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Nest site selection by Sarus Crane *Grus antigone* in the Wetlands of Lucknow, Uttar Pradesh, India

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Abstract

In present study, nest site selection of Sarus Cranes *Grus Antigone* was studied in Lucknow district from May 2014 to June 2016. According to study results, Sarus cranes preferred ponds and lakes and avoided agricultural swampy areas. Factors associated with the selection of nest sites included water body size, distance to water, water depth and the level of nest concealment. Nest size was a function of the habitat used for nesting; nests were largest in lakes, and slightly smaller in ponds habitats. Preferred nest sites by Sarus Cranes were associated with large water bodies in pond (76617.4 m²), a certain water depth (average 77.9, 118.3 and 65 cm pond, lake and agricultural marshland respectively), and a certain distance from the mainland (54.3, 95.1 and 51 m pond, lake and agricultural marshland respectively) of wetland.

Keywords: Sarus Crane, Nesting Site, Lucknow District, Wetlands, Habitat

Introduction

Nest site selection is a critical part of birds breeding ecology, especially for wetlands birds. Managers must have knowledge of the relationship between nest site selection and nest success before undertaking habitat management and conservation [23]. The ecological condition of wetland habitats supports the survival of not only vulnerable Indian sarus crane but also several endangered species of fishes and plants, hence there is a compulsory need to understand the conservation priorities and to design and implement conservation action plan. Nest site selection involves the specific choice of a site to build a nest just prior to egg laying. The nests were mainly located in ponds, lakes and non-cultivated agricultural field [6]. Sarus Crane is sociable birds [13] and large flocks exist, especially during the breeding season [10]. Sarus cranes have evolved to inhabit wetland areas and will mainly nest in wetlands [1, 8, 12, 19]. Nests are typically composed of aquatic vegetation and submerged in water. Nests are circular or oblong with a broad base and a depression in the center [14].

Information on how birds use different types of habitat for nest construction and move within landscapes is critical for avian ecology, conservation, and management. Understanding nest site selection characteristics are imperious for making conservation conclusions on bird habitat, and executives typically lack such knowledge [3, 5, 21]. In this study, we provide the nest site selection criterion, nests characteristics of sarus cranes, their habitat utilization, and the influence of one parameter over the others. The findings from this study are expected to establish a baseline on the nesting and ecological behavior and habitat variability of sarus cranes in the area.

Materials and Methods

Study area

Study was carried out in Lucknow district from May 2014 to June 2016. Lucknow district is a fragment of Central Ganga Plain in the state of Uttar Pradesh covers an area of 2,528 km and lies between North latitudes 26°30' and 27°10' and East longitudes 80°30' and 81°13' (Fig. 1). A total population of Lucknow is 34 lakhs as per 2011. The general elevation of the district varies between 103 and 130 meters above mean sea level showing the southeasterly slope. During the study, wetlands of Lucknow and its associated areas (Itaunza, Gosaiganj, Amethi, Mahona and Bakshika Taalab) were covered. The Gomati River, the chief geographical feature, meanders through the city, dividing it into the Trans-Gomati and Cis-Gomati regions.

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The climate of Lucknow city is of the subtropical type with three distinct seasons namely summer, monsoon and winter. In summer temperature ranges from 25-45 °C while in winter from 2-20 °C, the average annual rainfall is about 1014.7 mm. The principal river Gomti originates near the Maldo Tada town of Pilibhit. The river extends to about 900 km. Some of the tributaries of this river are Kukrail, Loni, Beta etc.

Disturbance to breeding cranes includes egg collection by people, egg destruction by buffaloes, cows, and feral dogs, and no disturbance to nesting cranes. Some of the wetlands were selected by the local government for economic development as fish cultivation and water chestnut cultivation. Several developmental activities and artificial establishments have been built near the wetland.

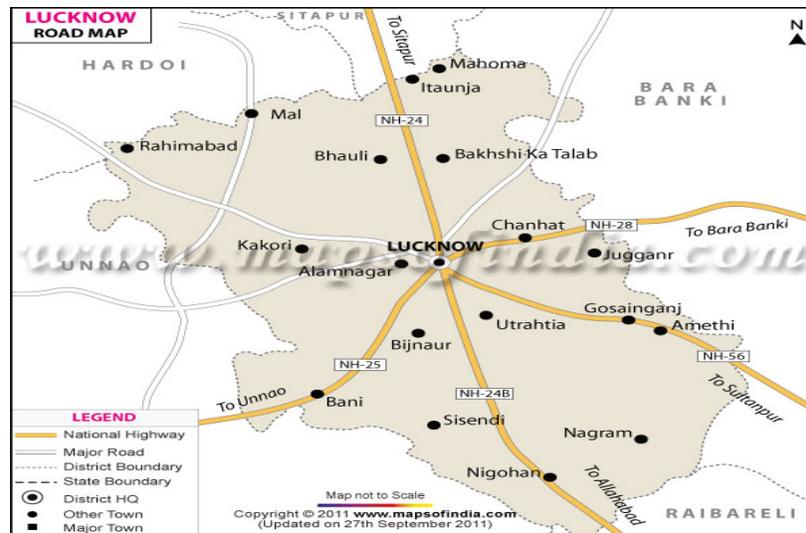


Fig 1: Map of Study area (Lucknow District)

Data collection

The study consisted of surveys conducted between May 2014 and June 2016. This elaborate study coincided with the egg-laying season for sarus cranes. This helped reduce pseudo replication as a result of the birds remained near their nests throughout this point to guard the nesting space and eggs [2]. We troop a vehicle at 15–20 km/h and look over both sides of the road to locate incubating cranes and nests, similar to the method used by [4] in a study of Sarus Cranes *G. antigone*. The open and flat location made it easy to trace crane territories and nests.

The steps were used to determine nest sites and locate nests: 1. to locate paired and non-breeding cranes along both side of road; 2. determine whether or not the site was a nest site by observing the paired birds for 15-20 minutes (i.e. cranes return following the disturbance); 3) cast an eye over the habitat after site selection. After the nest was located, measured nest site parameters. Parameters were measured by the same persons through the three years to diminish data inconsistency.

We ascertained nest-site positions on foot by the natural markers on the ground. We then started measuring the environmental variables by plot sampling. Plots were circular and centered on Sarus crane nests. The area of the “nesting site” is outlined as a five-meter radius circle the nest. “Nesting site characteristic” indicates the situation of a nest within the nesting site in terms of its proximity to nearest agriculture field and disturbance by livestock. “Water regime within the nesting site” indicates the general level of status (permanently dry space, permanently wet space however while not open water, permanently flooded space, sporadically flooded space, permanent water body). “Landscape round the nest” indicates the distance of nearest neighbor habitat in terms of the four quarters of the horizon measured cartographically. “Disturbing factors” indicates the distance of a building or settlement, and route and foot path

from the nest measured cartographically. Nest characteristics were: nest height (from water to top of nest platform in cm), shortest distances to nearest water body and the mainland (m), water body area, area of nest site (m²), water depth near nest, nest depth and width, mean grass height near nest, grass height near nest the nest and a concealment category (open vs. concealed).

Statistical analysis

Data on habitat use and types were obtained from the wetlands of Lucknow district. Nest parameters (nest length, width, height, and water depth near nest) among different habitats were examined using a one-way ANOVA test. Pearson correlation was used to analyze the relationship between water depth and nest height in the different microhabitats [22]. All data were analyzed using PAST 3.12 software. Means are given \pm SE.

Results and Discussion

During the study, 15 nests were found (9 pond, 5 lake and 1 agriculture nests). Sarus crane nested on elevated platforms within wetlands was made up of grassy islands, aquatic vegetation and mud. Nest shape was trapezoidal, having a broad base inundated in water with a slenderer crown. The nest above the water surface level was round or rectangle. The centre of the nest was always to some extent depressed. The Sarus crane nested either in pond, lake or in agricultural marshland (Table.1). Interpreting to some studies [17] in areas with large wetland territories, Sarus used more wetlands and in areas where farming dominated, they used more crop fields. cranes were using agriculture fields as both nesting and foraging grounds [16]. The most preferred habitat were wetlands (73-85%) as compared to crop fields (27-15%) [18, 9]. The maximum of the Sarus crane were seen in agri-cultural fields (53%) in both summer in addition to winter in UP [15].

Table 1: Distribution of Sarus Crane nest in different habitat

SN	Habitat	Number of Nests	% of occurrence
1	Pond	09	60
2	Lake	05	33
3	Agricultural marshland	01	7

The nest and nest site selection

On the evaluation of nest site factors resulted that majority of

nest sites (6 out of 9) within the pond were close to any road or building while in lake most of the nest sites (4 out of 6) were far from any road or building (far: $\geq 1,000\text{m}$ and close: $\leq 1,000\text{ m}$). In pond nest site (6 out of 9) were close to an agricultural field while in lake most of the nest sites (4 out of 6) were close to the agricultural field (far: $\geq 500\text{m}$ and close: $\leq 500\text{ m}$). Nesting sites within ponds (5 out of 9) as well as lakes (4 out of 5) were low disturbed by livestock (Table 2).

Table 2: Nest site factors among different habitats of Sarus Crane in Wetlands of Lucknow district

SN	Habitat Type	Distance to road and building (m)	Distance to nearest agricultural field (m)	Disturbance (High/Low)
1	Pond	Close	Close	High
2	Pond	Close	Close	High
3	Pond	Far	Close	Low
4	Pond	Close	Far	High
5	Pond	Close	Far	Low
6	Pond	Close	Close	Low
7	Pond	Close	Far	Low
8	Pond	Far	Close	High
9	Pond	Far	Close	Low
10	Lake	Far	Close	Low
11	Lake	Far	Close	Low
12	Lake	Close	Far	Low
13	Lake	Far	Close	High
14	Lake	Far	Close	Low
15	Agricultural marshland	Far	Close	High

Legends: Distance to road and building (m): (far: $\geq 1,000\text{m}$ and close: $\leq 1,000\text{ m}$), Distance to nearest agricultural field (m): (far: $\geq 500\text{m}$ and close: $\leq 500\text{ m}$, Disturbance (High/Low): (High: livestock, humans or dogs can approach as close as 10–20 m; or Low: livestock cannot approach the nest site due to a water barrier)

Nest alteration

Nest modification is very peculiar character during breeding period. Freshly leaves, stems and tubers also recorded during the study. Alteration activity mainly observed afternoon by either of parent during incubation; one of the parent collect the nest materials and other rearrange the collected materials.

Nest diametric and nest site requirement

Nest site selection indicated that pond habitats were more preferred by sarus crane by nesting. Lake was least selected for nesting, but agricultural marshland was selected according to its availability during study period. In the present study, detailed information on nest site selection, water body area, water depth near nest, grass height around and nearby nests are significant factors affecting nest site selection in Wetland. Preferred nest sites by Sarus Cranes were associated with

large water bodies in pond (76617.4 m²), a certain water depth (average 77.9, 118.3 and 65 cm pond, lake and agricultural marshland respectively), and a certain distance from the mainland (54.3, 95.1 and 51 m pond, lake and agricultural marshland respectively) of wetland (Table 3).

Larger water bodies like lake and a larger distance to land ($>90\text{ m}$) are likely to prevent land predators from accessing nests, whereas deeper water near nest sites was also likely selected to reduce losses to nest predators. Grass height near the nest is one of key factor for selection of nesting site because more the nest less the chance of predation and nest concealed with vegetation near the nest. During study in pond there are Open (6), Concealed (4), in lake Open (4) Concealed (1) and in agricultural marshland only Concealed (1) nest was observed.

Walkinshaw had measured dimension of nine nests of Sarus Crane [19]. Probably all were taken from natural marshland. His values of length and width at water level averaged 150.7 (94-277) x 167.7 (119-309) cm across and the nests were narrow at the top. The water depth in the agricultural marshland was certainly higher than the one reported for natural marshland by Walkinshaw [20].

Table 3: Nest parameters and nest site characteristics among different habitats of Sarus Crane in Wetlands of Lucknow district.

Variables		Habitats		
		Pond	Lake	Agricultural marshland
Nest	Length (cm)	151.4±19.7(9)	256.8±13.2(5)	236.3 (1)
	Width (cm)	26.5±1.8(9)	37.8±0.9(5)	38 (1)
	Depth (cm)	22.2± 0.9(9)	33.8±1.7(5)	15.3 (1)
	Height (cm)	23±1.8(9)	31.4±1.06(5)	39.6 (1)
	Circumference (cm)	277.9±36.4(9)	457.1±23.6(5)	381 (1)
Nest site	Shorter distance from mainland (m)	54.3±23.6(9)	95.1±10.3(5)	51 (1)
	Water depth near the nest (cm)	77.9±7.4(9)	118.3±10.4(5)	65 (1)
	Grass height near the nest (cm)	102.7±6.8(9)	121.8±18.6(5)	143.6 (1)
	Area of nest site (m ²)	1.45±0.3(9)	3.12±0.6(5)	4.4486 (1)
	Water body area (m ²)	76617.4±18825.5(9)	1151154.4±276996.05(5)	162134.5 (1)
	Concealment category (open [nest visible] vs. concealed [nest hidden by vegetation])	Open (6) Concealed (4)	Open (4) Concealed (1)	Concealed (1)

Effect of habitat on nest size and water depth requirement

Nests in the lake habitat had the highest length, width (282 cm, 40 cm). Water depth around the nest varied from 42 cm to 106 cm, 98 cm to 150 cm with an average of 77.9 ± 7.4 (n=9) 118.3 ± 10.4 (n=5). Certain water depth was a prerequisite for the nest site selection. floating nests were generally recorded in lakes where the water depth relatively higher. A relationship between the nest height and water depth shown in Fig.2.

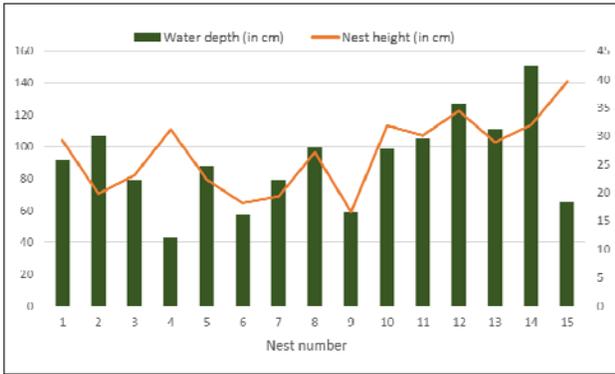


Fig 2: Influence of water depth on nest height

Correlation between mean water depth and nest height

The value of R was 0.42. Although technically a positive correlation, the relationship between water depth near the nest and nest height variables is weak shown in fig.3 (the nearer the value is to zero, the weaker the relationship). The value of R², the coefficient of determination, is 0.1764. Due to greater difference amongst the water depth and nest height data, this reduced the dependency of the correlation establishment. Whooping Crane had established a positive correlation between water depth around the nest and corresponding nest height from ground [11].

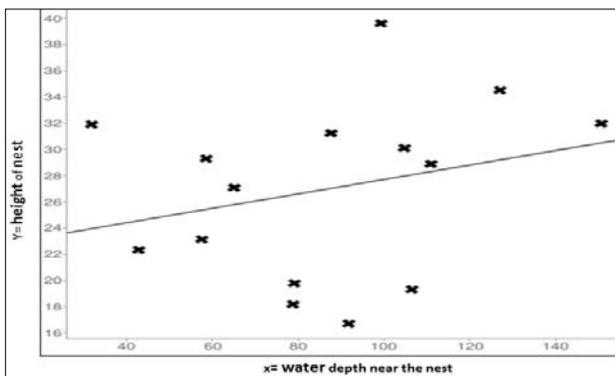


Fig 3: Correlation between mean water depth and nest height.

Effect of habitat on mainland distance and grass height near the nest

The significance of specific distance of nest from mainland was mainly to prevent the approach of ground predators to nest. Certain height of grass near the nest covers the nest and safeguard of nest. More the distance from the mainland lesser the height of grass near the nest. Influence of mainland distance from nest site on grass height near the nest shown in fig. 4. Road effects on wildlife also include reduction in the quality of habitat for birds through noise production or visual disturbance [7].

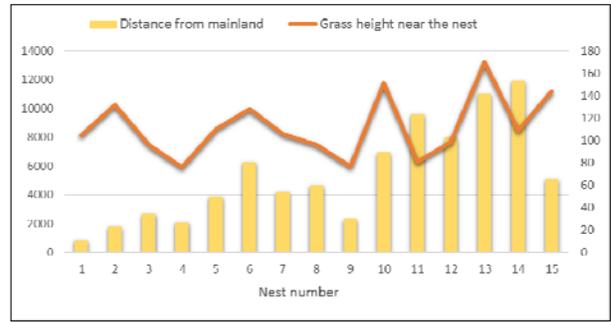


Fig.4: Influence of mainland distance from nest site on grass height near the nest

Correlation between mainland distance from nest site and grass height near the nest

The value of R is 0.3408. Although theoretically a positive correlation, the relationship between mainland distance from nest site on grass height near the nest variables is weak shown in figure 5 (the nearer the value is to zero, the weaker the relationship). The value of R², the coefficient of determination, is 0.1161.

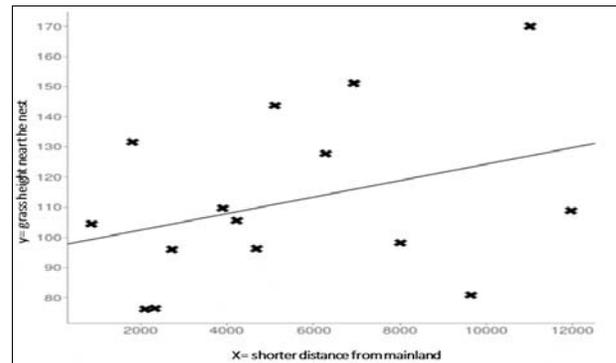


Fig 5: Correlation between mainland distance from nest site and grass height near the nest.

In pond area of Lucknow Wetland, those small pond serve as a buffer area for breeding cranes. However, we found nest in agricultural marshland habitat, signifying a possible response to a drop in suitable breeding habitat. Nests in such unsuitable habitat might face higher destruction.

Conclusion

Study concludes that disturbance, water depth and nest habitat type were likely to be limiting factors for nest site selection at wetlands of Lucknow. The nests which were situated near the mainland and very low level of water depth had strong disturbance and low nests success and Vice-versa. Our results are significant for protection management and provide quantitative reproductive data for this species. The present study recommends regulatory livestock in the marshland during specific periods of breeding and creating several buffer zones near lake and pond areas that forbid livestock grazing. Education is a vital part of any attempt to enforce legal protection for the sarus crane and for the long-term conservation of the species more community protection groups and education and awareness programmes will be required in other breeding areas. Development of Sarus Mitra network of farmers, village communities, specially school students will enable improved conservation of the species.

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References

1. Ali S, Ripley SD. Handbook of the birds of India and Pakistan (Compact ed.). Bombay, India: Oxford University Press, 1983.
2. Aryal A. Status and population of sarus crane (*Grus antigone antigone*) in lowland of West-Central region of Nepal. A report submitted to Oriental Bird Club (OBC), UK, 2004; 4.
3. Bock CE. The role of ornithology in conservation of the American West. Condor, 1997; 99: 1-6.
4. Borad CK, Mukjerjee A, Parasharya BM. Nest site selection by the Indian Sarus Crane in the paddy crop agroecosystem. Biological Conservation, 2001; 98:89-96.
5. Caughley G. Directions in conservation biology. Journal of Animal Ecology, 1994; 63:215-244.
6. Cody ML, (ed.). Habitat Selection in Birds. Academic Press, Inc, Tokyo, 1985; 4-46.
7. Forman RT, Alexander LE. Roads and their major ecological effects. Annual Review of Ecology and Systematics, 1998; 29:207-231.
8. Gole P. The status and ecological requirement of Sarus crane. Phase I. Paper presented in the Asian Crane Congress at Rajkot, Gujrat, India, 1989.
9. Gole P. The status and ecological requirements of sarus crane. Phase I. Pune, India: Ecological Society, 1989; 45.
10. Johnsgard PA. Crane music, a natural history of American cranes. Lincoln, NE: University of Nebraska Press, 1996; 136.
11. Kuyt E. The nest and eggs of the Whooping Crane, *Grus americana*. The Canadian Field-Nat, 1995; 109:1-5.
12. Latt TN. Seasonal change in social structure, behavior and habitat use by sarus crane in the semi-arid region of north-western India. Dehradun, India: Wildlife Institute of India, 2001.
13. Lloyd J, Mitchinson J. The book of animal ignorance. London, England: Faber and Faber, 2009; 240.
14. Mukharjee A, Soni VC, Borad CK. Nest and egg of sarus crane (*Grus Antigone Antigone* Linn.). Zoos' Print Journal, 2000; 15:375-385.
15. Sundar KSG, Kaur J, Chaudhary BC. Distribution, demography and conservation status of the Indian Sarus Crane (*Grus antigone antigone*) in India. Journal Bombay Natural History Society, 2000; 97:319-339.
16. Sundar KSG. Using road transact to monitor abundance, demography and habitat use of Sarus cranes, *Grus antigone*: A case study from Etawah and Mainpuri districts, Uttar Pradesh. Unpublished report submitted to ICF, 2003; USA.
17. Vyas R. Breeding success and chick mortality in Sarus cranes. Newsletter for Birdwatchers, 1999; 39:5-7.
18. Vyas R. Status of Sarus crane *Grus antigone antigone* in Rajasthan and its ecological re-quirements. Zoos' Print Journal. 2002; 17:691-695.
19. Walkinshaw LH. Cranes of the world. New York, NY: Winchester Press [Supplement of Range Maps and Egg Records privately published as The Cranes. 1973; 1(1).
20. Walkinshaw LH. Cranes of the World. Winchester Press, New York, 1973.
21. Willson MF, Gende SM. Nesting success of forest birds in southeast Alaska and adjacent Canada. Condor, 2000; 102:3:14-324.
22. Zar JH. Bio statistical analysis. 4th edition. New Jersey, USA: Prentice-Hall, 1999. Zhang L, An B, Shu M, Yang X. Nest-site selection, reproductive ecology and shifts within core-use areas of Black-necked Cranes at the northern limit of the Tibetan Plateau. Peer j, DOI 10.7717/peerj. 2017; 2939:1-19.