros, by the rhino sub committee. Wildlife status evaluation of IBWL. Govt of India. New Delhi

Tiwari, A. 2002. Creation of viable breeding satellite population of Great India One-horned Rhinoceros (*Rhinoceros unicornis*) in Badhital sector of Dudhwa National Park .UP Forest Department Project Plan

Bist, S.S., 2002(Ed). A.J.W. Milroy's: Management of Elephants in Captivity, pp-74. West Bengal Forest Department Publication / Report

Dey, R. 2000. Management Plan of Dudhwa National Park for the period 2000-01 to 2010-11

Wildlife Institute of India Project Report, 2002: Management of forests for biological diversity and productivity, WII-USDA Forest Service Project (1996 –2002)

Pandit. P.K. 1996. Management Plan of Jaldapara Wild Life Sanctuary for the period 1997-98 to 2006-07

THE TIMES OF INDIA, NEW DELHI

A new home for rhinos at Dudhwa sanctuary

By Mohit Dubey
Times News Network

LUCKNOW: Hostility between two male rhinos and fear of vendetta from a calf on an elder — the lone reproducing male rhino at the Dudhwa national park — has jolted the state forest department into action.

The outcome: A sprawling new 20-square km home, dotted by swamps and grasslands, for the 17 Indian Rhinoceros housed here.

Confirming that the second phase of the 'Rhino rehabilitation project' had begun after it was undertaken in 1984, chief wildlife warden R L Singh said on Monday that electric fencing of the new area had begun.

Back from a two-day visit of Dudhwa, Singh said that they had decided to "get going" after reports that the hostility among male members was posing a major safety hazard for the regionally extinct race of Indian rhinos. The new area being carved out in the thickets of Dudhwa involves two swamp areas of Bhadi and Churaila Taal. The second phase entails an expenditure of Rs 15 lakh that involves the setting up of a field headquarters in the area, some watch towers and the construction of the electric fencing.

The department has cleared renovation of a dilapidated and abandoned rest house at *Changa Nala* which would serve as the field headquarters. Dudhwa houses 17 rhinos which is the largest concentration in India except for the Brahmaputra valley in North-East.

The second phase of the "Rhino rehabilitation" project has also been hurried through since the incidence of tiger preying have increased manifold in the area. Fears of inbreeding have also forced foresters hands. Six animals have fallen to the wild cat in the last two decades.

