

# WILDLIFE CORRIDOR MAPPING BETWEEN ROYAL BARDIYA NATIONAL PARK, NEPAL AND KATARNIYAGHAT WILDLIFE RESERVE, INDIA BY USING GIS.

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## ABSTRACT

This paper deals with the potential corridor analysis between the Royal Bardiya National Park, Nepal and Katarniyaghat Wildlife Reserves, India. Possible forest corridors between Royal Bardiya National Park (RBNP) and Katarniyaghat Wildlife Reserve, India (KWR) were studied with the help of field survey, direct observation and informal discussion with the local people/concerned authorities. Three different corridors along the Karnali-Geruwa and Khaurahi, Orai and Babai river system were identified from the Topo-map of 1:25,000 scale and field survey. GPS was used for ground points verification. Arc View 3.2a and Arc Info 3.4/3.5 versions GIS software packages were used for wildlife corridor mapping purpose. Along the proposed buffered corridors, different forest conservation and management practices, wildlife distribution and movement areas, bottleneck areas, degraded habitats, poaching threat areas and anthropogenic activities were compared and analyzed for corridor suitability. Restoration of vegetation and critical habitat along the proposed corridor should be given priority with the accomplishment of Integrated Conservation Development Program. Additionally, minimization of all kinds of pressures in the corridor areas and providing higher protection to proposed corridors are highly recommended.

## 1. INTRODUCTION

Nepal's conservation history can be traced back from 1950s. Conservation and protection initiatives have been taken through establishing a Rhino Sanctuary in Chitwan in 1956, with an objective to protect the one-horned rhinoceros. HMG of Nepal approved a comprehensive plan for creating a network of national parks and equivalent reserves to protect endangered species of wildlife and representative examples of diverse ecosystems for their scientific educational, scenic and recreational values in the 1970s (Upreti, 1991). About 18.11 % (Jha *et al.*, 2001) of the total country's land is under the PAs. It comprises the nine national parks, three wildlife reserves, one hunting reserve and three conservation areas in different physiographic regions.

The consequences of exceptional diversity of habitats within a relatively small area have produced a remarkable variety of wildlife and floral communities in Nepal. But, over extraction of natural resources, deforestation and forest clearing, soil erosion, sedimentation, flooding, drought, etc are the major threats in wildlife habitat management. These have lead to habitat fragmentation additionally. So far the connectivity is considered an immediate need for isolated PAs for conservation and restoration of habitats.

In general, corridors are the linking passage or avenues along which long wide ranging animals can move safely and feel safely, plants can propagate, genetic interchange, population can move in response

to environmental changes and natural disasters, and threatened species can be replenished from the other areas (American Wildlands, 2001).

Moreover, habitat is a combination of food, water, shelter, and space arranged to meet the needs of wildlife. The tiger, rhino and elephant, at the apex of the food web, are an indicator species of a healthy ecosystem. Acting as an umbrella group, their conservation includes the preservation of a whole array of species sharing the same habitat. These mega fauna have played an important role in the rise of the international conservation movement, however the long-term survival of these animals is uncertain, largely due to the loss and fragmentation of its habitat, poaching and the illegal trade of their body parts (DNPWC, 1999b). Tigers, elephants and rhinos are categorized as flagship species for this landscape as they form an effective link between species-oriented management and management for biological diversity ((WTLC, 2002). Holistically, Corridors are those landscapes, which facilitate as alternative habitat and movement of migratory fauna and also help in maintaining the territory. In the recent year, wildlife corridor mapping has emerged as a new technique that helps to identify corridor and connectivity between two-isolated habitats. Therefore, it is imperative to identify potential linkages between two or more isolated habitats and GIS mapping is the most sophisticated tool extensively used in gathering a wide range of ground information including vegetation types and their distribution pattern.

## **2. STUDY AREA**

### **Royal Bardiya National Park, Nepal**

Royal Bardiya National Park (RBNP), is the second largest national park lying in the low land of southern terai in the mid-far-western region of Nepal. The Park is having the diverse habitat with wide diversity of flora and fauna. It is also known as the second alternative habitat for Rhinos having core area of 968 sq. km and buffer area of 327 sq. km. situated between latitude 28° 15' to 28° 40'N and longitude 81° 12' to 81° 43' E. It is flanked by two main river systems; Karnali-Geruwa towards southern-west and Babai towards the southern-east. The landscape adjacent to the RBNP towards the southern region is occupied by continuous forest patches that extend to the Indian border. Seasonally this forest stripe is used as migratory route by several mammals.

### **Katarniyaghat Wildlife Reserve, India**

The Katarniyaghat wildlife Reserve is situated on the Indo-Nepal border in Bahraich district of Uttar Pradesh, India. It represents the Terai-Bhabhar Bio-Geographic sub-division of Upper Gangetic plains. Owing to great vegetation diversity the area is a mosaic of diverse habitat. The most interesting features of this reserve are the occurrence of Great Indian One-Horned Rhinoceros (*Rhinoceros unicornis*) and other mammals. Additionally, the reserve occupies as the center land between other two Protected Areas, Dudhuwa National Park towards west and Bardiya National Park to the north and characterized by the center-landing habitat while migrating from Dudhuwa to RBNP a Vice-versa, for rhinos and other mammals as well.

### **Problems of the study area**

The study area has suffered from habitat loss due to fragmentation, degradation, encroachment and overgrazing with time. It has witnessed a rapid increase in human habitation and cattle grazing, enhancing biotic pressure on the forest, which is particularly acute in the national forest across the area that is taken for current study as in Dalla, Pattharbhoji, Dandagaun, Bajpur, Majhara and Kotthiyaghat along the eastern branch of Karnali river and in Geruwa and Khaurahi riverside. Similarly, the continuous forest stripe in Pratappur, Kaligaudi, Pereni, Buthkaiya, Sukhad, Godahana, Sutahiya, Chhotki taduwa and Rajwara along the Orai riverside and Bargada, Khaillar, Bankati and Khunpur under Babai riverside are also fragmented. The losses of continuous forest corridor along these regions are due to excessive anthropogenic influences (KMTNC, 2001) hindering the movement/migration especially for mega fauna within the RBNP and KWR. Poaching and harassment to the wildlife are a menace and conflict between the human and wildlife that is increasing due to deterioration in habitat quality along the corridor areas.

### 3. Materials and Methods

Table 1 shows the types of data and materials used in this study.

Table 1. The research materials and data used in this study, are listed as follow:

Topographic maps: 1:25,000 Scale, Sheet No: 2881 09B, 9D, 10A, and 10B. Digital data (Source: Survey Department)
An altimeter, Global Positioning System (GPS), Herbarium Kit, Measuring tape, Rope, etc.

Field visit was undertaken on March –April, 2002 for the assessment of current status of the corridors, the extent of degradation and changes in the forest cover, bottleneck area, poaching threat area and forest conservation practices in all three corridors at Karnali-Geruwa and Khaurahi river, Orai river and Babai river. The field work also included measurement / observation of longitude/latitude, altitude, cattle movement, wildlife movement, human use of corridor, forest type and settlement.

#### 3.1 GIS application for Wildlife Corridor Mapping

GIS operation with buffering the proposed corridor was done with considering the river system, continuous forest patches and habitat used by the mega fauna and other mammals as migratory route.

The PC ARC/INFO, a vector data structure GIS software was used to analyze and processing of the data. Methodology adopted were as follows:

- I. Data input (digitizing, editing, cleaning, topology building and preparation of digital data base)
- II. Separation of different layers such as: forest land, cultivated land, river and water bodies, road and settlements, etc.
- III. Map overlay
- IV. Buffering of each corridor river taking into 1.5km, 3km and 5km.
- V. Producing results by analyzing the suitability comparing with different variables.

#### 3.2 Suitability Variables

The suitable corridor is distinguished with comparing the following variables that are existed in the field:

- Settlement along the buffer corridor
- Road accessibility
- Continuous forest strips
- River system
- Conservation Practices
- Wildlife movement

### 4. RESULTS AND DISCUSSION

Different layers of developed map showed the natural continuity of forest stripe and river system adjacent to Royal Bardiya National Park to Katarniyaghat Wildlife Reserve, India and was found as migratory route and seasonal alternative habitat especially used by Elephant, Tiger and Rhino along all the three different corridors. The proposed corridor between RBNP and KWR includes diverse habitat with forest, grassland, farmland, river, riverbank with high chances of prey availability. The route was most prominently used as corridor by mega fauna and other wildlife currently. But some areas along these corridors were found at risk forming bottlenecks and gaps for safe migration and for dispersal due to several anthropogenic activities (shown in Map).

#### 4.1 Corridor Suitability Analysis

The corridor suitability was compared and analysed with different variables as, settlement, road access, continuous forest patches, water bodies and wildlife movement over the proposed corridor. Among the three, the Karnali-Geruwa and Khaurahi river corridor was found most suitable. Additionally Orai river corridor having dense mixed sal forest might act as alternative migratory route while passing from RBNP to KWR and vice-versa. Babai river corridor was found less suitable for mega fauna movement and dispersal but few habitats like southern-east of Babai valley of RBNP, was good for translocated rhinos, and Khairapur, at Panditpur area having last remaining population of Blackbuck (*Antelope cervicapra*) might be restored for better wildlife habitat management along the corridor.

**Table 2: Corridor Suitability Analysis**

River System	Suitability Variables					
	Settlement	Water bodies	Road access	Continuous Forest Patches	Wildlife movement	Suitability Analysis
Karnali-Geruwa	Less within the different buffer corridor i.e <0.5 km	Available throughout the year.	Least. Cartroad only upto 0.8 km	Diversity of forest and habitat.	Regular and seasonal	Most suitable
Orai	Excessive towards the edge of forest. >1km within buffered corridor	Not available in all seasons	Excessive. >2.5km	Good continuity of forest stripe that extend to KWR, India. Diverse in habitat type.	Seasonal and dispersal is high.	Moderately suitable
Babai	More within different buffered corridor i.e >1km	Available in very least amount.	Excessive. >2.0km	Less continuity. Not so diverse habitat.	Not Regular/Occasional	Less Suitable

It is concluded that the present proposed status of corridors was not satisfactory. Although the overall forest cover is decreasing except some areas, the wildlife movement and dispersal habitat was found high. Several anthropogenic activities like, cattle grazing, illegal tree felling, land encroachment, forest fire etc. have encompassed negative impact on corridor forest/areas. Hence, it is imperative to conserve or restore corridor forests/river and minimize the disturbances. If these disturbances/ excessive pressures over corridor areas leave unchecked, it is feared that the mega fauna migration, dispersal and gene flow will be ceased within the PAs.

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## List of Maps



