2025-2040

HORNBILLS *of* NORTH BENGAL

A Conservation Action Plan for five species in the landscape

2025-2040

HORNBILLS *of* NORTH BENGAL

A Conservation Action Plan for five species in the landscape

We would like to acknowledge, and thank, each and every participant who took part in the workshop and contributed towards the conservation action plan:
Aditya Pradhan, Rana Dey, Amir Kumar Chettri , Ranjana Saha, Anil Lomgel, Rohan Pandit, Anup Rai, Rupen Lepcha, Apurba Chakraborty, Sana Huque, Archisman Bandyopadhyay , Sanjok Dewan, Biswapriya Rahut, Saumik Pal, Deo Prasad Pradhan, Sherub, Dipankar Lahkar, Sunil Rai, Dorjey Sherpa, Sunita Khatiwara, Dwaipayan Rano, Supriya Samanta, Mangal Tsering, T.R Shankar Raman, Pasang Lepcha, Trisa Bhattacharjee, Priya Tamang, Utpal Nandi, Rajib Saha, Sitaram Mahato, Kezajacho Dukpa and Sikander Dewan.

We thank the West Bengal Forest Department for the support provided towards the ongoing hornbill research in North Bengal and for supporting the creation of this conservation action plan for hornbills. We also thank all the members from the communities that we have engaged with during the course of the work for sharing their invaluable knowledge and understanding of hornbills and the forest and for contributing towards our work in many ways. We are deeply grateful to Sitaram Mahato, Kezajacho Dukpa and Sikander Dewan — for their immense contributions and dedication to the hornbill research work in North Bengal. We also thank Arkajyoti Shome and Dollar Ganguly for their contribution to this project in the past. We thank Dr. Rohit Naniwadekar, Dr. Pranav Trivedi, Soumya Banerjee, Saniya Chaplod, Sanjay Rai, our colleagues at Nature Mates-Nature Club and NCF's Eastern Himalaya Programme and admin team for their various contributions to the project.

We are grateful for the funding support from the Conservation Leadership Program (CLP) for trusting the process and for recognizing the value in the development of this conservation action plan. We also thank the Serenity Trust, Whitley-Segré Conservation Fund (WSCF), Stop Poaching Fund and Rohini Nilekani Philanthropies (RNP) for supporting the hornbill research work in North Bengal over several years.

For further information about this action plan and its implementation, please contact: Karishma Pradhan (karishma@ncf-india.org) or Dr. Aparajita Datta, Co-Chair (Asia) IUCN SSC Hornbill Specialist Group (aparajita@ncf-india.org) from Nature Conservation Foundation (NCF) or Arjan Basu Roy (naturemates@gmail.com) from Nature-Mates Nature Club.

A collaboration between the Nature Conservation Foundation, Nature Mates–Nature Club, the IUCN SSC Hornbill Specialist Group, and Zooreach/ IUCN SSC Conservation Planning Specialist Group

Front cover: A newly fledged Rufous-necked hornbill chick at Latpanchar; Sikander Dewan

Back cover: Forests of Buxa Tiger Reserve; Karishma Pradhan

Photo credits: Aparajita Datta; Deokaramit (Wikimedia Commons); Jaya Samkutty (eBird); Karishma Pradhan; Kezajacho Dukpa; Prem Tok; Shilpita Mandal; Sikander Dewan and Sitaram Mahato

Design: Janhavi Rajan, Nature Conservation Foundation, India

Recommended citation: Pradhan, K., Datta, A., Basu Roy, A., Mandal, S., Molur, S., Iyer, P., Das, P. 2025. Conservation Strategy and Action Plan for five species of hornbills in the North Bengal landscape of Indian Eastern Himalaya.

ORGANIZERS

nature conservation foundation

NATURE MATES

zoo reach
Zoo Outreach Organisation

বন বিভাগ

FUNDING INSTITUTIONS

CONSERVATION LEADERSHIP PROGRAMME

the serenity trust

ROHINI NILEKANI philanthropies

KNOWLEDGE PARTNERS

Hornbill Specialist Group

IUCN SSC Species Survival Commission

CONSERVATION PLANNING SPECIALIST GROUP
Changing the Future for Wildlife

PARTICIPATING ORGANIZATIONS

Aaranyak

aTree

birdwatchers' Society

EXISTENCE CONSORTIUM

HATHI SATHI FOUNDATION

hnaf

MAHANANDA ECO TOURISM AND CONSERVATION SOCIETY

NATURE ENVIRONMENT & WILDLIFE SOCIETY

N.V.S.E Society

PRAKRITI SAMSAD

WWF

SIKKIM FOREST

ཨོ་རྒྱན་དབང་ལྷུག་ནགས་ཚལ་ཞིབ་འཚོལ་དང་སྦྱོང་བརྡར་སྤེལ་ཁང་།
Ugyen Wangchuck Institute for Forestry Research and Training

CONTENTS

Acronyms and Abbreviations 1

Forewords 3

Executive Summary 6

CHAPTER 1. CONSERVATION ACTION PLAN (2025-2040) 7

Background 8

Hornbills of North Bengal 10

Hornbill research in North Bengal 11

Conservation Action Planning Workshop overview 12

About the Conservation Action Plan 13

Proceedings of the Conservation Planning Workshop for Hornbills of North Bengal 14

The Conservation Action Plan for Hornbills in North Bengal 20

Vision 20

Threats 20

Objectives and activities of the action plan 23

CHAPTER 2. STATUS REVIEW 47

Species description 48

Breeding biology 66

Nest trees of hornbills 68

The importance of hornbills: functional role 70

Threats and challenges 72

Global and Indian context 72

Hunting 72

Habitat loss, degradation and fragmentation 73

Climate change 74

CHAPTER 3: RESEARCH AND OTHER OUTPUTS 75

Key findings of the hornbill research in North Bengal 76

Hornbill distribution and abundance 76

Breeding biology of hornbills 79

Hornbill roost monitoring 81

Community engagement 83

Land use land cover map 84

Citizen science data: hornbill sightings 86

List of participants 91

References 93

Annexure I: The Conservation Planning Workshop 96

Features of the Conservation Planning Workshop 96

Acronyms *and* Abbreviations

ATREE – Ashoka Trust for Research in Ecology and the Environment
BWS – Birdwatchers' Society
HNAF – Himalayan Nature Adventure and Foundation
METACOS – Mahananda Ecotourism and Conservation Society
NCF – Nature Conservation Foundation
NEWS – Nature Environment & Wildlife Society
NMNC – Nature Mates-Nature Club
NVSES – Neora Valley Sustainable Ecological Society
UWIFORT – Ugyen Wangchuck Institute for Forestry and Research and Training
WBFD – West Bengal Forest Department
WWF KCL – World Wildlife Fund-India's Khangchendzonga Landscape
Zooreach – Zoo Outreach Organisation

Forewords

HORNBILLS OF NORTH BENGAL: A BLUEPRINT FOR CONSERVATION

To call hornbills among the most magnificent birds of tropical Asia and Africa would still be an understatement. India is fortunate to harbour nine of the 32 hornbill species found in Asia, including two that are found nowhere else in the world—the Malabar Grey and the Narcondam hornbills. The northeastern region of India, along with northern West Bengal, is home to five hornbill species. Sadly, all five are facing varying levels of threat. The usual culprits—habitat loss, felling of mature trees, hunting for ornamental body parts, and a covert illegal wildlife trade—are driving their decline. This unfortunate pattern repeats across the globe, affecting most of the 62 known hornbill species, of which 26 are listed as threatened or near threatened by BirdLife International and the IUCN.

Fortunately, targeted, science-driven conservation efforts have proven effective in saving species across the world. In the same spirit, a commendable initiative has been launched by the Nature Conservation Foundation, Nature Mates, Zoo Outreach Organisation, and the West Bengal Forest Department through the release of this comprehensive and timely Hornbill Action Plan. Though this document focuses specifically on North Bengal and its five hornbill species, the conservation strategies it recommends are broadly applicable to many other species and regions. I consider this action plan a model template—one that can guide similar efforts for other taxa.

The high calibre of this publication is unsurprising, given the impressive team behind it: seasoned hornbill researchers like Aparajita Datta, Karishma Pradhan, TR Shankar Raman, and committed conservationists such as Sanjay Molur, Dipankar Lahkar, Arjan Basu Roy, among several others. The plan is grounded in extensive stakeholder consultation—bringing together forest department officials, local NGOs, and regional experts. As I often say,

“Art is ‘I’, Science is ‘we’, and Conservation is ‘us’.” This document embodies that sentiment beautifully: conservation belongs to all of us, from villagers residing in hornbill habitats to policymakers in Kolkata’s Writers’ Building.

The more difficult challenge lies ahead—translating these thoughtful recommendations into meaningful action. Implementation must be the joint responsibility of government agencies, civil society groups, and local communities. Ultimately, the true measure of success will be visible not just on paper but in the wild—in the form of thriving hornbill populations.

The ambitious goals of this plan are matched by the magnitude of challenges ahead. Yet, I am encouraged by the image on page 19—a group photograph of bright, young conservationists, all beaming with enthusiasm. Their optimism and commitment offer a glimpse of hope that hornbills will continue to grace our forests. Let the future of hornbills, and of countless other species, be as vibrant and promising as the smiles of these spirited youth.

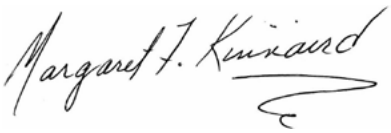
Dr. Asad Rahmani
Eminent Ornithologist &
Former Director, Bombay Natural History Society

PROTECTING NORTH BENGAL'S HORNBILLS: A ROADMAP FOR ACTION

Hornbills are among the most visually striking and ecologically significant bird species in Asia and Africa. Their impressive beaks and casques are as fascinating in form as they are in function, and their critical role as seed dispersers is pivotal in maintaining the health and biodiversity of the ecosystems they inhabit. Hornbills are also cultural icons, deeply embedded in the folklore and traditions of many communities across Asia and Africa.

The North Bengal landscape of India's Eastern Himalaya is home to five species of hornbills, including the globally threatened Great, Wreathed, and Rufous-necked hornbills. These species, along with the Indian Grey and Oriental Pied hornbills, contribute to the region's rich avifauna. However, they face increasing challenges to their persistence, including habitat loss, degradation and fragmentation, hunting for meat and body parts and most recently, a changing climate. Given their ecological, social and economic importance, losing these populations would have devastating impacts on nature and people's well-being.

This report highlights the remarkable efforts made to date to monitor and protect these birds in North Bengal but most importantly it lays out an action plan co-created by a multidisciplinary team comprised of private and public sectors. One of the stated goals of the IUCN Hornbill Specialist Group is to ensure robust actions plans that aim to better focus and hone our conservation efforts for all 62 hornbill species; this report provides a much-needed contribution to that goal. By identifying the greatest threats to the populations, the gaps in our knowledge and the goals, objectives and specific activities needed for each species, the information provided here allows researchers, conservationists, policymakers and local communities to move in the right direction to safeguard hornbills in north Bengal and beyond. Our next challenge is to ensure that the drafted actions are funded, launched and show positive changes in hornbill conservation. It is not a small challenge and will take time but is critical for the region and the world.



Dr. Margaret Kinnaird
Margaret Kinnaird Conservation biologist &
Managing Editor for IUCN PARKS journal
Former Head of WWF-International

Executive Summary

Conservation Action Plan for five species of hornbills in the North Bengal landscape of Indian Eastern Himalaya (2025-2040)

The northern part of West Bengal is home to five species of hornbills—Great, Indian Grey, Oriental Pied, Rufous-necked, and Wreathed Hornbills. These birds, with wide-ranging habitats, are found across Protected Areas (PAs), Reserved Forests, Community Forests, agricultural fields, and even in and around human settlements. A multi-stakeholder approach is essential to protect and secure hornbills and the habitat in the long-run.

A Conservation Action Planning workshop held from February 21-23, 2024, brought together stakeholders from various sectors, including the West Bengal state forest department, wildlife research and conservation organizations, community members, independent researchers, tea gardens and youth groups from North Bengal, Sikkim, Assam, and Bhutan. The workshop facilitated intensive discussions leading to the development of a comprehensive Conservation Action Plan for hornbills in North Bengal.

The plan outlines a long-term, 15-year strategy to protect and study hornbills in this important landscape, focusing on a multi-stakeholder collaboration. The goal is to establish a healthy, sustainable, and growing hornbill population by 2040. The plan is organized into five key areas:

1. Species and Habitat Management
2. Research and Data Sharing
3. Community Stewardship and Ownership
4. Multi-stakeholder and Transboundary Coordination
5. Outreach and Education

Successful implementation of the plan will require collaboration and engagement among organizations, individuals, and communities involved. The overall aim is to foster a collective effort that ensures the long-term conservation of hornbills and the habitat in North Bengal and the adjoining transboundary landscape.

CHAPTER 1

CONSERVATION ACTION PLAN

BACKGROUND

Hornbills belong to the Order Bucerotiformes in two families – the Bucorvidae family (two species of ground-hornbills in Africa) and the rest of the species in the Bucerotidae family. There are 62 hornbill species currently recognized worldwide, of which 32 species are found in Asia, with 30 in Africa (including the two ground-hornbills).

With their striking over-sized beaks and casques and often contrasting black, white or brown plumage, bright patches of orbital skin, long eyelashes, brightly colored gular (throat) pouches, they are unique and charismatic. They occur in wet tropical forests, open drier forests and savannahs and the Asian forest hornbills are among the largest volant birds in tropical forests. They range in size from 200–300 g to 4 kg.

Hornbills get their name from the prominent casques – a horn-like projection on the top of the beak. Most hornbill species have prominent casques, while some have lines or ridges on the upper beaks, and some like the Malabar Grey Hornbill does not have a casque or markings. Casques are usually hollow, only the Helmeted Hornbill has a solid casque.

India is home to nine hornbill species, of which five are listed as Vulnerable by the IUCN. Among these five, the Narcondam Hornbill is endemic to a 6 km^2 island in the Andaman & Nicobar Islands, while the Malabar Grey Hornbill is endemic to the Western Ghats. The Great Hornbill occurs in three disjunct populations in the Western Ghats, Northeast India, and the foothills in northern India. Within India, the Wreathed Hornbill and Rufous-necked Hornbill occurs in Northeast India and northern West Bengal. The Rufous-necked Hornbill has a more restricted distribution in Northeast India than the Wreathed Hornbill and is usually found in elevations above 500 m. The Austen's Brown Hornbill occurs in eastern Assam, Arunachal Pradesh, parts of Mizoram, Nagaland and Manipur, while the Malabar Pied-Hornbill found in parts of southern and central India are listed as 'Near Threatened' on the IUCN Red List of Threatened Species.

The Oriental Pied Hornbill is listed as Least Concern and has disjunct populations in India. This species is also known to adapt in secondary forest habitats, agriculture lands and degraded habitats. The Indian Grey Hornbill is also listed as Least Concern and is the most widely distributed species in the Indian sub-continent. The Great, Wreathed, Rufous-necked, Oriental Pied, and the Brown Hornbill are more widely distributed in South and South-east Asia.

While hornbills are omnivores, many species, especially the large-bodied species are highly frugivorous, and therefore play an important ecological role as seed dispersers as they disperse seeds far from the parent fruit trees without causing damage to the seeds. Passage

through the gut often enhances germination success of seeds. Hornbills are also important in the folklore, myths of many rural communities and in some sites boost bird tourism opportunities improving the local economy.

Hornbills are secondary-cavity nesters, which means they cannot build their own nest; hence they depend on natural cavities that have formed due to trunk decay or due to broken branches or facilitated by other birds such as woodpeckers. Parental investment of hornbill parents during the breeding season is very high as the female seals herself inside the cavity for 3-4 months, while the male delivers food for the female and chick during this long breeding period.

There have been several studies on hornbills and their biology in India. More studies have been focused on the species in the Western Ghats and Northeast India, especially in the state of Arunachal Pradesh. Very little was known about hornbills and their distribution from the northern parts of West Bengal, which is part of the Eastern Himalaya.

HORNBILLS OF NORTH BENGAL

Five species of hornbills are found in North Bengal - the Great Hornbill (*Buceros bicornis*), Indian Grey Hornbill (*Ocyceros birostris*), Oriental Pied Hornbill (*Anthracoceros albirostris*), Rufous-necked Hornbill (*Aceros nipalensis*) and Wreathed Hornbill (*Rhyticeros undulatus*). The Great, Wreathed and Rufous-necked Hornbills are globally threatened and are listed as Vulnerable by the IUCN Red List (BirdLife International 2020). The Oriental Pied and Indian Grey Hornbills are listed as 'Least Concern' and the latter species is mostly found in agricultural, semi-rural landscapes and near urban settlements.

Hornbills are known to be distributed across several protected areas (PAs) in northern West Bengal such as the Buxa Tiger Reserve, Jaldapara National Park, Gorumara National Park, Chapramari Wildlife Sanctuary, Neora Valley National Park and Mahananda Wildlife Sanctuary. Apart from these PAs, hornbills also occur in the territorial forests of Jalpaiguri, Kalimpong, Cooch Behar, Baikunthapur and Kurseong Divisions. Many human settlements, crop lands, tea gardens and cinchona plantations interspersed between these forest areas, are also used by hornbills in this landscape.

North Bengal is also the westernmost limit of the global distributional range for the Wreathed and Rufous-necked Hornbills.

HORNBILL RESEARCH IN NORTH BENGAL

Nature Mates-Nature Club (NMNC) and the Nature Conservation Foundation (NCF) started the hornbill research and conservation work in North Bengal.

The broad objectives of the hornbill research and conservation project were to:
1) Collect baseline information on hornbill ecology (population status, breeding, roosting, diet) of all four sympatric hornbill species found in the North Bengal landscape.
2) Quantify and understand the vegetation structure and composition of hornbill habitats.
3) Initiate hornbill conservation in collaboration with the West Bengal Forest Department and other important stakeholder groups.

Since 2017, we have worked extensively to understand hornbills and their habitat in Buxa Tiger Reserve and since 2021 in Latpanchar, fringe village of Mahananda Wildlife Sanctuary. Apart from these, short surveys for hornbills have also been conducted in Mahananda Wildlife Sanctuary, Neora Valley National Park and Jaldapara National Park.

At Buxa Tiger Reserve, we surveyed the park over two non-breeding seasons to estimate hornbill densities and abundance. This was the first detailed baseline of hornbill population from North Bengal. The estimated density of the three large-bodied species – Great Hornbill (GH), Wreathed Hornbill (WH) and Rufous-necked Hornbill (RNH), was < 1 bird per km^2, while that of the Oriental Pied Hornbill (OPH) was around 11 birds per km^2 (Pradhan et al. 2024b).

We have also located and monitored 47 hornbill nests of four species in Buxa Tiger Reserve since 2018 and six hornbill nests of two species in Latpanchar and the Mahananda Wildlife Sanctuary since 2022. The nesting period varies across species but largely takes place between February-end to July at both sites. The mean nesting duration in Buxa for GH is 117 days ((SD ± 2.65), OPH is 88 days (SD ± 5.20), RNH is 118 days (SD ± 2.65) and WH is 133 days (SD ± 9). The average nesting success of hornbill nests in Buxa TR is 81% (range of 50-100 %) from 2018 to 2024 and at Latpanchar the average nesting success is 88.89% from 2022 to 2024 (range of 66 – 100%).

Additionally, we monitor seven roost sites in Buxa Tiger Reserve: four of these sites are used by the Great Hornbill and are located in hill forest patches close to small water bodies. Three sites are used by Wreathed Hornbill in riverine habitats (Mandal et al., 2024). The count of GH individuals at roost sites range from 1 – 20 individuals daily, whereas the WH numbers range from 1-224 individuals daily (Mandal et al., 2024). The number of birds visiting the roost sites decreases in the breeding season.

The vegetation surveys in Buxa Tiger Reserve estimate the average tree density as 91.9 trees/ha (SE ± 7.5) with the overall tree density (GBH ≥ 25 cm) ranging from 7.8 to 425.6 trees/ha across the 81 trails that were sampled (Pradhan et al., 2024b). Since 2021, we have also been studying the tree phenology of selected species to understand the seasonal and annual patterns of leafing, flowering and fruiting of 63 tree species in Buxa TR and 23 tree species in Latpanchar.

The hornbill research in North Bengal has helped us understand the ecology of hornbills better and has also helped to identify threats, research and conservation opportunities in the landscape. The research findings are shared in detail in Chapter 2 of the action plan.

WORKSHOP OVERVIEW

North Bengal is an important landscape for hornbills, with three globally threatened species found here, two of which occur at the extreme end of their global distributional range. The distribution of hornbills in North Bengal spreads over a large area that includes several protected areas, reserved forests, plantations and settlements. The jurisdiction and governance bodies differ among these sites, and each site has several stakeholders that would have a crucial role in designing and implementation of any conservation intervention.

We believed that it was important to share our research findings with other groups in the region and increase support for the long-term conservation and persistence of hornbills in the North Bengal landscape. This led to the idea of developing a conservation action plan for hornbills through a multi-stakeholder approach. It was expected that the conservation action plan would broadly help identify the threats, priority needs and develop a road map to protect and improve overall hornbill conservation in North Bengal by establishing an alliance with key stakeholders.

The objectives of developing the hornbill conservation plan were to:

1. Develop a clear plan and strategy for a landscape-level approach to hornbill conservation through a facilitated discussion and planning with goals, objectives, targeted activities with timelines.
2. Identify institutions and individuals to drive and implement the activities/ interventions articulated in the action plan.
3. Generate funding and support for activities and conservation measures.
4. Develop evaluation and monitoring indicators for tracking progress.
5. Build alliances and a collaborative conservation network for knowledge-sharing, action and training/building capacities.

ABOUT THE CONSERVATION ACTION PLAN

Conservation action planning is a process where all aspects of conservation of a species (or a small group of similar/related species) or a landscape such as: threats, geographic distribution, landscape and topography, land use, biology, ecology, social, demography, are discussed by representative members of all stakeholder groups in an objective manner with the support of a facilitator.

The Conservation Planning Specialist Group (CPSG) supports an approach known as the One Plan Approach (https://www.cpsg.org/) where species conservation planning includes populations occurring in the wild with relevant stakeholders such as wildlife biologists, managers, conservationists, and local community members, and populations occurring in captivity (like in Zoos) with relevant stakeholders such as zoo managers, educators, veterinarians, and captive breeding specialists. Although conservation planning for these two populations (wild and captive) has been undertaken separately in the past, the current One Plan approach integrates this wherever applicable.

In this case, the conservation action planning workshop was more focussed on landscape level conservation using hornbills as a flagship species group to develop a conservation action plan for the region.

PROCEEDINGS OF THE CONSERVATION PLANNING WORKSHOP FOR HORNBILLS OF NORTH BENGAL

A Conservation Action Planning workshop was held from February 21-23, 2024 to discuss and plan necessary actions for hornbill conservation in the region. The workshop was facilitated by Dr. Sanjay Molur and Mrs. Priyanka Iyer from the IUCN Conservation Planning Specialist Group-South Asia and Zoo Outreach Organization.

The workshop was attended by 38 participants primarily from the North Bengal region, and a few members from Sikkim, Assam and Bhutan. Among the participants were officials from the West Bengal Forest Department representing the five forest divisions of north Bengal, community members, scientists and researchers from 12 NGOs, an official from the tea garden association, nature guides, and civil society members. The workshop facilitated intensive discussions leading to the development of a comprehensive Conservation Action Plan for hornbills in North Bengal. The proceedings for each day is shared below.

Day 1:

Introduction and presentations

The introductory talk by Dr. Sanjay Molur & Priyanka Iyer introduced participants to the workshop process, with a brief introduction to the conservation planning specialist group and also brief preliminary description of the process. This was followed by a presentation by Dr. Aparajita Datta on a general introduction to hornbills, their habitats and the need for hornbill conservation efforts. A presentation on hornbill research and conservation in North Bengal was presented by Karishma Pradhan that shared some baseline information from the work in North Bengal. A brief presentation on the different types of land use and forest cover found in the region was shared by Priyanka Das. A land use and forest cover map was also presented with areas and percentages for better understanding.

Participant introductions

The participants introduced themselves mentioning the region or organization that they represented.

A detailed introduction of CPSG workshop process was then presented by Dr. Sanjay Molur and Priyanka Iyer followed by an introduction to the visioning process to come up with a vision statement.

The participants formed different working groups of Foresters, Community, NGOs, Cross-border to help draft a vision statement for the conservation action plan. Each group presented their vision statement and members then collectively attempted to edit the statement.

Day 2:

Vision statement

The day started with the involvement of all participants to continue discussing and improving the Vision Statement for the conservation action plan.

Threats to hornbills and the habitat

Participants were then divided into four mixed groups. Using the Mind Map technique, each group had to create a mind map listing all possible threats to hornbills and the habitat. The 4 groups were - Oriental Pied hornbill; Rufous-necked Hornbill; Indian Grey Hornbill and Wreathed Hornbill. Each group comprised 2 Recorders (flipchart and computer), a Facilitator, and a Presenter. Each group had to list out all the possible threats related to hornbills and their habitats using a mind map approach. Attempts were then made to find linkages between the listed threats. Presenters of each group shared their threats and linkages in a plenary discussion.

The group members for this exercise are listed below:

Group: Indian Grey Hornbill

Members: Saumik Pal, Apurba Chakraborty, Sanjok Dewan, Sitaram Mahato, Dorji Sherpa, Amir Chhetri, Kezajacho Dukpa, Archishman Bandyopadhyay, Sherub

Group: Oriental Pied Hornbill

Members: Karishma Pradhan, TR Shankar Raman, Sunita Khatiwara, Sana Huque, Aditya Pradhan, Utpal Nandi, Dwaipayan Rano, Rajib Saha

Group: Wreathed Hornbill

Members: Arjan Basu Roy, Aparajita Datta, Pasang Lepcha , Sikandar Dewan, Priya Tamang, Rupen Lepcha, Alok Rai

Group: Rufous-necked Hornbill

Members: DP Pradhan, Rohan Pandit, Priyanka Das, Shilpita Mandal, Supriya Samanta, Dipankar Lahkar, Anil Lomjel, Trisa Bhattacharjee

Identifying goals for the conservation plan

After discussing the threats, the next session revisited the vision statement in a plenary discussion format to separate and list out different themes from the vision statement. Through discussions, all related themes were then categorized into 5 goals that would broadly help to achieve the vision.

The goals that were identified are listed below:

Species and habitat management
Outreach and education
Community ownership and stewardship
Multi-stakeholder engagement and trans-boundary coordination
Research and data sharing

Goals, objectives and activities

After this, the participants were divided into five working groups on the basis of the five goals that were identified in the previous exercise. Participants were given a choice to join the group based on their interest in the listed goals. Each working group had to then list objectives to achieve the goals.

In the plenary session, each working group put forth their objectives before all participants to elicit suggestions.

This was followed by another break-out session within the same working group members. In this session, members came together to list out activities against each of the previously listed objectives. Additionally, the activities had to be identified as short-term and long-term, frequency of conducting the activities and the areas where the activities would be carried out.

The group members for listing out objectives and activities for each goal are listed below:

Goal 1: Species and habitat management

Members: Dorjay Sherpa, Anup Rai, Apurba Chakraborty, Saumik Pal, Mangal Tshring Lepcha, Utpal Nandi, Biswapriya Rahut, Dwaipayan Rano, Archisman Bandyopadhyay

Goal 2: Outreach and education

Members: Rajib Saha, Sitaram Mahato, Priya Tamang, Kezajacho Dukpa, Shilpita Mandal, Trisa Bhattacharjee

Goal 3: Community stewardship and ownership

Members: Sana Huque, Karishma Pradhan, Sanjok Dewan, Rupen Lepcha, Amir Chhetry, and Deo Prasad

Goal 4: Multi-stakeholder and Transboundary Coordination

Members: Priyanka Das, Dipankar Lahkar, Supriya Samantu, Sherub

Goal 5: Research and data sharing

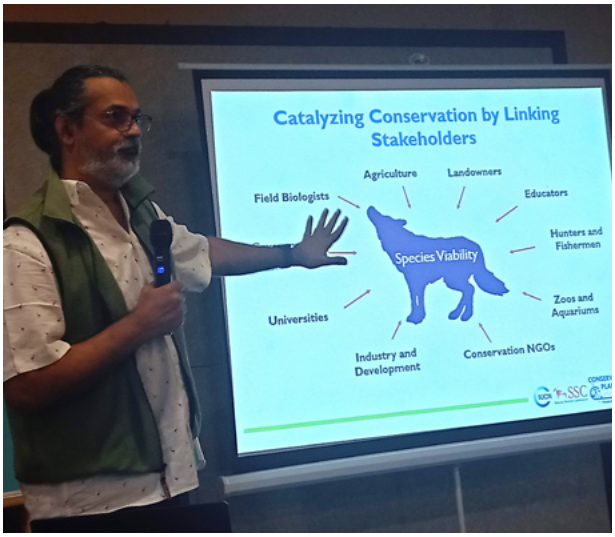
Members: Aditya Pradhan, Sunita Khatiwara, Rohan Pandit, Arjan Basu Roy, TR Shankar Raman, Aparajita Datta

Day 3:

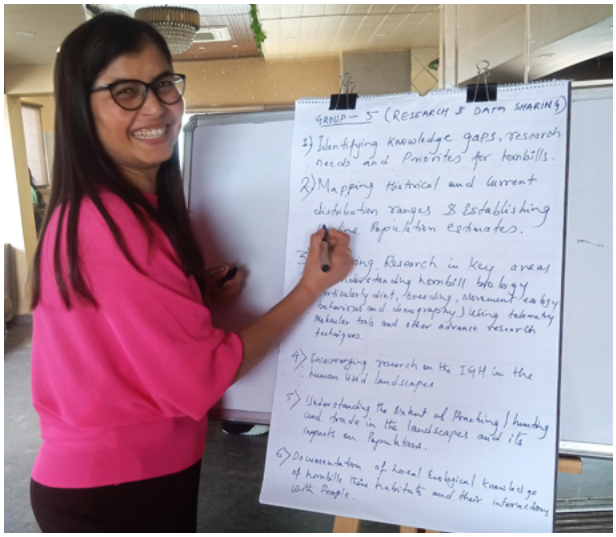
Participants gathered in a plenary format to go through the activities under each goal and then together identified key players in implementing each of the action points. A lead organisation/individual was identified along with collaborating organisations/ individuals. Some suggestions of non-participatory organisations/individuals were made who will be contacted post workshop for their inputs and confirmation. After the plenary, the participants expressed their feedback about the workshop and its utility during the final closing where certificates were distributed. The workshop closed with the promise of sending out a first draft by email for the participants to comment upon and for exploring possible collaborations.


02/23/2024


Hornbills disperse seeds of over 100 tree species


Catalyzing Conservation by Linking Stakeholders
Agriculture
Landowners
Field Biologists
Educators
Hunters and Fishermen
Species Viability
Zoos and Aquariums
Universities
Industry and Development
Conservation NGOs


Buxa Tiger Reserve
7th year of monitoring hornbill nests in 2024
Intensive nest watches in 2018 & 2019 at 2 GH and RNH nests
37 known hornbill nests of all four species until 2023
Nest tree characteristics and nest habitat recorded


GROUP – 5 (RESEARCH & DATA SHARING)
1) Identifying knowledge gaps, research needs and Priorities for hornbills.
2) Mapping historical and current distribution ranges & Establishing
Population estimates.
4) Encouraging research on the IGH in the
human Used landscapes
5) Understanding the Status of Poaching / hunting
and trade in the landscapes and its
impacts on Populations.
6) Documentation of local Ecological knowledge
of hornbills their habitats and their interactions
with People.


zoOreach
ction Planning Workshop
ills in North Bengal
2024 at Siliguri, West Bengal
Supported by:

The Conservation Action Plan *for* Hornbills *in* North Bengal

VISION

By 2040, to establish a healthy, sustainable, and growing hornbill population in North Bengal and the adjoining transboundary landscape by promoting collaboration, habitat protection, connectivity and restoration, scientific and traditional knowledge exchange, sustainable management strategies, threat reduction with community ownership and stakeholder engagement

THREATS

Habitat loss and degradation

- Deforestation - Logging and felling of trees
- Clear felling of trees in territorial forests
- Lopping of dead dry trees and fuelwood collection
- Limited availability of hornbill nest trees, cavities, roost trees and food trees in PAs, territorial and community forests
- Disturbance and loss of hornbill roosting sites
- Habitat fragmentation and limited connectivity between forest patches
- Land encroachment including outside of PA and notified forest areas
- Forest fires

Management practices

- Very few tree species that are known to be hornbill food, nest and roost tree species are currently used in the forest department's plantation drives
- Unscientific afforestation schemes
- Clear felling coupes (CFC) leading to habitat loss and loss of potential nest trees and hornbill food trees
- Increase in monoculture & cash crop plantations and change in land-use pattern
- Better management practices required for invasive plant species
- Limited funding support to the local forest divisions that leads to shortage of man-power and inadequate vigilance and protection in forests

- Species specific management plans can potentially alter habitats for other wildlife species and change vegetation composition
- Lack of inclusivity of local people in decision making and implementation of management and conservation practices
- Unregulated use of pesticides and insect trapping mechanisms in adjoining tea gardens affecting pollination and other ecosystem services
- Limited rescue and rehabilitation centres for injured wildlife or lack of awareness among local communities of existing rescue and rehabilitation centres for injured wildlife

Developmental activities

- Ill-planned and infrastructure development and linear infrastructure disrupting natural habitats and creating forest fragments
- High tension lines causing hornbill deaths by electrocution
- Erection of mobile towers

Natural threats

- Wind storm, cyclone, landslide causes felling of nest, food and roosting trees
- Natural predation (marten, snakes)
- Flood and changes in river courses can alter hornbill roosting sites

Anthropogenic pressures

- Poaching and hunting of adult and chick hornbills (for meat, trade, amusement)
- Marginalisation of communities (lack of settlement, forest rights and limited access to resources)
- Lack of awareness of wildlife laws and forests rights
- Unregulated tourism, increased demand for wildlife sightings among visiting urban tourists and improper waste management
- Unethical birding practices and disturbance to birds even during the breeding season
- Noise disturbance (crackers to drive away wildlife, honking, chain-saw, loud picnic music, playback) and light pollution
- Use of poisons, pesticides and insect traps in crop fields and tea gardens that affects pollination
- Lack of alternative livelihood in the forest fringe villages results in increased anthropogenic pressures on natural resources, shifting cultivation, forest fires and increased grazing pressures
- Geopolitical tension, political and economic instability increases people's dependence on forest resources
- Cultural use in traditional practices of meat, feather, beaks, casque and oil in medicines, shaman practices, traditional beliefs and superstition

- Improper management plans during large gatherings for religious festivals inside forests
- Growth of human population surpasses the carrying capacity of an area leading to over exploitation of natural resources and disrupting the ecological balance
- Lack of ownership and stewardship of local communities and local administrative bodies
- Lack of awareness on environment and its linkages to overall human well-being among people

Limited scientific research

- Limited scientific knowledge and understanding on hornbill ecology in the landscape
- Lack of documentation and sharing of traditional knowledge
- Insufficient understanding and data on diseases affecting hornbills
- Lack of data sharing and limited public engagement among researchers and other stakeholders
- Limited funding availability, resources and interest to support research and conservation

Climate change

- Changes in the tree phenology and changes in fruit availability patterns and possible impact on breeding period and breeding success

Insufficient data sharing and collaborations

- Lack of data sharing and collaboration between different stakeholders (NGOs, Forest Department, JFMC, local communities, administration and national and international governments)
- Limited public engagement
- Lack of international policies and collaborations between governments and NGOs to conserve species and the habitat in the larger transboundary landscape

OBJECTIVES AND ACTIVITIES OF THE ACTION PLAN

GOAL 1
OBJECTIVE 1

Goal 1: Enhance hornbill conservation efforts and improve habitat management.

Objective 1: Protection of hornbills and their habitat in and around protected areas.

Activity	Deliverable/Output	Timeline	Region	Key players
1.1 Initiate smart patrolling for observing, recording and protecting hornbills, other wildlife and tree species.	1.1.1 Development of a monitoring system/app for entering hornbill detections, nesting, roosting observations. 1.1.2 Development of detailed protocols for regular monitoring of hornbill populations, nest trees, and food trees. 1.1.3 Trained master trainers from different forest divisions and members from the JFMCs and EDCs 1.1.4 Collated and analysed data on hornbill numbers, movement, habitat use, and overall habitat.	Long-term, recurring frequency	All notified forest areas (Protected Areas and Territorial Forests), Revenue/ Community (Khasmahal) forests and Sacred forests	WBFD, NMNC, NCF, METACOS, WWF-KCL, NVSES
1.2 Include protection of hornbills, nest trees and food trees and overall habitat in the working and management plans of the Wildlife and Territorial Forest Divisions	1.2.1 Recommendations provided for hornbill conservation and habitat improvement in the management plans of the Forest Department 1.2.2 Protection measures for hornbills, nest trees, food trees, and overall habitat included in the working and management plans of different Divisions of the Forest Department 1.2.3 Improved protection and management of critical hornbill habitats.	Long-term, site-specific	All notified forest areas (Protected Areas and Territorial Forests)	NCF, NMNC, IUCN HSG, WBFD

GOAL 1
OBJECTIVE 1

Activity	Deliverable/Output	Timeline	Region	Key players
1.3 Identification and protection of traditional sacred groves by community participation	1.3.1 Traditional sacred groves identified and documented with community participation 1.3.2 Increased community engagement and stewardship in conserving these important sites. 1.3.3 Strengthened collaboration between local communities and conservation efforts.	Long-term, recurring, site-specific	Sacred groves across the hornbill distribution range of North Bengal	Local communities, WWF-KCL, WBFD, NVSES, METACOS, NMNC, Amir Chhetri
1.4 Management of invasive species and its threats to key habitats	1.4.1 Report on the spread and impact of invasive species in hornbill habitats through secondary literature review, forest department's management plans and on-ground surveys 1.4.2 Effective management strategies for invasive species developed and implemented. 1.4.3 Enhanced health and stability of key hornbill habitats	Long-term, recurring, site-specific	All notified forest areas (Protected Areas and Territorial Forests) and Revenue/ Community (Khasmahal) forests	WBFD, NCF, NMNC

Activity	Deliverable/Output	Timeline	Region	Key players
1.5 Train and equip rescue and rehabilitation centres to handle injured hornbills and other birds	1.5.1 Well-equipped rescue and rehabilitation centres with trained staff for handling injured and hornbills rescued from trade 1.5.2 Enhanced capacity for the effective treatment and care of injured hornbills 1.5.3 Improved survival and recovery rates for injured hornbills and other bird species. 1.5.4 Increased community awareness and support for wildlife rescue and rehabilitation efforts.	One time, long-term	Targeted rescue and rehab centres in North Bengal	IUCN-HSG, WBFD, NCF, NMNC
1.6 Skill development and execution of artificial nest box installation and maintenance and repair of nests when necessary.	1.6.1 Number of trained members on tree climbing and nest repair skills 1.6.2 Number of nests repaired to make them suitable for nesting 1.6.3 Number of occupied nests after the repair 1.6.4 Number of artificial nest boxes installed and used	Short-term, periodic, site-specific	All notified forest areas (Protected Areas and Territorial Forests), Revenue/ Community (Khasmahal) forests, tea gardens and cinchona plantations	IUCN HSG, NCF, METACOS, NMNC, WBFD
1.7 Identification of cavities and potential cavities for hornbill nesting through routine observation and monitoring	1.7.1 Increased number of hornbill nests and potential nest trees protected in various sites	Long-term, recurring, site-specific	All notified forest areas (Protected Areas and Territorial Forests) and Revenue/ Community (Khasmahal) forests	Local communities, WBFD, NVSES, METACOS, NMNC, NCF

GOAL 1
OBJECTIVE 2

Goal 1: Enhance hornbill conservation efforts and improve habitat management.

Objective 2: Improve hornbill habitat and habitat connectivity using ecologically-sound and science-based restoration.

Activity	Deliverable/Output	Timeline	Region	Key players
2.1 Incorporation of restoration in existing management plans to improve habitat and connectivity of forests	2.1.1 Restoration practices incorporated into existing management plans to enhance habitat quality and forest connectivity 2.1.2 Increased habitat availability and movement corridors for hornbills and other wildlife.	Long-term	All notified forest areas (Protected Areas and Territorial Forests) and Revenue/Community (Khasmahal) forests and tea gardens	WBFD, Tea Gardens, NCF, NMNC
2.2 Conduct workshops and trainings for the Forest Department frontline staff, community members, BMCs, JFMCs and EDCs and other formal and non-formal local NGOs and youth organizations on ecological restoration practices and monitoring protocols	2.2.1 Training and workshops conducted on ecological restoration practices and monitoring protocols. 2.2.2 Increased knowledge and skills in ecological restoration and monitoring among participants 2.2.3 Strengthened collaborations between communities and institutions involved in ecological restoration projects.	Long-term, recurring	North Bengal and the adjoining states	NCF, NMNC, WWF, WBFD, METACOS, NVSES, Priyanka Das and Amir Chhetri
2.3 Raise indigenous plant species in forest nurseries and community-owned nurseries for restoration and provide trainings on nursery management	2.3.1 Trainings conducted on nursery management, collection of seeds and restoration practices 2.3.2 Native plant species raised in forest and community-owned nurseries for restoration projects. 2.3.3 Enhanced capacity of nurseries to produce and manage indigenous plants.	Long-term, recurring	Forest Department nurseries, community-owned nurseries and tea garden nurseries	WBFD, NCF, NMNC, Priyanka Das and Amir Chhetri

Activity	Deliverable/Output	Timeline	Region	Key players
2.4 Assist natural regeneration of saplings and carry out supplemental planting with native tree species to improve habitat and connectivity	2.4.1 Area of restored habitats using scientific restoration practices 2.4.2 Supplemental planting of native tree species to enhance habitat quality and connectivity. 2.4.3 Improved habitat conditions in the restored areas	Long-term, recurring	All notified forest areas (Protected Areas and Territorial Forests) and Revenue/Community (Khasmahal) forests	WBFD, Local communities and local NGOs, NCF-NMNC, WWF-KCL
2.5 Application of social and agro-forestry model in the community –owned land to connect fragmented forest patches	2.5.1 Improved connectivity between forest patches 2.5.2 Economic benefits to the local communities	Long-term, recurring	Revenue/Community (Khasmahal) forests	Social Forestry Division, local communities and local NGOs, WWF-KCL, NMNC, NCF, NVSES, METACOS
2.6 Establishing fire management team especially during dry season	2.5.1 Create local groups and facilitate trainings to increase skilled personnel 2.5.2 Develop fire-management protocols	Long term, recurring	All notified forest areas (Protected Areas and Territorial Forests) and Revenue/Community (Khasmahal) forests	WBFD, local community members

GOAL 2
OBJECTIVE 1

Goal 2: Building and sharing scientific and traditional knowledge for hornbill research and conservation.

Objective 1: Identify knowledge gaps and research needs and priorities for hornbills.

Activity	Deliverable/Output	Timeline	Region	Key players
1.1 Review and compile all relevant literature on hornbills from the landscape to understand the past status and distribution of hornbills in the region	1.1.1 Comprehensive review and compilation of relevant literature on hornbills from the landscape. 1.1.2 Detailed understanding of the past status and distribution of hornbills in the region. 1.1.3 Improved knowledge base for developing conservation strategies.	Short-term (1-2 years), one-time	North Bengal and the adjacent states and countries	NMNC and NCF
1.2 Brainstorming workshop to decide research needs and priorities	1.2.1 Identification of research needs and priorities for hornbills in the landscape 1.2.2 Research plans and strategies developed based on workshop discussions. 1.2.3 Strengthened collaboration among researchers, conservationists, and stakeholders	Short-term; one-time	North Bengal and the adjacent states and countries	NMNC and NCF, Bhutan (UWIFORT)- Dr Sherub

Goal 2: Building and sharing scientific and traditional knowledge for hornbill research and conservation.

GOAL 2
OBJECTIVE 2

Objective 2: Mapping historical and current distributional ranges and monitoring population of hornbills across the North Bengal landscape.

Activity	Deliverable/Output	Timeline	Region	Key players
2.1 Range-wide distribution survey using established standardized monitoring protocols through a collaborative approach with all relevant stakeholders	2.1.1 Established standardized monitoring protocols for hornbill distribution and population estimation 2.1.2 Baseline data established for hornbill populations across their range 2.1.3 Improved understanding of hornbill distribution, habitat use, and population dynamics.	One-time, short-term (2 years), entire area	All notified forest areas (Protected Areas and Territorial Forests), Revenue/ Community (Khasmahal) forests, Tea gardens and Cinchona plantations	BWS, NCF, NMNC, METACOS, NVSES, with others relevant groups
2.2 Carry out co-ordinated surveys to estimate and monitor hornbill population across the landscape every four years	2.2.1 Census reports on population data and trends for hornbills 2.2.2 Improved understanding of population changes and conservation status over time. 2.2.3 Strengthened collaboration and data-sharing among survey teams and stakeholders.	Long-term, recurring	All notified forest areas (Protected Areas and Territorial Forests), Revenue/ Community (Khasmahal) forests, Tea gardens and Cinchona plantations	NMNC, NCF, Aaranyak, BWS, WBFD, Sikkim Forest Dept, NVSE, Assam Forest Department, Hathi Sathi, ATREE, WWF-KCL , SNAP, UWIFORT (Dr. Sherub), Prakriti Samsad, HNAF

GOAL 2
OBJECTIVE 3

Goal 2: Building and sharing scientific and traditional knowledge for hornbill research and conservation.

Objective 3: Identifying and mapping habitats of high conservation value for hornbills in the landscape.

Activity	Deliverable/Output	Timeline	Region	Key players
3.1 Developing habitat suitability maps to identify high conservation areas for hornbills using satellite images and remote-sensing	3.1.1 Habitat suitability maps developed to identify conservation areas for hornbills 3.1.2 Identification of critical habitats and potential conservation areas for hornbills. 3.1.3 Inform planning and decision-making for habitat protection and management to support hornbill conservation	One-time, short-term	All notified forest areas (Protected Areas and Territorial Forests), Revenue/ Community (Khasmahal) forests, Tea gardens and Cinchona plantations	Priyanka Das & NCF, NMNC, Aaranyak
3.2 Assessing and monitoring habitat structure, species composition and quality through field surveys across land-use strata.	3.2.1 Assessment report of habitat structure and species composition 3.2.2 Detailed data on tree densities and habitat quality 3.2.3 Evidence-based recommendations to improve overall habitat.	Recurring; periodic	All notified forest areas (Protected Areas and Territorial Forests), Revenue/ Community (Khasmahal) forests, Tea gardens and Cinchona plantations	NCF, METACOS, NVSES, BWS (Volunteer help), WWF-KCL (volunteer)
3.3 Using people's knowledge (interviews, mapping) to identify suitable forest patches used by hornbills in human-use landscapes.	3.3.1 Documentation of people's knowledge on hornbill movement and behaviour 3.3.2. Identification of critical habitats for further surveys and potential conservation areas for hornbills.	One-time, over 5 years	Villages in and around (PAs and non-PAs) and community forests within the hornbill distribution range	NMNC, NCF, Amir Chhetri, NVSES, Sikkim FD, METACOS, WWF - KCL

Goal 2: Building and sharing scientific and traditional knowledge for hornbill research and conservation.

GOAL 2
OBJECTIVE 4

Objective 4: Fostering research on understanding hornbill biology (diet, breeding, movement ecology, behaviour and demography) using advanced research techniques.

Activity	Deliverable/Output	Timeline	Region	Key players
4.1 Training and capacity-building of local researchers and practitioners in hornbill field research methods and techniques, data analysis/ writing and publication.	4.1.1 Enhanced capacity of individuals and organizations trained in hornbill research 4.1.2 Improved data analysis, writing, and publication capabilities among participants. 4.1.3 Increased capacity and skilled personnel for conducting hornbill research and generating impactful findings.	Recurring, long-term, entire	North Bengal, adjacent states and countries	NCF, IUCN HSG, ATREE and WWF-KCL
4.2 Developing training modules and resources that are widely available for hornbill researchers.	4.2.1 Manuals, guides, and other resource materials produced and made available 4.2.2 Widely accessible educational materials supporting hornbill research.	One-time, short-term, entire	North Bengal, adjacent states and countries	NCF, IUCN HSG, ATREE and WWF-KCL
4.3 Developing proposals, securing funding and carry out research on key aspects of hornbill biology	4.3.1 Submitted proposals for hornbill research 4.3.2 Research grants received to carry out hornbill research 4.3.3 Peer-reviewed articles, reports, and papers published in scientific journals. 4.3.4 Establishment of partnerships with other research institutions, conservation organizations, and stakeholders.	Recurring, long-term	North Bengal	NCF, NMNC, Aaranyak, NVSES, METACOS, ATREE

GOAL 2
OBJECTIVE 4

Activity	Deliverable/Output	Timeline	Region	Key players
4.4 Encouraging research on lesser-studies species and habitats such as Indian grey hornbill in human-use landscapes	4.4.1 Increased understanding of biology, behaviour, ecology, and conservation needs of lesser-studies hornbill species 4.4.2 Scientific papers and reports based on the research 4.4.3 Evidence-based recommendations provided to develop conservation and management practices for the species and habitat	One-time, short-term (5 years)	West Bengal and adjacent states	METACOS, HNAF, Hathi Sathi
4.5 Building a digital knowledge hub for sharing knowledge and data related to hornbills for all relevant stakeholders with adequate safeguards.	4.5.1 Centralized repository of hornbill research and information related to hornbill conservation 4.5.2 Knowledge gaps and priority needs identified from this repository 4.5.3 Increased collaboration and support across institutes for conducting hornbill research and conservation	Recurring, long-term	North Bengal	NMNC, NCF with WBFD

Goal 2: Building and sharing scientific and traditional knowledge for hornbill research and conservation.

GOAL 2
OBJECTIVE 5

Objective 5: Understanding anthropogenic and natural threats to hornbill populations (poaching/hunting and trade, climate change, land-use change) in the landscape.

Activity	Deliverable/Output	Timeline	Region	Key players
5.1 Assessment of extent of poaching/ hunting and trade.	5.1.1 Number of incidents reported for each hornbill species 5.1.2 Identified hotspots and mapping the key regions for incidents 5.1.3 Better understanding of any trends, routes of hornbill trade 5.1.4 Strategic points listed for reducing hornbill trade and shared with respective agencies/institutes.	Recurring, long-term	North Bengal, adjacent states and countries	WBFD, NMNC, NCF
5.2 Creating a database or an app for recording/ reporting hornbill seizures (dead, alive), poaching cases/locations and deaths.	5.2.1 A comprehensive database that is available for use by researchers and policy makers. 5.2.2 Evidence-based recommendations provided to inform policies on illegal wildlife trade	Recurring, short-term (2–3 years)	North Bengal, adjacent states and countries	WBFD and associated agencies
5.3 Establish 3-4 long-term research stations to monitor climate, phenology and hornbills.	5.3.1 Continuous and systematic data on climate variables, phenological changes, and hornbill populations. 5.3.2 Scientific papers and reports based on data collected from the research stations. 5.3.3 Standardized protocols and methodologies for data collection and analysis. 5.3.4 Databases that are available for use by researchers and conservationists.	Recurring, long-term	North Bengal and adjacent states	NMNC, NCF, WBFD
5.4 Develop a Land-Use Land-Cover (LULC) map to detect forest cover change in the landscape	5.4.1 A map showing the Land-Use Land-Cover (LULC) classifications and reflecting changes over time 5.4.2 Overview of key changes detected, including for key hornbill habitats 5.4.3 Data on the amount of forest cover loss or gain, percentage change, and affected areas. 5.4.4 Areas identified for restoration and habitat connectivity	Recurring, long-term	North Bengal, adjacent states and countries	NCF and Aaranyak

GOAL 2
OBJECTIVE 6

Goal 2: Building and sharing scientific and traditional knowledge for hornbill research and conservation.

Objective 6: Documentation of local ecological knowledge of hornbills, their habitats and hornbill-human relationships.

Activity	Deliverable/Output	Timeline	Region	Key players
6.1 Document Local Ecological Knowledge (LEK) through Focus-Group Discussions (FGDs) with the help of local village-level institutions	6.1.1 Summaries of local ecological knowledge related to species and landscape 6.1.2 Documentation of traditional practices, beliefs, management and customs of people's relationships with nature	Long-term	Hornbill distributional range in North Bengal	NCF, ATREE, METACOS, NVSES
6.2 Carrying out ethnographic surveys, recording folktales, songs and cultural references to hornbills.	6.2.1 An overview of key findings from the ethnographic surveys, including major themes and insights. 6.2.2 Written records of folktales involving hornbills and their cultural significance. 6.2.3 Documentation of various cultural references, practices, and rituals related to hornbills. 6.2.4 Recommendations for incorporating local ecological knowledge and cultural significance into conservation strategies.	Long-term	Hornbill distributional range in North Bengal	NCF, ATREE, METACOS, NVSES
6.3 Understanding people-hornbill relationships (perceptions, attitudes and behaviours) and resource-use and dependency through household surveys, interviews and group discussions	6.3.1 Comprehensive summary of the household surveys, interviews and group discussions conducted with community members 6.3.2 Recommendations based on surveys to enhance community-led conservation of hornbills	One-time, short-term (5 years)	Hornbill distributional range in North Bengal	NCF, ATREE, METACOS, NVSES, WWF-KCL, Hathi Sathi, Zooreach, NMNC

Goal 3: Enable hornbill conservation through community stewardship and ownership.

GOAL 3
OBJECTIVE 1

Objective 1: Encourage coexistence of hornbills and people through community stewardship.

Activity	Deliverable/Output	Timeline	Region	Key players
1.1 Establish and create a network of village-level hornbill protection committees, local NGOs, comprising local residents in identified hornbill hotspots (could be voluntary or paid).	1.1.1 A network of members from various hornbill protection committees in North Bengal 1.1.2 Increased community engagement and ownership in hornbill conservation efforts.	One time	Hornbill distributional range in North Bengal	NCF, WWF-KCL, NVSES, Priyanka and Amir, WBFD through JFMCs, Tea gardens, Indian Tea Association (Terai Branch), METACOS
1.2 Train and equip community members to lead conversations and conduct targeted awareness programmes on hornbills and nature conservation	1.2.1 Trained community members on conducting awareness campaigns 1.2.2 Enhanced awareness and protection of hornbill populations in identified hotspots	Short-term, recurring	Hornbill distributional range in North Bengal	WWF-KCL, Zooreach , METACOS, NCF, NMNC
1.3 Facilitate the sharing of ideas, research, conservation and evaluation of progress in hornbill conservation through workshops and seminars involving community members, partners, and stakeholders.	1.3.1 Enhanced collaboration and communication among community members, partners, and other stakeholders through these workshops and seminars 1.3.2 Improved knowledge on hornbill research and conservation.	Long-term, recurring	Hornbill distributional range in North Bengal	NCF, NMNC, WWF-KCL, NVSES, METACOS
1.4 Conduct cultural and conservation festivals to celebrate hornbills	1.4.1 Increased love and support of people towards hornbills 1.4.2 Increased positivity towards hornbill conservation	Long-term, recurring	Hornbill distributional range in North Bengal	All stakeholder groups

GOAL 3
OBJECTIVE 2

Goal 3: Enable hornbill conservation through community stewardship and ownership.

Objective 2: Build and enhance capacity for community-led hornbill research and conservation.

Activity	Deliverable/Output	Timeline	Region	Key players
2.1 Conduct site-based trainings and initiate community-led conservation interventions to locate, monitor and protect hornbill nests and population outside PAs	2.1.1 Increased vigilance, documentation and protection of hornbill nests and hornbill population outside PAs 2.1.2 Increased local participation and stewardship in hornbill conservation 2.1.3 Number of known hornbill nests, roost sites and hornbill chicks successfully fledged from the monitored nests 2.1.4 A list and map of potential and known hornbill nest trees outside Protected Areas through routine observation and monitoring	Long-term, recurring	Revenue/Community (Khasmahal) forests, Tea gardens and Cinchona plantations	IUCN HSG, NMNC, NCF, METACOS, NVSES, WBFD
2.2 Develop resources and training modules for leadership and skill training among community members	2.2.1 Skilled local personnel to lead the research and conservation at sites 2.2.2 Increased ownership and stewardship among community members about conservation of hornbills and the natural heritage	Long-term, recurring	North Bengal	IUCN HSG, NMNC, NCF, METACOS, NVSES,

Goal 3: Enable hornbill conservation through community stewardship and ownership.

GOAL 3
OBJECTIVE 3

Objective 3: Encourage ethical nature tourism and tourism-based livelihood opportunities.

Activity	Deliverable/Output	Timeline	Region	Key players
3.1 Trainings and refresher workshops on tourism and hospitality and ethical wildlife tourism can be conducted in areas where community members are interested to explore nature tourism	3.1.1 Community members equipped with skills to develop and manage nature tourism enterprises 3.1.2 Enhanced awareness and practice of ethical wildlife tourism 3.1.3 Formation of local tourism associations that advocate for ethical nature tourism	Short-term but follow up with necessary revisions every 2–3 years	Hornbill distributional range in North Bengal	NCF, NMNC, WWF-KCL, NVSES, METACOS
3.2 Develop guidelines on responsible tourism practices in consultation with community members	3.2.1 Comprehensive guidelines on responsible tourism practices developed in consultation with community members. 3.2.2 Increased awareness and adoption of sustainable tourism practices within the community. 3.2.3 Sustainable economic benefits for the community from ethical nature tourism. 3.2.4 Enhanced protection and conservation of natural resources and local culture.	Short-term but follow up with necessary revisions every 2–3 years	Hornbill distributional range in North Bengal	METACOS, Amir Chhetri, NVSES, WWF-KCL, BWS
3.3 Prepare hornbill information pocket guides for tourists and posters for general information. These resources can be done in English, Bengali and Nepali	3.3.1 Hornbill information pocket guides for nature guides and tourists. 3.3.2 Informative posters distributed for awareness 3.3.3 Increased knowledge and appreciation of hornbills among locals and tourists.	Long-term, recurring	Hornbill distributional range in North Bengal	METACOS, Amir Chhetri, NVSES, WWF-KCL, NCF, NMNC

GOAL 3
OBJECTIVE 3

Activity	Deliverable/Output	Timeline	Region	Key players
3.4 Provide trainings on diversifying livelihood opportunities for creating souvenirs and other local products	3.4.1 Diversified livelihood opportunities and increased income sources for community members 3.4.2 Strengthened community engagement in sustainable economic activities.	Long-term, recurring	Hornbill distributional range in North Bengal	METACOS, Amir Chhetri, NVSES, WWF-KCL, WBFD, NCF, NMNC, ATREE
3.5 Sensitize the urban bird enthusiasts, photographers on ethical bird-watching practices	3.5.1 Adoption of responsible and respectful bird-watching practices. 3.5.2 Reduced disturbance to birds and their habitats.	Short to long-term, recurring	Urban and peri-urban centres	All stakeholder groups, BWS

Goal 4: Improve multi-stakeholder and transboundary coordination for hornbill conservation.

GOAL 4
OBJECTIVE 1

Objective 1: Establish communication mechanism between key stakeholders in the inter-state and transboundary landscape.

Activity	Deliverable/Output	Timeline	Region	Key players
1.1 Identify stakeholders (local & transboundary – Govts, NGOs NGIs, communities, private sectors) to collaborate for hornbill research and conservation in the inter-state and transboundary landscape	1.1.1 Comprehensive list of local and transboundary stakeholders interested in hornbill research and conservation 1.1.2 Strengthened partnerships for research and conservation initiatives among different stakeholders of states and countries	Short-term	North Bengal, Sikkim, Assam and the countries of Nepal, Bhutan & Bangladesh	All stakeholder groups
1.2 Create working groups and organize participatory meetings (intra, inter & transboundary)	1.2.1 Established working groups with clear roles, responsibilities and timelines. 1.2.2 Enhanced communication and cooperation among stakeholders. 1.2.3 Improved coordination of research and conservation efforts within the landscape and across borders.	Long-term, recurring	North Bengal, Sikkim, Assam and the countries of Nepal, Bhutan & Bangladesh	NCF, NMNC, IUCN HSG, Aaranyak, UWIFORT

GOAL 4
OBJECTIVE 2

Goal 4: Improve multi-stakeholder and transboundary coordination for hornbill conservation.

Objective 2: Assess policies and practices affecting hornbill conservation in the inter-state and transboundary landscape.

Activity	Deliverable/Output	Timeline	Region	Key players
2.1 Collate, review and maintain relevant documents (plans – action, management; policy, laws, rules, guidelines, future development plans) that affect hornbill conservation across different sites	2.1.1 Centralized repository of action plans, management plans, policies, laws, rules, guidelines, and future development plans that could affect hornbill conservation 2.1.2 Improved coordination of conservation efforts across different habitats, states and countries.	Short-term, recurring	North Bengal and the neighbouring states and countries	All stakeholder groups

Goal 4: Improve multi-stakeholder and transboundary coordination for hornbill conservation.

GOAL 4
OBJECTIVE 3

Objective 3: Evaluate and integrate improved approaches/ policies for hornbill conservation in the inter-state and transboundary landscape.

Activity	Deliverable/Output	Timeline	Region	Key players
3.1 Integrate revisions to existing policies to align and achieve goals of respective stakeholders, states and countries after adequate public consultations	3.1.1 Suggestions to amend existing policies 3.1.2 Updated policies with changes to improve hornbill research and conservation	Short to long-term, recurring	North Bengal and the neighbouring states and countries	All stakeholder groups
3.2 Implement modified policies through on-the-ground participation	3.2.1 Identification of responsible parties and required resources for implementation 3.2.2 A report on the implementation work 3.2.3 A framework to monitor the implementation of the revised policies.	Short-term, recurring	North Bengal and the neighbouring states and countries	All stakeholder groups
3.3 Suggest further amendments based on evaluations and on-ground impact	3.3.1 Documentation of review meetings with stakeholders (local & transboundary) 3.3.2 A comprehensive report detailing the findings from evaluations and implementation of the policies 3.3.3 Specific, actionable recommendations for amendments. 3.3.4 Drafts of the revised policies incorporating the suggested amendments.	Long-term, recurring	North Bengal and the neighbouring states and countries	All stakeholder groups

GOAL 4
OBJECTIVE 4

Goal 4: Improve multi-stakeholder and transboundary coordination for hornbill conservation.

Objective 4: Collaborative efforts at the national and international levels to fight illegal trade of hornbills. Collaborative efforts at the national and international levels to fight illegal trade of hornbills.

Activity	Deliverable/Output	Timeline	Region	Key players
4.1 Bring together key agencies to collaborate and cooperate to share intelligence on hornbill trade	4.1.1 A formal agreement or memorandum of understanding (MOU) among key agencies outlining the terms of collaboration and cooperation and responsibilities of each agency 4.1.2 Protocols for data sharing, access, and confidentiality. 4.1.3 Reports documenting the progress and outcomes of the collaboration.	Short-term, recurring	North Bengal and the neighbouring states and countries	Government and other related agencies working on wildlife trade
4.2 Encourage enforcement checks and patrols at the inter-state and international borders for hornbill trade	4.2.1 Increased enforcement presence and surveillance for hornbill trade 4.2.2 Assessment reports with details of hornbill parts confiscated and other information related to the confiscation at these points	Short-term, recurring	North Bengal and the neighbouring states and countries	FDs and NGOs as mediators
4.3 Design and produce engaging posters and videos to educate the public about the laws and consequences of illegal wildlife trade, specifically focusing on hornbills.	4.3.1 Campaigns to raise awareness about hornbill trade 4.3.2 Visually appealing posters in multiple languages with clear messages about the laws and consequences of illegal wildlife trade. 4.3.3 Impactful videos featuring narratives and visuals about impact of illegal trade on hornbills 4.5.4 Creation of social media-friendly posters and videos for sharing on platforms like Facebook, Instagram, Twitter, and YouTube.	Short-term, recurring	India and the neighbouring countries	All stakeholder groups

Goal 5: Outreach and education: Instil ownership and appreciation for the natural world through nature education modules and outreach.

GOAL 5
OBJECTIVE 1

Objective 1: Foster love and care towards hornbills through long-term, site and age-appropriate nature education programmes. state and transboundary landscape.

Activity	Deliverable/Output	Timeline	Region	Key players
1.1 Design and implement site and age specific nature education modules and activities (indoor and outdoor) and corresponding props for school students	1.1.1 Nature education modules developed and conducted for different age groups across different sites 1.1.2 Relevant props and materials provided to support effective teaching learning experiences 1.1.3 Feedback received from students and teachers to help improve the modules and activities. 1.1.4 Enhanced understanding of the surrounding environment and inter-connections among students and community members. 1.1.5 Celebration of World Hornbill Day across different sites	Long-term, recurring	Rural and urban schools in North Bengal	NMNC, Zooreach, WWF-KCL, METACOS, NVSES, NCF,
1.2 Conduct training workshops and provide resource materials to teachers and local groups to impart nature education at their respective sites	1.2.1 Improved capacity of educators and local groups to design and deliver engaging age and site-specific nature education modules 1.2.2 Resource materials, such as activity manuals and props developed and shared 1.2.3 Reports summarizing the outcomes of the workshops and feedback from the trainees 1.2.4 A network of trained nature educators receiving continued support to design and implement nature education modules at their respective sites	Long-term, recurring	Rural and urban settings in North Bengal	NMNC, Zooreach, WWF KCL, METACOS, NCF,

GOAL 5
OBJECTIVE 1

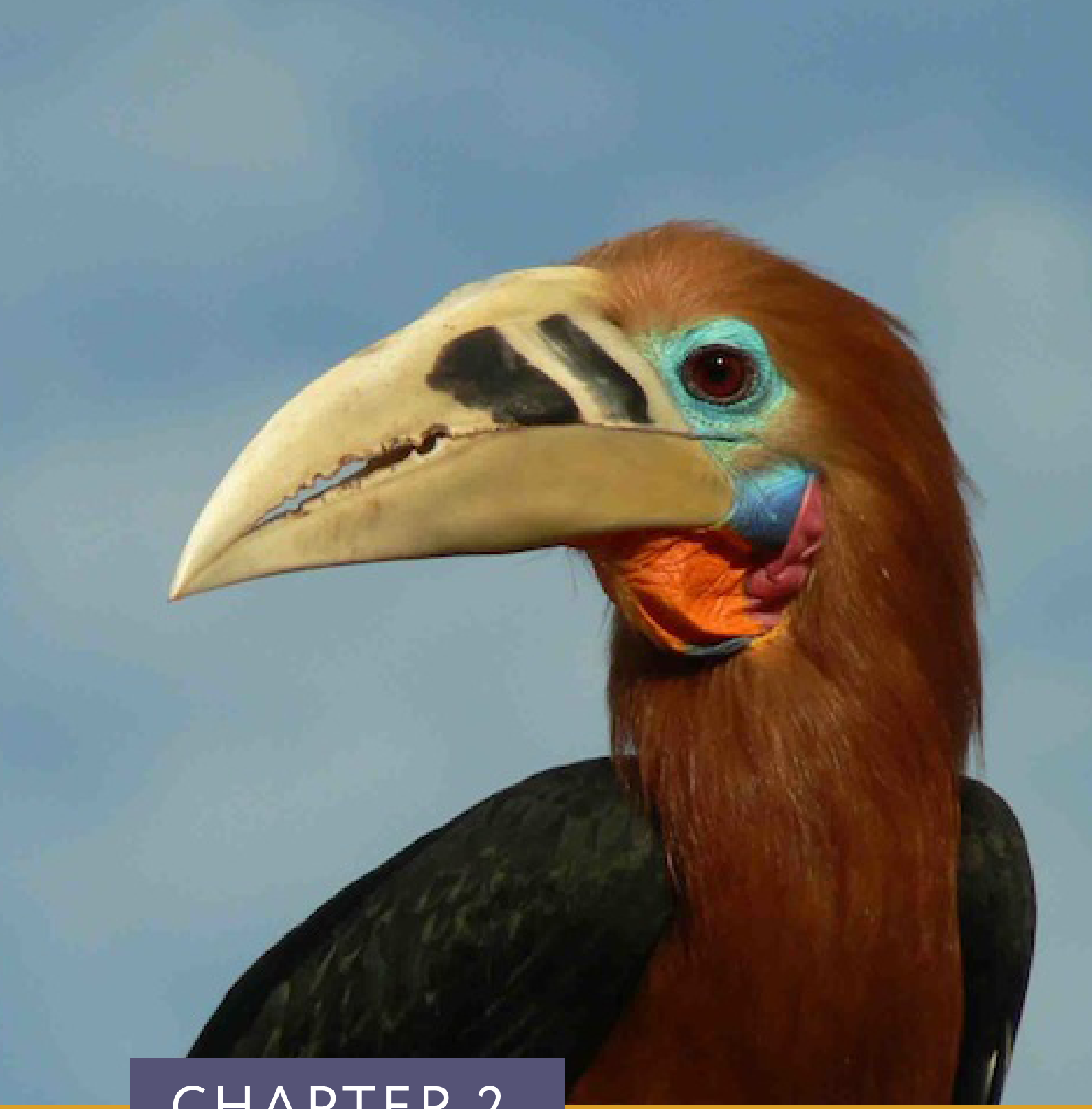
Activity	Deliverable/Output	Timeline	Region	Key players
1.3 Conduct talks/ seminars related to hornbills, forests and climate change for local communities, students, and other urban citizens	1.3.1 Successfully conducted talks and seminars that present work on hornbills, forests and climate change 1.3.2 Increased awareness and understanding among students and urban citizens about hornbills and their role in forest ecosystems. 1.3.3 Enhanced knowledge of the impact of climate change on wildlife and forests. 1.3.4 Strengthened network between academic institutions, local communities, researchers and urban citizens.	Long-term, recurring	North Bengal	NCF, NMNC, Zooreach, WWF KCL, NVSES, METACOS
1.4 Organize mobile awareness drives- education vans that could visit villages to share facts and information about hornbills and other wildlife	1.4.1 Increased awareness and love for hornbills among communities 1.4.2 Continuous engagement with community members through these activities	Long-term, recurring	Across the hornbill distributional range in North Bengal	NMNC, NVSES, METACOS, WWF KCL, Zooreach, NCF
1.5 Organise sensitisation workshops across different sites to create love and concern for hornbills and to destigmatize myths and beliefs	1.5.1 Increased awareness and love for hornbills	Long-term, recurring	Across the hornbill distributional range in North Bengal	NMNC, NVSES, METACOS, WWF KCL, Zooreach, NCF
1.6 To encourage tea-estate managers to practice organic plantations	1.6.1 Hornbill and biodiversity-friendly habitats within tea gardens	Long-term, recurring	Tea gardens in the hornbill distributional range in North Bengal	Indian Tea Association (Terai Branch), Hathi Sathi

Goal 5: Outreach and education: Instil ownership and appreciation for the natural world through nature education modules and outreach.

GOAL 5
OBJECTIVE 2

Objective 2: To build a sense of pride among citizens about hornbills through strategic media engagement.

Activity	Deliverable/Output	Timeline	Region	Key players
2.1 Establish or activate dedicated social media pages to share hornbill-related content (photos, videos, research findings) to actively engage with online communities	5.1.1 Shared photos, videos, and research findings related to hornbills on different social media platforms 5.1.2 Increased engagement with online communities through interactive content. 5.1.3 Enhanced public awareness and interest in hornbill conservation.	Long-term, recurring	Not applicable	Existing websites and social media pages of IUCN-HSG, NCF and other institutions
2.2 Develop posters and short videos on hornbills in local languages, also including research highlights and findings	5.2.1 Posters and short videos on hornbills developed in multiple languages. 5.2.2 Broader dissemination of conservation messages to diverse audiences.	Long-term, recurring	Hornbill distributional range in North Bengal and adjoining areas/ online	NMNC, Zooreach, WWF KCL, NCF
2.3 Document folk tales and cultural stories associated with hornbills and share through different media	5.3.1 Creative documentation of folk tales and cultural stories associated with hornbills produced 5.3.2 Increased local engagement and celebration of folktales and nature-culture relationships	Long-term, recurring	Hornbill distributional range in North Bengal and adjoining areas/ online	NMNC, Zooreach, WWF KCL, NCF, NVSES, METACOS



CHAPTER 2

STATUS REVIEW

Species Descriptions

GREAT HORNBILL *Buceros bicornis*

Local names in North Bengal: *Bengali*: Raj dhanesh; *Nepali*: Hongrayo; *Dzongka*: Ghora.

Local names in Northeast Indian states: *Apatani*: Piga gyala; *Assamese*: Raj dhanesh/ Hivang; *Cachari*: Dao yung; *Hindi*: Banrao; *Kannada*: Garuda/Dodda mangatte; *Khampti*: Ko-kakhum; *Lisu*: Chinna/Tsinna; *Malayalam*: Komban vezhambal; *Marathi*: Garud; *Miju Mishmi*: Awayhala; *Mising*: Migumgare; *Nyishi:* Paga; *Tangsa*: Hurang/Uchang; *Wancho*: Kooga.

Conservation status: 'Vulnerable' in the IUCN Red List of Threatened Species. Schedule 1 species in the Wildlife Protection Act 1972.

Description

Great Hornbills are the largest hornbills in India, measuring between 112 and 150 cm in length. Males typically weigh between 2.6 and 3.9 kg, while females weigh between 2.16 and 3.35 kg. These birds are characterized by their distinctive white tails with horizontal black bands, white necks and wing bars, and black wings edged with white tips.

The colour of a Great Hornbill's eyes helps identify its sex: males have red eyes with black

skin (rim) around them, while females have white eyes with red skin (rim) around them. Another distinguishing feature is their long yellow beak, topped by a casque. The male's casque is flat, forked in front, and edged with black, whereas the female's casque is smaller and lacks black markings. Additionally, the white plumage on their head, neck, wing coverts, and tail base is often stained yellow from oil secreted by the preen gland.
Great Hornbills fly with heavy wing beats and long glides. Their call is a loud, reverberating "kok-kok," which can be heard up to a kilometer away. They typically call in pairs and also produce other guttural, loud duet calls.

Distribution

Great Hornbills are found in three distinct regions of South Asia: The Western Ghats, the Himalayan foothills from Uttarakhand to southern Nepal and Bhutan, and the Indian Eastern Himalaya of Northeast India and northern West Bengal. They also inhabit areas in Myanmar, islands in the Mergui archipelago, southern China, Vietnam, Laos, Cambodia, Thailand, peninsular Malaysia, and Sumatra, Indonesia.

These birds primarily live in primary evergreen and moist deciduous forests, mainly in lowland areas but can be found at elevations up to 2,000 m in some regions. They are also seen in selectively logged forests and plantations near larger forests and often fly over open areas between forests.

In India, protected areas where Great Hornbills are commonly seen include Anamalai Tiger Reserve and Dandeli National Park in the Western Ghats; Corbett Tiger Reserve in northern India; and Kaziranga National Park, Pakke Tiger Reserve, Namdapha Tiger Reserve, and Manas National Park in Northeast India. In North Bengal, they are found in Buxa Tiger Reserve, Gorumara National Park, Jaldapara National Park, Neora Valley National Park, and Mahananda Wildlife Sanctuary. Great Hornbills also inhabit areas outside these PAs, including community forests, territorial forests, tea gardens, and other plantation sites.

Diet

Great Hornbills are primarily fruit-eaters, with ripe fruits comprising over 90% of their diet. They also consume small birds, reptiles, small mammals, eggs, and arthropods. Figs are particularly important in their diet, with key species including *Ficus altissima, F. nervosa, F. drupacea, F. benjamina,* and *F. elastica*. Other important food plants include fruits from the Lauraceae family (*Litsea, Cinnamomum, Beilschmiedia, Alseodaphne*, and *Phoebe* species), Meliaceae family (*Aglaia, Dysoxylum, Chisocheton,* and *Aphanamixis* species), Myristicaceae family (*Horsfieldia kingii* and *Knema* species), Rosaceae family (*Prunus ceylanica*), Burseraceae family (*Canarium strictum*), and Annonaceae family (*Polyathia simiarum*) (Datta, 2001; Datta & Rawat, 2003, 2008; Naniwadekar et al., 2015).

Breeding behaviour

Great hornbills are known to be monogamous, and appears to be territorial during the breeding season. Breeding is from February to July in the Indian Eastern Himalaya, and from December to June in the Western Ghats.

The nesting cycle ranges 102–138 days in and around the Pakke Tiger Reserve, Arunachal Pradesh (Datta, 2001; Datta et al., unpublished data) while in Thailand it ranges 102–144 days. Great Hornbills usually produce one chick, although 2 eggs are laid. Incubation is for around 38-45 days. Several visits are made daily by the male to deliver food. The male perches near the cavity, regurgitates fruits out from his gullet to the female. After the chicks hatch, the amount of food delivered increases. In Pakke TR, females came out after about 96 days and while chicks remained inside for up to a month more (Datta, 2001; Datta et al., unpublished data). The chick reseals the cavity and comes out about a month later (Datta, 2001).

In Buxa Tiger Reserve, the nesting duration of Great Hornbill was systematically recorded from 2018 to 2024. The nesting duration for this species ranged 113–123 days with a mean nesting cycle of 117 days (SD ± 2.65) across 7 years (Mandal et al., 2025). The female entry takes place between February 15th and March 24th. The female exits the cavity after an average of 93 days, mostly between May-end and July 1st week, while the chick remains in the cavity for an additional 23 days (3–4 weeks) on an average. The chick fledging takes place between June-end to 1st week of July. On an average, the Great Hornbill females enter the nest between February-end to early-March and the chick fledging takes place in late June (Mandal et al., 2025).

At Latpanchar, a fringe village of the Mahananda Wildlife Sanctuary, we have been monitoring one Great Hornbill nest since 2022. The female enters the nest towards the end of March and the chick exit takes place in July. However, we have the nesting duration of 125 days from only one year in 2024 (Mandal et al., 2025).

During the breeding season, male Great Hornbills display a spectacular behaviour known as aerial casque butting, where they clash their casques while in flight. In 2024, a flock of juvenile Great Hornbills was observed engaging in bill grappling at a roost site in Buxa Tiger Reserve (S. Mandal & S. Mahato, pers. obs.).

Movement and ranging patterns

A study in Pakke Tiger Reserve, estimated the home range for breeding Great Hornbills to be less than 2 km^2 while the home range of two non-breeding Great Hornbills were 58 km^2 and 63 km^2 (Naniwadekar et al., 2019a). This estimate is however, based only on 2-3 months of tracking data, annual home ranges are not known. The mean daily distance

covered by the breeding birds was above 6.5 km, while the non-breeding birds covered an average distance of less than 5 km daily (Naniwadekar et al., 2019a).

Male Great Hornbills in Thailand also exhibit varying movement and home range patterns depending on the season. During the breeding season, males are reported to travel between 4 to 14 km daily (Poonswad & Tsuji, 1994) and maintain a home range of approximately 7 km^2. In the non-breeding season, their home range varies from 2 km^2 to 11 km^2 in different forest sites. Furthermore, GPS satellite telemetry has revealed that the annual home range for one Great Hornbill family was 600 km^2 (Poonswad et al., 2013). Great Hornbills are typically observed in pairs or family groups, although larger flocks are sometimes seen on large fruiting trees, especially fig trees. In the evenings, Great Hornbills are also seen gathering in communal roost sites.

Roosting

At Buxa Tiger Reserve, we have located four roost sites of the Great Hornbill. We conducted systematic monitoring at one of these sites since 2018. At this site, our study shows that that during the non-breeding season, the mean number of Great Hornbills roosting in hill forests was 6 ± 0.78 (range:1-20). During the breeding season, the number of birds visiting the site were lower with numbers ranging from 1-7 birds (Mandal et al., 2024).

A telemetry study in Pakke Tiger Reserve showed that Great Hornbills mostly roost in forests, away from river banks (Naniwadekar et al., 2022). Hornbills flew over a large range each day between the time they left their roost sites and returned in the evening banks (Naniwadekar et al., 2022).

Population estimates

In India, there are density estimates for the Great Hornbill from multiple sites. The mean density of the Great Hornbill estimated in one study in Namdapha Tiger Reserve is 3.9 birds/km^2, with seasonal variation ranging 2.1-12.7 birds/km^2 (Naniwadekar & Datta, 2013).

In and around Pakke Tiger Reserve, density estimates from different studies have ranged 3.1-11.95 birds/km^2 within protected areas and hunting habitats (Dasgupta & Hilaluddin, 2012) . In North Bengal's Buxa Tiger Reserve, the Great Hornbill has a mean density of 0.21 birds/km^2, with an estimated population of 161 birds in the park based on field surveys conducted from 2019 to 2021 (Pradhan et al., 2024b).

In the Western Ghats, the density of Great Hornbill ranges 3.4-9.55 birds/ km^2 (Raman & Mudappa, 2003). In the Western Ghats, density ranged 1.5-4.4 individuals/km^2 in

PAs, and 0–4.5 individuals/km^2 in reserved forests and rainforest fragments (Mudappa & Raman, 2009). A recent study estimated higher densities in Anamalai Tiger Reserve (~4 birds/km^2) compared to adjoining shade coffee plantations (~2 birds/km^2) in the breeding and non-breeding periods (Pawar et al., 2021). Outside PAs, even if adjacent, population densities are usually considerably lower, often well below 1 individual per km^2 and it has been driven to local extinction in several sites in Arunachal Pradesh. The global population has been estimated on a precautionary basis as roughly 13,000–27,000 mature individuals (Bird Life International 2020).

Links:
iucnhornbills.org/great-hornbill

INDIAN GREY HORNBILL *Ocyceros birostris*

Local names in North Bengal: *Bengali*: Puttial Dhanesh.

Local names in Northeast Indian states: *Gujarati*: Chilotro; *Hindi*: Dhanesh/Dhanmar/Dhand/Dhanel; *Marathi*: Bhinas; *Tamil*: Munu mukkula/Irawakke; *Telugu*: Supanati/Kommu kasiri

Conservation status: Listed as 'Least Concern' (LC) on the IUCN Red List. Schedule 1 species in the Wildlife Protection Act, India.

Description

This brownish-grey bird is the most common of the Indian hornbills. Among the smallest of the Indian hornbill species, it measures about 50 cm in length and weighs less than 1 kg. It has a blackish beak with a casque, which is pointed in the front for males and smaller in size for females. The bird's long grey tail is tipped with black and white, a feature that becomes conspicuous when it lands.

The male has red-brown eyes with black orbital skin, while the female has dark brown eyes, with dull red orbital skin. Their call consists of a variety of squealing and cackling

notes, along with some short piping sounds. One of their calls is a shrill "wheee," and another is a cackling "k-k-k-ka-e."

Distribution

This species is endemic to South Asia. It has a widespread distribution in India, ranging from the Himalayan foothills' southwards through the Indian peninsula. It is not as common in the wet forests of the Western Ghats but is predominantly found in the Eastern Ghats of India. It does not occur in the Northeast part and higher up in the Himalaya, although it is found in North Bengal. Apart from India, it is also found in parts of Pakistan, Nepal, and Bangladesh.

The species inhabits deciduous forests, woodlands, and thorn forests, and has also adapted to human-modified habitats such as city gardens, plantations, and parks. While it is usually found in the plains up to 600 m in elevation, it has been reported at altitudes up to 1,400 m in the Himalayan foothills.

Diet

The diet of this species primarily consists of fruits, particularly figs, and occasionally also flowers. Additionally, it preys on various animals, such as insects, small reptiles, rodents, and bird nestlings. Food is mainly fruits, important food species in the breeding season are *Actinodaphne* (Lauraceae) and *Olea* (Oleaceae).

It is widely distributed in the Eastern Ghats and is a key seed disperser of these forests where other hornbill species are not known to occur.

Breeding behaviour

The elaborate courtship rituals starts 3 months before (inspection, cleaning of nest cavity, bill-grappling, courtship feeding and pulling each other's tail) and the pair mate many times before female entry into the nest cavity. The female seals the cavity with droppings and food pulp, and the male often assists by delivering mud.

A study in south India recorded the nesting duration from March to June, in which the female remained sealed inside the nest for an average of 76 days (Santhoshkumar & Balasubramanian, 2010). The chicks remained in the nest for an average of 13 days after the female exits and two chicks emerged per nest. The entire nesting cycle lasts approximately 87 days (Santhoshkumar & Balasubramanian, 2010).

While it primarily nests in natural cavities, this species has been recorded using artificial nest boxes and even holes in buildings for nesting.

Population estimates

The Indian Grey Hornbill is usually found in pairs or small flocks of 5-6, but can be seen in larger groups of up to 30 birds at fruiting trees. The global population of the species is not yet estimated. However, the population is known to be stable and the species is commonly seen in many parts of the Indian subcontinent. It is one of the most-reported hornbill species in India, with many sightings on the citizen science platform Hornbill Watch reported from outside of PAs and in parks and gardens of many cities (Datta et al., 2018).

Links:

iucnhornbills.org/indian-grey-hornbill-2

ORIENTAL PIED HORNBILL *Anthracoceros albirostris*

Local names in North Bengal: *Bengali*: Kak Dhanesh; *Nepali*: Dhanesh/Kaag dhanesh; *Dzongka*: Chya gobo.

Local names in northeastern states: *Assamese*: Kao dhanesh/Hay tuk tek ee; *Cachari*: Dao yung kashiba; *Khampti*: Kokey-khao; *Miju Mishmi*: Langsin; *Mising*: Tekteki; *Nyishi*: Garhe; *Wancho*: Long-o.

Conservation status: Least Concern (LC) on the IUCN Red List. Schedule 1 species in the Wildlife Protection Act, India.

Description

The Oriental Pied Hornbill males measure 70–85 cm in length and weigh 680–907 g, while females are smaller, measuring 60–65 cm in length and weighing 500–879 g. Males have a creamy bill with a large black base on the mandible and a large, cylindrical casque with a black, projecting front part. In contrast, females have a smaller bill and casque, with black markings, and the lower mandible features a dark red spot. Both sexes are very vocal, often calling with squeals and chuckles, and their call typically sounds like a cackling "kek-kek-kek-kek."

They have pale blue skin around their eyes and on their throats. When in flight, they can be distinguished from the similar-looking Malabar Pied Hornbill by their tail, which is more black.

Distribution

The Oriental Pied Hornbill is found across southern Nepal, southern Bhutan, northern Bangladesh, northern and northeastern India, Myanmar, the Mergui Archipelago, southern China, Vietnam, Laos, Cambodia, and parts of Thailand, Singapore, and northeastern Peninsular Malaysia. Its range may overlap with that of the Malabar Pied Hornbill (*A. coronatus*) in Jharkhand, the hill forests of Odisha and Andhra Pradesh (Grimmett et al. 2022; Datta et al., 2018), although no hybrids have been recorded. This species was also reported from Chandigarh and Delhi, which are urban cities (Datta et al., 2018). One sighting of this species was also reported from Madhya Pradesh (eBird).

They are frequently seen in Rajaji National Park and Corbett Tiger Reserve in northern India, as well as in Nameri Tiger Reserve, Pakke Tiger Reserve, Buxa Tiger Reserve, Mahananda Wildlife Sanctuary, and several other PAs throughout the Indian Eastern Himalayan region. They are also found outside these PAs in forest edges, open moist deciduous and evergreen forests, riverine forests, secondary and logged forests, as well as gardens, agricultural fields and human settlement areas. They are typically found at elevations up to 700 m and are particularly common in riverine and secondary forests.

Diet

This species is known to be more adaptable and is seen commonly in secondary forests. Unlike other Asian hornbills, the Oriental Pied Hornbill does not rely on primary forests for feeding and breeding. Its diet is mixed but predominantly frugivorous, comprising of fruits from secondary forest species, lianas, and of Lauraceae, Meliaceae, Annonaceae, and Moraceae (figs) families (Datta, 2001; Datta & Rawat, 2003).

In Pakke Tiger Reserve, 30–40 fruit species are recorded in their diet (Datta, 2001; Datta & Rawat, 2003) and 49 species in Thailand (Poonswad et al., 2013). Oriental Pied hornbills also feed on invertebrates, small vertebrates, birds' eggs, and reptiles. They are also known to catch fish and crabs in shallow pools and pick termites from termite hills.

Breeding behaviour

The species is monogamous and sometimes territorial. The breeding is typical with the female entering the nest cavity and sealing the cavity opening. The males of this species have been observed providing mud to the female for sealing.

The clutch size could range 1–4 eggs. The incubation period lasts 25–33 days, and the female remains in the nest for 66–100 days, either emerging with the chicks or up to 20 days before

they do. In northeastern India, the nesting duration ranges 80–125 days, with the breeding season extending from early to mid-April to July, with a few instances of early nesting in March (Datta, 2001; Datta et al., unpublished data).

In Buxa Tiger Reserve, the nesting duration for Oriental Pied Hornbills from 2018 to 2024, ranges 83–91 days (Pradhan et al., 2024a). The mean nesting duration across these years was 88 days. Typically, the nesting period begins between mid-March and mid-April, with the female hornbill entering the nest cavity between March 16th and April 18th (Pradhan et al., 2024a). Both the female and the chick have been observed to exit the cavity together if the clutch size is one. When the clutch size is two, one chick usually remains in the nest for another 2–3 days. The female and chick exit generally occurs between June 7th and July 14th. On average, the females enter the nest in late March, while the female and chick exit the cavity in late June.

Movement and ranging patterns

They are known to be widespread and common in some places. They frequent secondary forests and open patches, and are often seen in groups of 5–10 birds, calling to each other. While primarily observed in pairs or family groups, they are sedentary and territorial, with flocks of up to 170 birds recorded in the non-breeding season in Thailand (Poonswad et al., 2013). They also enjoy dust-bathing when they find a patch of loose mud on the ground.

The Oriental Pied Hornbill is an adaptable and opportunistic species that can breed in cultivated areas and near villages, and feed on ornamental fruit trees. Although they can survive in degraded secondary forests, the complete loss of forest cover, particularly in lowland foothill forests, may lead to population declines.

Population estimates

The density estimate for the Oriental Pied Hornbill in the Pakke Tiger Reserve was 19.48 birds/km^2 whereas the density estimates reduced to 5.32 birds/km^2 in the adjoining hunted habitats (Dasgupta & Hilaluddin, 2012). In Buxa Tiger Reserve, the mean density of this species is 10.58 birds/km^2, with an estimated population of 8,050 birds in the park based on field surveys conducted 2019 to 2021(Pradhan et al., 2024b).

The Oriental Pied Hornbill density in Khao Yai NP, Thailand is 21 birds/km^2 (Poonswad et al., 2013). Although the species can survive in degraded secondary forest, complete loss of forest cover, especially in lowland foothill forests may cause declines. It is hunted less than the other three larger species in northeastern India.

Links:

iucnhornbills.org/oriental-pied-hornbill

www.iucnredlist.org/species/22682437/184925767#assessment-information

RUFOUS-NECKED HORNBILL *Aceros nipalenis*

Local names in North Bengal: Bengali: Lal galla Dhanesh; *Dzonkha*: Tekte; *Nepali*: Dhanesh/Rato Dhanesh.

Local names in Northeast Indian states: *Apatani*: Pesu; *Cachari*: Dao yung gajao; *Khampti*: Koka; *Lepcha*: Kolep; *Lisu*: Michuti sikhoo; *Miju Mishmi*: Kaunsahala; *Nyishi*: Peo; *Tangsa*: Hujung/Wujung; *Wancho*: Kung-ap.

Conservation status: 'Vulnerable' in the IUCN Red List of Threatened Species. Schedule 1 species in the Wildlife Protection Act 1972. Listed as High Priority for conservation in the State of India's Birds Report (2023) assessment.

Description

The Rufous-necked Hornbill is a large hornbill species, with males measuring 99–122 cm in length and weighing approximately 2.5 kg. Females are smaller, weighing around 2.27 kg. Males have a distinctive rufous head, neck, and underparts, with glossy black upperparts. Their glossy black wings have a white trailing edge. In contrast, females lack the rufous colour and are entirely black.

Both males and females have pale ivory bills with black grooves on the upper mandible, which can be used to estimate the bird's age. They also have blue orbital skin and a distinctive scarlet red throat pouch. The upper half of their tail is black, while the lower half is white. Female Rufous-necked Hornbills can be distinguished from female Wreathed Hornbills by their blue bare skin around the eye, red throat pouch, and the absence of a visible casque.

They have short bark like calls that sound like *"kuk, kuk"* which are repeated and often accompanied by a response from another individual/partner.

Distribution

The Rufous-necked Hornbill is currently found in the Indian Eastern Himalaya, Bhutan, eastern Myanmar, northern and western Thailand, southern China, northern Laos, and northern Vietnam. Its presence in Cambodia is unconfirmed. Although it was thought to be extinct in Nepal, it was rediscovered in 2021, when it was photographed in eastern Nepal.

Despite its relatively wide range, the species is rare in most areas. However, it is more commonly seen in Bhutan and certain parts of India. In India, the Rufous-necked Hornbill has a resident, breeding population in and around the Buxa Tiger Reserve, Mahananda Wildlife Sanctuary, and Neora Valley National Park in northern West Bengal. It is also found in protected areas of Arunachal Pradesh, such as Namdapha Tiger Reserve, Eaglenest Wildlife Sanctuary, and the higher elevations of Pakke Tiger Reserve. The species prefers hill evergreen forests between 500 and 2,200 m in elevation but has occasionally been observed at altitudes as low as 150 m.

Diet

The Rufous-necked Hornbill is primarily frugivorous, feeding mainly on berries, drupes, and capsular fruits of species in the Lauraceae, Meliaceae, Annonaceae and Moraceae (figs) families (Naniwadekar et al., 2015). During the breeding season, it also supplement its diet with animal matter such as crabs, frogs, and bird eggs.

Breeding behaviour

The species is monogamous and probably territorial. It is mostly seen in pairs and appears to be more sedentary than other hornbill species. It is sometimes seen in large numbers on fruiting trees. The breeding season in Arunachal Pradesh and North Bengal, in the Indian Eastern Himalaya, is from mid to late April to July and August.

At Buxa Tiger Reserve, the nesting duration of Rufous-necked Hornbills was systematically recorded from 2018 to 2024. The nesting duration for this species ranged

116–121 days, with a mean nesting period of 118 days (SD ± 2.65) (Mandal et al., 2025). Typically, the nesting period begins between late March and late April/early May. At the end of the nesting period, the female and chick exit the nest together in July. The average female entry period is in mid-April and average chick fledging period is in late July. At Latpanchar, a fringe village of Mahananda Wildlife Sanctuary, the female entry takes place in the first week of April and the chick fledges between July end and first week of August. The average nesting duration at Latpanchar in 2023 and 2024 is 117 days (SD ± 3.2) (Mandal et al., 2025).

Population estimates

In India, density estimates for the Rufous-necked Hornbill is known from Namdapha Tiger Reserve, Eaglenest Wildlife Sanctuary, and Buxa Tiger Reserve. In Namdapha Tiger Reserve, the density is 6.9 birds/km^2 (Naniwadekar & Datta, 2013), while in Eaglenest Wildlife Sanctuary, it is 6.12 birds/km^2 (Shukla et al., 2016). Buxa Tiger Reserve has a comparatively lower density estimate of 0.04 birds/km^2 (Pradhan et al., 2024b). An unpublished study has estimated the density of this species in Latpanchar, on the fringes of Mahananda Wildlife Sanctuary, to be 9.65 birds/km^2 based on surveys in a small area from 2021 to 2023 (Pradhan et al., 2024a).

Links:

iucnhornbills.org/rufous-necked-hornbill

WREATHED HORNBILL *Rhyticeros undulatus*

Local names in North Bengal: *Bengali*: Dhanesh/ Holud thole dhanesh; *Nepali*: Kalo dhanesh; *Dzongka* – Tekte.

Local names in Northeast Indian states: *Assamese*: Mah do la; *Cachari*: Dao rai; *Khampti*: Koka; *Lisu*: Kokoi; *Mising*: Garugare; *Nyishi*: Poo/Pou; *Tangsa*: Hwungap/Ungap; *Wancho*: Ulat.

Conservation status: 'Vulnerable' in the IUCN Red List of Threatened Species. Schedule 1 species in the Wildlife Protection Act 1972. Listed as High Priority for conservation in the State of India's Birds Report (2023) assessment.

Description

Wreathed Hornbills are among the larger species of hornbills. Males measure 100–117 cm in length and weigh 2.04–3.65 kg, while females measure 84–98 cm and weigh 1.36–2.68 kg. The hornbill is predominantly black with a fully white tail. They exhibit distinct sexual dimorphism. Males have a chestnut-brown head and a bright yellow throat, whereas females have a bright blue throat. Both sexes have an incomplete band or marking on their throats. The casque on their beak is unique, that resembles a carved piece of wood with neat furrows or wreaths, which gives the species its common name. These birds are also known as the Bar-

pouched Wreathed hornbill. The sides of their bills also have ridges. Their call consists of three notes, sounding like "oek-uk-uk," and is repeated multiple times. Sometimes the call can be very loud and distinct. They have loud wing beats that can be heard up to 1 km.

Distribution

Wreathed Hornbills are found in the forested hills of Northeast India, as well as in Bangladesh, Nepal, Bhutan, Myanmar, Thailand, Cambodia, Laos, Vietnam, Peninsular Malaysia, Indonesia (particularly on Sumatra), and several other islands in South-east Asia. They primarily inhabit lowland foothill semi-evergreen and evergreen forests, but they also seasonally migrate to elevations of up to 2,500 m.

In Northeast India, it is commonly seen in Manas National Park, Nameri Tiger Reserve, Pakke Tiger Reserve, Namdapha Tiger Reserve and Raimona National Park. North Bengal forms the westernmost part of the global distributional range for this species. It is mostly found in and around Buxa Tiger Reserve, although there are some records of the species further west, up to the Mahananda Wildlife Sanctuary.

Diet

The Wreathed Hornbill is highly frugivorous, primarily feeding on berries, drupes, and capsular fruits of primary forest species from the Lauraceae, Meliaceae, Annonaceae and figs (Moraceae) families (Datta & Rawat, 2003; Naniwadekar et al., 2015). During the breeding season, their diet expands to include reptiles, crabs and other arthropods. In Pakke, Wreathed Hornbills are known to consume fruits of over 60 different species (Datta, 2001a; Datta & Rawat, 2003).

Breeding behaviour

The species is monogamous, non-territorial, and is known to fly over large areas and also exhibit seasonal altitudinal preferences by moving to higher elevations during the non-breeding season. The breeding season for Wreathed Hornbills in Northeast India is from March to early August. The nesting cycle ranges 120–140 days (Datta, 2001; Datta et al., unpublished data). The female and chick usually exit the nest together, or in a gap of 2–3 days. Juveniles of both sexes have plumage similar to that of adult males.

The nesting duration of Wreathed Hornbills was recorded from 2018 to 2024 in Buxa TR. The nesting duration for this species ranged 125–145 days, with the mean nesting cycle of 133 days (SD± 9) from 2018-2024 (Mandal et al., 2025). Typically, females enter the nest cavity between mid-March and mid-April (Mandal et al., 2025). During fledging, both the female and chick have been observed to exit the nest together. The chick fledging usually takes placed between July-end and early-August, but, in 2020 a chick exit took place very late on September 11th.

Movement and ranging patterns

In Pakke Tiger Reserve, the home range of a breeding Wreathed Hornbill was 54 km² and the average distance covered daily was about 25 km (Naniwadekar et al., 2019a). In Thailand, the home range of the breeding adults was 10 km² and 28 km² for the non-breeding birds (Poonswad & Tsuji, 1994).

The Wreathed Hornbill moves seasonally and is also seen in the higher elevations up to 2000 m in the winter months.

Roosting

The telemetry study in Pakke Tiger Reserve confirmed that Wreathed Hornbills roosts close to rivers (Naniwadekar et al., 2022). In the Reserved Forest, adjoining the Pakke Tiger Reserve in Arunachal Pradesh, roosting flocks of up to 100 birds are seen (Datta, 2001; Pradhan et al., 2022). Occasionally, flock size of 200–300 birds is also seen roosting inside Pakke (N. Borawake & B. Basu, pers. obs.). It is known to roost communally in large flocks of up to 1,000 birds in Thailand (Poonswad et al., 2013).

At Buxa Tiger Reserve, we have located three roost sites of the Wreathed Hornbill. We have conducted systematic monitoring at one of these sites since 2019. At this site, during the non-breeding season, the mean number of Wreathed Hornbills roosting along a riverbank was 42 ± 7.26 (range:1–224). The numbers show a stark decline in the non-breeding season, when the site was either unused or had only 1–2 Wreathed Hornbills visiting on some days (Mandal et al., 2024).

Population estimates

The Wreathed Hornbill shows a seasonal movement pattern in Namdapha Tiger Reserve, with densities peaking at 68 birds/km² in November–December and declining to 1 bird/km² in March–April (Naniwadekar & Datta, 2013). In and around Pakke Tiger Reserve, density estimates range from 5 to 15 birds/km² within protected areas and hunted habitats (Dasgupta & Hilaluddin, 2012). In Buxa Tiger Reserve, the mean density of this species is 0.49 birds/km², with an estimated population of 375 birds in the park based on field surveys conducted from 2019 to 2021 (Pradhan et al., 2024b).

Links:
iucnhornbills.org/wreathed-hornbill

Breeding Biology

Hornbills are secondary cavity nesters and depend on already existing cavities to nest in. These tree cavities are formed naturally due to a branch break-off or due to other bird activities such as by woodpeckers, barbets. Hornbills are known to re-use the cavities for nesting each year, as long as the cavities are still suitable and meet the nesting requirements.

The hornbill pair looks for cavities that are large enough to accommodate the female and the chicks till the chicks grow. The breeding period starts with the courtship period, the male is seen feeding the female and coaxing her. During this time, the pair is also seen visiting and inspecting the cavities to determine its conditions and suitability for nesting. After mating, the female gets ready to enter the cavity. Sometimes the female may enter and exit the cavity couple of times, before finally settling in to nest. She then seals the cavity opening with her droppings. In some species, the male may bring sealing material such as mud and assist the female to seal the nest cavity. The female leaves a tiny slit open through which the male passes food items. This nest-sealing behaviour in hornbills is unique among birds and is thought to have evolved to avoid predation.

The female usually lays two eggs, although in most of the large hornbills, only one chick survives. Smaller-sized hornbills like the Oriental Pied and Rufous-necked Hornbills usually have two chicks that survives. In some of the species like the Brown Hornbill up to 5-6 chicks can fledge. During the time of nesting, the female remains completely sealed inside the nest for 3-4 months, depending on the species. The larger-sized hornbills take about 4 months while the period is slightly lesser for the smaller-sized species. During this period, the female and the chicks are completely dependent on the male for providing them with food. The male carries food that includes fruits and animal items in his throat pouch and passes them through the slit. The male makes several visits throughout the day, which increases after the chicks' hatch and starts to grow. On hot and humid days, the female puts her beak out through the slit and keeps it open. The female hornbill and the chicks throw their excreta through the slit, by turning her back towards the cavity and shooting out the droppings. Droppings usually contain undigested pulp, fig seeds and insect chitin. Through the slit, she also regurgitates seeds of the larger non-fig fruits that were fed by the male. One may notice a large number of seeds on the forest floor below the nest.

In Arunachal Pradesh, most hornbill species start nesting in mid to end-March and the mother and chick come out only in mid-July to early August. In North Bengal, nesting usually begins in the end of February and stretches till July/August. The breeding cycle ranges from around 90 days for the Oriental Pied Hornbill to about 120-130 days for the Great and Wreathed Hornbills. In Arunachal, in the low-elevation forest, the breeding season of hornbills overlaps with the peak availability of ripe fruit of many tree species of the Meliaceae, Lauraceae and Myristicaceae families (April-July).

When the chicks are big enough, the female hornbill breaks the seal and comes out first, and the chick usually comes out a few days later. In some species, like the Great Hornbill, the mother hornbill comes out a few weeks earlier and helps the male feed the chick.

The chick/chicks stays with the parents for some months and family groups of 3 are often seen during August/September. It is believed that for some hornbill species, the chicks/ juveniles may stay with the parents for 9 months to a year, while juveniles of some species like the Great Hornbill and Wreathed Hornbill can also be seen together in larger flocks in the non-breeding season.

Nest Trees *of* Hornbills

Hornbills nest in existing tree cavities on large tall trees. The cavity used by hornbills for nesting is a natural hole located high up on the tree, with an elongated, oval or round shape. The shape can often be distinctly associated with particular species, for example, most Great Hornbill nests are elongated in shape. The nest-sealing behaviour of hornbills is a unique feature of their breeding behavior/biology. The female enters and seals herself up with faeces, bits of wood, bark and debris. In some smaller species, like the Oriental Pied Hornbill, the male brings mud to the female to seal the nest. She leaves a vertical slit open through which the male passes food.

In Pakke Tiger Reserve, 85% of nests are on *Tetrameles nudiflora*, an emergent, softwood species that is wind-dispersed. In Buxa Tiger Reserve, 43% of nest trees are on *Tetrameles nudiflora,* 11% on *Terminalia bellerica*, 7% on *Shorea robusta* and 4% on *Schima wallichi*. Apart from these, a few other tree species are also used for nesting. In Latpanchar, hornbills have used *Tetrameles nudiflora, Ailanthus grandis* and *Schima wallichi* for nesting.

Several kinds of hardwood species (mainly dipterocarps) are used for nesting in Thailand and Western Ghats.

The Importance *of* Hornbills

FUNCTIONAL ROLE

Hornbills, especially the large-bodied forest species are highly frugivorous. In a review by Kitamura (2011) hornbills have been recorded to consume and disperse the seeds of 748 species in 252 genera from 79 families. Liang et al. (2024) in a recent review where an Asian hornbill frugivory database was created reported that fruits or seeds from 471 plant species, 240 genera and 84 families were reported to be consumed only for Asian hornbills. In Arunachal Pradesh, around 100 tree species have been recorded in the diet of hornbills in Pakke Tiger Reserve (Datta, 2001b; Datta & Rawat, 2003; Datta et al., unpublished data). Hornbills eat fruits of various kinds—figs (Moraceae) and different types of non-fig fruits—usually single-seeded fleshy drupes/berries or lipid-rich dehiscent arillate capsular fruits. They especially consume fruits of Lauraceae, Meliaceae, Myristicaceae, Myrtaceae, some Annonaceae, Burseraceae and Rosaceae (Datta, 2001; Naniwadekar et al., 2015). They are effective dispersers due to a number of reasons in terms of both quality and quantity of seed dispersal. Hornbills are selective eaters, they will consume only ripe fruits, rejecting unripe fruits. They swallow fruits whole and do not usually peck at or damage the seeds. Most fruits they eat have large seeds (2–4 cm). The fleshy part is processed in the proximal gut and the seeds are regurgitated out. Most seeds of non-fig fruits are regurgitated. The tiny seeds of figs and a few other small-seeded non-fig fruit species are defecated (Datta, 2001). Studies have shown that hornbills do not spend a long time when visiting fruit trees, with average visit times of 10–15 minutes before moving on (Naniwadekar et al., 2019b). This behaviour makes them better dispersers as they move away from parent trees and are likely to be taking seeds far from the parent tree which is often critical for effective dispersal and establishment. For certain large-seeded species, they are more reliable and effective seed dispersers and their combined visitation rate and fruit removal rate is greater than several other avian frugivores (Naniwadekar et al., 2019b). They also have relatively long gut passage times (Datta, 2001; Shukla et al., 2018), therefore the seeds of fruits they have eaten will be regurgitated some place further away. Hornbills fly long distances in the forest looking for ripe fruits. A telemetry study of tagged hornbills, (Naniwadekar, et al., 2019a) found

that the median dispersal distance of seeds was around 250-300 m for the Great Hornbill and maximum distance was up to 2.5-13 km, while for the Wreathed Hornbill, median dispersal distance was 1,354 m, and maximum was up to 11 km.

Hornbills disperse seeds in a clumped/aggregated manner at nest and roost sites, where there is high seed and seedling mortality due to seed predation and pathogens, however during their usual daily foraging movements they travel over several kilometers and at trees where they perch for shorter times, they disperse seeds in a more scattered way. Naniwadekar et al. (2021) estimated that during foraging movements, hornbills can disperse 600-11,600 seeds per day per km^2.

Without hornbills, seeds of many species may not be able to travel far and find new places to grow. The presence of hornbills symbolize a healthy forest. They are important in keeping the forest alive and growing. If we lose hornbills, many forest trees that depend on them to spread their seeds may eventually decline or disappear from the forest too.

Threats *and* Challenges

GLOBAL AND INDIAN CONTEXT

Hornbills are sensitive to disturbance due to their large size, specific food and nesting requirements and their long breeding duration. Many hornbill species are also endemic and restricted in range which makes their global population even more vulnerable. There have been rapid population declines for some species in many parts of their range.

Threats related to hunting and habitat loss remain similar across the range of these species in South and South-east Asia, although degree of hunting and rates of forest loss differ. However, the legal protection status and conservation actions varies across range countries which likely affects the population status locally. A deforestation analysis from 2000 to 2012 estimated the rate of forest loss within the range of these hornbill species. Given the current rates of loss in their ranges coupled with hunting threat, the Wreathed, Rufous-necked Hornbills are projected to decline by 30–49% over three generations IUCN (2020). Generation lengths for the Great, Wreathed, Rufous-necked Hornbills are 18.3 years, 19 years, and 9.4 years, respectively (Bird et al., 2020).

The Indian Eastern Himalaya is home to six hornbill species - Great Hornbill (GH), Indian Grey Hornbill (GrH), Oriental Pied Hornbill (OPH), Brown Hornbill (BH), Rufous-necked Hornbill (RNH) and Wreathed Hornbill (WH). Of these, the BH, RNH and WH are restricted to the Eastern Himalaya landscape in India. The GH, WH and RNH are generally given the highest legal protection nationally and occur in several PAs across many range countries.

HUNTING

Hunting poses a substantial threat to the Great, Rufous-necked and Wreathed Hornbills in the Eastern Himalayan region especially in some states of Northeast India. A survey found that the GH is mainly hunted for food, casque and tail feathers, which are used

as adornments by local communities. A GH casque can fetch up to $90, and a single tail feather $15 in Northeast India. Local hunting is a much lesser threat for the GH in northern India and the Western Ghats. The RNH occurs at higher elevation in subtropical forests. Hunting is primary threat to the species in Arunachal Pradesh, Nagaland and Mizoram, where it is targeted primarily for meat and secondarily for its casque/feathers. Where GH does not occur, the casque of the RNH is used in ceremonial headgear, while the tail feathers are occasionally sought for cultural reasons, and the meat is consumed. The WH is also targeted for its meat, as a trophy or for its feathers. The WH is less preferred for its body parts than the GH. The fat of these species, is used by some communities for its perceived medicinal value and for polishing guns. These species are also captured for the pet trade with chicks reported as being collected in south India, Thailand, Myanmar, Bangladesh and other South-east Asian countries which appears to be on the rise. The pet trade is at the local and international level.

In North Bengal, there is anecdotal information that live hornbills used to be sold to traders, possibly for the pet trade until the late 1980s. However, this appears to have reduced considerably. However, in the past few years, there have been some incidents of Oriental Pied Hornbill captures (mostly chicks) from North Bengal.

HABITAT LOSS, DEGRADATION AND FRAGMENTATION

Forests are lost to illegal logging and land conversion for settlements, agriculture and commercial cash crop monoculture plantations. In some areas, studies have shown that the GH have very large home ranges, although in the breeding season, ranges have found to be small of 1–2 km^2 in Arunachal Pradesh, the species requires extensive tracts of undisturbed forest and is unable to persist in areas where lowland forest has been reduced to small fragments. The WH has a very large home range and therefore requires large tracts of undisturbed forest. It is wide-ranging in the non-breeding season while preferring to nest in lowland forests which is particularly impacted by deforestation. Proximity to human populations is strongly avoided especially in North-east India where these species are susceptible to hunting. In north-eastern India, only 5% of the landscape offers suitable habitat. These two species have disappeared from places where they used to be common while it has declined in abundance at sites where it persists. A study found that the decline of hornbills in hunted and logged forests results in reduced seed dispersal.

Similar threats apply to the RNH. Its dependence on large trees for feeding and nesting makes it susceptible to deforestation and habitat degradation through logging, shifting cultivation and clearance for agriculture. They occur in hill forests and are not known to make wide-ranging movements. They have small annual home ranges (c. 25 km^2) though a recent study from Bhutan suggests larger ranges.

CLIMATE CHANGE

There is some evidence from Arunachal Pradesh that nesting patterns are being affected by changes in the climate with timing of nesting shifting (early or late) from long-term patterns. This maybe also negatively affecting nest occupancy and nesting success in some years for the GH and WH.

CHAPTER 3

RESEARCH AND OTHER OUTPUTS

Key Findings *of* the Hornbill Research *in* North Bengal

Some of the project's key findings of the hornbill research in North Bengal conducted by Nature Mates-Nature Club (NMNC) and Nature Conservation Foundation (NCF) from 2018 to 2024 are summarized below.

HORNBILL DISTRIBUTION AND ABUNDANCE

To estimate hornbill density, abundance and distribution in Buxa Tiger Reserve, an occupancy-based survey was completed over two non-breeding seasons (September-March) of 2019-2020 and 2020-2021.

The total 760.87 km^2 area of Buxa Tiger Reserve was divided into 25 km^2 grids. Three transects of 1.5 km were walked in each grid. In a total effort of 225.2 km across 81 transects over two years, the estimated density of the three large-bodied species was low (< 1 bird per km^2), while that of the Oriental Pied Hornbill was around 11 birds per km^2. Abundance estimates ranged from a mean of 27 birds for the Rufous-necked Hornbill, 161 for the Great Hornbill, 375 for the Wreathed Hornbill and 8050 for the Oriental Pied Hornbill in Buxa Tiger Reserve. These results have been published recently in Pradhan et al. (2024b).

Table 1: Summary of the total number of detections, encounter rates, and flock size of four hornbill species (Great Hornbill, Wreathed Hornbill, Rufous-necked Hornbill and Oriental Pied Hornbill) sampled over two non-breeding seasons in Buxa Tiger Reserve with a total effort of 225.2 km from 2019 to 2021.

Species	Total detections (visual detections)	Encounter rates for visual detections (± SE)	Flock encounter rates for combined detections (visual and aural) (± SE)	Mean flock size (SE)
Great Hornbill	20 (3)	0.01 (± 0.01)	0.06 (± 0.02)	2 (± 0.58)
Wreathed Hornbill	15 (9)	0.03 (± 0.02)	0.04 (±0.02)	2.3 (± 0.56)
Rufous-necked Hornbill	6 (2)	0.01 (±0.01)	0.02 (± 0.01)	1 (± 0)
Oriental Pied Hornbill	182 (76)	0.24 (± 0.05)	0.54 (± 0.08)	2.2 (± 0.36)

Table 2: Density (birds per km^2) and abundance estimate of four hornbill species (Great Hornbill, Wreathed Hornbill, Rufous-necked Hornbill and Oriental Pied Hornbill) in Buxa Tiger Reserve.

Species	Mean density estimate (95% CI)	Abundance (95% CI)	Coefficient of Variation (%)
Great Hornbill	0.21 (0.06–0.79)	161 (43–600)	73.6
Wreathed Hornbill	0.49 (0.17–1.45)	375 (128–1,104)	58.7
Rufous-necked Hornbill	0.04 (0.01–0.2)	27 (5–151)	106.8
Oriental Pied Hornbill	10.58 (6.4–17.48)	8,050 (4,871–13,303)	25.9

*CI: Confidence Interval

Since December 2021, we also conducted transect surveys to estimate hornbill population and abundance in Latpanchar, a fringe village of Mahananda WS located at an elevation of 1,100 m. For this, 7 trails were established and each trail was surveyed twice a month to record hornbill presence, cluster size and the perpendicular distance of the bird from the trail.

From December 2021 to December 2023, in a total effort of 344.9 km, the density estimate for the Rufous-necked Hornbill was 9.65 birds/km^2 (95% CI 2.51–37.02), with a CV of 61.8%. The cluster density estimate was 3.74/km^2 (95% CI 1.32–10.57) with a CV of 47.36% (Pradhan et al., 2024a). We had a similar result while analysing the data for one year from December 2021 to December 2022, where in an effort of 188 km, the density of the Rufous-necked was 8.83 birds/km^2 (95% CI 2.37–32.83) with a CV of 58.88%. The average encounter rates for direct sightings of the Rufous-necked was 0.31 birds/km (SE ± 0.05) and for the Great Hornbill was 0.04 birds/km (SE ± 0.01).

Similarly, we also conducted a park-wide survey in Mahananda WS between November 19th and the December 12th, 2023. In a total effort of 40.5 km, there were 16 detections of the Oriental Pied Hornbill, of which 6 were direct sightings and 10 were calls. There were 5 detections (all calls only) of the Great Hornbills. However during the survey there were no detections of the Rufous-necked and Indian Grey Hornbill- the other two species known to occur in this park.. The overall encounter rate (detections/km) for Oriental Pied Hornbills was 0.40/km. The encounter rate for Great Hornbills was 0.12/km. Four Great Hornbills and 12 Oriental Pied Hornbills were recorded outside of transects, while foraging on fruiting trees or while flying overhead. More sampling effort over a longer time period is needed to obtain adequate number of sightings for obtaining density estimates.

In 2018, in a rapid survey conducted in the Neora Valley National Park there were at least 10 detections of the Rufous-necked Hornbill observed in an effort of about 60 km. Similarly, in 2023, a preliminary visit was made to Jaldapara National Park. Although the survey was mostly conducted by travelling in a vehicle to most parts of the park, there were 5 detections of the Oriental Pied Hornbill (4 direct sightings) and 1 direct sighting of the Great Hornbill.

More than 5,000 hornbill sightings (prior to December 2023) have been collated from various citizen science platforms such as eBird, iNaturalist, Hornbill Watch and from social media pages on Facebook. The observations help to understand the extent of each of the 5-hornbill species' range across North Bengal. These observations are made from

across Protected Areas, Reserved Forest and human settlements in different parts of North Bengal. We have created maps based on these sightings for each of the five hornbill species (Pages 86-90).

BREEDING BIOLOGY OF HORNBILLS

From 2018 to 2024, we have located 47 hornbill nests of the four species—with a total of nine Great hornbill, 25 Oriental Pied hornbill, nine Rufous-necked hornbill and four Wreathed hornbill nests in Buxa Tiger Reserve.

BUXA TIGER RESERVE

Table 3: Year-wise known nests for each species at Buxa Tiger Reserve

Year	Great hornbill (GH)	Oriental Pied hornbill (OPH)	Rufous-necked hornbill (RNH)	Wreathed hornbill (WH)	Total nests
2018	5	3	2	1	11
2019	5*	5	6	2	18
2020	5	6	6	2	19
2021	6	10	7	2	25
2022	7	13	6**	2	28
2023	8	19	7	3	37
2024	7***	25	8	4	44

*One GH nest tree fell in a storm in 2018 and has been removed from the total GH nest count from 2019 onwards

** One of the RNH nests (MH_RNH) was taken over by GH pair and from 2022 counted as a GH nest.

***A second GH nest fell in the non-breeding season in 2023 and has been removed from the total GH nest count from 2024 onwards

Great hornbill nesting summary

Since 2018, we have located nine Great hornbill (GH) nests in Buxa Tiger Reserve. Out of these, two nest trees have fallen during storms in 2018 and 2023 respectively and one nest that was earlier used by a Rufous-necked hornbill was taken over by GH from 2022 onwards.

The female entries have mostly taken place from end of February until early-March across all year. In 2021, one of the GH female entry took place on March 24th which extended the chick exit towards the end of July. The mean chick exit across the years largely falls between June-end to 1st week of July. The nesting duration for the Great hornbill has ranged between 113 – 123 days with mean duration of 117 days (SD ± 2.65).

Oriental Pied hornbill nesting summary

Since 2018, we have located 25 Oriental Pied hornbill (OPH) nests in Buxa Tiger Reserve. The female entries for Oriental Pied hornbill take place between mid-March to mid-April. The chick exit occurs in June with some exits extending to the first half of July. The mean nesting duration across the years ranges between 83 – 91 days for this species with an overall mean of 88 days (SD ± 5.20).

Rufous-necked hornbill nesting summary

Since 2018, we have located nine Rufous-necked hornbill (RNH) nests in Buxa Tiger Reserve. The female entry for the Rufous-necked hornbill takes place from the end-March until end-April/early May, while the chick exit takes place in July. The nesting duration ranged from 116 to 121 days with an overall mean duration of 118 days (SD ± 2.65) from 2018-2024. Most Rufous-necked hornbill nests in Buxa are situated in difficult-to-access areas, especially during the monsoon season. This limited accessibility is challenging for regular monitoring, making it difficult to determine the exact dates of female entry and chick fledging, especially the latter as exit happens in July in peak monsoon time in far-away nests.

Wreathed hornbill nesting summary

Since 2018, we have located four Wreathed hornbill (WH) nests in Buxa Tiger Reserve. The female entry for the Wreathed hornbill takes place from mid-March to mid-April, while the chick fledging is between end-July to early-August. However, in 2020, a chick fledging took place on September 11th at a nest where the female entered late on April 19th.

The nesting duration for this species ranged 125-145 days with the mean nesting cycle of 133 days (SD ± 9) from 2018-2024.

The average nesting success of hornbill nests in Buxa TR is 81% (range of 50–100 %) from

2018 to 2024. Four nest trees have fallen in Buxa Tiger Reserve during storms. There have also been incidents of Oriental Pied Hornbill nests getting disturbed by humans. We have also observed interspecific competition for nest sites where a Rufous-necked Hornbill nest was taken over by Great Hornbill. These interactions have led to abandonment of some nests in the middle of the breeding season.

The main nest tree species in Buxa Tiger Reserve are *Tetrameles nudiflora* (Moina), *Schima wallichi* (Chilaune), *Terminalia bellirica* (Bahera), *Shorea robusta* (Sal), and *Ailanthus grandis* (Gokul). In Buxa TR, 43% of hornbill nest trees are on *Tetrameles nudiflora*, an emergent, softwood tree locally known as Moina in Bengali.

LATPANCHAR AND MAHANANDA WILDLIFE SANCTUARY

Since 2022, we have known of six nests of Great and Rufous-necked Hornbills in and around Latpanchar, fringes of Mahananda WS. Some of these nests include those that used to be active and used by hornbills in the past but have not been active since our study. The female entry for the RNH takes place in the first week of April (April 2 - 6) and the chick fledging takes place towards the end of July. Two chicks are recorded each year at one of the Rufous-necked Hornbill (RNH) nests and the chicks exit from the nest on separate days about 5-6 days apart. The female entry for the Great Hornbill (GH) takes place at the end of March and the chick exit is in July. The average nesting duration for the RNH is 117 days (SD ± 3.2) and for the GH is 125 days.

At Latpanchar, the nesting success is 88% from 2022 to 2024 (range 66 - 100%). In Latpanchar, the tree species used are *Tetrameles nudiflora* (Moina), *Schima wallichi* (Chilaune), and *Ailanthus grandis* (Gokul). A nest on a *Castanopsis indica* (Katus) tree in Latpanchar fell during a storm.

HORNBILL ROOST MONITORING

Some hornbill species exhibit communal roosting in sites that are used over many years with visits occurring consistently or intermittently across months in a given year. Communal roosting has been reported in Great, Oriental Pied and Wreathed Hornbills from western Arunachal Pradesh (Datta, 2001; Naniwadekar et al., 2022). They were seen to roost in open grasslands along riverbanks or on cliffs with fewer trees near rivers and perennial streams. At Buxa too, Wreathed Hornbills use riverine habitat, while Great Hornbills roost in good hill forest patches and their roost sites were near small water bodies.

At Buxa Tiger Reserve, we have located a total of seven roost sites: four are of Great Hornbill and three are of Wreathed Hornbill. One GH roost site and one WH roost site are monitored regularly, while others are monitored sporadically. We monitored the Great Hornbill roost site during the non-breeding months in 2018-2021 and throughout the year (both breeding and non-breeding months) in 2022 and 2023. We monitored the Wreathed Hornbill roost site during the non-breeding months in 2019-2021 and throughout the year (both breeding and non-breeding months) in 2022 and 2023. The results have been published in Mandal et al. (2024).

Summary of roosting numbers of Great Hornbill at one roost site from 2018 until August 2023 (Mandal et al., 2024)

- Numbers seen in roost site in non-breeding months (August-January) ranges 1-20
- Numbers seen in roost site in breeding months (April-June) ranges 1-7
- Numbers seen in transition months (February, March and July) ranges between 2-19
- Highest individuals seen in the roost site has been 20 on a single observation day.

Summary of roosting numbers of Wreathed Hornbill at one roost site from 2019 until August 2023 (Mandal et al., 2024)

- Numbers seen in roost site in non-breeding months (September-February) ranges 1-224
- Numbers seen in roost site in breeding month (May-July) is 1
- Numbers seen in transition months ranges between (March, April and August) 1-44
- Highest individuals seen in the roost site is 224 counted on a single observation day

Vegetation surveys and tree phenology monitoring

The plotless method of Point Centre Quarter (PCQ) was used to understand the vegetation structure and composition in Buxa TR. Our findings suggest that the average tree density is 91.9 trees/ha (SE ± 7.5) and overall tree density (GBH ≥25 cm) ranged from 7.8 to 425.6 trees/ha across the 81 trails that were sampled (Pradhan et al., 2024b). The mean total basal area of trees was 8.5 m^2 (SE ± 0.52) with a range of 2.98-27.55 m^2 across all trails (Pradhan et al., 2024b).

We are also currently monitoring the monthly tree phenology of 800+ individual trees of 63 tree species in Buxa TR and 154 individual trees of 23 tree species in Latpanchar. The presence and absence of flower buds, flowers, ripe and unripe fruits and leaf phenophase (new, mature, old, leafless) are recorded every month. The phenological monitoring is

being done to understand seasonal and annual patterns of leafing, flowering and fruiting in Buxa (tropical forest) and in the Latpanchar area (subtropical forest). It provides an understanding of seasonal fruit availability patterns for hornbills and is also important to understand and determine any change in these patterns due to climate change.

COMMUNITY ENGAGEMENT

North Bengal has communities of various ethnic groups, including some indigenous tribes. Bengali, Bihari, Nepali are some of the dominant ethnic groups of the region. The indigenous tribes include the Rabha, Santhals, Garos, Dukpa, Oraos, Toto, Lepchas, among others. The adjoining areas of most Protected Areas and Reserved Forests have a high human density and are also surrounded by tea gardens and cinchona plantation sites.

Many of these communities continue to be dependent on natural resources for their daily household use and sometimes also for commercial purpose (Das, 2005). Thus, it is important to have local community members as an integral and important stakeholder by involving them in developing and implementation of conservation plans in this landscape. In order to understand the socio-economic status, general awareness and perception of local people, we conducted social surveys in Buxa Tiger Reserve and fringes of Mahananda Wildlife Sanctuary in 2022. For household surveys, we covered 15% of the total households in each village and completed surveys in 155 households across 10 villages. Most of the households were dependent on more than one source of income - agriculture, livestock and labour were the primary sources of livelihoods at these sites. Perception towards trends in hornbill population differed between members of each village and across sites. In terms of resources, water and fuelwood are the most important natural resource that the communities are dependent on. We also documented the oral history of each village with inputs from 48 elderly members from the 10 villages.

The understanding of the historical context and nature-people relationships through the in-depth interview surveys provided a strong foundation while developing conservation strategies during the conservation action planning workshop.

With regard to hornbills, most community members express a favourable attitude while at some sites hornbills are also directly linked to their culture and livelihoods.
In addition to the surveys, we have also engaged with other groups such as local bird/ tourist guides, frontline staff of the forest department and local schools through various trainings and workshops. Our engagement with local schools has turned into an annual

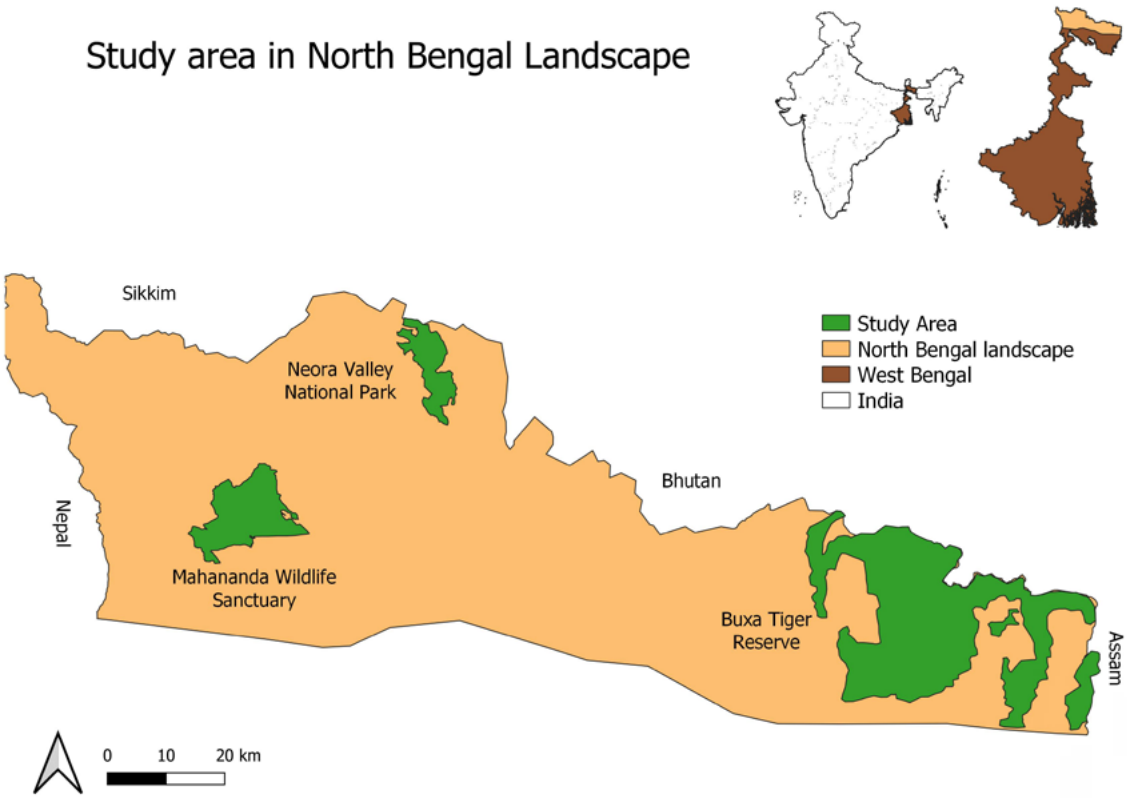
event where we organise a nature education programme for students of school in Buxa and Latpanchar to foster love, appreciation and a deep connection with nature.

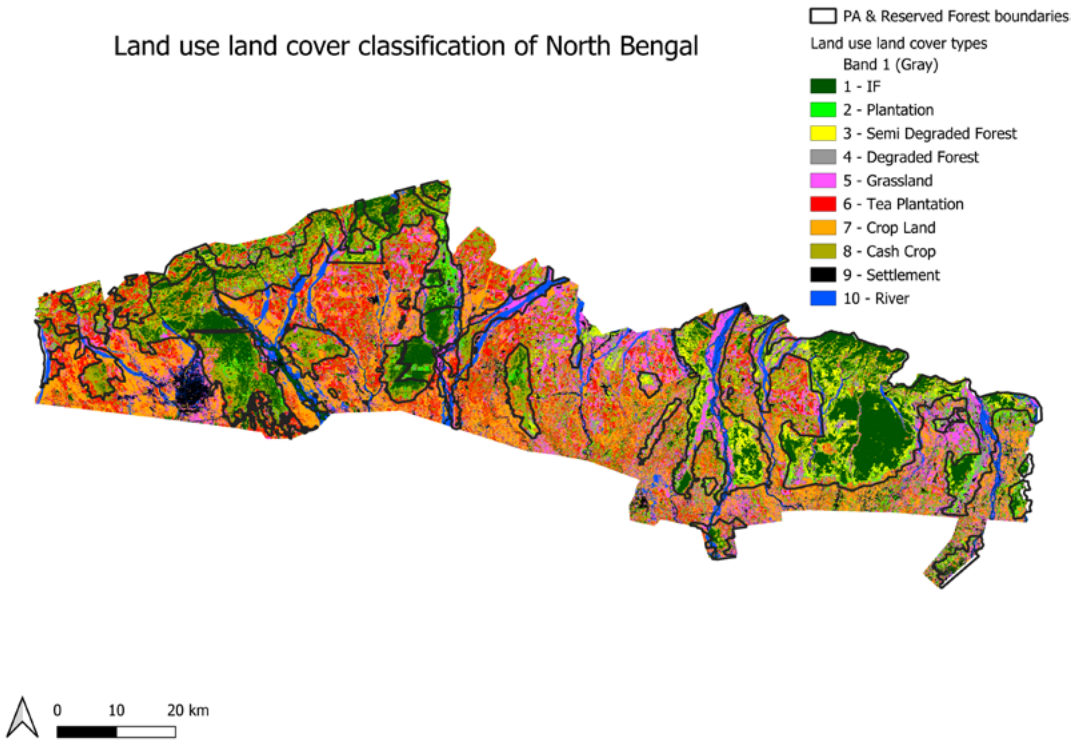
LAND USE LAND COVER MAP

A land use land cover map was created for the North Bengal region that extended from the Mechi river in Indo-Nepal border to Sankosh river in West Bengal-Assam border. In the south, the extent of forest presence was used as the limit of the study area. In the north, the study area was limited by an elevation ranging from 1,000-1,500 m asl. The area comprised of parts of Darjeeling, Kalimpong, Jalpaiguri, Alipurduar and Cooch Behar district. The forest divisions comprised of Wildlife III division, Darjeeling Wildlife Division, Kurseong Division, Kalimpong Division, Gorumara Wildlife Division, Baikunthapur Division, Jalpaiguri Division, Cooch Behar Division and Buxa Tiger Reserve. The major forest types are Northern Tropical Semi-evergreen forest and Tropical Moist deciduous forest and the grassland type is East Indian alluvial grassland (Champion and Seth, 1968). A multitude of reasons led to the fragmentation of forest in the landscape like the clearing of natural forest for timber plantations and tea estates by the erstwhile colonial administration, settlement of Taungya cultivators in the 19th century, establishment of army units in the 1960s, and anthropogenic pressure from the growing human population (Roy, 2015; Nagendra et al., 2009).

Total area classified: 6926.45 km^2

Class	Pixel sum	Percentage (%)	Area (km^2)
Intact forest	3701190	21.37	1480.476
Plantation	695640	4.02	278.256
Semi-degraded forest	1407420	8.12	562.968
Degraded Forest	1340064	7.74	536.026
Grassland	1384302	7.99	553.721
Tea Plantation	2499617	14.44	999.847
Crop land	2731873	15.78	1092.749
Cash Crop	1957920	11.31	783.168
Settlement	689361	3.98	275.744
Water Body	908733	5.25	363.493





Caveat

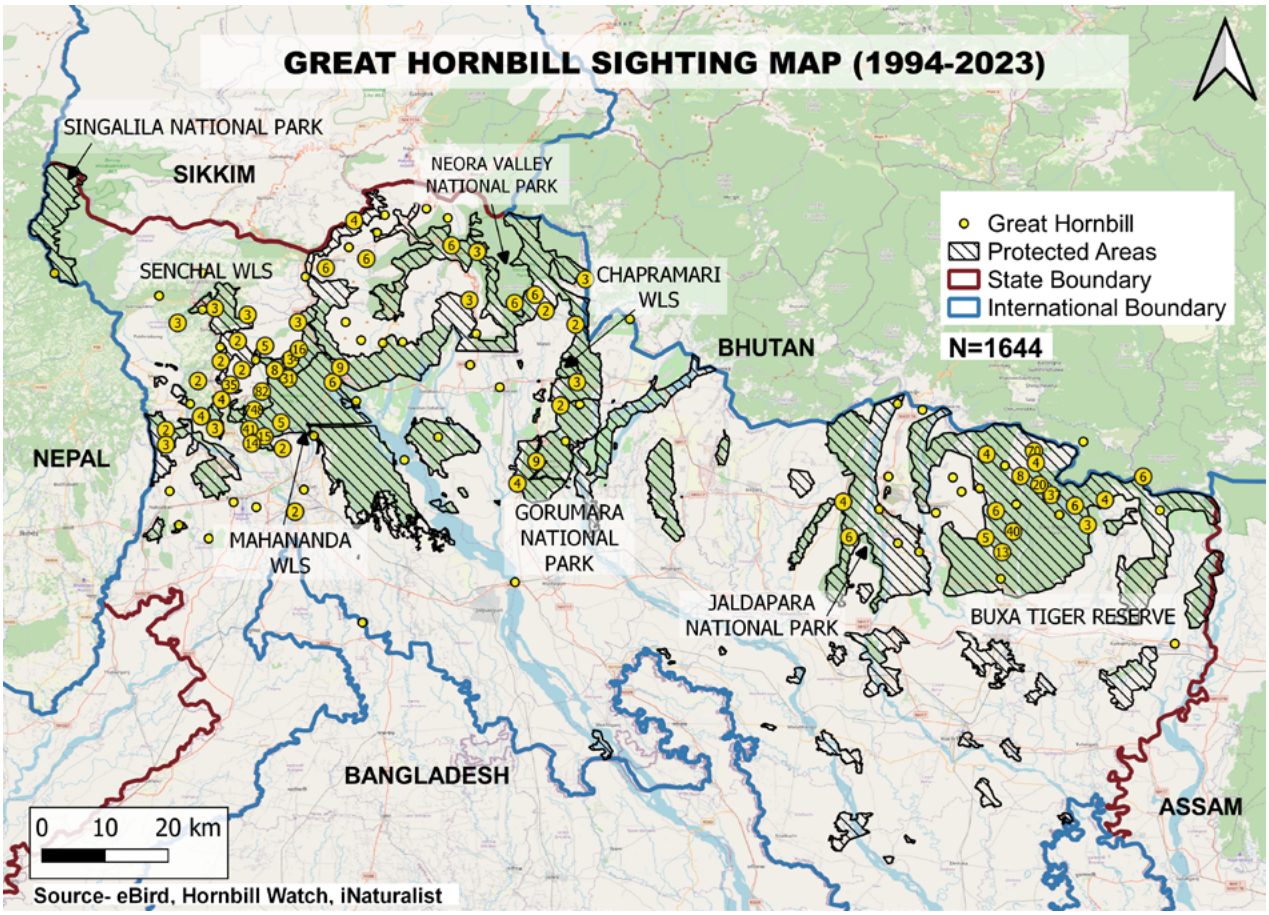
Monoculture cash crops and monoculture or mixed plantations has very similar signatures. Due to this, some area which falls within forest jurisdiction has been classified as Cash Crop. Please note that the areas that have been classified as Cash Crop inside boundaries of various forest divisions are monoculture or mixed plantations.

CITIZEN SCIENCE DATA: HORNBILL SIGHTINGS

All recorded sightings of hornbills until December 2023 were extracted from various citizen science (eBird, Hornbill Watch and iNaturalist) and social media platforms. Some of the records from eBird dated back to the 1970s. We used the information to create a map of the sightings recorded for each of the five hornbill species found in North Bengal.

Great Hornbill sightings in North Bengal

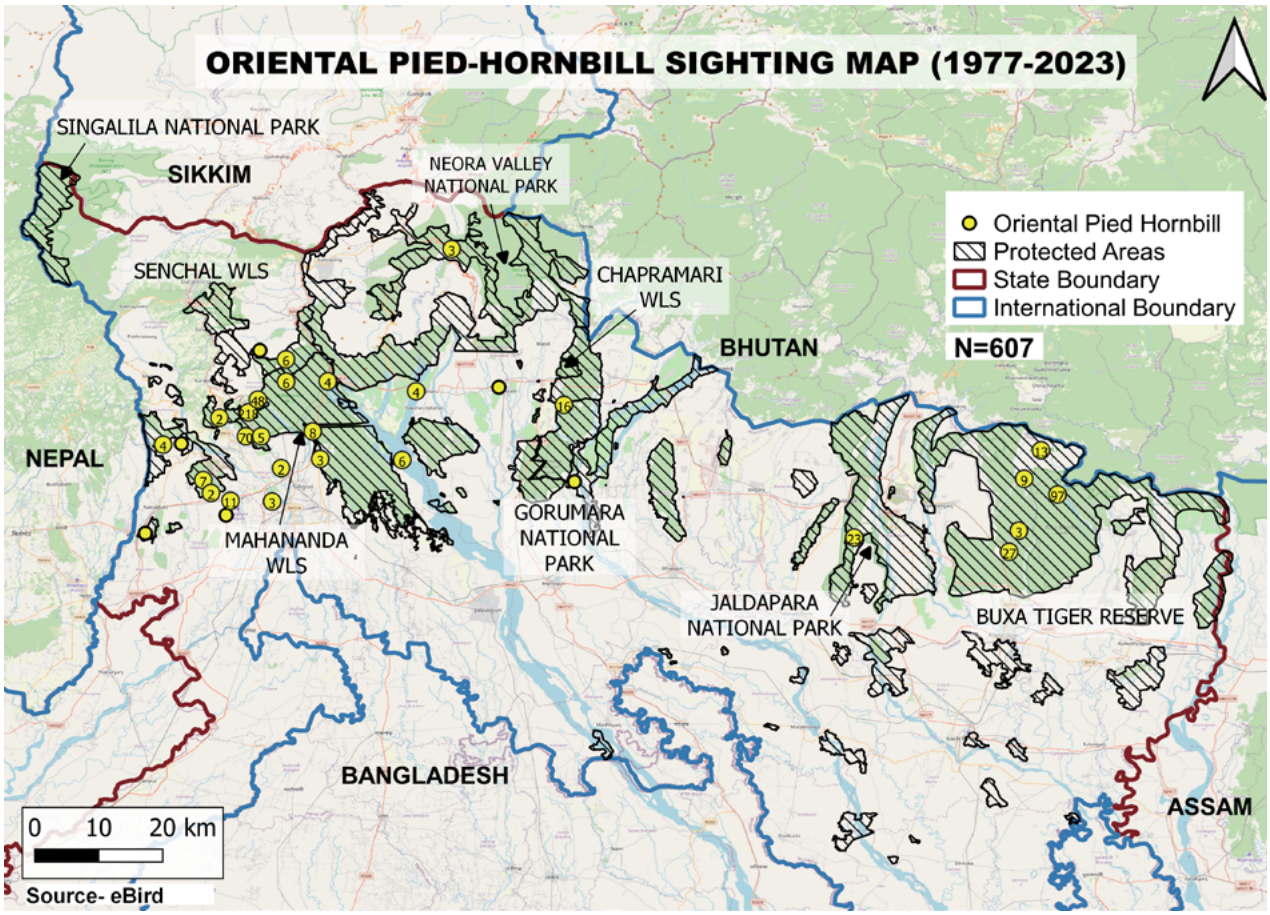
A total of 1,644 sightings of Great Hornbill in North Bengal was recorded across various platforms. This species is widely distributed in the region and is also reported across different elevation gradients from the plains of the terai to the higher elevations of Neora Valley National Park and the adjacent areas of Kalimpong.



*Protected Areas include Reserve Forests, National Parks, Wildlife Sanctuaries and Tiger Reserves.

Oriental Pied Hornbill sightings in North Bengal

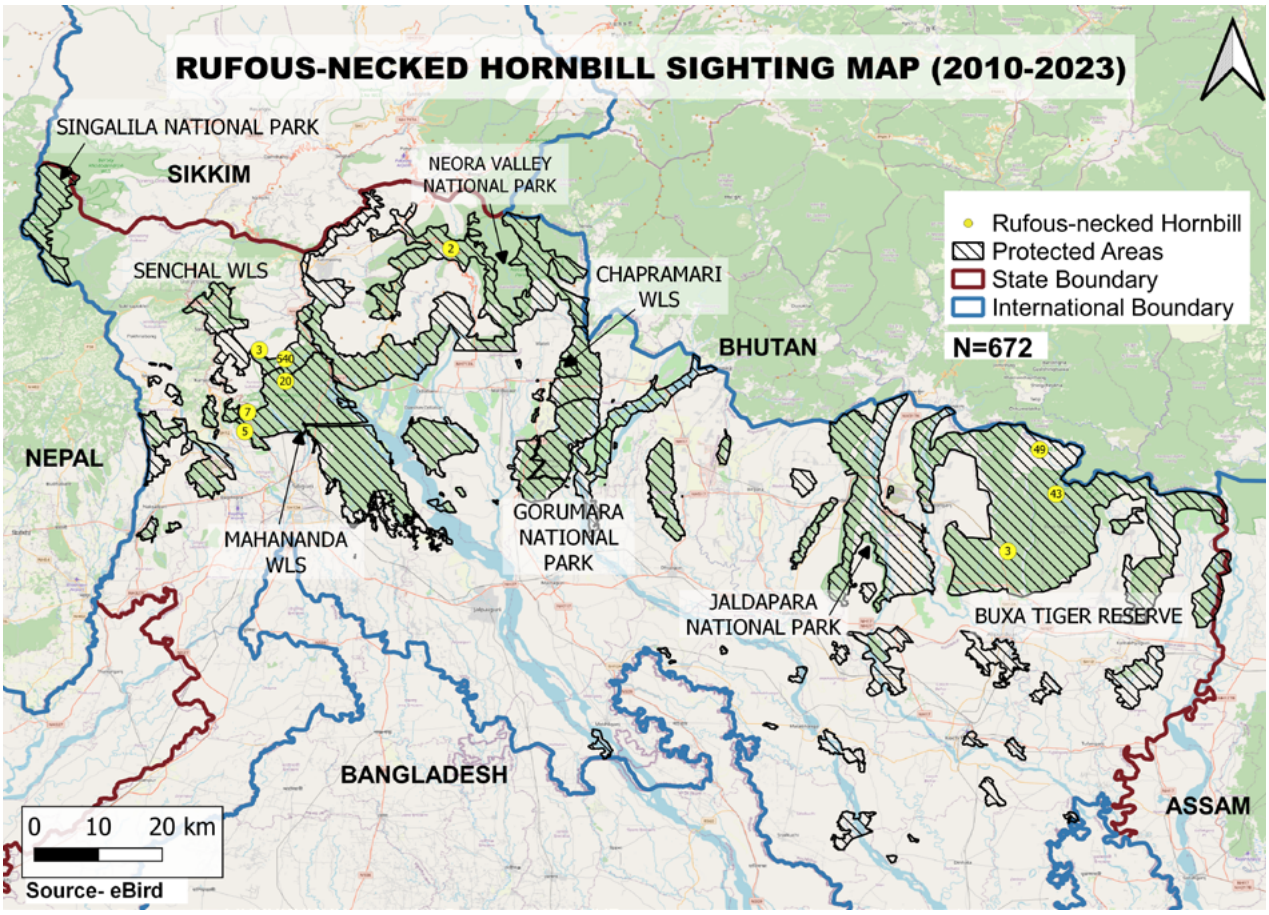
There were 607 observations of the Oriental Pied Hornbill from North Bengal. This species occurs across the North Bengal landscape and is largely reported from the lower elevation belts of the terai region. Most of the sightings have been reported from in and around the Mahananda Wildlife Sanctuary and Buxa Tiger Reserve.



*Protected Areas include Reserve Forests, National Parks, Wildlife Sanctuaries and Tiger Reserves.

Rufous-necked Hornbill sightings in North Bengal

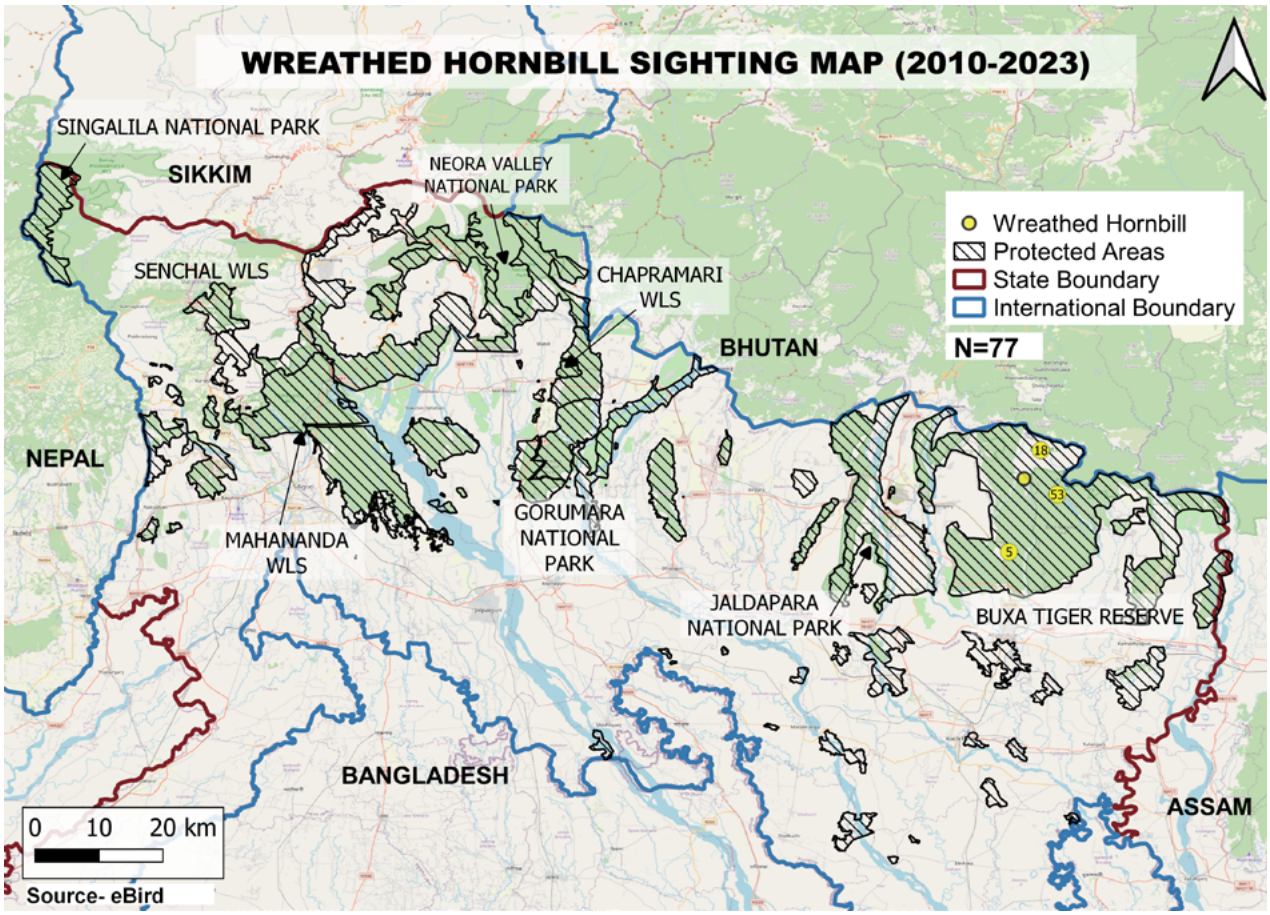
The Rufous-necked Hornbill is a species that mostly prefers higher elevations. There are 672 sightings reported for this species. Most of the sightings are from Latpanchar, a fringe village of the Mahananda Wildlife Sanctuary and from Buxa Tiger Reserve. There are also records from Mahananda Wildlife Sanctuary and Neora Valley National Park where this species is known to occur.



*Protected Areas include Reserve Forests, National Parks, Wildlife Sanctuaries and Tiger Reserves.

Wreathed Hornbill sightings in North Bengal

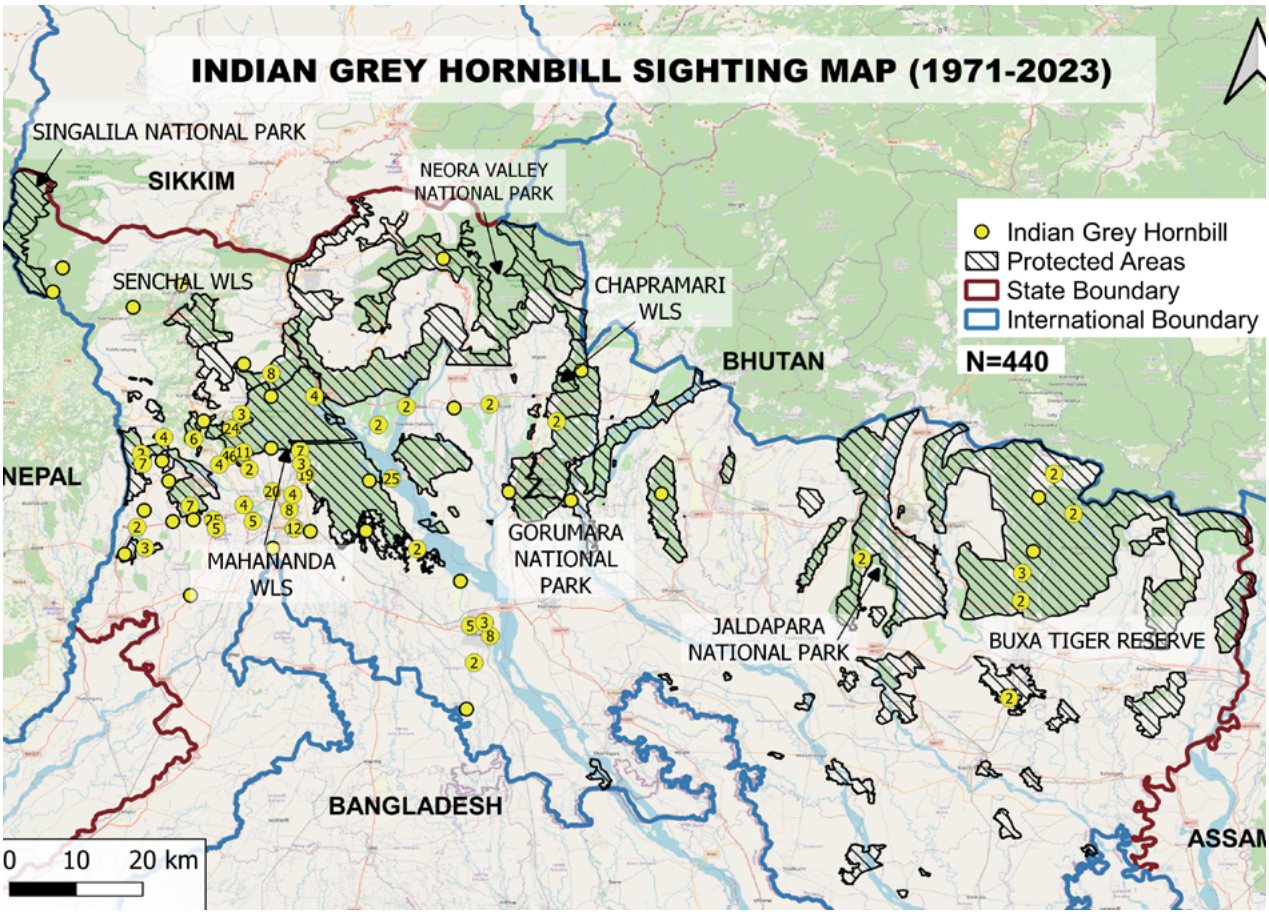
There were 77 records of the Wreathed Hornbill. All the sightings were reported from Buxa Tiger Reserve, which is the westernmost part of its global distributional range.



*Protected Areas include Reserve Forests, National Parks, Wildlife Sanctuaries and Tiger Reserves.

Indian Grey Hornbill sightings in North Bengal

There were 440 sightings reported for the Indian Grey hornbill. The Indian Grey Hornbill is largely reported from in and around the Mahananda Wildlife Sanctuary. Many of the sightings are also from landscapes outside forest which could include tea gardens, settlements and agriculture fields. Sightings of the species is mainly reported from the western part of North Bengal and reduces in the eastern part, although there are a few sightings from Jaldapara and Buxa Tiger Reserve.



*Protected Areas include Reserve Forests, National Parks, Wildlife Sanctuaries and Tiger Reserves.

List of participants

Name	Designation	Organization / Institute/ region	Email address
Aditya Pradhan	PhD Student	ATREE	aditya.pradhan@atree.org
Amir Kumar Chhetri	Fellow	Coexistence consortium (Local community member from Pani jhora village, near Chapramari)	amirchhetri1988@gmail.com
Anil Lomgel	Deputy Ranger Forester	Forest Department, Darjeeling Wildlife Division	anillomjel@gmail.com
Anup Rai		Forest Department, Darjeeling Wildlife Division	
Dr. Aparajita Datta	Senior Scientist and Co-Chair (Asia) - IUCN SSC Hornbill Specialist Group	Nature Conservation Foundation	aparajita@ncf-india.org
Apurba Chakraborty	Assistant Secretary	Prakriti Samsad- The Council of Nature Watchers	apurbac106@gmail.com
Archisman Bandyopadhyay	Forest Range Officer	Forest Department, Kalimpong Forest Division	archisman.iitd@gmail.com
Arjan Basu Roy	Secretary	Nature Mates- Nature Club	naturemates@gmail.com
Biswapriya Rahut	President	Birdwatchers' Society (pan Bengal organisation)	bishwapriya@gmail.com
Deo Prasad Pradhan	President	Mahananda Eco Tourism and Conservation Society (Local community member from Nurbong Tea Estate, near Mahananda)	pradhandeoprasad@gmail.com
Dr. Dipankar Lahkar	Senior Manager	Aaranyak	dipankar.lahkar@gmail.com
Dorjey Sherpa	Forest Range Officer	Forest Department, Jalpaiguri Forest Division	sherpajee777@gmail.com
Dwaipayan Rano	Forest Range Officer	Forest Department, Baikunthapur Forest Division	dwaipayan.rano@gmail.com
Karishma Pradhan	Project Manager	Nature Conservation Foundation	karishma@ncf-india.org
Kezajacho Dukpa	Field Assistant	Nature Mates-Nature Club	kezajacho@gmail.com
Mangal Tsering Lepcha	Beat Officer	Forest Department, Kurseong Forest Division,	
Pasang Lepcha	Project Officer	WWF- India, Darjeeling office	plepcha@wwfindia.net
Priya Tamang	Forest Range Officer	Forest Department, Baikunthapur Forest Division	priya.blone@gmail.com
Priyanka Das	Fellow and Researcher	Coexistence Consortium	priyankadasconnect@gmail.com
Priyanka Iyer	Co-Chair / Researcher	CPSG-South Asia / Zoo Outreach Organisation	priyanka@zooreach.org
Rajib Saha	Field Assistant	Hathi Sathi Foundation	saharajib533@gmail.com
Rana Dey	Secretary	Indian Tea Association (Terai Branch)	ranadey.ita@gmail.com
Ranjana Saha	Researcher	Nature Environment & Wildlife Society	ranjana.saha@yahoo.in
Rohan Pandit	Senior Project Officer	WWF- India, Sikkim Office	rpandit@wwfindia.net
Rupen Lepcha	President	Neora Valley Sustainable Ecological Society (NVSES)	lepcharupensamsingkm@gmail.com

Name	Designation	Organization / Institute/ region	Email address
Dr. Sana Huque	Project Manager	Nature Conservation Foundation	sanahuque@ncf-india.org
Dr. Sanjay Molur	Co-Chair / Executive Director	CPSG-South Asia / Zoo Outreach Organisation	sanjay@zooreach.org
Sanjok Dewan	Secretary	METACOS	sanjokdewan23@gmail.com
Saumik Pal	Assistant Secretary	Himalayan Nature and Adventure Foundation, Siliguri	saumikpal15@gmail.com, hnafsiliguri@gmail.com
Dr. Sherub S	Head-CoC (Researcher)	Center for Conservation (CoC), Ugyen Wangchuck Institute for Forestry Research and Training (Bhutan)	sherub@uwice.gov.bt
Shilpita Mandal	Researcher	Nature Mates- Nature Club	shilpitamandal0401@gmail.com
Sikander Dewan	Field Assistant	Nature Conservation Foundation	-
Sitaram Mahato	Field Assistant	Nature Mates-Nature Club	sitarammahato15399@gmail.com
Supriya Samanta	Fellow	Zoo Outreach Organisation	supriyasamanta1234@gmail.com
Sunil Rai		Forest Department, Kurseong Forest Division	-
Sunita Khatiwara	Research Officer	Forest & Environment Department, Government of Sikkim	sunitakhatiwara@gmail.com
Dr. T R Shankar Raman	Senior Scientist	Nature Conservation Foundation	trsr@ncf-india.org
Trisa Bhattacharjee	Researcher	Zoo Outreach Organisation	trisa@zooreach.org
Utpal Nandi	Forest Range Officer	Forest Department, Kalimpong Forest Division	utpalnandi92@gmail.com

References

Bird, J. P., Martin, R., Akçakaya, H. R., Gilroy, J., Burfield, I. J., Garnett, S. T., Symes, A., Taylor, J., Şekercioğlu, Ç. H., & Butchart, S. H. M. (2020). Generation lengths of the world's birds and their implications for extinction risk. *Conservation Biology*, *34*(5), 1252–1261. https://doi.org/10.1111/cobi.13486

Das, B. (2005). Role of NTFPs among forest villagers in a Protected Area of West Bengal. *Journal of Human Ecology*, *18*, 129–136.

Dasgupta, S. (2012). Differential effects of hunting on populations of hornbills and imperial pigeons in the rainforests of the Eastern Indian Himalaya. *Indian Forester*, *138*(10), 902–909.

Datta, A. (2001). An ecological study of sympatric hornbills and fruiting patterns in a tropical forest in Arunachal Pradesh. Ph.D thesis, Saurashtra University, 245 pp.

Datta, A., Naniwadekar, R., Rao, M., Sreenivasan, R., & Hiresavi, V. (2018). Hornbill Watch: A citizen science initiative for Indian hornbills. *Indian Birds*, *14*(3), 65–70.

Datta, A., & Rawat, G. S. (2003). Foraging patterns of sympatric hornbills during the nonbreeding season in Arunachal Pradesh, Northeast India. *Biotropica*, 35, 208-218.

Datta, A., & Rawat, G. S. (2008). Dispersal modes and spatial patterns of tree species in a tropical forest in Arunachal Pradesh, Northeast India. *Tropical Conservation Science*, *1*(3), 163–185. https://doi.org/10.1177/194008290800100302

Kitamura, S. (2011). Frugivory and seed dispersal by hornbills (Bucerotidae) in tropical forests. *Acta Oecologica*, *37*(6), 531–541. https://doi.org/10.1016/j.actao.2011.01.015

Liang, H., McConkey, K. R., & Lim, J. Y. (2024). From beak to fruit: An Asian hornbill database for frugivory and seed dispersal research. *Global Ecology and Conservation*, *51*, e02879. https://doi.org/10.1016/j.gecco.2024.e02879

Mandal, S., Ganguly, D., Pradhan, K., Mahato, S., Dukpa, K., Shome, A., Roy, A. B., & Datta, A. (2024). Roosting patterns of hornbills in Buxa Tiger Reserve in the Indian Eastern Himalaya. *Hornbill Natural History & Conservation*, 5, 25-40.

Mandal, S., Pradhan, K., Mahato, S., Dukpa, K., Dewan, S., Datta, A., Basu Roy, A. (2025). Study of hornbills in the forests of Himalayan foothills of West Bengal with emphasis on their foraging habit, mate selection and breeding preferences. Interim

report submitted to the West Bengal Forest Department. Nature Mates Nature Club & Nature Conservation Foundation, 69 pp.

Mudappa, D., & Raman, T. R. S. (2009). A conservation status survey of hornbills (Bucerotidae) in the Western Ghats, India. *Indian Birds*, *5*(4), 90-102.

Roy, M. (2015). Habitat use and foraging ecology of the Asian elephant (*Elephas maximus*) in Buxa Tiger Reserve and adjoining areas of northern West Bengal. Vidyasagar University. https://doi.org/10.13140/RG.2.1.1978.8644

Nagendra, H., Paul, S., Pareeth, S., & Dutt, S. (2009). Landscapes of Protection: Forest Change and Fragmentation in Northern West Bengal, India. *Environmental Management*, *44*(5), 853–864. https://doi.org/10.1007/s00267-009-9374-9

Naniwadekar, R., & Datta, A. (2013). Spatial and temporal variation in hornbill densities in Namdapha Tiger Reserve, Arunachal Pradesh, North-East India. *Tropical Conservation Science*, *6*(6), 734–748. https://doi.org/10.1177/194008291300600603

Naniwadekar, R. M., C., & Datta, A. (2015). Fruit resource tracking by hornbills at multiple scales in a tropical forest in India. *Journal of Tropical Ecology*, *31*, 477–490. https://doi.org/10.1017/S0266467415000449

Naniwadekar, R., Mishra, C., Isvaran, K., & Datta, A. (2021). Gardeners of the forest: Hornbills govern the spatial distribution of large seeds. *Journal of Avian Biology*, *52*(11). e02748. https://doi.org/10.1002/ece3.7151

Naniwadekar, R., Rathore, A., Shukla, U., Chaplod, S., & Datta, A. (2019a). How far do Asian hornbills disperse seeds? *Acta Oecologica*, *101*, 103482. https://doi.org/10.1002/ece3.7151

Naniwadekar, R., Chaplod, S., Datta, A., Rathore, A., & Sridhar, H. (2019b). Large frugivores matter: Insights from network and seed dispersal effectiveness approaches. *Journal of Animal Ecology*, *88*, 1250–1262.

Naniwadekar, R., Rathore, A., Shukla, U., & Datta, A. (2022). Roost site use by Great (*Buceros bicornis*) and Wreathed (*Rhyticeros undulatus*) Hornbill and its implications for seed dispersal. *Biotropica*, 54(6): 1315-1319.

Pawar, P. Y., Mudappa, D., & Raman, T. R. S. (2021). Hornbill abundance and breeding incidence in relation to habitat modification and fig fruit availability. *Ibis*, *163*(2), 473–485. https://doi.org/10.1111/ibi.12895

Poonswad, P., Kemp, A. C., & Strange, M. (2013). Hornbills of the world: A photographic guide. Draco Publishing and Distributions Pte. Ltd.

Poonswad, P., & Tsuji, A. (1994). Ranges of males of the Great Hornbill *Buceros bicornis*, Brown Hornbill *Ptilolaemus tickelli* and Wreathed Hornbill *Rhyticeros undulatus* in Khao Yai National Park, Thailand. *Ibis*, *136*(1), 79–86. https://doi.org/10.1111/j.1474-919X.1994.tb08133.x

Pradhan, K., Mandal, S., Mahato, S., Dukpa, K., Dewan, S., Datta, A., & Basu Roy, A. (2024a). Study of hornbills in the forests of Himalayan foothills of West Bengal with emphasis on their foraging habit, mate selection and breeding preferences. Interim

report submitted to the West Bengal Forest Department. Nature Mates Nature Club & Nature Conservation Foundation, 55 pp.

Pradhan, K., Datta, A., Ganguly, D., Naniwadekar, R., Mahato, S., Dukpa, K., Banerjee, S., & Roy, A. B. (2024b). Hornbill abundance and habitat relationships in a human-impacted protected area in the Indian Eastern Himalaya. *Global Ecology and Conservation*, *51*, e02868. https://doi.org/10.1016/j.gecco.2024.e02868

Pradhan, K., Tachang, T., Tai, B., Gyadi, R., Tok, P., Tachang, T., Tachang, V., Tayem, N., Kino, N., Keyang, K., Waru, S., & Wage, T. (2022). *Hornbill Nest Adoption Program (HNAP) Annual Report*, Nature Conservation Foundation, 23 pp.

Raman, T. R. S., & Mudappa, D. (2003). Correlates of hornbill distribution and abundance in rainforest fragments in the southern Western Ghats, India. *Bird Conservation International*, *13*(3), 199–212. https://doi.org/10.1017/S0959270903003162

Santhoshkumar, E., & Balasubramanian, P. (2010). Breeding behaviour and nest tree use by Indian Grey Hornbill *Ocyceros birostris* in the Eastern Ghats, India. *Forktail*, *26*, 82–85.

Shukla, U., Naniwadekar, R., & Datta, A. (2016). Abundance estimates of the Rufous-necked hornbill *Aceros nipalensis*, and characterization of a montane subtropical tropical forest in the Indian Eastern Himalaya. *Indian Birds*, *12*(4 & 5), 128–134.

Shukla, U., Naniwadekar, R., Rathore, A., & Datta, A. (2018).Variability in gut passage times of Asian hornbills. *The Sarawak Museum Journal*, *LXXIX*, 167–194. https://doi.org/10.61507/smj22-2018-9SP3-13

Annexure I

CONSERVATION PLANNING WORKSHOP

Conservation Planning Workshops have become accepted tools for collection and assessment of data - both published and unpublished—in interactive exercise structured by principles and guidelines. These principles and guidelines are designed to extract a maximum of factual as well as insightful information that can be applied to conservation action or construction of a management action plan to save a species, a group of species, or an ecosystem. These exercises involve a collection of individuals and organizations that are ideally and carefully selected for their relevance to past, present and future conservation involving the target species and habitat. Ideally the workshops are made up of about 30-40 people. In the process, some of the enthusiasts become experts, and experts more enthusiastic.

Some of the key features of Conservation Planning workshops include:

1. Facilitation
2. Ownership and Stakeholder participation
3. Ground-rules
4. Objectivity
5. Human psychology
6. Continuity
7. Teamwork
8. Science
9. Change
10. Process

The above listed features have been described in detail below.

FEATURES OF THE CONSERVATION PLANNING WORKSHOP

Some of the features of Conservation Planning workshops which are unique are described below and can be used as food for thought.

Facilitation

The CPSG processes generally have a leader that is trained or otherwise skilled in "facilitation".

By facilitation we mean that:

1. The leader of the workshop does not so much lead or dominate, as much as guides or "facilitates". There is a world of difference.
2. A facilitator doesn't try to impose his knowledge or opinions on the workshop but uses their "people skills" and other tools to bring about (facilitate) the most objective and insightful information and results for the workshop. There is an objective (e.g. to develop objectives for a conservation action plan for Hornbills of North Bengal) and guidelines (which have to be agreed upon by the group).
3. The facilitator's goal is to help the participants achieve their group goals. This frequently involves the setting aside of individual goals.
4. The facilitator also does not contribute any information regarding the species or landscape as he/she is not a participant but a neutral member. But the facilitator will ask relevant questions to steer conversations into the right direction.
5. The facilitator also does not express any personal emotions towards the group and this is to ensure no personal emotions or agendas impact the process and divert the group from the main goal of developing the conservation action plan.

Ownership and Stakeholder participation

The Conservation Planning Specialist Group (CPSG) doesn't initiate workshops themselves. They respond to requests by others for facilitation and technical support. CPSG assists the host to plan the workshop so that all the relevant agencies and individuals (known as "stakeholders") are invited. "Stakeholders" are people who have something to lose if the species goes extinct or if management action impinges on their rights. Unless all of the stakeholders "buy in" to the workshop, e.g., feel a sense of ownership, implementation of the recommendations will be very difficult or just impossible. In fact, one of the principles of CPSG process workshops is that 90% of the information about species and their habitats exists in wildlife field managers and stakeholders' heads. It has never been, and probably never will be published – and it's this information that we vitally need to save species and ecosystems.

The facilitator will use various techniques and tools to ensure his/her best that all stakeholders participate to their full potential and all the information relevant to the workshop is shared with the groups and documented to be incorporated into the plan. Some of these tools and techniques are mind maps, use of post-its for all workshop participants to write up their information, using large flip charts and GIS maps that showcase not only distribution but land use changes, threats and habitat types. The facilitator will also take support of translators if there are members from the local community attending the workshop to ensure inclusiveness.

Ground-rules

The guidelines or ground-rules listed on the next page need to be agreed upon as a "Contract" by the Workshop group. Generally, the Facilitator projects them on the screen of an overhead projector. These ground rules may slightly vary depending on specific workshop species, local realities, cultures and the range of stakeholder participation.

Objectivity

One of the suggested requirements for being a Conservation Planning Workshop leader or facilitator is that the person be an "outsider" that is outside the agency responsible for the species and outside the area of other stakeholders. The leader—and to a great extent the modelers and even some of the other scientific experts - should not have a vested interest in the result beyond saving the species. It is hard to be objective about matters close to home and also to deal with your own colleagues in an objective manner. The facilitator should be person who can sort differences between agencies and institutions because he has nothing to fear and nothing to gain.

Human psychology

The Conservation Planning Workshop (CPW) process has evolved using principles which address some facts of human psychology which are not normally confronted in technical and scientific professional disciplines. The need for a facilitator as workshop leader and the insistence on objectivity in CPWs are predicated on facts that everybody knows but doesn't like to talk about. This may seem uncomfortable since there are multiple stakeholders with different perspectives and possible agendas. A CPW brings these varying perspectives into the open and helps everyone see the larger goal using different tools and techniques to keep aside behaviours that go against the larger vision.

Continuity

A CPW is not a sprint but more like a marathon. It is the first step of a conservation strategy and many of the participants are given specific responsibilities at the end of the workshop. This makes follow up more systematic and ensures continuity to achieve the goals set by the planning team during the workshop.

Teamwork

CPWs are predicated on the fact that a team (if it is a real team) can achieve a better result than an individual. For a CPW, team members are carefully selected, or should be to include a mix of persons from the entire spectrum of disciplines and even business and social structures, which impinge on the potential of the species to survive. Thus, it is better to hold the workshop in the range of the species, so that people even from local areas can be involved.

Science

The guiding principle for CPSG process workshops is science. It is to achieve scientific objectivity untainted by ego, vested interest, sentiment, old ideas, etc. in order to see the problems faced by the species clearly and try to solve them objectively. CPSG has more than 500 members from all over the world. Many of these are renowned experts in population biology, population genetics, in situ and ex situ management, human demography etc. and they are sometimes called in to donate their time and energy to help solve a sticky conservation problem where there is no local expert.

Change

The CPSG process is perpetually updating to ensure that it is keeping up with the progress in science, its techniques and changing styles of interpersonal communications in the work space.

Process

After an initial introduction of the subject, the participants and setting of ground rules, the workshop undergoes a visioning process to set the broad aim towards which the participants wish to proceed throughout the duration of the action plan. The facilitator constantly guides the group to encourage productive brainstorming and deter destructive discussions on personal agendas. The vision statement is almost a dream-like scenario where the participants would like to see the species in an ideal situation in the distant future. This vision may or may not be realistic but it is a dream statement agreed by all participants and towards which all participants progress.

During the brainstorming the group goes through the cycle of divergence (where the group will start discussion relevant topics and get distracted with other topics) and convergence (the group is discussing distracted but slowly progressing towards relevant aspects) organically as a whole group and the facilitator gently guides the group through the process and eventually land on the vision statement.

Once the vision is set, the next step is to set three to four goals that break down the vision into achievable statements. Each of these goals are further broken down into objectives and each objective is further broken into activities. And the facilitator ensures that these are developed by dividing the participants into working groups.

All of these characteristics go together to make the 'process'. CPWs are 'dynamic processes' not static, one-time events.

All these things make Conservation Planning Workshops different from other workshops.