Agricultural Wetlands in a North Indian SarusScape

Distribution, Human Dependence and Patterns of Wetland Use by Birds in South-western Uttar Pradesh

K S Gopi Sundar & Swati Kittur

March 2013
K. S. Gopi Sundar  Director, Program SarusScape, International Crane Foundation, E11376, Shady Lane Road, WI 53913, USA & Scientist, Cranes & Wetlands Programme, Nature Conservation Foundation, 3076/5, Gokulam Park, Mysore 57002, India.

Swati Kittur  Research Associate, Cranes & Wetlands Programme, Nature Conservation Foundation, 3076/5, Gokulam Park, Mysore 57002, India & Research Associate, Program SarusScape, International Crane Foundation, E11376, Shady Lane Road, WI 53913, USA.

Photos: © K. S. Gopi Sundar

Cover photos: a. A village pond in Aligarh district; b. Large concentration of waterbirds in a seasonal marsh beside a town in Aligarh district; c. A drying pond in Etawah district from which clay is regularly removed; d. A picturesque pond in Etawah district with Lesser Whistling Teals; e. Painted Stork foraging in a marsh in Kannauj district; f. A Sarus Crane foraging in a wheat field beside a wetland in Mainpuri district.

Report design: Darcy Love.


The contents of this report are the collective property of the Nature Conservation Foundation, India and the International Crane Foundation, USA. Contents of the report may not be used without prior permission.

Acknowledgements

This project was possible thanks to the funding support extended by the Arthur L. & Elaine V. Johnson Foundation. Additional support provided through the International Crane Foundation (ICF) and the Nature Conservation Foundation (NCF) by Polly & Bo Beal, Sunita Chaudhry, Lata Kittur, and the Derse Foundation is gratefully acknowledged.

Invaluable administrative support was provided at the ICF, NCF and the Wildlife Protection Society of India. In particular, we thank D. Koehler, S. Prabhakaran, J. Sauer, and S. Vaish.

For assistance during field work, we thank Dushyant Paliwal (Aligarh), Deepu Singh (Etawah), and Vikas (Etawah). We gratefully acknowledge the various village panchayats and farmers for their time, knowledge, and invaluable discussions.

Useful comments and discussions that helped improve the report were kindly provided by Julie Langenberg. Lastly, but certainly not the least, we acknowledge the support provided by Mr. Rupak De, Principal Chief Conservator of Forests (Wildlife), Uttar Pradesh.
Executive Summary

Agricultural wetlands, or isolated wetlands on agricultural landscapes, are among the least studied ecosystems in the tropics despite growing evidence of their ability to help conserve biodiversity and benefit humans in multiple ways. The current status and values of such wetlands in the Gangetic flood plains is very poorly understood. The world’s largest Sarus Crane population inhabits this region, and a sound understanding of wetland values will assist to secure crucial habitat for this globally threatened crane species.

A landscape-scale investigation of the potential multifunctionality of these wetlands in an important SarusScape was carried out specifically to (1) map wetlands and compute basic metrics to describe their distribution, (2) understand ownership status of wetlands as well as document the various ways in which humans use them, (3) evaluate the level of awareness among village councils (panchayats) regarding a recent Supreme Court judgment that mandates protection of common use wetlands, and finally, (4) understand the species diversity of birds persisting in these wetlands while also understanding patterns and processes responsible for the observed bird in these wetlands. The study focuses on seven districts in south-western Uttar Pradesh that host significant populations of Sarus Cranes. Field work was designed *a-priori* to ensure that areas with different densities and extents of wetlands were covered as part of the survey.

![Figure 1](image-url) This figure shows the location of the survey area in India (a), and the focal districts in the state of Uttar Pradesh with major rivers marked (b). The *a-priori* stratification using density and extent of wetlands into four strata and the randomly chosen grids (in bold) are shown in (c). Representative grids of each of the four strata showing the variation in density and extent of wetlands are shown in (d).
A large number of wetlands (>11,000) were mapped in the seven focal districts. However, the landscape has <1% of its surface area as wetlands: this is very low and underscores the urgent need to not only ensure the protection of all existing wetlands, but also the urgent need to increase wetland areas using restoration principles. Additionally, the vast majority of wetlands that remain were tiny (<0.5 m²), and showed aggregated patterns of distribution on the landscape. These conditions indicate that further conversion of wetlands is likely to be rapid. On average, wetlands were >500m from the wetland nearest to them with some districts having wetlands separated by >7 km suggesting that several wetland taxa are likely unable to move between wetlands under current conditions. This suggests that the ability of the landscape to retain wetland taxa is declining.

Using simple metrics, we develop a composite map to help identify areas of low, medium and high persistence of wetlands that can help locate areas of high conservation value and to identify areas that need wetland restoration.

We visited 28 randomly chosen wetlands of various sizes, and most of these were community lands managed by panchayats, though three wetlands were privately owned, and few were owned by multiple government and private agencies. Each wetland was used in multiple ways by humans, but primarily as a source for irrigating crop fields and for livestock grazing. Hunting of water birds using either guns or poisons was observed or suspected in a majority of the visited wetlands. Land use change via illegal encroachment, and deterioration

**Figure 2.** Size classes of wetlands in the seven focal districts. Numbers below the names of districts are the numbers of wetlands in each district used to compute the bar graph.

**Figure 3** Spatial distribution of wetlands in 7 district of Uttar Pradesh represented in 5’x5’ grids. Maps show (a) number of wetlands, (b) extent of wetlands (in ha), and (c) average size of wetlands in each grid. Map (d) is a composite showing the most important areas for wetland conservation (see Methods for details). Black polygons are district boundaries (see Figure 1b for names).
of wetlands via illegal cultivation of water chestnut and fish farming were recorded in the majority of wetlands. It was not always possible to recognize land use change of wetlands as illegal encroachments simply by observation since private lands frequently merged with common use wetlands. *Panchayats* were not aware of the existence of the Supreme Court judgment on common lands. A large-scale awareness campaign that enables *panchayats*, and other governmental agencies, to learn of this judgement is urgently required.

We used the double-observer method to count birds in the visited wetlands to ensure that we could correct for detectability (see power point for details). A relatively large number of bird species (99) were observed in surveyed wetlands despite the survey being carried out in a lower-than-average rainfall year and including very small wetlands in the sample size. Species richness of birds varied due to differing densities and extents of wetlands indicating that bird distribution here was affected at the landscape scale due to the configuration of wetlands. Six species were identified that used areas with larger wetlands preferentially, and this list included the globally-threatened Sarus Crane. Several resident bird species were identified to be strong indicators of wetland configuration. These include four near-threatened species such as the Painted Stork and Oriental Darter, and several common species such as the Woolly-necked Stork, Little Cormorant, and the Bronze-winged Jacana.

Focusing on these species whose presence in wetlands are affected both by size of the individual wetland as well as the landscape-level configuration of wetlands can help monitor wetland conditions over the long-term on this agricultural landscape. Bird diversity in the wetlands was influenced largely by the process of species turnover. In other words, more species are retained on the landscape only if a higher number of wetlands remain, notwithstanding wetland size. This is in contrast to the long-standing assumption that the process leading to high bird diversity in wetlands on a landscape scale is nestedness, or that a few large wetlands are adequate to retain the majority of the bird species on the landscape.

Birds can use wetlands (and other habitats) on a landscape in various ways. Two key patterns are nestedness and turnover. Knowing the pattern of distribution is crucial to plan conservation strategies on a landscape scale. Click on the image above to learn what the two patterns mean, and their conservation implications.
Serious threats observed to wetlands included encroachments (like this wetland being converted to a fishing pond in Hathras district, left), and removal of water for cultivation (like in this wetland in Mainpuri district, right).

Several common waterbirds were reliable indicators of wetland size and configuration on the landscape including the Grey Heron (left) and Bronze-winged Janaca (right), while the globally-threatened Sarus Crane (center) was found in higher numbers in larger wetlands.

A variety of threats that were contributing to deterioration of wetlands and shrinkage of wetland area were documented to be almost ubiquitous. However, the ability of wetlands in Uttar Pradesh to maintain high species diversity despite high intensity of human use was also apparent: this landscape has the highest documented wetland bird diversity of any agricultural landscape in south Asia. Our results show that having intensive human use alone is not a deterrent to high species diversity of birds that even include many species of conservation significance. However, curtailing activities that are reducing the potential of the wetlands to serve dual needs – human use as well as species conservation – is essential.

Results from this study can help guide science-based conservation planning for wetlands and wetland birds. The descriptive metrics showing wetland distribution and the robust field design used to study bird use of wetlands helps underscore the need to include wetlands of all sizes. This study therefore provides a strong scientific foundation to include a large number of wetlands in conservation planning. Also, the results clearly show that conservation management requires being scaled up from a single-site approach to a philosophy and practice that is able to take into account entire landscapes to be truly beneficial to taxa such as birds. This includes wetland density and extent, but a range of other factors also potentially affect wetland biodiversity. Similar robust wetland surveys are conspicuously absent in south Asia and are urgently required to help improve our efficiency of conserving wetlands, as well as the large set of species reliant on this important habitat.

Our observations also point to the need for multiple governmental agencies being required to help retain wetlands on the landscape, and ensuring the continuance of their multifunctionality. Policies catering to wetland management and conservation require avoiding focusing on any single aspect (e.g. biodiversity; rural development). Finally, policies need to be multi-faceted much like the wetlands that provide multiple uses to humans as well as serving as important habitat to birds.
The survey helped identify waterbirds that could serve as indicators of wetland size and density. Several waders including the migratory Common Sandpiper, and flocking species such as the Ruff were found more in small wetlands. Sarus Cranes were found everywhere, but their numbers increased in larger wetlands. Some common species like the Black-winged Stilt and the White-throated Kingfisher were cosmopolitan using all locations on the landscape equally.