

Research

CONSERVATION REGIME AND LOCAL POPULATION ECOLOGY OF SARUS CRANE (*GRUS ANTIGONE ANTIGONE*) IN WEST-CENTRAL REGION OF NEPAL

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ABSTRACT

The research explores the current and future conservation regime, and local population ecology of globally threatened water bird Sarus Crane (*Grus antigone antigone*) in Rupandehi, and Kapilvastu districts of Nepal. The study strongly recommended to declaring certain areas of these districts as a Sarus Crane Conservation Area (SCCA) for its future better management regime.

A total of 168 Sarus Cranes were recorded in the area (100 in Rupandehi and 68 in Kapilvastu district). Overall population density of Sarus Crane was 9.3 individual/100 km². Seventy percent of Sarus Cranes were using farmland while 30% using wetland as a regular habitat. Current threats to the Sarus Crane population are habitat loss and degradation, high electrical cable line, sugar cane cultivation surrounding the Sarus crane habitat, dam and cementation in water canal, water pollution due to nutrients and chemical leakage in water bodies, environmental contamination and other anthropogenic causes.

Keys words: *Sarus crane, threatened, low land, wetlands*

INTRODUCTION

Nepal is rich in avifauna diversity, with 863 birds species been recorded (BCN, 2009). The distribution of birds in Nepal follows three dimensional zonation: altitude, south-north and east-west, with diverse topography, climate and vegetation factors. The lowlands support the richest diversity of avifauna similar to the Indian realm and the high regions maintain much Northern form originated from Palaearctic. Large birds such as raptors, ducks, cranes, gulls and even some small perching birds fly over the high mountains (Masatomi 1994).

Nine bird species are protected by National Park and Wildlife conservation ACT - 1973. It includes two species of storks, three species of pheasants, two species of floricans, one crane and one hornbill. Out of them Black Stork and Sarus Crane occur in the wetlands of Lumbini.

Black Storks migrate from Europe during winter while Sarus Cranes are native species (Suwal 1999).

Sarus belongs to the phylum: *Chordata*, Class: *Aves*, Order: *Gruiiformes*, Family: *Gruidae*. Family *Gruidae* has altogether 15 species belonging to four genera and two sub-families. Cranes are found in all the continents except in South America and the Antarctica. Among these, four species of cranes have been recorded from Nepal. Common Crane (*Grus grus*) and Demoiselle Crane (*Anthropoides birgo*), are the high altitude passage migrants from the Palaearctic region. Black-necked Crane (*Grus nigricollis*) - a vagrant species has been recorded in Nepal. They are Tibetan highland species, and a small population migrates to Bhutan. The Sarus Crane (*Grus antigone*) is a non-migrant sub-species of Indian sub-continent (Inskipp and Inskipp 1991). It is the only resident breeding crane in India, Nepal and Southeast Asia, and is the world's tallest flying bird. Three subspecies are recognized, with a total estimated population between 13,500 and 15,500 (Meine et al. 1996). The Indian Sarus Crane (*G. antigone antigone*) is common in Northern India and rare in Southern Terai region of Nepal but has been extirpated from large portions of its historic range and continues to decline in areas where it still exists.

In this context, this research was carried out to assess conservation status and population ecology of Sarus Crane in Rupandehi and Kapilvastu districts low land region of Nepal.

STUDY AREA

Study areas were Rupandehi district (27° 20'- 27° 45' N and 83° 10'- 83° 30' E) and Kapilvastu district (27° 25'- 27° 84' N and 82° 75'- 83° 14' E) of Nepal (figure 1). Rupandehi district lies in the Terai region and situated in Lumbini Zone of western development region in Nepal (DDC 2003b).

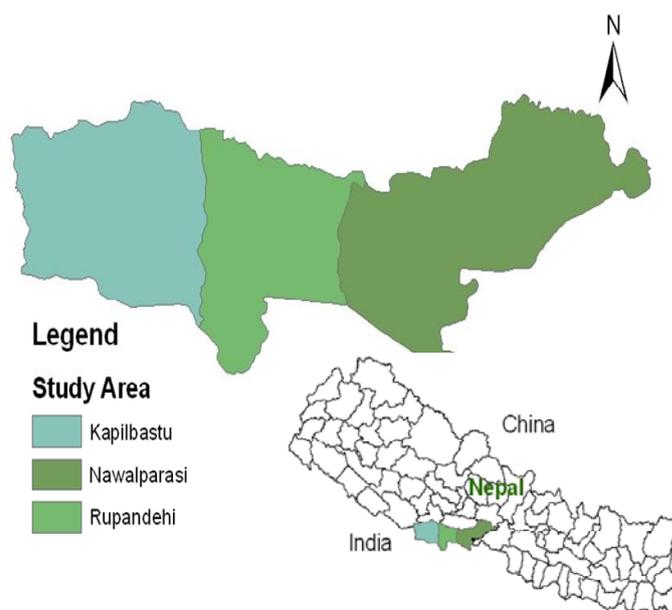


Figure 1: Study areas (intensive study areas were Kapilvastu and Rupandehi district) Nawalparasi district is another Sarus Crane distribution district of Nepal

Kapilvastu district lies in adjoining district of western boundary Dang districts lies in west and Argakhachi district lies in north, Rupandehi district lies in the East and India lies in South (DDC 2003a). Survey was conducted in all VDCs of Rupandehi and Kapilvastu district of Nepal.

Rupandehi and Kapilvastu landscapes consists generally two types of forests: natural forest and artificial forest (plantation). Sal (*Shorea robusta*) Forest: Sal forest is associated with *Terminallia tomentosa*, *Terminallia belerica*, *Lagerstroemia parviflora*, *Dillenia pentagyna*, *Syzygium cumini*, and *Semicarpus anacardium*. Sissoo-Khair (*Acacia catechu- Dalbergia sissoo*) forest: This forest occurs on newly deposited alluvium, often gravely along streams and rivers of the study area. Other riverine forest: Small strips of forest are found in moist localities near streams. This forest type includes tropical evergreen forest *Michelia champaca*, *Listea spp.*, *Phoebe canceledata*, *Actinodophae angustifolia*, *Cinnamomus spp.* and tropical deciduous riverine forest, usually dominated by *Bombax ceiba*, *Holoptelea integrifolia* and *Trewia nudiflora* together with other species found in the Sal forest. The area occupied by this type of forest is not large and does not extend far from the stream banks. Plantation forest is situated inside the Lumbini Garden, private land and some community forest area which is chiefly composed of Sissoo (*Darbergia sissoo*).

Wetlands found in the study areas include lakes, oxbow lakes, village ponds, reservoirs banks, rain water basins and paddy fields. During the monsoon, all the cultivated lands become wetlands with adequate water. There are five major rivers: Rohini, Tinau, Danob, Telar, Badaganga and Kothi. Minor tributaries of the Ganges flow from north to south into the lowlands of Rupandehi district. Oxbow lakes of Khuda bagar, rainwater depression of Semari and pounds of Ahirauli are the important wetlands of Rupandehi and Jagadishpur reservoir. Ajinggara Lake, Lambu Sagar Lake, Badaganga Badaha area, Niglihawa Lake, Sagar Lake, Loharaila Lake and Sakhuwani Lake are the important wetlands of Kapilvastu district.

The study area harbors globally threatened species of birds such as Lesser Adjutant Stork *Leptoptilus javanicus*, White-rumped Vulture *Gyps bengalensis*, Slender-billed Vulture *Gyps tenuirostris*, Pallas's Fish Eagle *Haliaeetus leucoryphus*, Black Stork *Ciconia nigra* and Sarus Crane. Other common bird groups consist of mynas, parakeets, woodpeckers, drongos, herons, warblers, ducks, storks, sandpipers, koels, doves etc. (Suwal 1999).

METHODOLOGY

The Preliminary survey was carried out to locate the Sarus Crane's potential areas prior to actual field work. Presence and absence survey for Sarus Crane was carried out in each Village Development Committee (VDCs) within both districts along with questionnaire survey with concerned and knowledgeable persons such as farmers, local leaders, District Forest Office staffs and Lumbini Crane Sanctuary (LCS) staffs. The field data were collected during 2003 to 2004 and literature based data were collected during 2003 to 2009 from different wetland and Sarus Crane associated publication to prepare this paper.

Population count was done by direct observation in all potential habitats. Direct count of the Sarus Crane number (chick, adult, and egg) was done in each potential area. The population was counted with the assumption that Sarus Crane activities remains within the fixed territory (breeding period) in order to avoid the double count of same species in other sites of study area. We used motorbike, bicycle and on foot walk to access the potential habitat of Sarus Crane with binocular. Sarus Crane was counted in all potential habitats within both districts, comprising open area of cultivation, wetlands, rivers and riverbank (total available habitat area). Population density of Sarus Crane was calculated using the following mathematical formula.

$$\text{Population density of Sarus Crane} \longrightarrow \frac{\text{Total Number of Sarus Crane observed}}{\text{Total available habitat area}}$$

Distribution pattern and potential habitat of Sarus Crane was identified based on direct field observations and interview with the local people, staffs from District Forest Office and Lumbini Crane sanctuary and other interest groups such as local key informants and naturalists. Once the potential habitat was identified, the next step was to carry out questionnaire survey along these areas. In order to receive details on Sarus Crane habitat, further interviews were carried out with 10-12 local persons from each VDC.

Secondary data were assembled from the relevant published and unpublished documents.

RESULTS AND DISCUSSION

Results

Distribution of Sarus Crane

Sarus Cranes were distributed on Southern region of the both districts. Sarus Cranes were not recorded from the Northern part of the study areas which was composed with Sal and mixed forest along the Churia range.

Distribution of Sarus Crane in Jogada VDC, Masina VDC, Marcharbar site, and Kamariya VDC of Rupandehi district was higher compared to other parts of study areas. The population of Sarus Crane was distributed upto Kapilvastu district in the west and Nawalparasi district in the east. Before a decade, Sarus Cranes were distributed in almost all VDCs of Rupandehi except some of the northern VDCs namely Rudrapur, Saljhandi, Dadharakchhya, Devadaha VDCs and Butwal municipality because of the high Sal (*Shorea robusta*) and mix forest.

In Kapilvastu district, Sarus Cranes were distributed in all VDCs except some northern dense forest areas namely Gungauli, Shivagauhi, Shivapur, Dubiya, Mahendrakot and Motipur VDCs. The populations of Sarus Cranes have been abandoned from their permanent territory VDCs such as Bhagwanpur, Vidyanagar, Ramnagar, Shivanagar, Kushhawa, Sihokhor, etc. At present Sarus Cranes are congregated in south-east part of Kapilvastu district with high population. These VDCs are Patariya, Lawani, Hatihawa, Bithuwa and Pakadi VDCs of the district.

Population Status

The population of Sarus Crane was counted during October- December 2003. A total of 168 Sarus Cranes were recorded in Rupandehi and Kapilvastu districts of Nepal. In Rupandehi there were 76 adults and 24 chicks while 55 adults and 13 chicks were in Kapilvastu district.

Available habitat for Sarus Crane in Rupandehi and Kapilvastu districts were 868 Sq. Km and 938.04 Sq. Km respectively, which comprises open cultivated land, wetlands, rivers and river banks.

Density of Sarus Crane in Rupandehi and Kapilvastu districts was 0.1152 crane/km² and 0.0725 Crane/km² respectively. Overall population density on study area was 9.3 individual/100 km².

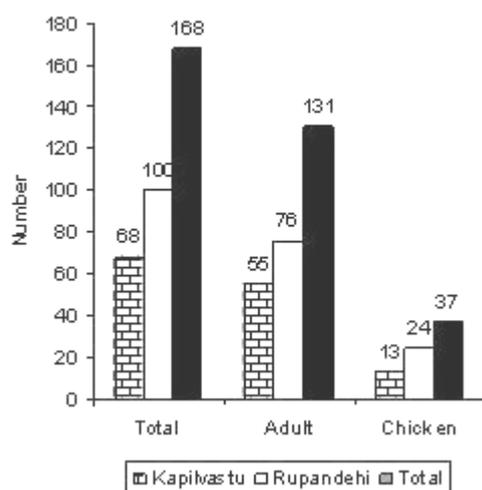


Figure 2: Total population of Sarus Crane in study area

The total number of Sarus Crane in Kapilvastu district was 68 (55 adult and 13 chicks). During the field survey, one fresh egg of Sarus Crane was observed at about 500m east side of Maharajung village of Maharajung VDC at the wetland of Kapilvastu district in 2003-11-1. There were high numbers of Sarus Crane in Patariya VDC where 7 with 6 adult and 1 chicken were counted. Availb of Sarus Crane is high in Pataraya VDC, Lawani VDC, Hatihawa VDC, Nandanagar VDC unlike other VDCs of Kapilvastu district.

Habitats Utilized by Sarus Crane

A total of 118 Sarus Cranes were counted in the farmland. The maximum nests were recorded (N-79) in farmlands and only 50 nest were recorded in the wetlands of the study areas. Average area covered by the nest was 1.45 square meters and average height of nest was 20.3 centimeter that ranged from 45 cm to 12 cm in height from the ground and water level of the ground. The mean depth of water around the nest was 7.9 cm with maximum depth of 25 cm with one egg recorded at Maharajgunj of Kapilvastu district.

Discussion

Population

Previous surveys (1995 and 1996) by Pratima Shrestha in Rupandehi and Kapilvastu district, were done by using transect line method along the accessible roads from the vehicles. Recent survey was based on direct observation method in its all potential and presence sites. Shrestha (1995) counted 98 and 93 individuals in Rupandehi district and 30 and 38 individuals in Kapilvastu district during consecutive years 1995 and 1996 respectively. As that study only considers accessible roads and missing other potential areas of Sarus Crane, the data given at that time has been leading as underestimate the actual number of species. Apparently this study shows the higher number of Sarus Cranes in same location which might be due to the different methodology used, however social survey also carried out to know the people perception about the population status of Sarus Crane in their area. 80.23% of respondents agree that the population of species is declining since few years.

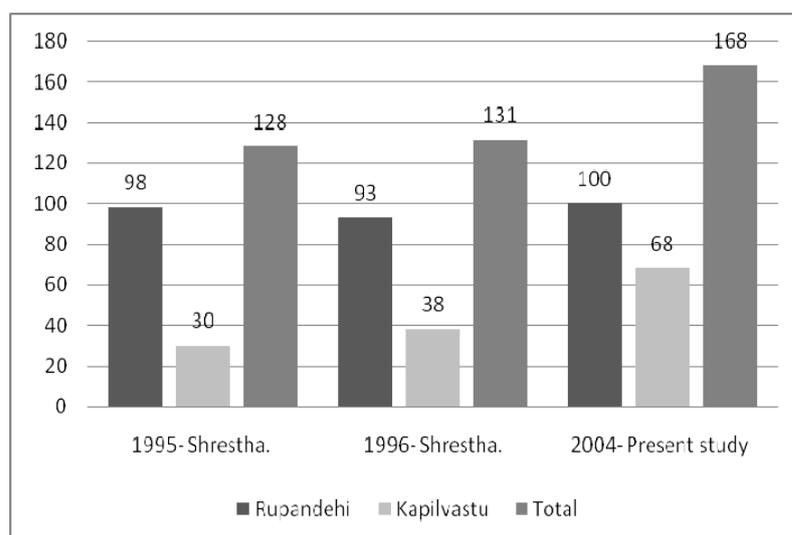


Figure 3: Sarus Crane population trend (comparison with past studies)

The bird mostly used rice and *Imperata* plants for nesting material. The choice of nesting material was depended upon the vegetation around the nest. Hence, all nests in the paddy fields used rice plants, *Eleocharis* spp. in the wetlands and ponds. Wild rice plants and other vegetation were used in the grasslands for nesting. Nesting material consisted primarily of *Imperata* grass. The plants were plucked from the roots (in the paddy field and wetland) and the grasses pulled out and piled into a mound. The shape of the nest is roughly circular to oval shape, with the mound in the center and a slight depression in the middle.

Based on the habitat of Sarus Crane presence, 67 and 51 Sarus Cranes in the farmland and 33 and 17 in the wetland were counted in Rupandehi district and Kapilvastu District respectively. It clues habitat use by Sarus Crane based on the food availability. Terai farmlands are covered with paddy from June to October, which support fish, frog, snail, and other insects which are

the prey for Sarus Crane; beside rice grains itself is food for Sarus. Hence, the concentration of Sarus is higher in the farmlands during June to October.

Habitat Loss and Degradation

Habitat loss and degradation is the most significant threat to the Sarus Crane population. Declines in habitat availability and quality affect the distribution, movement, and breeding success of cranes, and involve all habitat type- breeding grounds, migration stopover points and staging areas, wintering grounds, resident habitats, and roosting areas. Major forms of habitat loss and degradation affecting cranes include the following:

1. Conversion of wetlands

Most parts of the wetlands within study area owned by government have been encroached by local people for the cultivation of agricultural crops. In addition the private wetland owners follow the same trend of producing crops. Beside this wetlands have been converted for non agricultural purposes such as road construction and dam construction mostly in the Bithuwa VDC, Bahadurjung VDC, Ajingara VDC Patraya VDC, Niglihawa VDC, Manpur VDC of Kapilvastu district and Suryapur VDC, Kamaria VDC, Sadi VDC, Bishnupur VDC, Maryadpur VDC, Semari VDC of Rupandehi district. These are the significant activities which has adversely affecting the states of proper nesting, feeding, roosting habits of the Sarus, in the study area.

2. Over exploitation of wetland resources

Most of the people in this study area are dependent on wetland resources for their livelihoods. Human population has been increasing in study area, therefore, the Sarus Crane population is facing negative impacts due to overexploitation of the plants such as Water lily (*Nymphaea spp.*), water chestnut (*Trapa bispinosa*), Makhan (*Eurale ferox*), animal (i.e., fish, snail) and water resources of these wetlands. Poisoning fish and its overexploitation from the wetlands is most serious problem for the wetland and Sarus Crane Conservation in both district.

3. High electrical cable line

Collision of Sarus Crane in High Electrical Cable line has been another major reason for reducing number of this species in the study area. In Lawani VDC, Lumbini area, and other many VDC of both districts, there are many incidents of Sarus Crane being collided with Electrical cable line. According to a respondent, one Sarus Crane was dead at Lawani VDC in August 2003 due to the collision with electrical cable line. Similarly, in September 2003, one pair died in Rupandehi which was domesticated by owner of brick industries, in 2002 a pair Sarus died in Patraya VDC.

4. Sugarcane cultivation

Sugarcane cultivation is a severe problem for habitat destruction of Sarus Crane in the study area. There are two huge Sugar Cane processing factories in the Study area, one in the Rupandehi municipality and other in the Krishnagar site of Kapilvastu district. There is another Sugar Cane Factory in the adjoining district of Rupandehi, i.e. Sunawal in Nawalparasi district. These industries have been consuming large quantities of Sugar Cane as a raw material. These industries are encouraging local people to cultivate Sugar Cane offering those cash in exchange. Cultivation of Sugar Cane in the Krishnagar site is high and most of farmland is converted into the Sugar cane cultivation land. There are similar situation in Rupandehi and Nawalparasi district. Sugar Cane field is not suitable for the Sarus Crane habitat; therefore, Sarus Crane has been abandoned from Krishnagar site since 5 years.

5. Development activities and urban expansion

Agricultural land of the both district has been converted into village settlements, housing, industrialization and other developments activities (i.e. the highway construction), such activities throughout the study area has caused disturbance to Sarus Crane population and their activities.

6. Dams & cementation in water canal

Several organizations such as Department of irrigation, Non Governmental Organisation (NGO) and International Non Governmental Organisation (INGO) were involved in the construction of Dams and Cementation of water Canal to prevent water leakage. This has changed the traditional open canal system of irrigation which was supporting survival of wetlands flora and fauna alongside the canal. This has also threatened the feeding habit and the habitat of Sarus Crane and other wetland species who survived on traditional open canal.

7. Pollution due to insecticide, pesticide and chemical fertilizer and environmental contamination

Farmers of both districts have been using large quantity of chemical fertilizer, insecticide and pesticide expecting high quantity and quality of crop production. These activities have directly affected to the Sarus Crane and the other species of surrounding. Some of pesticides used are Malathin, Gamoxin, Metacid, Thaiden, etc. and; chemical fertilizers are Urea, potash, currently used by farmers. These types of pesticide/insecticide and the Chemical fertilizer directly kill and reduce the number of small animal and plant that are the food for other birds and animal. These also affect on the Sarus Crane's physiology, reproduction success and food sources. About 90% farmers are unaware of these effects. Other serious problem is the discharge of Industrial wastage. More than 150 large and small industries exist in the both districts (DDC 1999). Paper Mills, Triveni distillery, Resin and turpentine industry, Sugar mill and brick industries are the major sources for polluting river and air quality of the study area. These industries dispose their untreated chemical wastes to the river. Some of the rivers such as

Dano river, Tinau river, Badganges and others small rivers are facing similar problem. Aquatic lives, some dependent birds (Cranes, Stork, Ibises etc) even cattle and locals have adversely been affected from such polluted water. More than 30 cattle were dead due to drinking of polluted water from Dano River (Suwal et al. 2003).

8. Direct exploitation

Sarus Cranes population is threatened due to hunting, eggs and chicken thefts. Stealing of eggs and chicken has been common among children more compared to adults, and these activities were high in Kapilvastu district than Rupandehi district. According to the statistic of Nepal, most of the population in Kapilvastu is dominated by Muslim religion unlike Rupandehi. It is also presume that Muslim children are more involved in stealing eggs and chicken for food and fun and also due to lack of awareness. In contrast hindu has believes that more Sarus Crane presence will increase in crops production. However, the involvement of hindu children was also seen in the study area. In Lumbini area there were also reports of Sarus eggs eaten by Python, and destroyed by grazing animals such as Blue Bull referred as trampling effect.

9. Other anthropogenic threats

Interference or disturbance by people could be an indirect cause of reproductive failure and mortality in Sarus Cranes. Such interference can occur in any phase of the Cranes life cycles, but it is most critical during the breeding season, when adults are establishing territories and nesting birds and young are most vulnerable. Encroachment upon or disturbance of crane nests renders eggs and young birds are more vulnerable to predation.

Ninety percent out of 86 respondents were unaware of legal status of Sarus Crane, its conservation status and importance. They were not interested in conservation issues of Sarus. Therefore, public awareness is must essential mean to conserve the Sarus Crane in the both districts.

Government should change their conservation regime towards proper management of Sarus Crane population outside the protected area by declaring Nawaparasi, Kapilvastu and Rupandehi district as a Sarus Crane Conservation Area (SCCA).

In this scenario we have recommended the following important findings for Sarus Crane conservation.

1. Sarus Crane conservation awareness programme should be conducted in both districts including students, farmer and hunter etc. it is also recommended that conservation awareness programme focusing towards Muslim Society of the study area would be much more effective nevertheless every society are equally concerned.
2. Restoration and management of the existing wetlands of both districts are required in order to provide habitat for Sarus Cranes.

3. Use of insecticide/pesticide and chemical fertilizer are higher in farmland of both district. Awareness of side effects, promotion of biological controllers and exploring less harmful techniques such as composting and implementing organic farming will have significant positive impact in conservation issues of the species
4. Sarus Crane Management Action Plan and Integrated Conservation Programmes are essential for proper conservation of Sarus Crane in the study area.
5. The Nepal Electricity Authority should put visual markers in their 132 kV and 11 kV transmission cable to avoid bird collision.
6. Rapid action should be taken to declare adjoining area of both districts covering Lumbini of Rupandehi district, Taulihawa municipality area of Kapilvastu and Marchawar site of the Rupandehi district as a Sarus Crane Conservation Area. Government of Nepal and other INGOs, NGOs should launch the integrated Conservation programmes for the Sarus Crane conservation. Legal provision should be implemented regarding hunting, stealing of eggs and chicken control.
7. Captive propagation should be carried out within the Lumbini Crane Sanctuary and initiate to re-establish a population in their former range such as Koshi Tappu Wildlife Reserve and other Terai district of Nepal where the habitat is suitable for the Sarus Crane.
8. There should be wetland conservation area in order to provide additional habitat for Sarus Cranes.

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