

1. Summary

The study was carried out in Sarpang District in southern Bhutan with the objective to study the hornbill's status, threats and people's perception on conservation of all four species of hornbills found in Bhutan. The study was carried out from March, 2020 to October, 2020. It covers a total transect length of 72 kilometers along the existing cattle tracks, footpath, and farm roads. Rufous-necked hornbill is recorded at the highest elevation of around 1800masl and oriental-pied hornbill is recorded at the lowest elevation of around 250masl.

Rufous-necked hornbill and Great hornbill were encountered at higher elevation and Oriental-pied hornbill and Wreathed hornbill at lower elevation during survey. The encounter rate are Great hornbill (0.25), Rufous-necked hornbill (0.22), Wreathed hornbill (0.13), and Oriental-pied hornbill (0.21) which means it is uncommon in the study area. The major threat for hornbills within the study area are road construction, and logging and firewood collection. Hornbills mostly forage near human settlements such as at the edge of agriculture land and disturbed forest and return to undisturbed area for nesting. There is correlation between trees used by hornbills for nesting and the trees used by local people for timber and firewood purpose.

2. Introduction

Hornbills are the group of distinctive and charismatic birds found only in tropical Asia and Sub-Saharan Africa. Presently, there are four species of hornbills (Bucerotidae) found in Bhutan. All four species was sighted from Sarpang District and its biological corridor during the study period. Rufous-necked hornbill (Vulnerable), Great hornbill (Vulnerable), Wreathed hornbill (Vulnerable) and Oriental-pied hornbill (Least Concern) under Red List Category & Criteria (Birdlife International, 2016; Birdlife International, 2018).

The study was conducted in Sarpang District in the southern part of the country (Figure 1). It covers an area of approximately 1666.15 km² with elevation ranges from 100m to 4000m above sea level. The area under forest cover is about 89.58% of the total area of the district. The broadleaf forests with teak and other valuable tree species constitute 88.64% of the entire forest cover. The District serve as biological corridor to Royal Manas and Jigme Singye National Park and Phibsoo wildlife sanctuary. Sarpang District is considered one of the important Bird areas from 23 important bird areas in Bhutan. All four species of hornbills, critically endangered White Billed Heron, and other threaten species are also found within the study area. Therefore, Sarpang District and its biological corridors is very important for survival and conservation in the future.

3. Project objectives

- i. To assess the population status of all the hornbills under Sarpang District
 - The population status of hornbills was assessed using encounter rates of hornbills per km of trail travelled.
- ii. To assess the importance of biological corridors for conservation of hornbills
 - Importance of biological corridor and people's perception was collected using questionnaire survey.
- iii. To identify anthropogenic threats and give awareness program on significance of hornbills
 - Done awareness in small groups.

4. Methods

Table 1: Methods and activities

Date	Activities
March (6 th - 24 th)	✓ Data collection through a questionnaire survey in 4 villages (Chhudzom, Jigmecholing, Pelrithang, and Singye) of Sarpang District.
April (1 st -28 th)	✓ Done awareness program in 4 villages in small groups because people were not allowed to gather in mass due to COVID-19.
May (12 th - 20 th)	✓ Data collected (Field survey) during breeding season – Transect 1 to 3 ✓ Collected information about anthropogenic threats to the hornbills. ✓ Identified nesting sites and tree species that were frequently used by hornbills for breeding and feeding.
27 th May – June 9 th)	✓ Data collection during breeding season - Transect 4 and 5 ✓ Collected information about anthropogenic threats that cause impact to the hornbills.

5. Result

i. Study area maps

The study was carried out under Sarpang District. There are three protected areas and one biological corridor for free movement of birds and animals. I have selected five transect line of various length (Table 2) for assessing the encounter rates of hornbills. Five nesting sites were identified within the perimeter of 5km² under Jigmichhoeling geog. One nest was abandoned in the last breeding season (2020) and the reason is still unknown. Biological corridor and community forest are the most important habitat for hornbills according to local people where they closely interact. Local people depend on natural resources (Timber, wild vegetables, and firewood) which are mostly available in biological corridor and community forest area.

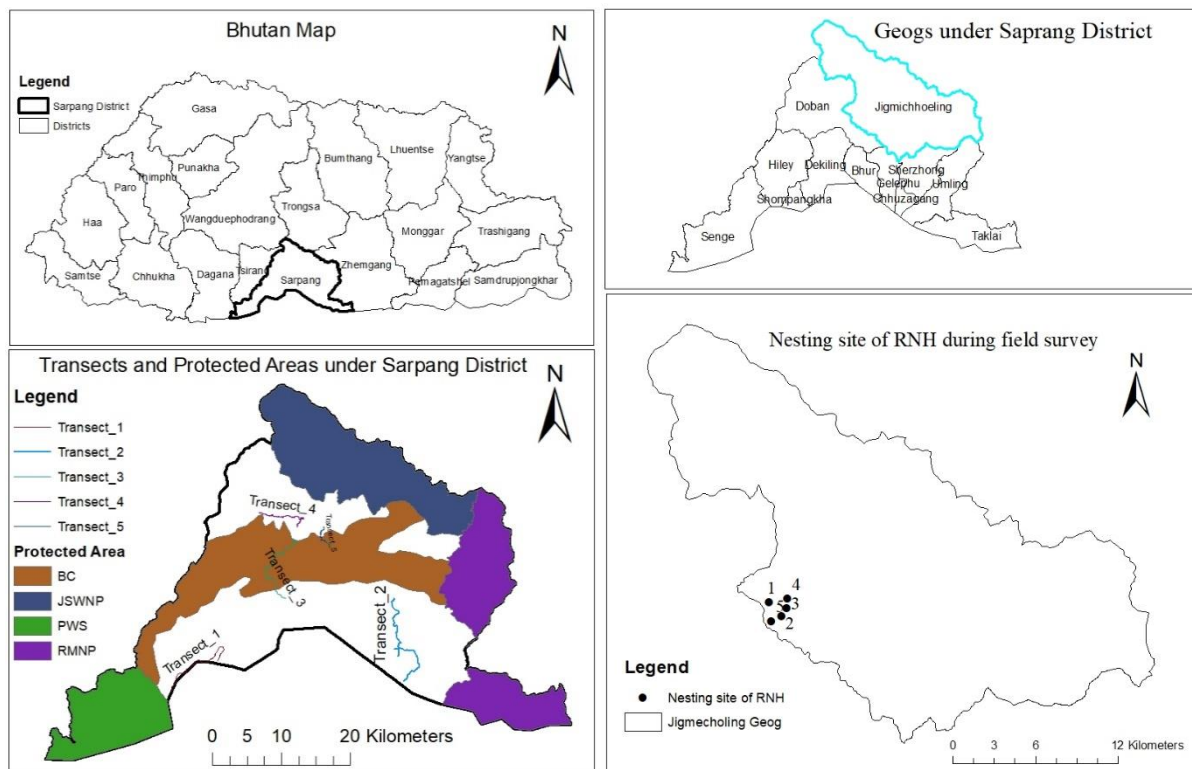


Figure 1: Transects for all hornbills (5 transect lines) and nesting sites of Rufous-necked hornbills

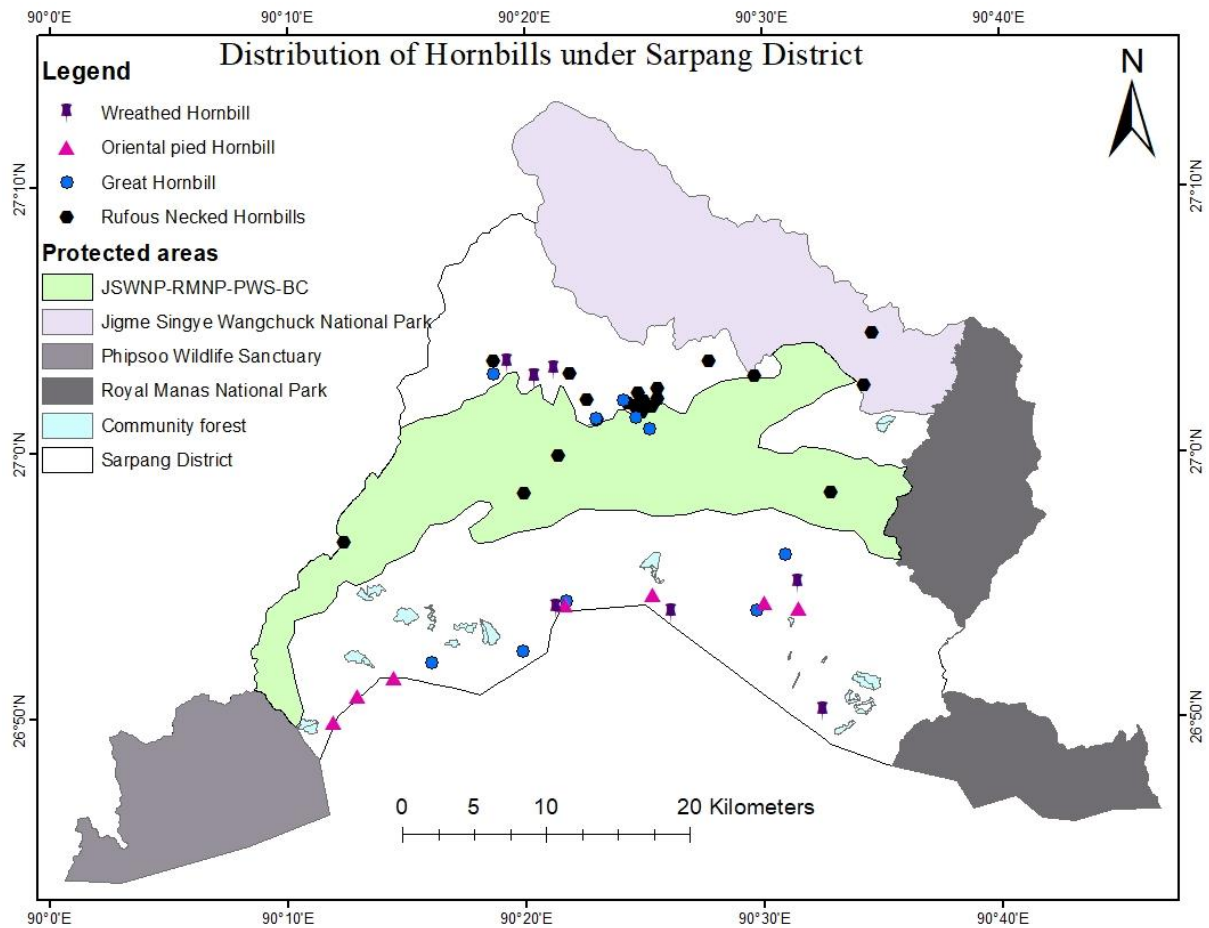


Figure 2: Distribution of four species hornbills in Sarpang district (Both primary and secondary reference data were used for distribution)

Table 2: Information about the transects including coordinates, habitats, and distance

Transect	Coordinates	Habitats	Date	Distance (Km)
Transect 1	26°52'2.475"N 90°14'30.952"E	Human settlements and secondary forest	12/05/2020 - 14/05/2020	14
Transect 2	26°53'36.482"N 90°31'6.534"E	Human settlements and secondary forest	16/05/2020 - 17/05/2020	21
Transect 3	26°59'7.997"N 90°20'20.592"E	Biological corridor	20/05/2020	17
Transect 4	27°2'56.075"N 90°21'27.667"E	Human settlement and secondary forest	29/05/2020 - 30/05/2020	12
Transect 5	27°1'18.846"N 90°24'46.667"E	Human settlement and biological corridors	04/06/2020 - 06/06/2020	8

ii. Population status:

Transect 1: Three species sighted (Oriental-pied, Wreathed and Great hornbill)

Transect 2: Three species sighted (Oriental-pied, Wreathed and Great hornbill)

Transect 3: Two species sighted (Great and Rufous-necked hornbill)

Transect 4: Two species sighted (Great and Rufous-necked hornbill)

Transect 4: Two species sighted (Great and Rufous-necked hornbill)

Great hornbill are sighted both at lower and higher elevation. Rufous-necked hornbills are sighted at higher elevation. Wreathed and oriental pied are sighted at lower elevation.

Calculation of encounter rate of hornbills

Encounter rate = Number of individuals encounter/ total distance travelled (km)

The total distance covered during the field survey for all the hornbills: 72km

Table 3: Summary of hornbills observed during survey

Hornbills	Track 1	Track 2	Track 3	Track 4	Track 5	Total no. of hornbills	Encounter rate
Rufous-Necked Hornbill	0	2	4	4	6	16	16/72 = 0.222
Great Hornbill	3	2	2	5	6	18	18/72 = 0.250
Wreathed Hornbill	2	6	2	0	0	10	10/72 = 0.133
Oriental Pied Hornbill	6	5	4	0	0	15	15/72 = 0.203

Table 4: Aundance category, abundance score, and ordinal scale (Bibby et al., 1992)

Abundance category (number of individuals/distance (km))	Abundance score	Ordinal scale
<0.1	1	Rare
0.1-2.0	2	Uncommon
2.1-10.0	3	Frequent
10.1-40.0	4	Common
40.0+	5	abundant

The encounter rate of all four species of hornbills falls within abundance category of (0.1-2.0) which means the hornbills are uncommon in the study area.

iii. Demographic information

The questionnaire collected five types of demographic information, including gender, age, occupation, family members, and education. The surveyed individuals were 60% male and 40% female. Most of the respondent (51.7%) were aged between 41-60 years, (38.3%) were 21-40 years, and (15%) are older than 60 years. Occupations were mainly agriculture-related activities (50%). A few respondents were also engaged in others, such as government jobs and business activities. Most of the respondents were illiterate (66.7%). Very few were had done secondary schooling and graduation.

Table 5: Demographic information of population

Element	Group	Number	Proportion (%)
Gender	Male	36	60.0
	Female	24	40.0
Age	20 and below	3	5
	21-40 years	17	38.3
	41-60 years	31	51.7
	Above 60 years	9	15
Occupation	Farmer	50	82.0
	Government job	3	4.9
	Business	3	4.9
	Others:	5	8.2
No. of family members	1-3 members	15	24.6
	4-6 members	44	72.1
	7-9 members	2	3.3
Education level	Illiterate	40	66.7
	Primary	12	20
	Secondary	4	6.7
	Graduate	4	6.7

iv. Threats to Hornbills

According to the questionnaire survey, the highest threat for hornbills is from logging and firewood collection (36.7%). People depends on forest for timber to construct houses and cattle sheds. Rural people mostly depends on firewood for cooking purpose and heating home. There are still some places without accessibility of electricity. There is very low threats from forest fire, grazing and fodder collection, and human disturbance with (40%, 46.7% and 45%) respectively. The forest fire is very rare in southern area where the weather remain humid most of the time. There is medium level of disturbance from road construction with 48.3%. There

are lots of on-going farm road construction without proper Environment Impact Assessment but still people are with the view of low impact to the hornbills

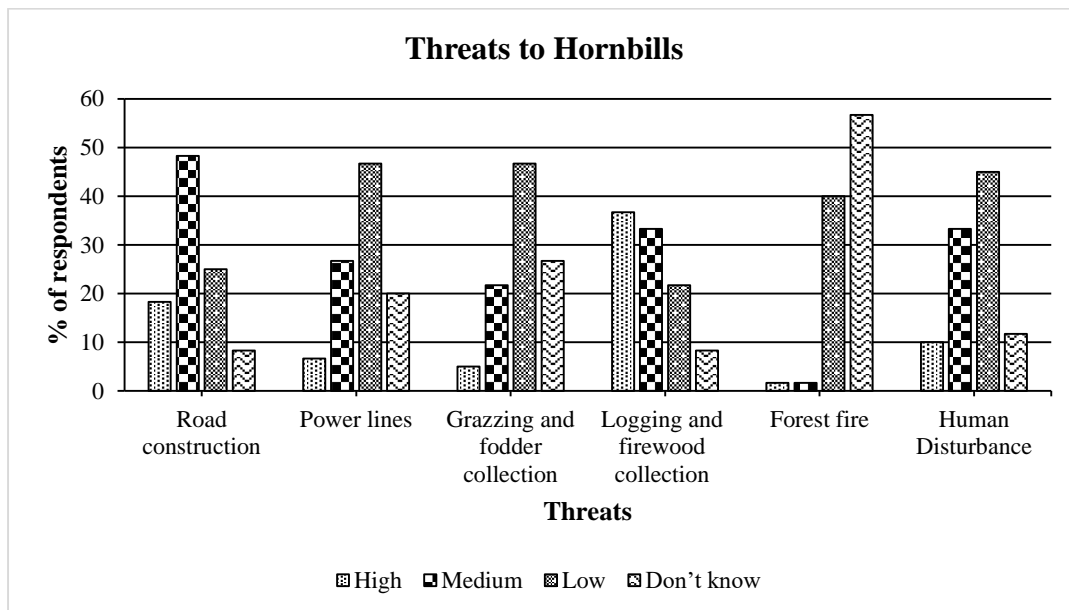


Figure 3: Threats to hornbills

v. *Status of Hornbills*

56.5% of the respondent says that the population of hornbills remain same in the past 10 years. Only 20% of respondent are with the view that the population of hornbills are decreasing. Most people responded that the population of hornbills depends on season to season and availability of food resources in their locality.

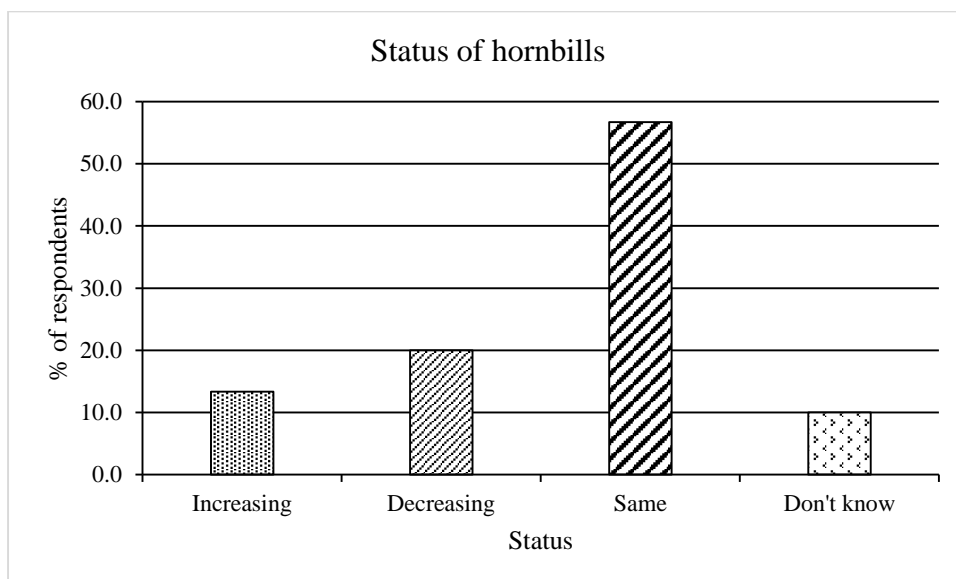


Figure 4: Status of hornbills

vi. Importance of Biological corridors for conservation of hornbills

Biological corridors (BCs) helps hornbills for movement from one habitat to another without any disturbance. More than (50%) of the respondent identified biological corridors as very important habitat for conservation of hornbills and (6.7%) of the respondent says it's not important. Bhutan has around (51.4%) of the total area under protection including national parks, wildlife sanctuary, strict nature reserve and biological corridors. Although people had seen high number of hornbills at the edge of the agriculture land (36.7%), they said they forage near human settlements and disturbed area and will return back to primary forest (21.7%) for nesting.

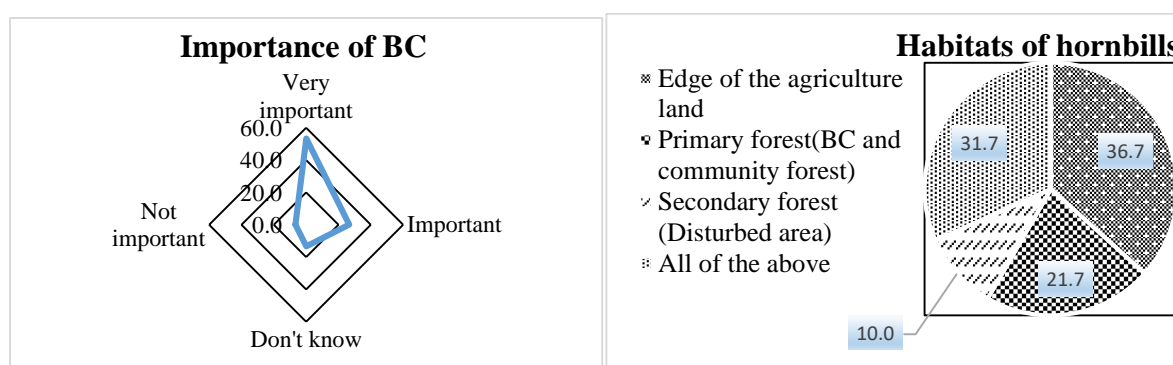


Figure 5: Importance of biological corridors for conservation of hornbills

vii. Conservation awareness

Many of the respondent were not aware (83.3%) of the hornbills as threatened species. Around 16.7% of the respondents are aware of the hornbills as threatened species. Only the literate people are aware of hornbill's status in the red list. This indicate that we need lots of awareness for the conservation of hornbills in Bhutan. Although Rufous-necked hornbill, Great hornbill, and Wreathed hornbill is categorised as vulnerable by the Birdlife International. In Bhutan Rufous-necked Hornbill is listed in protected species under the schedule I of the Forest and Nature Conservation Act of Bhutan, 1995. The two other hornbills are still not listed as protected species in Bhutan. So, there is need to list Wreathed hornbill and Great hornbill as protected species.

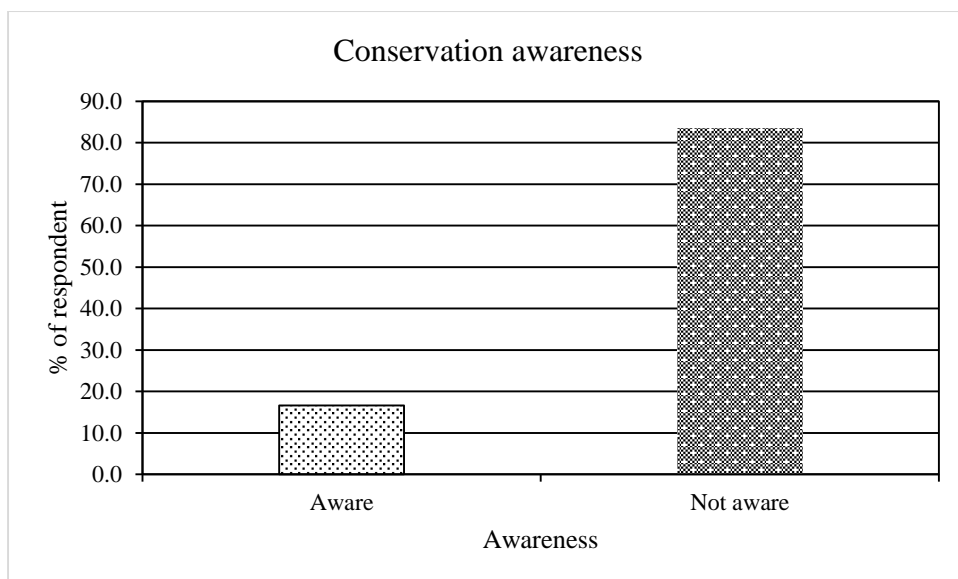


Figure 6: Conservation awareness of hornbills

Recommendation

1. The Department of forest and park services, Royal Government of Bhutan have to list Great hornbill and Wreathed hornbill as protected species under forest and nature conservation act of Bhutan since it is vulnerable.
2. There is need for awareness to the local people. Local people are not aware of hornbills as threatened species according to questionnaire survey.
3. There is need for monitoring the hornbill's nest every year by the relevant authority from felling down.

Acknowledgements

1. Oriental bird club for providing funds for the research on hornbills in Bhutan and IdeaWild for Global Positioning System (GPS).
2. Ugyen Wangchuck Institute for Conservation and Environmental Research for research and Sarpang Dzongkhag Forest Division for Permit to carry out research
3. Villagers, forest officials, and friends for providing information about hornbills and helping in data collection.

4. Funding

1. The March Conservation Fund of Tides Foundation



2. IdeaWild



Appendices



Trees fell down for timber



Trees fell down for honey (Beehive)



Local person sharing about nesting site



Burning of bushes near agriculture field



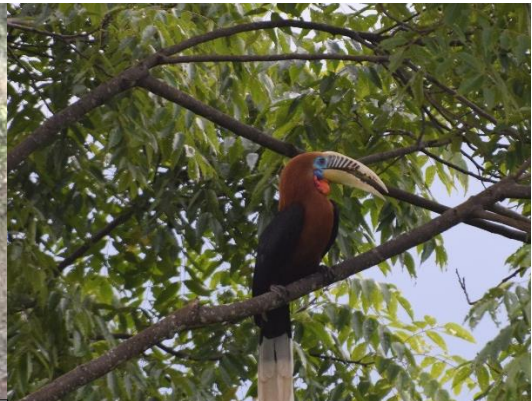
Grazing cattle in the habitats of hornbills



Data collection with the help of GPS



Nesting cavity of RNH



Rufous-necked hornbill



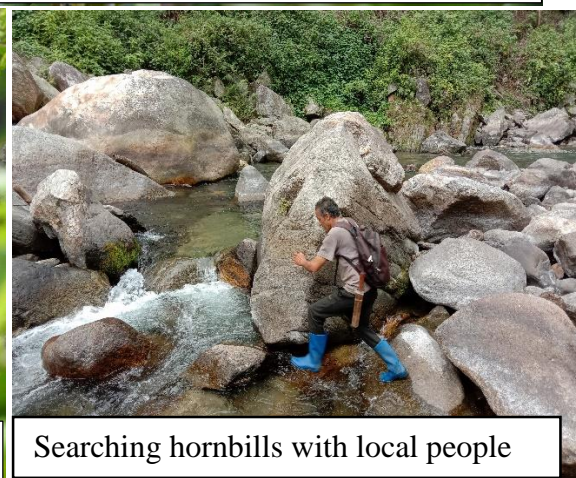
Great hornbill (Khandal, 2020)



Wreathed hornbill (Wangdi, 2020)



Oriental-pied hornbill (karda, 2020)



Searching hornbills with local people

Appendices

These questionnaires are solely for personal research and information of the interviewee is fully confidential

Date:..... Interviewer:.....

Village:..... Geog:

A. GENERAL INFORMATION

1. Name of the respondent:

2. Gender: (i) Male (ii) Female (iii) Other (Specify):

3. Age (Years): (i) 20 and below (ii) 21- 40 (iii) 41- 60 (iv) 61 and above

4. Education: (i) Graduate (ii) Secondary (iii) Primary (iv) NFE (v) Illiterate

5. Occupation: (i) Private jobs (ii) Labours (iii) Farmers (iv) Government jobs (v) Business (vi) Religious institution (vii) Others (Specify).....

6. Household members: (i) 1-3 members (ii) 4-6 members (iii) 7-9 members (iv) 10 and above

7. Income per year (Nu.): (i) Below 20,000 (ii) 21,000-50,000 (iii) 51,000-1 lakh (iv) Above 1 lakhs

B. SPECIES AND HABITAT INFORMATION

8. Have you seen Hornbills? (i) Yes (ii) No If yes: Q.9

9. What species? (Where: (i) Edge of agricultural land (ii) Riverside (iii) Primary forest (Biological corridor and community forest) (iv) Secondary forest (disturbed forest)

What species	Where	When (Season) or all season	How many of them
Rufous necked hornbill			
Great hornbill			
Wreathed hornbill			
Oriental pied hornbill			

10. Have you seen a Hornbill nest? Where (tree species)? Describe? When do you think that hornbills are nesting?

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11. Do you know what hornbills are eating? Do they eat and damage your crops? When (? Where? What?

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12. What do you think the population status of Hornbills over last 5-10 years in your areas?

(i) Increasing (ii) Decreasing (iii) Same (iv) Don't know

If increasing or decreasing, why?

(Reason).....

.....

THREATS INFORMATION

13. Do you hunt or seen other people hunting hornbills in your areas?

(i) Yes (ii) No

If yes, why?

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14. Do you use any part of the birds for traditional medicine or religious significance?

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15. Which tree species do you extract for firewood and rural house building timber? Specify species for firewood.....

Specify species for rural timber.....

16. What are the most hampering threats to Hornbills in your area? Please rank them,

(1) High (2) Medium (3) Low (4) Don't know (*Tick the most appropriate*)

Sl. No.	THREATS	High	Medium	Low	Don't know
01.	Road construction				
02.	Power lines				
03.	Grazing and fodder collection				
04.	Logging and firewood collection				
05.	Forest fire				
06.	Disturbance (people & noise)				

CONSERVATION

17. How important would you rate the biological corridor and non-protected area in conservation of hornbills

(i) Very important (ii) Important (iii) Don't know (iv) Not important

18. Awareness on protected status of hornbills: (i) Aware (ii) Unaware

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19. Awareness on endangered status of hornbills: (i) Aware (ii) Unaware

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20. Your view on conservation of Hornbills?

(i) Social value (ii) Ecotourism value (iii) Conservation value

21. Additional information:

Do you have any other comments? Do you know of any tale/legend about hornbills? Do you like these birds?

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