

BLUE BULL (*Boselaphus tragocamelus*) IN LUMBINI - A WORLD HERITAGE SITE OF NEPAL

by Achyut Aryal

Introduction

Lumbini is the birth place of Lord Buddha and listed as a World Heritage Site. The Lumbini area covers 7.7 km² and is administered by the Lumbini Development Trust (LDT). Lumbini is one of the prime tourism destinations of Nepal. The trust maintains various Buddhist temples and other historical places at the site.

Nilgai or Blue bull (*Boselaphus tragocamelus*) is one of the largest Asian antelopes found in the Lumbini area of Rupandehi district. The LDT area provides a significant habitat for Blue bull.

The Government of Nepal protects the country's endangered flora and fauna through legislation and there are various animals in the protected lists. Blue bull is an important wildlife species, but is not a protected species. The Government of Nepal has established protected areas for the conservation of endangered flora and fauna. These flora and fauna are being depleted day by day due to over-exploitation, pollution, habitat destruction, poaching and human and livestock pressure in their habitat (HMG/Nepal, 2002). The population of Blue bull has been declining at a higher rate over the last five years in Nepal and therefore, conservation of Blue bull is a national and global concern (Subedi, 2001). The population of Blue bull is declining from the Terai area due to hunting and habitat destruction (HMG/Nepal, 2002; Aryal, 2004), but not enough studies have been carried out to understand the population trends. Only two studies on Blue bull have undertaken in Nepal (Subedi, 2001; Khattri, 1993).

Rupandehi and Kaplivastu districts are potential Blue bull habitats, but no conservation measures have been taken, hence the higher rate of decline in the population of Blue bull (Subedi, 2001). It is

necessary to identify Blue bull habitats and their carrying capacity. If the population exceeds the habitat's carrying capacity, a translocation program should be initiated to move the animals to other suitable places in the country. This will also help to reduce the crop damage caused by Blue bulls that is experienced by local people.

The present study assessed the crop damage and extent of conflict between local people and Blue bulls, determined the carrying capacity of the LDT area for Blue bull and the population status of Blue bull in the LDT area. Developing natural sites where tourists can observe Blue bull and Sarus crane is a possible option, so there is an urgent need to develop an effective action plan for Blue bull conservation and management in the LDT area. A participatory approach conservation plan is needed for wildlife management (John *et al.*, 1995); therefore, this study proposes a participatory action plan for effective management of Blue bull which would support sustainable tourism and contribute to the local economy of the study area.

The findings of this research would be useful not only for the LDT area, but also for the proper management of Blue bull populations in other parts of the country to ensure their long-term survival in their natural habitat.

The objectives of the study were to:

- estimate the population of Blue bull in the Lumbini Development Trust (LDT) area;
- analyze the carrying capacity of the LDT area for the Blue bull population;
- assess the crop damage caused by Blue bulls and the impact on local livelihoods; and
- develop a participatory Blue bull conservation action plan for contributing to the local

economy and sustainable tourism in the Lumbini area.

Study area

The study area covered the LDT area and the surrounding Rupandehi district. Of the 7.7 km² LTD area, after excluding infrastructure and road areas, only 5.14 km² could be considered potential habitat of Blue bull.

Methods

The study was carried out through questionnaires and direct field observations. Crop damage was measured on the basis of questionnaires and direct field observations in the affected areas. Previous available data regarding crop damage and interviews with 142 respondents from the study area were also considered. The transect line count

method was used for the population count (Sale *et al.*, 1988) and the carrying capacity was calculated on the basis of assessments of food, cover and habitat of Blue bull. The Z test was used for testing the Null/alternative hypothesis. The testing was conducted at a 5% level of significance, with a value of 1.96.

Carrying capacity

The carrying capacity (CC) of the area for Blue bull was determined from data collected by the field inventory, based on Alberta (2004). The ecological sustainable stocking rate (ESSR) reflects the maximum number of animals [e.g. (ha)/animal unit month (AUM)] that can be supported by the plant community given the inherent biophysical constraints and the ecological goal of sustainable health and proper functioning of the plant community.

CC-

$$\text{Area (ha) available for Blue bull excluding road, infrastructure, river (A)} \\ \text{ESSR (Ecological Sustainable Stocking Rate).}$$

Where,

$$\text{ESSR} = \frac{\text{Amount of feeding (kg)/blue bull per month}}{\text{Biomass (kg)/ha} * \text{Safe use factor (25-50%)}}$$

Alberta (2004) recommended that utilization levels are generally considered to range between 25 to 50% of total production, depending on the ecological site. These percentages of production use are called *safe use factors*. It is the percentage of the total biomass production of the ecological site that is available for utilization by animals. The safe use factor considers the given inherent biophysical constraints and the ecological goals of sustainable health and proper functioning of the area. The remaining biomass production (carry over) is allocated for ecological maintenance. Recommended safe use values vary according to the ecological site and management. For the study it was calculated as 50 percent.

According to data from the Central Zoo, on a daily average an adult Blue bull needs 14 kg of biomass of palatable species (420 kg per month).

The biomass (kg)/ha is calculated by the weight of the food plant multiplied by the available area

(A). The weight of the food plant was calculated by designing a sample plot (1 m x 1 m) for herbs. Plots measuring 10 m x 10 m were laid out to determine the tree species density (Stromberg, 1995). Simple random sampling was used to determine the biomass of species. Altogether, 42 plots were laid out in the study area. Crown cover and ground cover were also observed. Palatable and unpalatable species were identified with the help of knowledgeable local people and weighed.

Results and discussion

Population status of Blue bull in LDT area

A total of 41 Blue bulls were counted in the LDT area: 10 males, 15 females and 16 juveniles. The population density of Blue bull in the LDT area is 8 individuals/km². The sex ratio of male to female is 2:3.

Population trend

Blue bulls have been recorded in the LDT area since the early 1990s. They are believed to have come from Kakrahawa forest (Indian side), which is approximately 10 km away from the LDT's southern boundary. They followed the path of Kakrahawa forest to Sattabazar Forest and to Kothi river ridge to the LDT area. The initial population was estimated to be around 5-10 individuals. The estimated population had reached nearly 200 in 1997, but this was based on public opinion. According to the local people, the Blue bull population kept increasing until 1999. The increased Blue bull population started to exert tremendous pressure on the adjacent cultivated land, causing crop damage. That situation developed a serious conflict with local farmers. The affected farmers requested the government to control the Blue bulls. In response to this request, five animals were translocated to Banke reserve forest in 1998 (Subedi, 2001). Subedi (2001) counted only 11 Blue bulls in the LDT area, but he used only the Bhairawaha-Taulihawa highway as a transect line and hence fewer animals were counted. According to the local people, during 1998-2000, there was a drastic increase in deaths of Blue bulls, which could have been caused by foot and mouth disease (FMD). Two blood samples were taken during the translocation to Banke forest in 1998, which showed signs of foot and mouth disease (Subedi, 2001). This was not the only the cause of the drastic decline of the Blue bull population; other factors included poisoning, revenge killing by farmers and less available palatable vegetation.

Habitat structure

The LDT area was covered with plantation forest dominated by Sissoo (*Dalbergia sisso*), followed by Saguwan (*Tictona grandis*), Eucalyptus, Jamun (*Eugenia jambolana*), etc.

Seventy-nine percent of the potential habitat of Blue bull is covered by forest and the other 21% is grassland or open land. During the field survey, all Blue bulls were seen in the forest and not in open land. Generally Blue bulls use open grassland for grazing.

Approximately 43% of the study area had dense crown cover (75-100%), 27% had moderate crown cover (50-75%), 14% had sparse crown cover (25-50%) and the remaining 16% had very sparse crown cover.

During the study period most of the ground layer vegetation was dry and covered with litter. Most of the ground layer was covered with grass species (e.g., *Imperata cylindrica* and *Cynodon dactylon*); about 16% of the area had dense ground cover (75-100%), followed by 44% with moderate ground cover, 29% with sparse ground cover and 11% having very sparse ground cover. From October/November to April/May, ground herbs become dry and hence, this is a food deficiency period, during which time the LDT authority totally bans livestock grazing in Blue bull potential habitat.

Carrying capacity (CC)

The carrying capacity for a grazing disposition of a given size represents the maximum number of animals that can be sustained without causing a downward trend or without degrading the resources in their habitat. Suggested ecological sustainable stocking rate (ESSR) values provided in the plant community guide are determined from a combination of clipping studies.

In order to sustain the ecological health and function of the plant community, ESSRs are based on a standardized biomass allocation and forage requirements of one Blue bull unit (i.e., 420 kg/month). (Reference: Central Zoo, Kathmandu, 2005).

The LDT area was divided into two parts to calculate the carrying capacity of Blue bull, which were separated by the Bhairahawa-Taulihawa highway. The northern part of the highway is a potential site for the management of wildlife tourism. The carrying capacity of both sites were calculated.

Palatable species preferred by Blue bull were identified with the help of local knowledgeable persons (e.g., shepherds, villagers). Eleven species of herbs/grasses were found in the study area and out of these, 5 species were found to be

palatable species for Blue bull. These included *Imperata cylindrica* and *Cynodon dactylon*.

There were no branches below 7 feet, so the tree biomass was neglected in the calculation of biomass; dry leaves of trees were calculated as unpalatable species.

The carrying capacity of the LDT area north of the highway was as follows:

- Area (ha) available for Nilgai excluding road, infrastructure, river (A): 220 ha
- Amount of feeding (kg)/blue bull per month: 420 kg dry weight
- Total Biomass (kg)/ha: 682.936 kg (dry weight)
- Palatable species spp dry weight: 204kg/ha
- Safe use factor: 50%
- ESSR: 4.11

$$\text{CC- } \frac{220}{4.11} = 53.2 \text{ (=53) individual}$$

The carrying capacity of the LDT area south of the highway was as follows:

- Area (ha) available for Nilgai excluding road, infrastructure, river (A): 294 ha
- Amount of feeding (kg)/blue bull per month: 420 kg dry weight
- Biomass (kg)/ha: 682.936 kg
- Palatable species spp dry weight: 204kg/ha
- Safe use factor: 50%
- ESSR: 4.11

$$\text{CC- } \frac{294}{4.11} = 71.5 \text{ (72) individual}$$

From the above data, the total carrying capacity of the LDT area for the Blue bull is 125 for October-January; the carrying capacity during the dry season will be less. A detailed biomass study should be conducted to identify the carrying capacity in other seasons. Grazing competition from more than 1,000 livestock also reduces the amount of palatable species available to Blue bulls and has encouraged the introduction of unpalatable species in the area, causing the Blue bull to move to private lands in search of food. If livestock grazing pressure is controlled inside the LDT area, the movement of Blue bulls to private lands will be reduced significantly.

Man-Blue bull conflict

Blue bulls have a direct effect on the local livelihoods of the farmers in lands surrounding the LDT area, as they have always been closely associated with farmlands. Due to the open boundary of the LDT area, Blue bulls frequently visit the farmlands surrounding the LDT area and

destroy large quantities of agricultural crops and vegetables. The area around the LDT was highly affected up to 1 km from the boundary; areas 1-3 km from the LDT suffered medium effects, and areas more than 3 km from the LDT boundary were less affected.

Highly affected VDCs are Tenuhawa, Ekla, Madhuwani and Lumbini Adarsha. A large amount of crop damage has been recorded from Hamamapur, Shivagadiya, Ramawapur, Mahilwar, Padariya, Parsa and some parts of Yakla VDC.

Generally, Blue bull prefers the mature growth stage of different crops (e.g., paddy, maize, mustard, chili, cauliflower, cow-pea, black gram, cabbage, etc), while wheat, potato, radish and pumpkin are preferred in the early stages of growth, and lentils are preferred at all stages. Blue bulls were reported to feed on all the major crops grown in the boundary areas. Apart from agricultural crops, Blue bulls also caused considerable damage to vegetables. According to

the local people, male Blue bulls visited kitchen gardens more frequently than females. The local people claimed that about 5% of the total rice production is damaged by Blue bulls in areas 1 km from the LDT boundary, and 2% was damaged in areas 1-3 km from the boundary.

Impact on the local economy

Various factors such as seasonal cropping patterns, the absence of strong fencing and the types of crops grown in the field were the main factors governing the extent of crop damage. The types of crops damaged by Blue bulls varies with the season. Generally, damage incurred during the winter months was found to be higher than during the summer. The distance from the LTD boundary to the field also affects the amount of crop damage. There is an inverse relation between distance and crop damage, i.e., as the distance decreases, crop damage increases and vice versa. Crop types also play a significant role in crop damage. Mainly paddy, wheat, mustard, potato, peas and lentils were found damaged in the area. In interviews with 142 farmers surrounding the LDT area, rice/paddy was reportedly one of the most highly damaged crops, with approximately 5% of total production damaged by Blue bull. This amounts to 1,000 quintal, which is equivalent to NRs 900,000 (NRs 1= US\$74). Wheat crops also suffered damages by Blue bulls equivalent to NRs 1,103,595. So it seems that there is a significant amount of crop damage done by Blue bulls, which has an impact on the local livelihood in the areas surrounding the LDT.

Efforts made to minimize crop damage

Efforts have been made by both villagers and the LTD authorities to minimize crop damage from Blue bull. The Trust erected a brick wall fence along the parsa to the main gate, and most of the LTD boundary was fenced with barbed wire. Unfortunately, there is no fence anymore because the barbed wire was stolen. Local people regularly guard their crops in the field night and day. To deter the Blue bulls, some local farmers used live hedge fences or barbed wire fences around their kitchen gardens, put up scarecrows or used fires to frighten the animals.

Threats

Some of the threats that Blue bulls face include the following:

- Grazing pressure: Every day more than 1,000 livestock graze inside the park, and constitute the main threat by consuming the food plants of Blue bull and inducing the introduction of unpalatable species.
- Disease transmission: Due to the livestock pressure in Blue bull habitat, there is a high probability of transfer of livestock diseases to Blue bull and vice versa.
- Firewood collection and grass cutting

Recommendations

- Barbed wire fencing should be erected around the LDT area.
- Livestock grazing and grass cutting inside the LDT areas should be restricted.
- A public awareness program should be initiated to disseminate conservation education to the local villagers about the importance of wildlife resources, and especially about the newly endangered status of Blue bull.
- A detailed biomass study should be conducted to identify the carrying capacity of Blue bull habitat in the dry season.
- Incentives should be provided to local affected farmers in the form of monetary compensation for crop damage, skill development training, income generation training, etc.
- Non-timber forest products (NTFPs) such as Sarpagantha and Mentha should be cultivated in high crop damage areas (1 km from the Trust boundary) as alternative crops which are unpalatable to Blue bulls.
- The LDT should be actively involved in biodiversity conservation activities, such as the restoration of wetlands, regular patrolling, conservation awareness activities, etc.
- Participatory Conservation Action Plan activities must be implemented for better management of Blue bull and other wildlife and to raise the local livelihoods.

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LOST WITH FIRE

by Manjula Menon

In India, Western Ghats is one of the richest centers of endemism and a region diverse in fauna and flora. A number of programs are currently being implemented for conservation of biodiversity and sustainable utilization in this particular hot spot region – mainly inventories and *in situ* and *ex situ* conservation. The ecosystem is under severe threat from various natural and anthropogenic pressures. One of the greatest pressures is from forest fires. Forest fires are usually the result of three main factors: a heat source, a fuel that burns, and oxygen to propagate combustion. Ignition sources may be natural or human-caused. Fuel refers to the different components of the vegetation layer, both live and dead materials. The effects of forest fires have in turn created a situation that has resulted in severe climatic conditions leading to a significant loss of biodiversity. In recent years, there has been an increase in forest fires due to land use changes and climate warming.

There has also been much concern regarding forest fires at the global level. According to

researchers of the UK-based University of Leicester, the wild fires that scorched parts of Indonesian forests in 1977 spewed as much carbon into the atmosphere as the planet's biosphere absorbs in a year. This led to a sharp increase in global warming during 1998. Forest fires, especially in the Western Ghats, have led to large scale losses of both wild flora and fauna. The tropical dry deciduous forests of Western Ghats are more susceptible to fire than the moist deciduous and dry thorn forests. This can be attributed to the longer dry season of the dry deciduous forests, and hence, larger amounts of dry matter. Studies in Western Ghats have also revealed higher incidences of fire in areas with a high density of *Sorea roxburgii*.

Forest fires also have considerable effects on the faunal species. There have been observations of Indian rock pythons bearing fire scars in the forests of Mudumalai sanctuary. Many insects and birds (e.g., Yellow-wattled lapwing) build their nests on the ground, which in the event of fire could be charred.