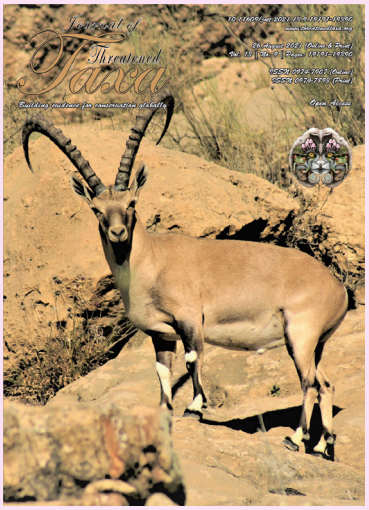
Journal of Threatened Taxa

Building evidence for conservation globally

www.threatenedtaxa.org

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)



COMMUNICATION

POPULATION STATUS AND DISTRIBUTION OF THE CRITICALLY ENDANGERED BENGAL FLORICAN *HOUBAROPSIS BENGALENSIS* IN THE GRASSLAND OF KOSHI TAPPU WILDLIFE RESERVE, NEPAL

Ritika Prasai, Hemanta Kafley, Suraj Upadhaya, Swosthi Thapa, Pratistha Shrestha, Alex Dudley & Yajna Prasad Timilsina

26 August 2021 | Vol. 13 | No. 9 | Pages: 19293–19301
DOI: 10.11609/jott.6503.13.9.19293-19301

For Focus, Scope, Aims, and Policies, visit https://threatenedtaxa.org/index.php/JoTT/aims_scope
For Article Submission Guidelines, visit https://threatenedtaxa.org/index.php/JoTT/about/submissions
For Policies against Scientific Misconduct, visit https://threatenedtaxa.org/index.php/JoTT/policies_various
For reprints, contact <ravi@threatenedtaxa.org>

Publisher & Host

WILD ZOOREACH Threatened Taxa

The challenges of the climate crisis are frustrating. Learn to lead to make a positive change.

The Ram Hattikudur Advanced Training in Conservation (RHATC) is a four-month residential course mentored by Indian and international experts. The course will bridge the gap between academics and on-ground conservation realities by equipping you with knowledge, tools, and an understanding of global conservation issues.

Challenge yourself

- Resolve conservation challenges.
- Develop skills in assessments and planning.
- Exposure to real-time conservation needs.
- A window into conservation NGOs.
- Potential opportunities for internship.
- Potential job opportunities with conservation organizations.
- Pursue conservation careers
- Potential to start your own organization.
- Exposure to conservation experts.
- Develop leadership skills.

Apply now!

Applications open: 09 August 2021
Application last date: 31 August 2021
Course start date: 12 October 2021

To know more visit:
www.rhatc.zooreach.org

Ram Hattikudur
Advanced Training in Conservation

ZOOREACH
ZOO OUTREACH ORGANIZATION

Journal of Threatened Taxa | www.threatenedtaxa.org | 26 August 2021 | 13(9): 19293–19301
ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)
https://doi.org/10.11609/jott.6503.13.9.19293-19301
#6503 | Received 30 July 2020 | Final received 23 July 2021 | Finally accepted 07 August 2021

COMMUNICATION

Population status and distribution of the Critically Endangered Bengal Florican *Houbaropsis bengalensis* in the grassland of Koshi Tappu Wildlife Reserve, Nepal

Ritika Prasai [1], Hemanta Kafley [2], Suraj Upadhaya [3], Swosthi Thapa [4], Pratistha Shrestha [5], Alex Dudley [6] & Yajna Prasad Timilsina [7]

[1,4,5,7] Institute of Forestry, Hariyokharka, Pokhara 33700, Nepal.
[1,2] Wildlife, Sustainability, and Ecosystem Sciences, Tarleton State University, Stephenville, TX 76402, USA.
[1] Nepal Nature Foundation, Koteshwor, Kathmandu 44622, Nepal
[3] Himalayan Conservation and Research Institute, Thulibheri-3, Dunai Bazar, Dolpa 21400, Nepal.
[3] Department of Natural Resource Ecology and Management, Iowa State University, Ames, IA 50010, USA.
[6] Katie Adamson Conservation Fund, 8156 South Wadsworth Blvd, Suite E174, Littleton, Colorado 80128, USA.
[1] ritikaprasai3@gmail.com (corresponding author), [2] kafley@tarleton.edu, [3] surajupadhaya99@gmail.com, [4] swosthinani@gmail.com, [5] pratistha.shrestha5@gmail.com, [6] alex.dudley50@gmail.com, [7] yptimilsina@iofpc.edu.np

Abstract: The Bengal Florican *Houbaropsis bengalensis* is one of the most threatened terrestrial bird species, listed as 'Critically Endangered' by the IUCN. This species is protected globally and locally due to very low population (global population is approximately 250–999 individuals), and little is known about its distribution and habitat use. We assessed population status and distribution of floricans in Koshi Tappu Wildlife Reserve, Nepal (KTWR). We surveyed 57 1-km^2 randomly distributed blocks across the reserve to record as many individuals as possible during their breeding season (March–May). We walked 2,964 transects (52 transects on each block) each of length 1 km on 57 blocks of 1-km^2 to estimate their population. We surveyed when the birds are most active during early morning (0600–0930 h) and later afternoon (1530–1900 h). We calculated grass importance value index (IVI), grass species composition, grass height, relative frequency of grass species, relative density of grass species, percent of grass ground coverage, presence/absence of human activity, and presence/absence of livestock to assess the habitat condition. We recorded 18 individuals (16 males and 2 females) inside the core of the reserve, where the habitat is dominated by *Imperata cylindrica*. Human disturbance had a negative impact on occurrence of the florican. We recommend implementing a Bengal Florican-specific conservation action plan to promote community-based conservation and restrict human encroachment in the grassland habitat.

Keywords: Conservation, human-wildlife interaction, importance value index, species composition, threatened species.

Editor: P.A. Azeez, Salim Ali Centre For Ornithology And Natural History, Coimbatore, India. **Date of publication:** 26 August 2021 (online & print)

Citation: Prasai, R., H. Kafley, S. Upadhaya, S. Thapa, P. Shrestha, A. Dudley & Y.P. Timilsina (2021). Population status and distribution of the Critically Endangered Bengal Florican *Houbaropsis bengalensis* in the grassland of Koshi Tappu Wildlife Reserve, Nepal. *Journal of Threatened Taxa* 13(9): 19293–19301. https://doi.org/10.11609/jott.6503.13.9.19293-19301

Funding: This project was funded by Rufford Foundation, UK.

Competing interests: The authors declare no competing interests.

Author details: See end of this article.

Author contributions: Ritika Parsai: Conceptualization, Methodology, Data Cleaning, Formal Analysis, Writing-original Draft, Funding Acquisition.Hemanta Kafley: Conceptualization, Formal Analysis. Suraj Upadhaya: Conceptualization, Formal Analysis, Writing-original Draft. Swosthi Thapa: Field work, Data Analysis, Writing-original Draft. Pratistha Shrestha: Field work, Data Analysis, Writing-original Draft. Alex Dudley: Data Cleaning, Data Analysis, Writing-review & Editing. Yajna Timilsina: Writing-review & Editing, Supervision

Acknowledgements: We extend our heartfelt gratitude to Rufford Foundation, UK who funded this entire project for two years (2017–2019). We would also like to thank the Department of National Parks and Wildlife Reserves, Nepal and Koshi Tappu Widlife Reserve, Sunsari, Nepal for providing research permit in the study area and supporting us throughout the project. Thanks to the members of eco-clubs and locals of Koshi Tappu areas who participated in the survey and helped us tremendously. We would like to thank Anish Timsina (Koshi Bird Society), Prem Adhikari (homestay owner), Laxmi Rai (ranger), Kumar Paudel, and Shivish Bhandari for their continuous assistance throughout the project.

INTRODUCTION

Bengal Florican *Houbaropsis bengalensis* is a 'Critically Endangered' bird species under the IUCN Red List (Brahma et al. 2013). A small and rapidly declining population due to widespread loss of habitat (Baral et al. 2013) renders it highly susceptible to extinction. BirdLife International estimated a global population of 250–999 individuals across the species' geographic range - India's Uttar Pradesh state towards the west through the northern range encompassing the Terai of Nepal to Assam and Arunachal Pradesh in India and historically up to Bangladesh (Collar & Inskipp 1984; Baral et al. 2002; Gray et al. 2009; Collar et al. 2017). Owing to the small population size this species is legally protected globally and locally (Brahma et al. 2013). An early status survey of Bengal Florican in Nepal in 1982 showed the presence of 56–82 birds (Inskipp & Baral 1970; Collar & Inskipp 1984).

Bengal Florican males are territorial during their breeding season (Gray et al. 2009; Baral et al. 2013) and are easily detected as they perform frequent territorial flight displays (Gray et al. 2009). The breeding season of Bengal Florican starts during early February and lasts till July (MoEF 2011). During the breeding season, male floricans establish individual territories (40–60 m) in open areas of short grasslands (Baral et al. 2002; Brahma et al. 2013; Packman et al. 2014; Collar et al. 2017). In one clutch, Bengal Floricans lay one to two eggs (Gray et al. 2009). The females raise their young alone without any help from males (Baral et al. 2002).

The Bengal Florican has been recorded in different national parks of Nepal including Koshi Tappu Wildlife Reserve (KTWR), Bardia National Park, Shuklaphanta National Park, and Chitwan National Park (Baral et al. 2020). However, rapidly changing habitat condition calls for urgent conservation action and research examining the vulnerability and resilience of this species to the environmental changes (Baral et al. 2013). Extensive loss and modification of habitat due to anthropogenic activities (Aaranyak 2009), over-grazing (Gray et al. 2009), increased poaching (Baral et al. 2002; Poudyal 2008), inappropriate grass fires (Collar & Inskipp 1984), burning and ploughing regimes (Jha et al. 2018), and increasing dominance of invasive species like *Mikania micrantha* (Baral et al. 2020) comprise the major immediate threats to this species within their preferred habitat inside protected areas (Baral et al. 2013).

KTWR holds the highest population of Bengal Florican (around 40) among the protected areas of Nepal (Baral et al. 2020). Furthermore, the recorded density of adult male florican in KTWR is highest on the Indian subcontinent (Baral et al. 2020). As 46.6 % of its area, primarily grasslands, comprises suitable florican habitat, appropriate management of Koshi Tappu's grassland is essential for the conservation of the species (Baral et al. 2013). Therefore, the objectives of this study were to: (i) assess the biophysical condition of the Bengal Florican's habitat in the Koshi Tappu Wildlife Reserve and (ii) understand the relationship between the habitat attributes and the population status of the species.

MATERIALS AND METHODS

Study area

KTWR harbors the highest population of Bengal Florican among the protected areas of Nepal (Baral et al. 2013). KTWR is located between 26.65° N, 87.00° E in the lowland Terai region of Nepal (Figure 1). Our study area comprised 175 km^2 of the Saptakoshi river floodplains spanning 75–81 m from the mean sea level. The Saptakoshi river floodplain is the most northeasterly extension of the Gangetic Plain (Convention on Migratory Species 2020). It covers parts of Sunsari, Saptari, and Udayapur districts of the Eastern Development Region of Nepal. KTWR is divided into three management divisions - core area (CA), buffer zone (BZ), and outside protected area (OPA) (Poudyal et al. 2008) which are unequal in size.

An estimated 70% of the reserve's land area is covered by 'phantas' (patches of short grasslands) (Jha et al. 2018), water and riverine forests and 46.6% of the KTWR is suitable for florican population distribution (Baral et al. 2020). *Typha spp*. and *Saccharum* spp. are the dominant plant species here, although patches of *Imperata* spp. and *Phragmites* spp. are also seen (Baral et al. 2013). Riverine vegetation dominated *by Dalbergia sissoo* and *Acacia catechu* trees dominates the islands and edges of the reserve (Convention on Migratory Species 2020).

More than 50% of the area in KTWR is covered by wetland, and the remaining area is intensively cultivated throughout the year (Baral et al. 2013). During the dry season (October–March), several islands are vegetated with *Saccharum* spp., *Imperata cylindrica*, and *Typha elephantina* which are collected by locals for household purposes (Poudyal 2008). The climatic condition of this area is tropical monsoonal type and experiences three distinct seasons, i.e., summer (February–May), monsoon (June–September), and winter (October–January) (MoEF 2008). The reserve is the first Ramsar

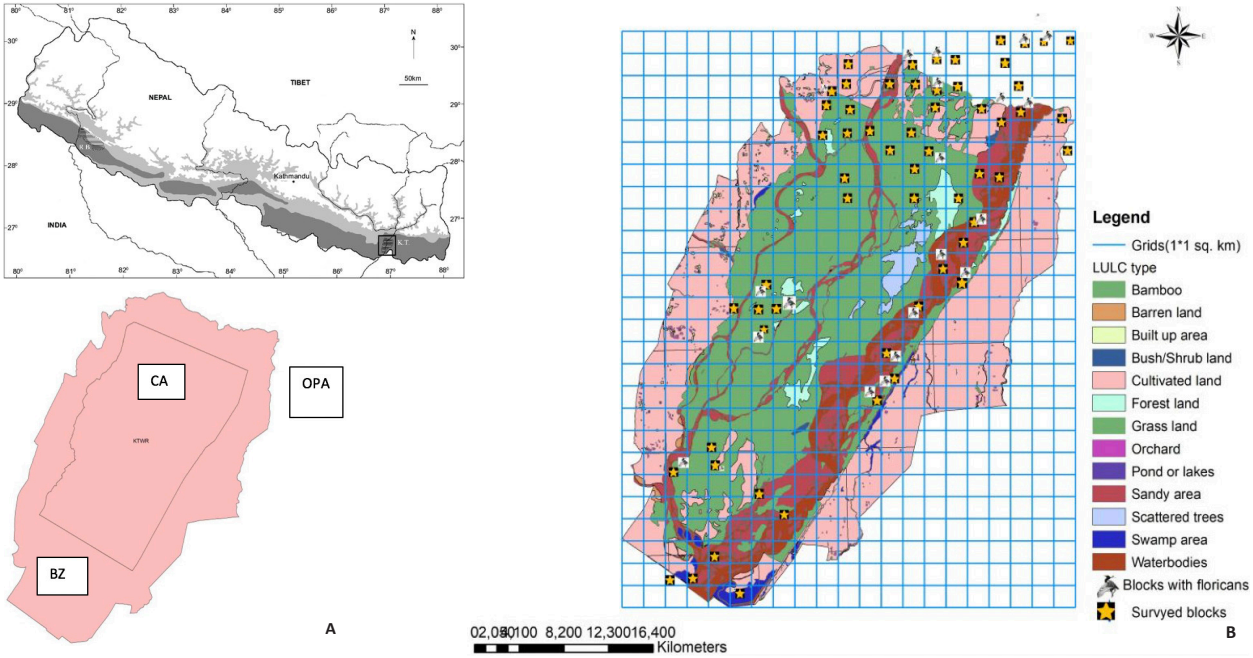


Figure 1 (A, B). Map of Koshi Tappu Wildlife Reserve showing the core area, buffer zone and outside protected area, land use and land cover classification and surveyed grids of 1 x 1 km.

site of Nepal declared in 1987 primarily for supporting more than 20,000 waterbird population and 200 species of fish (Baral et al. 2002). It serves as a breeding ground for many winter migratory birds due to favorable environmental and habitat characteristics. As nearly 20 globally threatened bird species have been recorded in this Reserve (Baral et al. 2013).

Data collection

Study area was divided into three categories based on the geographical locations and practiced conservation policies. CA is the innermost part of the reserve, where disturbance from external agents like people and livestock is restricted and wildlife policies and regulations are effectively implemented. BZ is partially restricted for locals to aid in conservation of CA. OPA is the area outside BZ and CA and is open to locals to conduct their daily activities and living.

Primary data was collected using 1 x 1 km random grids in the study area map using the fishnet tool in ArcGIS 10.9.1 software (ESRI Inc. year) (Figure 1). Nineteen grids from each management zones (CA, BZ, and OPA) were chosen for the survey. Those grids were named as blocks for our research study. Thus, 57 blocks were selected from the randomly designed grids to survey the grassland habitat condition and Bengal Florican population status in KTWR.

Bengal Florican survey and population estimation

A sweep count method (Baral et al. 2002) was used to survey presence/absence of the birds in each block. In the sweep count method, team members walked on total 2,964 transects (52 transects on each block) each of 1 km length on 57 blocks; 52 transects on each block were designed in such a way that 50 transects were spaced 20 m apart and the remaining two transects were walked on diagonals of the blocks. Only one member of the team walked a transect due to limited resources and there were 11 team members so in one survey occasion, 11 team members completed 11 transects. The survey team consisted of experienced observers and all observers used binoculars to confirm correct identification of the species and sex of the birds. All GPS locations and pictures of the birds were recorded for each sighting.

The study area was surveyed early in the morning (0600–0930 h) and later in the afternoon (1530–1900 h). In general, Bengal Floricans are active during dusk and dawn (Gray et al. 2009). Moreover, during the breeding season, male individuals are very conspicuous due to the active territorial displays (Gray et al. 2009). Male and female florican were distinguished from their physical appearance. Males have black plumage and appear completely white during their flight (MoEF 2008) (Image 1) except for the dark primary remiges, while females are buff brown and slightly larger than

Image 1. Bengal Florican *Houbaropsis bengalensis* flying through Koshi Tappu Wildlife Reserve, Nepal.

males (Poudyal 2008). In addition, only males show display characteristics during breeding season (Baral et al. 2002; Poudyal 2008; Jha et al. 2018; Convention on Migratory Species 2020) and their movements helped team members to count their population. Females are larger than males and easily distinguishable from males due to their body colour and size. Immature birds look like females but the experts can distinguish those from females based on their size and weight (Baral et al. 2002).

The total population was recorded based on equal sex ratio, i.e., 1:1 because female birds are extremely difficult to locate (Poudyal 2008; Brahma et al. 2009) and we had limited resources. However, for the future study we suggest to use the method as adopted by Baral et al. (2020).

Habitat survey

Six plots each spaced 200 m apart were made by dividing each block with the help of a measuring tape and a compass (Figure 2). This process was repeated inside every block. Further, 50 m radius circle was drawn inside each plot and the vegetation status inside each 50 m radius circle was studied to make the vegetation

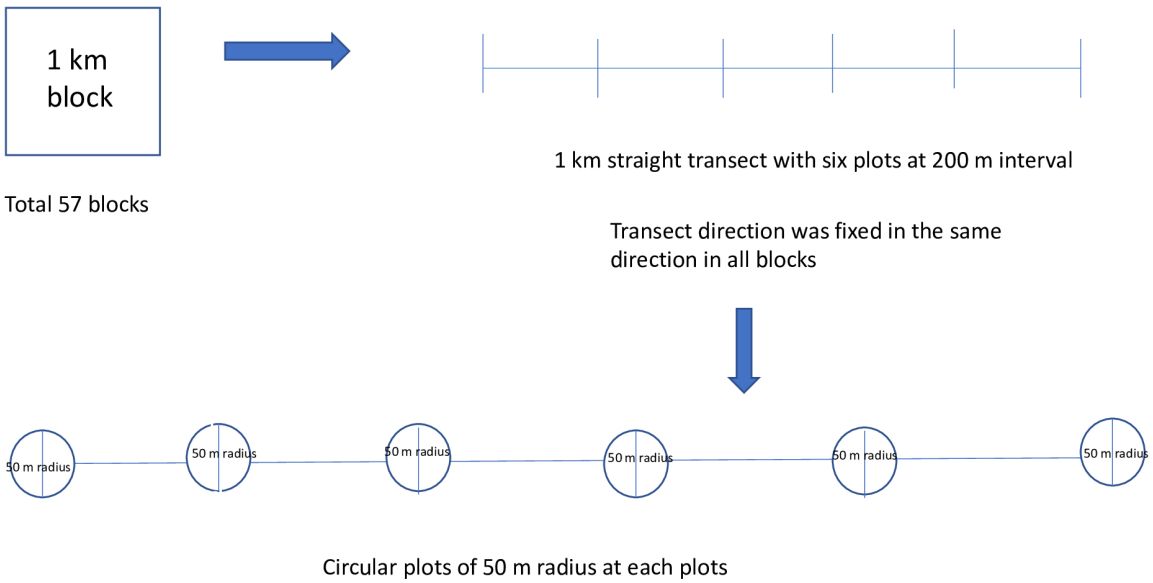


Figure 2. Habitat survey design for Bengal Florican.

survey easier as well as representative of each sample block. Information regarding grass height (cm), grass ground coverage (%), tree number, presence/absence of people, presence/absence of livestock, and dominant bird species were used to assess the habitat condition inside each 50 m radius vegetation plot. To measure the habitat disturbance due to humans and livestock we observed their movements within each block during the survey. If human or livestock movement was recorded inside the block it was recorded as a disturbed (Table 1). As floricans are extremely habitat specific and habitat sensitive birds, habitat disturbance due to external agents like people and livestock could impact in their occurrence (Baral et al. 2013).

Similarly, density, relative density, frequency, relative frequency, cover, and relative cover were used to compute important value indices of the grass species using the following standard formula (Thapa et al. 2020).

- Density of species A= Total number of individuals of species A in all sampling plots/ Total sampling plots
- Relative density of species A= Total number of individuals of species A / Total number of individuals of all species
- Frequency of species A= (Number of plots in which species A occurs x 100) / Total number of plot samples
- Relative Frequency of species A= (Frequency value of species A x 100) / Total frequency value of all species
- Cover %= (Approximate area covered by individual species) / (Total number of plots sampled) x 100
- Relative cover= (cover of individual species) / (Total cover of all species) x 100

Importance Value index (IVI)

- For grasses IVI = Relative density + Relative frequency + Relative cover

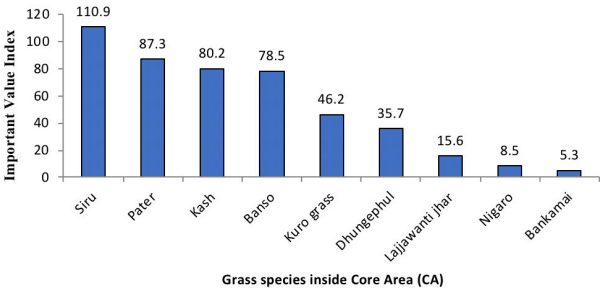


Figure 3. Importance value indices (IVI) of different grass species inside the core area of Koshi Tappu Wildlife Reserve, Nepal.

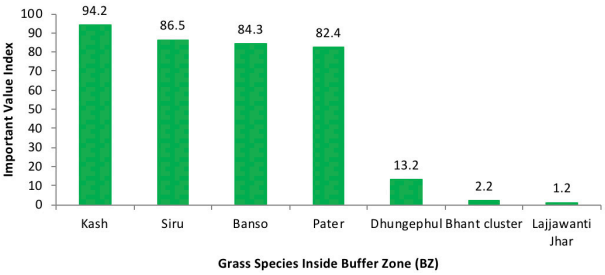


Figure 4. Importance value indices (IVI) of different grass species inside the buffer zone of Koshi Tappu Wildlife Reserve, Nepal.

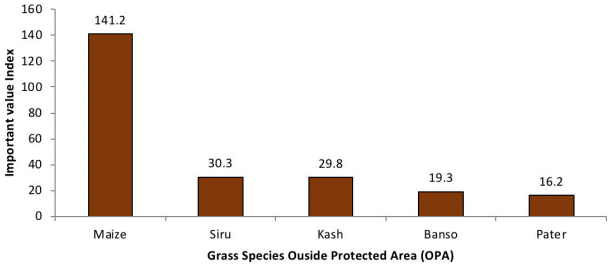


Figure 5. Importance value indices (IVI) of different grass species outside protected area of Koshi Tappu Wildlife Reserve, Nepal.

RESULTS

Altogether nine species of grass were recorded inside the CA, where 'Siru' *Imperata cylindrica* was the dominant grass with importance value index of 110.9. Pater *Samyda dodecandra* had importance value index of 87.3 followed by Kash *Saccharum spontaneum* 80.2, Banso *Digitaria ciligara* 78.5 (Figure 3). Likewise, seven different grass species were observed inside the BZ, among which Kash *Saccharum spontaneum* had the highest IVI of 94.2, followed by Siru *Imperata cylindrica* 86.5, Banso *Digitaria ciligara* 84.3, and Pater *Samyda dodecandra* 82.4 (Figure 4).

Five different grass species were recorded in the OPA, and among them maize *Zea mays* had the highest IVI of 141.2, followed by Siru *Imperata cylindrica* 30.3, Kash *Saccharum spontaneum* 29.8, and Banso *Digitaria ciligara* 19.3 (Figure 5). A total of 18 floricans (16 males and 2 females confirmed from regular field visits, previous records and information from local guides (2017–2019)) were recorded in the study area, and the overall population was assessed to be 36 assuming equal sex ratio (1:1) (Table 1). Florican were recorded from 17 blocks out of 57 blocks (29.82%) - 18 in the CA, 12 in the BZ and 6 in OPA (Figure 2). Other bird species were also recorded in study area while counting florican's population. Dominant bird species that were observed during the florican count were: Black Drongo *Dicrurus macrocercus*, Intermediate Egret *Mesophoyx*

Table 1. Florican population and record of people and livestock movement in studied blocks in Koshi Tappu Wildlife Reserve, Nepal.

Block	Plot descriptions	Status OPA, CA, BZ	Sighted Florican	Estimated Florican	People's presence/ absence	Livestock's presence/absence
1	Northern Radhabas	OPA	1	2	No	No
2	Jabdi waari	OPA	1	2	No	No
3	Jabdi paari	OPA	1	2	No	No
4	Jabdi	OPA	0	0	Yes	Yes
5	Jabdi paari	OPA	0	0	Yes	Yes
6	Chakadghatti Western	OPA	0	0	Yes	Yes
7	Chakadghatti	OPA	0	0	Yes	Yes
8	Srilanka Tapu	OPA	0	0	No	No
9	Srilanka Tapu	OPA	0	0	No	No
10	Srilanka Tapu	OPA	0	0	Yes	Yes
11	Bhakalpur	OPA	0	0	Yes	Yes
12	Bhakalpur	OPA	0	0	Yes	Yes
13	Bhakalpur	OPA	0	0	Yes	Yes
14	Bhakalpur	OPA	0	0	Yes	Yes
15	Bhakalpur (Bandhdanda)	OPA	0	0	Yes	Yes
16	Bhakalpur (Bandhdanda)	OPA	0	0	Yes	Yes
17	Bhakalpur (Bandhdanda)	OPA	0	0	Yes	Yes
18	Bhakalpur (Bandhdanda)	OPA	0	0	No	Yes
19	Bhakalpur (Bandhdanda)	OPA	0	0	Yes	Yes
20	Patthari, Saptari	CA	0	0	No	Yes
21	Patthari, Saptari	CA	0	0	No	Yes
22	Hawa Mahal	CA	0	0	No	Yes
23	Kushaha west	CA	0	0	No	No
24	Kushaha Katan	CA	1	2	No	No
25	Hawa Mahal	CA	2	4	No	Yes
26	Prakashpur Army post	CA	1	2	No	No
27	Madhuban Aapghanchi Western	CA	1	2	No	No
28	Madhuban Aapghanchi Western	CA	1	2	No	No
29	Hawa Mahal	CA	1	2	No	No
30	Bhakalpur	CA	0	0	No	No
31	Bhakalpur	CA	0	0	No	No
32	Bhakalpur	CA	0	0	No	No
33	Bhakalpur	CA	0	0	No	No
34	Bhakalpur	CA	1	2	No	No
35	Bhakalpur	CA	1	2	No	No
36	Patthari, Saptari	CA	0	0	No	No
37	Patthari, Saptari	CA	0	0	No	No
38	Patthari, Saptari	CA	0	0	No	No
39	Srilanka Tapu	BZ	0	0	No	No
40	Srilanka Tapu	BZ	1	2	No	No
41	Prakashpur	BZ	1	2	No	No

Block	Plot descriptions	Status OPA, CA, BZ	Sighted Florican	Estimated Florican	People's presence/ absence	Livestock's presence/absence
42	prakashpur	BZ	1	2	No	No
43	Radhabas West	BZ	0	0	No	No
44	Radhabas Western	BZ	0	0	No	No
45	Koshi-Barrage	BZ	0	0	Yes	Yes
46	Koshi-Barrage	BZ	0	0	Yes	Yes
47	Haripur	BZ	1	2	Yes	Yes
48	Haripur	BZ	0	0	Yes	Yes
49	Dakshin Duban, Saptari	BZ	0	0	Yes	Yes
50	Dakshin Duban, Saptari	BZ	1	2	Yes	Yes
51	Dakshin Duban, Saptari	BZ	0	0	Yes	Yes
52	Srilanka Tapu, Sunsari	BZ	0	0	Yes	Yes
53	Srilanka Tapu, Sunsari	BZ	0	0	Yes	Yes
54	Srilanka Tapu, Sunsari	BZ	1	2	No	Yes
55	Srilanka Tapu, Sunsari	BZ	0	0	No	Yes
56	Srilanka Tapu, Sunsari	BZ	0	0	No	Yes
57	Srilanka Tapu, Sunsari	BZ	0	0	No	Yes

OPA— outside protected area | CA—core area | BZ— buffer zone.

intermedia, Little Egret *Egretta garzetta*, and Asian Pied Starling *Gracupica contra*.

From our field observation we found that there might not be any relationship between grass height and florican occurrence. However, the florican numbers may be affected by a particular grass species' composition in their habitat. The largest population (18) was recorded inside the CA among three different habitat conditions (CA, BZ, OPA). The highest male florican population (9) was recorded inside the CA where *I. cylindrica* grass was the dominant grass with the importance value index of 110.9. Fewer population of florican were recorded in the OPA where we recorded less ground coverage of *I. cylindrica.*

Human disturbance was impacting negatively the florican population occurrence as found from our field observation. The highest florican population was recorded inside the CA, where human disturbance was less, than the OPA was observed (Table 1). Large populations of feral cattle were recorded in most of our study areas (CA, BZ, and OPA) which needs urgent attention from the concerned authority. As we recorded very few trees growing in the grassland, no relationship could be ascertained between tree growth and florican occurrence.

DISCUSSION

The distribution of Bengal Florican in different kinds of grassland habitat within KTWR was studied. Male and female florican were sighted from the tall grass of height 100–150 cm to the smaller grass height of 8–10 cm. However, female florican might prefer dense patches of tall grass for nesting purposes (Gray et al. 2009). Habitat selection of any grassland bird species primarily depends on bare ground exposure, vegetation height, litter depth (Fisher & Davis 2010). Increased grass height and reduced bare ground exposure can provide safety from their predators and protection from wind to the young and adult grassland birds (Fisher & Davis 2010). There are limited studies on explaining the biological relevance of litter depth in distribution of grassland bird species, litter depth might be useful for birds in building nests substrate, regulating soil microclimate, material for nutrient cycling (Fisher & Davis 2010). Floricans' preference to the lesser/no disturbance can be concluded when they have been sighted from the patches of tall grasses to open areas where there was very little or no disturbance from external agents/factors during our field surveys.

Bengal Floricans were sighted in 17 blocks out of 57 blocks and their population was estimated to be around 36. In contrast to this, the survey conducted by Baral et al. (2020) estimated the species' population to be 41 in

KTWR. Our study area covered a 57 km^2 area of florican habitat (81.55 km^2) while the survey conducted by Baral et al. (2020) covered 168.9 km^2 area during the survey. This could be the reason for the variation in estimated population size. In addition, the total population of floricans recorded in KTWR in 2012 survey was 47 (Baral et al. 2013) which demonstrates the trend of decreasing florican numbers even in their most suitable habitat in Nepal. Habitat degradation is considered as the major reason for florican population decline (Baral et al. 2013).

Only two out of 18 sightings during the survey were females. Inskipp and Inskipp's (1984) survey yielded a similar result when only 5–6 females were encountered among a total of 35–50 birds sighted. Marked differences between male and female florican' behaviour and habitat preference could explain this finding (Narayan 1992). In the site female florican mostly remain hidden and are rarely sighted during surveys (Baral et al. 2013).

The highest florican population was recorded inside the CA but the area cannot be claimed as the suitable habitat/preferred habitat for florican based on the population density only (Brahma et al. 2013). However, if the human presence/absence and the abundance of *I. cylindrica* highly account for florican occurrence, then the species' presence in the CA is favored by low human encroachment and higher dominance of *I. cylindrica* as observed from our field visits. Yet, robust investigation and detailed research focusing on impact of external agents in florican's occurrence is required to conclude this field observation. Increasing dominance of invasive species like *Mikania micrantha* even inside the CA is creating serious threats to florican in their present habitat (Baral et al. 2013). Further detailed studies focusing on other demographic factors (Baral et al. 2020), competition (Narayan 1992) and predation (Brahma et al. 2013) are necessary in order to understand the suitable habitat requirement of this species. Floricans are species with a highly specialized habitat and any severe disturbance in their habitat condition could cause their local extinction as observed in Bangladesh (Baral et al. 2013).

We noticed up to four Bengal Floricans (2 male and 2 female) in one block (1 km^2). From our regular visits and records, we found that this species has zero tolerance for habitat disturbance; a major reason for its population decline. The bird is extremely territorial (Gray et al. 2009) and shy and sensitive to its habitat condition (Narayan 1992). It is thought to occupy the same location until external disturbance prompts it to abandon its territory (Gray et al. 2009). In addition, detailed data on this species' association with other dominant bird species in the region is still lacking which is essential to understand its interspecific behaviour (Brahma et al. 2013). These kinds of associations are assumed to provide functional advantages and evolutionary benefits to the species involved (Brahma et al. 2013). Functional advantages include foraging advantages (to locate food resources) and anti-predator advantages (to detect and deter predators) (Brahma et al. 2013). Higher populations of florican were observed in the areas hosting the good populations of Black Drongo *Dicrurus macrocercus*, Intermediate Egret *Mesophoyx intermedia*, Little Egret *Egretta garzetta*, and Asian Pied Starling *Gracupica contra*.

We recommend implementation of effective habitat management policies and restricting anthropogenic activities, especially inappropriate burning and grass cutting, in the region to help these declining populations survive in the region. Detailed studies on their habitat requirements (Brahma et al. 2013), mating behavior (Gray et al. 2009) and intra- and inter-specific interactions (Narayan 1992) would greatly aid the effective protection of their remaining population.

REFERENCES

Baral, H.S., T.R. Bhatt, S.R. Giri, A.K. Ram, S.K. Shah, L.P. Poudyal, D. Chaudhary, G. Bhattacharya & R. Amin (2020). Status of the critically endangered Bengal Florican *Houbaropsis bengalensis* (Gmelin, 1789) in Koshi Tappu Wildlife Reserve, Nepal. *Journal of Threatened Taxa* 12(9): 16006–16012. https://doi.org/10.11609/jott.4832.12.9.16006-16012

Baral, H.S., A.K. Ram, B. Chaudhary, D. Chaudhary, A. Timsina, S. Acharya, K. Bidari, S. Acharya, B. Acharya, A. Karki & K.P. Acharya (2013). Survey of Bengal Florican *Houbaropsis bengalensis bengalensis* (Gmelin, 1789) (Gruiformes: Otididae) in the Koshi Tappu Wildlife Reserve and adjoining areas, Nepal. *Journal of Threatened Taxa* 5(7): 4076–4083. https://doi.org/10.11609/jott.o3240.4076-83

Baral, N., B. Tamang & N. Timilsina (2002). Status of Bengal Florican *Houbaropsis Bengalensis* in Royal Bardia National Park, Nepal. *Journal of the Bombay Natural History Society* 99: 413–417.

Brahma, N., P.C. Bhattacharjee & B.P. Lahkar (2013). Association of critically endangered Bengal Florican with other bird species in two sites of Manas, Assam, India. *Asian Journal of Conservation Biology* 2(1): 48–51.

Brahma, N., K. Choudhury, K.R. Sharma & M. Basumatary (2009). Bengal Florican conservation and research initiative in BTAD, India. Final Report, 64pp.

Collar, N., R. Burnside & P. Dolman (2017). Averting the extinction of bustards in Asia. *Forktail* 33: 1–26.

Collar, N.J. & C. Inskipp (1984). The Bengal florican: Its conservation in Nepal. *Oryx* 18(1): 30–35. https://doi.org/10.1017/S0030605300018561

Convention on Migratory Species (2020). Proposal for the inclusion of the Bengal Florican *(Houbaropsis bengalensis bengalensis*) in Appendix I of the convention. Gandhinagar, India.

Fisher, R.J. & S.K. Davis (2010). From Wiens to Robel: A review of grassland-bird habitat selection. *Journal of Wildlife Management* 74(2): 265–273. https://doi.org/10.2193/2009-020

Gray, T.N.E., N.J. Collar, P.J.A. Davidson, P.M. Dolman, T.D. Evans, H.N. Fox, H. Chamnan, R. Borey, S.H. Kim & R.N. van Zalinge (2009). Distribution, status and conservation of the Bengal Florican *Houbaropsis bengalensis* in Cambodia. *Bird Conservation International* 19(1): 1–14. https://doi.org/10.1017/S095927090800765X

Inskipp, C. & H.S. Baral (2010). Potential impacts of agriculture on Nepal birds. *Our Nature* 8: 270–312. https://doi.org/10.3126/on.v8i1.4339

Jha, R.R.S., J.J. Thakuri, A.R. Rahmani, M. Dhakal, N. Khongsai, N.M.B. Pradhan, N. Shinde, B.K. Chauhan, R.K. Talegaonkar, I.P. Barber, G.M. Buchanan, T.H. Galligan & P.F. Donald (2018). Distribution, movements, and survival of the critically endangered Bengal Florican *Houbaropsis bengalensis* in India and Nepal. *Journal of Ornithology* 159(3): 851–866. https://doi.org/10.1007/s10336-018-1552-1

Jones, J. (2001). Some uncubation and fledging periods of African birds. *The Auk* 118(2): 557–562. https://doi.org/10.1111/j.1474-919X.1942.tb03424.x

MoEF (2011). Guidelines for the Bengal Florican recovery programme Ministry of Environment and Forests, Government of Indiapp. 1–34

Packman, C.E., D.A. Showler, N.J. Collar, S. Virak, S.P. Mahood, M. Handschuh,T.D. Evans, H. Chamnan & P.M. Dolman (2014). Rapid decline of the largest remaining population of Bengal Florican *Houbaropsis bengalensis* and recommendations for its conservation. *Bird Conservation International* 24(4): 429–437.; https://doi.org/10.1017/S0959270913000567

Poudyal, L.P., P.B. Singh & S. Maharjan (2008). Status and Distribution of Bengal Florican *Houbaropsis bengalensis in Nepal, 2007:* Report to the Oriental Bird Club, UK and the Club 300 Foundation for Bird Protection, Sweden. Kathmandu, Nepal, 2–40pp.

Poudyal, L.P., P.B. Singh & S. Maharjan (2008). The decline of Bengal Florican *Houbaropsis bengalensis* in Nepal. *Danphe* 17: 4–6.

Thapa, R., B. Neupane, S. Ranabhat, M. Poudel & S. Panthi (2020). Habitat suitability of Wild Water Buffalo (*Bubalus arnee*) in Babai flood plain of Bardia National Park, Nepal. *Global Ecology and Conservation* 23: e01172. https://doi.org/10.1016/j.gecco.2020.e01172

Author details: Ritika Prasai is a MS graduate and currently working as a Data Specialist at Baylor University, Waco, Texas. She has expertise in geospatial data science and involved in research related to remote sensing, species distribution modelling, habitat modelling, land use land cover. She is actively involved in projects related to wildlife conservation of Nepal. Dr. Hemanta Kafley PhD is an assistant professor of wildlife science at the Tarleton State University, Stephenville, Texas. His research focusses on broader aspects of species-habitat relationships. Dr. Kafley's current research includes predictive distribution modeling of rare plants in Texas, developing habitat suitability index of giraffe, and habitat occupancy modeling of predators and prey populations in South Africa, and bio-cultural conservation issues in Bhutan. Suraj Upadhaya PhD, is a postdoctoral research associate in the Department of Natural Resource Ecology and Management, Iowa State University, and director at Himalayan Conservation and Research Institute. He conducts research and teaches in the areas of socio-ecological systems and human dimensions of natural resource management. His academic and professional's goals are to explore the dynamic relationship between natural resources and people, ensure the sustainability of natural resources in developed and developing countries, and channel his research to benefit the underprivileged population. Swosthi Thapa, interested in conducting research in the areas of natural resource management, forest governance, socio-ecological system, human environment interactions, and remote sensing, Swosthi Thapa is a graduate from Institute of Forestry, Tribhuvan University, Nepal, and Research Assistant at Southasia Institute of Advanced Studies(SiAS). She has strong interest in identifying human geography and connecting it with natural resources, exploring relationship between environmental components, and expand research areas in forestry sector. After working in different environmental projects, she has developed her professionalism and is continuously working in nature conservation sector. Pratistha Shrestha, a forestry graduate. An early career civil servant with a technical know-how. Area of interest includes research-based policy analysis and governance. Aims to channelize her learnings and knowledge in appropriate use of diplomacy, diaspora and development operations. Alex Dudley is Conservation Liaison for the Katie Adamson Conservation Fund (KACF), a nonprofit organization providing financial support and volunteer manpower to community-based endangered species initiatives worldwide. He also is a wildlife journalist whose work has appeared in Mongabay. In these roles, Alex has evaluated firsthand, and written about, new community-based endangered species partners for the KACF in Tanzania, Kenya, Uganda, Nepal, India, and Costa Rica. He holds a Bachelor of Arts Degree in African Studies from the University of Colorado at Boulder and a Master of Science in Conservation Leadership from Colorado State University. Yajna Prasad Timilsina is a Professor of statistics at Institute of Forestry, Pokhara, Nepal and mentors Statistics, Experimental design and Research methodology for undergraduate and graduate students. His interest area is natural resource modeling and sampling .He has also well expertized of data management and statistical analysis. He has published more than four dozens of articles in national and international peer reviewed journals.

Journal of Threatened Taxa

www.threatenedtaxa.org

OPEN ACCESS

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

August 2021 | Vol. 13 | No. 9 | Pages: 19191–19390
Date of Publication: 26 August 2021 (Online & Print)
DOI: 10.11609/jott.2021.13.9.19191-19390

Articles

On the impact of earthquake-induced landslides on Red Panda *Ailurus fulgens* (Mammalia: Carnivora: Ailuridae) habitat in Langtang National Park, Nepal
– Yogesh Rana Magar, Man Kumar Dhamala, Ajay Mathema, Raju Chauhan & Sijar Bhatta, Pp. 19191–19202

Rhesus Macaque *Macaca mulatta* (Mammalia: Primates: Cercopithecidae) in a human-modified landscape: population, activity budget, and societal perceptions in Bangladesh
– Sufia Akter Neha, Mohammad Ashraf Ul Hasan, Mohammad Abdul Baki & Subrina Sehrin, Pp. 19203–19211

Factors affecting the species richness and composition of bird species in a community managed forest of Nepal
– Bishow Poudel, Bijaya Neupane, Rajeev Joshi, Thakur Silwal, Nirjala Raut & Dol Raj Thanet, Pp. 19212–19222

Communications

A large mammal survey in Koyli Alpha Community Wildlife Reserve and its surroundings in the Great Green Wall extension area in Senegal
– Anna Niang & Papa Ibnou Ndiaye, Pp. 19223–19231

Blackbuck *Antilope cervicapra* (Mammalia: Cetartiodactyla: Bovidae) estimates in human-dominated landscape in Aligarh, Uttar Pradesh, India
– Mujahid Ahamad, Jamal A. Khan & Satish Kumar, Pp. 19232–19238

Diet of Leopards *Panthera pardus fusca* inhabiting protected areas and human-dominated landscapes in Goa, India
– Bipin S. Phal Desai, Avelyno D'Costa, M.K. Praveen Kumar & S.K. Shyama, Pp. 19239–19245

First record of interspecies grooming between Raffles' Banded Langur and Long-tailed Macaque
– Zan Hui Lee , Andie Ang & Nadine Ruppert, Pp. 19246–19253

Photographic evidence of Red Panda *Ailurus fulgens* Cuvier, 1825 from West Kameng and Shi-Yomi districts of Arunachal Pradesh, India
– Moktan Megha, Sylvia Christi, Rajesh Gopal, Mohnish Kapoor & Ridhima Solanki, Pp. 19254–19262

On the reproductive biology of the invasive Armoured Sailfin Catfish *Pterygoplicthys pardalis* (Castelnau, 1855) (Siluriformes: Loricariidae) from the natural drainages in Thiruvananthapuram, India
– Smrithy Raj, Suvarna S. Devi, Amrutha Joy & A. Biju Kumar, Pp. 19263–19273

On the high bird diversity in the non-protected regions of Trashiyangtse District in Bhutan
– Lam Norbu, Phuntsho Thinley, Tandin Wangchuck, Ugyen Dechen, Lekey Dorji, Tshering Choephel & Pasang Dorji, Pp. 19274–19292

Population status and distribution of the Critically Endangered Bengal Florican *Houbaropsis bengalensis* in the grassland of Koshi Tappu Wildlife Reserve, Nepal
– Ritika Prasai, Hemanta Kafley, Suraj Upadhaya, Swosthi Thapa, Pratistha Shrestha, Alex Dudley & Yajna Prasad Timilsina, Pp. 19293–19301

Is habitat heterogeneity effective for conservation of butterflies in urban landscapes of Delhi, India?
– Monalisa Paul & Aisha Sultana, Pp. 19302–19309

A preliminary checklist of moths (Lepidoptera: Heterocera) from Gangajalghati, Bankura, West Bengal, India
– Ananya Nayak, Pp. 19310–19323

First report of three species of the genus *Diaphanosoma* (Crustacea: Cladocera: Sididae) from Jammu waters (J&K), India
– Nidhi Sharma & Sarbjeet Kour, Pp. 19324–19337

Review

Wild ungulates in Jordan: past, present, and forthcoming opportunities
– Ehab Eid & David Mallon, Pp. 19338–19351

Viewpoint

The captive population of the Lion-tailed Macaque *Macaca silenus* (Linnaeus, 1758). The future of an endangered primate under human care
– Nilofer Begum, Werner Kaumanns, Alexander Sliwa & Mewa Singh, Pp. 19352–19357

Short Communication

Jaguar *Panthera onca* (Linnaeus, 1758) (Mammalia: Carnivora: Felidae) presumably feeding on Flathead Catfish *Pylodictis olivaris* (Rafinesque, 1818) (Actinopterygii: Siluriformes: Ictaluridae) at Aros and Yaqui rivers, Sonora, Mexico
– Juan Pablo Gallo-Reynoso, Pp. 19358–19362

Notes

Life near a city: activity pattern of Golden Jackal *Canis aureus* Linnaeus, 1758 (Mammalia: Carnivora: Canidae) in a habitat adjoining Bhubaneswar, India
– Subrat Debata, Pp. 19363–19366

Chemical immobilisation of a Eurasian Lynx *Lynx lynx* (Linnaeus, 1758) (Mammalia: Carnivora: Felidae) with ketamine-dexmedetomidine mixture in Ladakh, India
– Animesh Talukdar & Pankaj Raina, Pp. 19367–19369

White-bellied Heron Ardea insignis in Hkakabo Razi Landscape, northern Myanmar
– Myint Kyaw, Paul J.J. Bates, Marcela Suarez-Rubio, Bran Shaung, Han Nyi Zaw, Thein Aung, Sai Sein Lin Oo & Swen C. Renner, Pp. 19370–19372

Range extension of the Common Slug Snake *Pareas monticola* (Cantor, 1839) (Reptilia: Squamata: Pareidae): a new family record for Nepal
– Dipa Rai, Manoj Pokharel & Tapil P. Rai, Pp. 19373–19375

First record of *Mantispilla indica* (Westwood, 1852) (Neuroptera: Mantispidae) from the Western Ghats, India
– T.B. Suryanarayanan & C. Bijoy, Pp. 19376–19379

A new distribution record of the Western Ghats endemic damselfly *Melanoneura bilineata* Fraser, 1922 (Insecta: Odonata) from Maharashtra, India
– Yogesh Koli & Akshay Dalvi, Pp. 19380–19382

A new record of the Emerald Striped Spreadwing *Lestes viridulus* Rambur, 1842 (Zygoptera: Lestidae) from Nepal
– Manoj Sharma, Pp. 19383–19385

Rediscovery of the Bhutan Primrose *Primula jigmediana* W.W. Smith (Angiosperms: Primulaceae) after 87 years in Bumdeling Wildlife Sanctuary, Bhutan
– Tez B. Ghalley, Tshering Dendup, Karma Sangay & Namgay Shacha, Pp. 19386–19388

First report of *Golovinomyces* sp. causing powdery mildew infection on *Dyschoriste nagchana* in Western Ghats of India
– Sachin Vasantrao Thite, Pp. 19389–19390

Publisher & Host

WILD ZOOREACH
Threatened Taxa