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RESEARCH ARTICLE

Asian Woollynecks are uncommon on the farmlands of lowland Nepal

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Abstract Asian Woollyneck *Ciconia episcopus* is a globally threatened stork found across south and south-east Asian countries. In Nepal, it is considered as a fairly common resident species although categorized as 'Near-Threatened'. Here, we report on Asian Woollyneck occurrences in 116 transects (farmland-100, forest-8, river-8) each measuring 500 m across four districts of lowland Nepal (Kapilvastu, Chitwan, Sarlahi and Sunsari) and surveyed in multiple seasons from April 2018 to December 2019 for a total of 985 transect counts. Despite our extensive survey, we recorded Asian Woollynecks in only 14 transect counts of which eight were along the buffer zone of Chitwan National Park (CNP). All sightings were of small flocks with 1-2 storks. Majority of the sightings (85%) were in farmlands, remaining in river but not in forest. We observed one nest on a Sal *Shorea robusta* tree along the buffer zone of CNP in 2019 from which one chick fledged in early October. Our study adds to the meager information available on Asian Wollyneck in Nepal and indicates that this species is sparsely distributed in the lowland farmlands.

Keywords Chitwan National Park, farmland bird, nest, Sal tree, threatened species.

Introduction

Asian Woollyneck *Ciconia episcopus* is a globally "Vulnerable" stork species distributed across south and south-east Asian countries including India, Nepal, Pakistan, Bangladesh, Bhutan, Sri Lanka Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand and Vietnam with non-breeding populations in Iran and China (BirdLife International 2017). This species uses both artificial and natural wetlands such as agricultural lands, grassland, marshes, water holes, lagoons, flood plains, dams, flooded pastures, rivers, streams, lakes, and ponds (Sunder 2006; del Hoyo *et al*. 2020). Asian Woollynecks have been observed constructing nests on trees close to forest edges, wetlands, grasslands and agricultural lands (BirdLife International 2017), and more recently also on man-made structures such as cell-phone towers (Vaghela *et al*. 2015; Hasan and Ghimire 2020).

Asian Woollynecks are assumed to be declining in its range due to hunting, felling of nesting trees, habitat loss, fragmentation, wetland degradation, environment pollution and agro-chemicals (Inskipp *et al*. 2016; BirdLife International 2017). In Nepal, the species has been accorded the status of "Near-threatened" and is considered to be a fairly common resident species with a wide distribution across the length of the country and up to an altitude of 3,540 m (Inskipp *et al*. 2016; Ghale and Karmacharya 2018). However, a large distribution

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range and a stable population has been recorded in India (SoIB 2020) with more recent work suggesting that the population of Asian Woollynecks have been greatly underestimated (Kittur and Sundar 2020). Based on emerging new information, the global status of the species was reviewed recently and a tentative decision to categories the species from "Vulnerable" to "Near-threatened" has been announced (https://globally-threatened-bird-forums.birdlife.org/2020/06/asian-woollyneck-ciconia-episcopus-revise-global-status/). Information from Nepal with which to understand the status of Asian Woollyneck remains sparse. In this paper, we analyzed data from the Farmland Bird Survey Program conducted from across four districts in lowland Nepal to understand if Asian Woollynecks are indeed common and widespread on the farmlands of lowland Nepal. The data we are presenting is from a multi-site survey and is one of the very few systematic surveys from Nepal with ecological information available for this species. We therefore believe that our work can help evaluate the status of this species in the country.

Study area

The Farmland Bird Survey Program was conducted in lowland Nepal between 2018 and 2019 across the dominant agricultural areas in this region. The lowlands extend across approximately 885 km in an east-to-west direction and comprises 43% of the country's agricultural lands (Paudel *et al*. 2017). The agricultural landscape of lowland Nepal is a highly populated region and supports half of Nepal's human population (Central Bureau of Statistics 2012). The crops are seasonal with three district growing seasons. People grow rice in the monsoon or rainy season (June-September), and mustard, wheat, sugarcane, lentils during the much drier winter (November-February). Some people keep their land fallow after the rice harvest until the next rice growing season. Other farmers cultivate maize and rice in the summer (March-May) and keep fields fallow until the subsequent rice growing season (HBK, pers. obs.). We chose four districts (Sunsari, Sarlahi, Chitwan and Kapilvastu) across lowland Nepal to conduct the bird surveys (Figure 1). Ornithological work has been previously conducted in three of these four districts, and our work was the first to conduct field work to document birds in the Sarlahi district. There are two protected areas within the study sites namely the Chitwan National Park (CNP) in Chitwan district and the Koshi Tappu Wildlife Reserve in Sunsari district. Each protected area has designated buffer zones where people can stay with the intention of strengthening the linkage between biodiversity conservation and local communities.

Methods

We overlaid 2x2 km grids across the four districts and systematically selected 100 grids located in farmlands, eight in forests and eight along a river. Using Google Earth we established one 500 m transect in each grid ensuring that transects were > 1.2 km from each other (see Figure 1). We walked transects from April 2018 to December 2019 and counted all birds within 150 m on either side of each transect. We stratified the year into

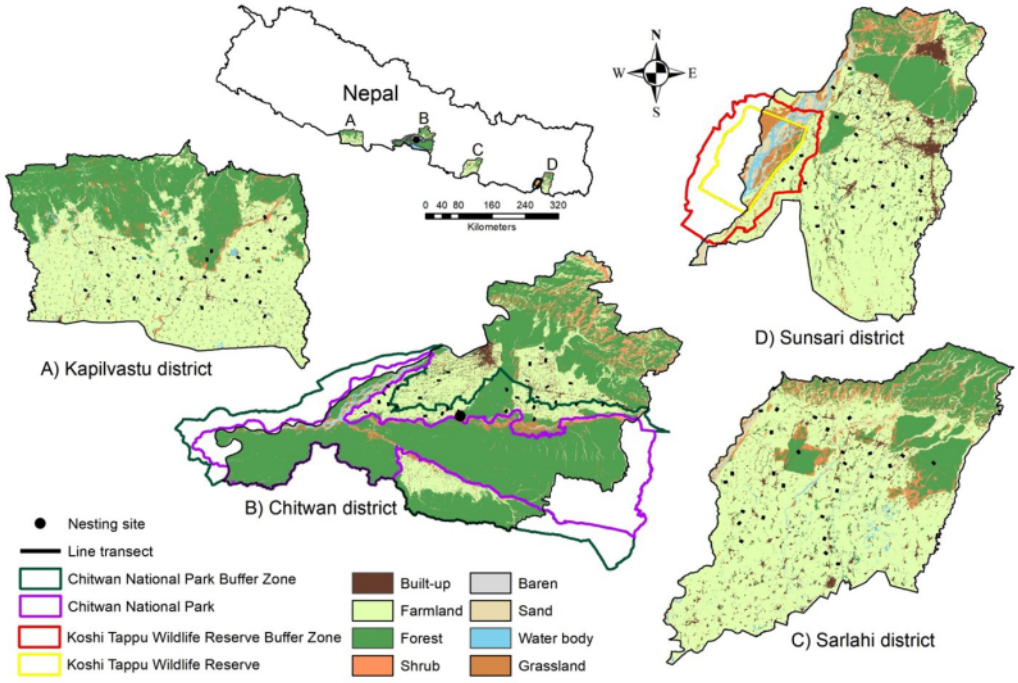

Figure 1: Study area showing locations of four focal districts in lowland Nepal (inset of Nepal map) where 116 transects of 500 m each were located systematically to count Asian Woollynecks between April 2018 and December 2019. Eight land uses derived from satellite imageries are shown for all districts, and the borders of two protected areas with buffer zones around each that were surveyed are shown. The location of a single Asian Woollyneck nest that was monitored during the study is also provided.

three seasons (summer: April-May, monsoon: July-August, and winter: December-January) and monitored each transect three times in each season. In Kapilvastu and Sarlahi districts, we could cover transects only twice during the summer due to the national lockdown imposed in Nepal following the outbreak of Covid-19. In total, we completed 985 transect counts. During transect surveys we located one nest of Asian Woollyneck which we visited multiple times between August-October 2019 to record the chick fledging.

Results

Out of 985 transect counts, we recorded Asian Woollynecks only in 14, and storks were seen in 11 out of the 116 separate transects (Table 1). Majority of the Asian Woollyneck observations (57%) were from Chitwan with the rest of the observations from Kapilvastu (21%), Sarlahi (14%) and Sunsari district (7%). All observations at Chitwan were made on farmlands inside the buffer zone of CNP. Asian Woollynecks were mostly seen on farmlands (86% of all transects on which storks were seen). The rest of the sightings were along the river and none were seen inside forests. There was some seasonal variation in observations with most sightings made during the monsoon (43% of all transects on which storks were seen) with fewer observations in the winter (36%) and summer seasons (21%). In each observation, flock sizes were small with 1-2 birds.

We located one nest with one chick on a Sal *Shorea robusta* tree inside CNP's buffer zone (N 27° 34' 12.24", E 84° 22' 53.64") that was ~ 150 m from farmlands and human settlements (Figure 1). We first observed the nest on 3 August 2019 and the chick was already hatched. We visited the nest repeatedly until 20 September 2019 when the chick showed signs of fledging. The chick and the adult birds had left the nest when we visited the nest on 7 October 2019.

Discussion

We conducted extensive surveys in farmlands of four districts which are potential Asian Woollyneck habitats in lowland Nepal, but storks were not

Table 1. Details of Asian Woollyneck sightings during surveys across four districts of lowland Nepal from April 2018 to December 2019. A total of 116 separate transects were located on agriculture fields, along rivers and in forests, and were covered 985 times during the survey.

District	Protection status	Location	Habitat	Season	No. of individuals
Kapilvastu	Outside protected area	N 27° 34' 19.84" E 83° 4' 48.47"	Farmland	Winter	2
	Outside protected area	N 27° 35' 19.65" E 83° 8' 42.54"	Farmland	Monsoon	1
	Outside protected area	N 27° 34' 45.91" E 82° 55' 54.65"	Farmland	Winter	2
Chitwan	Protected area	N 27° 35' 13.61" E 84° 31' 15.52"	Farmland	Monsoon	2
				Summer	2
	Protected area	N 27° 35' 33.65" E 84° 35' 58.26"	Farmland	Summer	1
				Monsoon	1
				Winter	2
	Protected area	N 27° 34' 41.99" E 84° 22' 38.97"	Farmland	Monsoon	2
	Protected area	N 27° 35' 1.78" E 84° 21' 27.06"	Farmland	Monsoon	1
	Protected area	N 27° 34' 47.62" E 84° 28' 0.88"	River	Summer	1
Sarlahi	Outside protected area	N 26° 53' 55.01" E 85° 33' 10.08"	Farmland	Winter	1
	Outside protected Area	N 27° 2' 29.83" E 85° 34' 39.10"	River	Winter	2
Sunsari	Outside protected area	N 26° 32' 17.28" E 87° 8' 21.27"	Farmland	Monsoon	1

common across sampled sites. This contrasts with the national assessment which suggests that this species has a widespread distribution in entire lowland Nepal including our field sites (Inskipp *et al*. 2016). During our study Asian Woollynecks were sighted more frequently on the farmlands located in the buffer zone of CNP where the species has been previously recorded (Inskipp *et al*. 2016). Urbanization is increasing significantly in Chitwan district making it one of the most urbanized districts in Nepal (Rimal *et al*. 2020). However, farmlands in this district, especially inside the buffer zone of the CNP, appear to support Asian Woollynecks throughout the year. Other studies have also reported Asian Woollynecks using farmlands throughout the year as foraging habitats in India, Myanmar and Nepal (Sundar 2006; Inskipp *et al*. 2016; Ghimire and Pandey 2018; Sundar and Kittur 2020; Tiwary 2020; Win *et al*. 2020).

Our effort was inadequate to estimate the population size of the Asian Woollyneck in the whole of Nepal. There are very few robust estimates of population sizes of this species in Nepal. Kittur and Sundar (2020) estimated 30 ± 22 Asian Woollynecks in a small area covering parts of Rupandehi and Kapilvastu districts using systematic road transects carried out seasonally between 2014 and 2019. Seasonal densities of Asian Woollynecks did not vary much in the two districts (see Kittur and Sundar 2020). In the same districts, in a slightly larger area, Ghimire and Pandey (2018) and Ghimire (2019) recorded < 50 individuals along seven roads transects that varied in length from 15 to 34 km between 2016 and 2018. During our surveys, Asian Woollynecks were observed more during the monsoon and the least in summer months identical to many other locations where multi-season work has been carried out (Kittur and Sundar 2020).

We always observed the species with 1-2 individuals, which is lower than flock sizes reported for lowland Nepal and India (Sundar 2006; Sharma and Singh 2018; Kittur and Sundar 2020). However, an unusually large flock of 28 Asian Woollynecks were seen recently in April 2020 along one of our transect in buffer zone of CNP, and were observed for three weeks (Y. Mahato, B. Bidari and R. Krishna, pers. comm. 2020). Large flocks of Asian Woollynecks have been reported from some locations in India as well but appear to be rare (Pande *et al*. 2007; Kittur and Sundar 2020).

Though the information currently available of Asian Woollynecks outside of Rupandehi and Kapilvastu is still meager, our systematic observations showed seasonal variations in the frequency of observations that suggest possible seasonal movements of this species to the mid-hill region of Nepal. Such movements have been suspected previously (Inskipp *et al*. 2016). Movement patterns of the species and location of breeding areas can be better understood by satellite tagging.

Previously records of Asian Woollyneck nests in Nepal have been from both the lowlands and the mid-hill regions (Inskipp *et al*. 2016). In addition, 12 nests were recorded from Rupandehi between 2016 and 2020 (P. Ghimire, pers. comm. 2020). Our record of one nest adds to this small number of observations of Asian Woollyneck nests in Nepal. A careful study on the breeding biology of Asian Woollynecks in Nepal is required to provide detailed information on nesting sites, nesting habitat requirements and nest survival.

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