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Hydrosere Succession Model of Marshy Wetland Mediated Nesting Behavior of Sarus Crane, *Grus antigone antigone* (Aves: Guridae)

Sushil Kumar Upadhyay[1*], Shiv Ji Malviya [2], Dheer Pal Singh[3] and Raj Singh[1]

Authors Affiliation:
[1]Department of Biotechnology, Maharishi Markandeshwar (Deemed to be University), Mullana, Ambala, Haryana 133207, India
[2]Department of Zoology, H.N.B. Govt. P.G. College, Naini, Allahabad, U.P., India
[3]Department of Zoology, Subharti College of Science, S. V. Subharti University, Meerut, Uttar Pradesh 250005, India.

***Corresponding address:**
Dr. Sushil K. Upadhyay, Department of Biotechnology, Maharishi Markandeshwar (Deemed to be University), Mullana, Ambala, Haryana 133207, India
E-mail:
sushil.upadhyay@mmumullana.org

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Abstract

The hydrosere succession is not a new to ecology, but succession mediated by sarus crane, *Grus antigone antigone* (Aves: Guridae) nesting was observed earlier than natural wetland succession. The sarus crane nest is weird to its large size and heavy inundated body mass. These nests were constructed inside marshy wetland during rainy seasons and have conservative values. Observations made during investigation that it was also contributed ecological succession to the wetlands. Eleven out of sixteen nests found at the margin of reservoir and in marshy landscape. This was reflected that this island like platform of sarus nest turned into land having pioneered land plant (grasses) stagnant and de-floating stage, reed swamp stage and sedge stage. The nest mediated succession is cooperatively very shorter than a natural hydrosere succession. Therefore, on the basis of contemporary survey and findings authors suppose to propose it as a hydrosere succession and can be a model or representation in ecological biology of nesting by sarus crane. Moreover, it facilitates the conservation of threatened species in adverse climatic condition and it is an outstanding way of ethological acclimatization of this unique bird for livelihood and sustainability.

Keywords: Nesting behavior, Sarus crane, Marshy wetland, Microhabitat, Hydrosere succession.

1. INTRODUCTION

A hydrosere is a succession which occurs in an area of fresh water such as in oxbow lakes and kettle lakes. In time, an area of open freshwater will naturally dry out, ultimately becoming land. Hydrosere is the primary succession sequence which develops in aquatic environments such as lakes and ponds. It results in conversion of water body and its community into a land community. The early changes are allogenic as inorganic particles such as sand and clay are washed from catchment areas and begin filling the basin of the water body. Later, remains of dead plants also fill up these bodies and contribute to further changes in the environment (Palmer and Nigel, 2005). The sarus crane (*Grus antigone*) has been listed as “vulnerable” in the International Union for Conservation of Nature (IUCN) red list of threatened species. Sarus cranes have evolved to inhabit wetland areas and will predominantly nest in marshlands (Walkinshaw, 1973; Ali and Ripley, 1983; Gole, 1989; Latt, 2001). 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 (Mukharjee et al., 2000). At dawn and dusk

only, sarus cranes fly short distances at the tree canopy level between foraging areas and roosting sites (Ali and Ripley, 1969).

The marshy wetland ecosystems are selected by this tallest flying bird for nest construction during the rainy seasons. These microhabitats are agricultural and non agricultural marshy wetland such as pondles, taali, paddy fields, canal seepage (Mukherjee, et al., 2000). A large ecological succession takes place from late winter to the midsummer. Simultaneously, two types of similar hydrosere succession observed in the marshy wetlands. One is mediated by crane nest which is faster than second naturally occurring succession of hydrosere. During the nesting time sarus crane becomes territorial. All nests were located in marshland and agricultural land with different variety of plant species (Tomar and Chouksey, 2018). Obliviously, the nest mediated is comparatively very smaller than natural hydrosere succession. But it passed two stages of hydrosere succession and can be a model or representation in ecology. Moreover it facilitate in completing the whole hydrosere succession process in the last stage. In this study, we provide the current status of habitat utilization, nest mediated succession and nesting biology of the sarus crane (*Grus antigone antigone*), state bird of Uttar Pradesh, India. The findings from this study were expected to establish a baseline on the overall conservation status, habitat availability, microhabitat utilization, ecological behavior, and nesting biology of sarus cranes in an area of subhumid region.

2. MATERIALS AND METHODS

Study area: Fatehpur is a district founded by Rishi Purwar in the state Uttar Pradesh, India, situated between two holy rivers Ganga and Yamuna. It is located between two important historical and industrial cities: Allahabad (famous as Prayag), and Kanpur (Manchester of East) of the state Uttar Pradesh, Republic of India. The northern and southern boundary of the district is limited by river Ganga and Yamuna respectively. The villages like Chivraha, Hussainganj, Asani, Bithaura, Dugari and few central localities including Khaga and Satnarayni were taken in consideration for investigations. The habitat was in the form of marshy perennial wetland. The topography formed so many pondles (marshy) during the rainy season among the cultivated field, those provides breeding grounds for sarus crane. Oscillation in climatic temperature was noteworthy and maximum temperature recorded 48–50 °C and minimum 1–3 °C during summer and winter season respectively.

Survey: Authors used binoculars, camera, motorbike, oar boat, field stick etc. for survey. The findings are based upon the work conducted during July to December, 2017. Survey was conducted in the first fortnight of each month. The observations of sarus crane nest were made while moving in an oar boat and walking along the croplands, marshlands, riparian wetlands and natural areas. Besides actual sightings, inquiries from local people (Mr. Santosh Kumar, Jahanpur, Bindaki, Fatehpur, Uttar Pradesh) were also made to ensure the estimate of existing nests and their perceptions about the existence while the estimation of microhabitats were based upon the onsite observations. The number of nest in agricultural and non-agricultural as well as marshy wetlands were located and recorded. The flora as material of nests for different stages of nesting mediated succession were collected and identified with the help of eminent taxonomists of BSI (Botanical Survey of India) and Aryal et al., (2009).

3. RESULTS

Fatehpur is a district in the state Uttar Pradesh, India situated between two holy rivers Ganga and Yamuna. Because of its openness landscape and biodiversity of flora and fauna, it was very important to investigate the population behavior in terms of nesting biology of state bird of Uttar Pradesh, sarus crane as a model of hydrosere. By the consecutive survey, about six types of wetland were recorded (Fig. 1). River / streams cover about 63% of total wetlands available in the district.

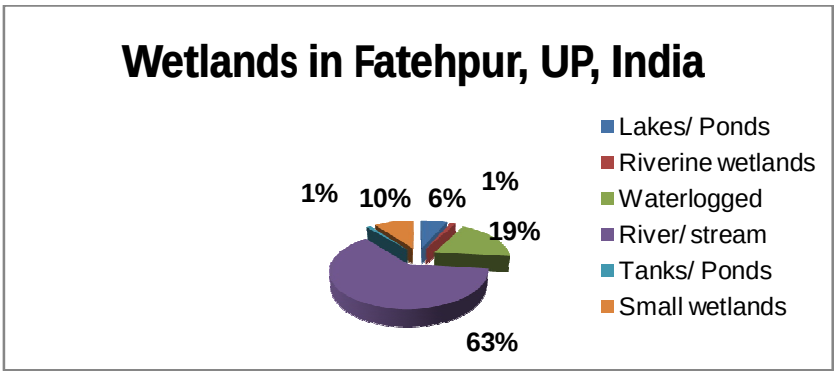

Fig. 1: The pie chart representation of wetlands in district Fatehpur, Uttar Pradesh, India.

A sum of sixteen nests was encountered during survey. Out of sixteen, eleven was found to be in agricultural land either it may be cultivated (6 numbers) or non-cultivated (5 numbers) fields (Fig. 2).

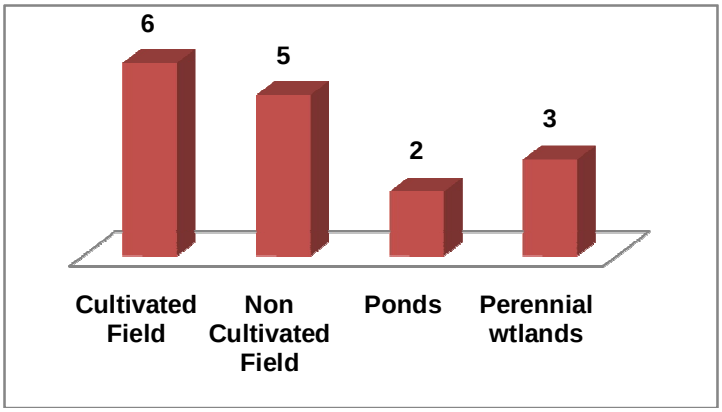

Fig. 2: The demographic distribution of nests during the period of investigation.

The sarus cranes at first prefer openness of habitat and very intelligent to elect the site of nesting. The selection of site depends upon the availability of wetland plants as nesting material, little interruption by anthropogenic activities, availability of molluscs and aquatic arthropods as food. In the rainy season, the submersed, rooted, inundated nests were recorded. The Cranes were found oriented in and around the nest during breeding seasons i.e. late September to early December (Fig. 3).

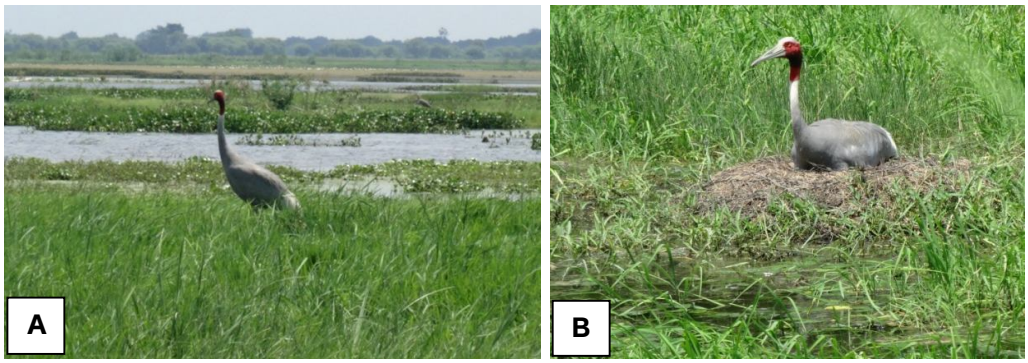

Fig. 3A, B: Territorial behavior of sarus crane and rooted, floating type nest in natural habitat.

The plant material used by the bird for construction of nest was recovered and identification worked out with the help of available keays and expertise of area. It was noticed that more nest materials was used by sarus crane in the natural marshy and reservoir landscape than the paddy field. The nests size was observed between 4–5 feet in diameter and 2–3 feet in thickness, with huge ball of biomass which was made by its surrounding aquatic plants (Fig. 4).

Fig. 4: Nest of sarus crane with huge ball of biomass made by its surrounding aquatic plants.

A circular gap of aquatic plant vegetation was created around the nest due to removal of plants and territory activity of crane. Most of the nests with such features were situated in pondels of non agricultural marshy fields. It was observed that the nest of sarus crane fastened due to dryness of habitat (marshy wetland) after the breeding seasons i.e. the commencement of winter season. It provided platform for the growth of pioneer grasses without reed and sedge stage of hydrosere (Fig. 5). In the last month of survey i.e. the onset of winter season these platforms were observed dry which latter transformed into agricultural and non-agricultural land platues (Fig. 6).

Fig. 5: Sarus crane nest after dryness of marshy habitat provided platform for the growth of pioneer grasses.

Fig. 6: Sarus crane nest turned in the grass land during late hydrosere succession of aquatic/ marshy wetland.

4. DISCUSSION

The nests were attached to bottom of marshy wetland when water level went down at the commencement of winter season. As a result, the buried parts of nest become humus earlier than submersed and rooted plant. This enriched the newly built up land platform and made it favorable for the growth of pioneer grasses, shrubs such as *Cynodon dactylon* spp., *Ipomoea* spp., *Cyperus* spp., *Setaris* spp., *Dichanthium* spp. provided an evidence to succession toward land ecosystem. It was the late hydrosere succession mediated through nesting biology of sarus crane because reservoir or rooted floating nests (Fig. 3) firstly turned into marshy nesting habitat (Fig. 4) followed by microhabitat with dry land having pioneer grasses (Fig. 5) and finally transformed in grass land nesting habitat (Fig. 6) during late hydrosere succession. The observations made that this type of hydrosere succession formed a land platform into marsh water which was very earlier than natural reed and sedge succession stage of hydrosere. The land platform provided vast variety of pioneer grasses which turned into land ecosystem. The crane nest mediated hydrosere succession contributed a key role to land formation in marshes of agricultural fields which help the farmers for early tilling, ploughing and sowing of Rabi crops. Wilcox (2004) observed that primary succession of plant communities directed toward a climax was not a typical occurrence in wetlands which was similar to the current observation. Because, these ecological systems were inherently dependent on hydrology and temporal hydrologic variability often caused reversals or setbacks in succession. The observation was controversial on the serial succession of hysrosere (Klinger, 1996). He also said that the hydrosere model to be different on the basis of type of water body.

The findings of the present work suggested that sarus cranes inhabit agricultural land, because of the suitability of habitat. Sarus cranes prefer agricultural land for feeding and wetlands for roosting (Aryal et al., 2009). The observations made that the heavy nests were earlier fasted into mud on dryness of marshy wetland corroborated the findings of Tomar and Chouksey (2018). They provide a humus mass for the growth of pioneer grasses before completely transformation of wetland. During nesting and breeding season, they became more territorial than the other period of life. Most of the nests were located marshland and agricultural land with the several phyto-diversity (Tomar and Chouksey, 2018). Sarus crane is one of the most impressive birds on the earth and an indicator to healthy agricultural land and wetlands. Therefore, study carried out between June to December to examine the sarus crane ethology, nesting biology and nesting mediated hyrosere succession during breeding and post breeding season in different localities between two holy rivers, Ganga and Yamuna in the district Fatehpur, Uttar Pradesh, India. Survey cum investigation reflected that sarus cranes were found in a pair, very precise for microhabitat, nesting biology and nesting mediated hydrosere succession which played a key role in conservation status and sustainability.

5. CONCLUSION

The different model of hydrosere succession was observed in the marshy wetlands between two holy rivers, Ganga and Yamuna of district Fatehpur, Uttar Pradesh, India. This type of succession was mediated by nesting biology and nesting material used in construction of nests by the sarus carne, *G. antigone antigone*, environmental oscillations, seasonality. It was observed that, nesting mediated succession was earlier and shorter than natural wetland succession because it crossed over reed and sedge succession stage of hydrosere. It contributed to land formation in marshes of agricultural fields which help the farmers for early tilling, ploughing and sowing of Rabi crops. By the findings of this study authors expected and supposed to propose that nesting mediated hydrosere succession establish a baseline on the overall conservation status, habitat availability, microhabitat utilization, ecological behavior, and nesting behavior of sarus cranes in an area of subhumid region.

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