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A STUDY ON THE STATUS OF HORNBILL SPECIES OF UTTARAKHAND, INDIA

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ABSTRACT

Nine species of hornbill are found in India, out of which three are recorded in Uttarakhand. Among these, one is classified as ***Vulnerable***, and two as ***Least Concern*** (IUCN Red List, 2020). Located in the western Himalayas, the Uttarakhand state, encompasses a wide range of vegetation zones including moist deciduous, mixed broadleaf, Sal-dominated and oak-*rhododendron* forests, providing diversified habitats for hornbill species. A comprehensive review was undertaken to identify diversity, distribution, key threats and conservation of hornbills in Uttarakhand state. Old grown forests support their population. Protected areas are supporting a good number of hornbills. In urban area their presence is depend upon the availability of large old trees for nesting. Major threats for these include habitat loss due to deforestation and infrastructure development, climate change, fragmentation of nesting habitats, reduction in the availability of large fruiting trees, and disturbances at breeding sites. The aim of this research paper is to understand the ecology, conservation status, and threats to hornbill species found in Uttarakhand, and to provide insights about conservation to ensure the long-term survival of hornbill populations in the State.

Key words: Conservation, Hornbill, Uttarakhand, IUCN, seed dispersers, threats.

INTRODUCTION

Hornbills are distinguished by their prominent, casqued bills and their dependence on forest ecosystems (Rana et al. 2025). In the tropical forests of Asia and Africa, hornbills, members of the family Bucerotidae are among the largest and most ecologically significant avian species (Kitamura 2011). Globally, there are approximately sixty-two hornbill species, with nine are recorded in India (Datta et al. 2018). Uttarakhand is the home of three hornbill species, ***Buceros bicornis* (Great Hornbill), *Anthracoceros albirostris* (Oriental Pied Hornbill),** and ***Ocyceros birostris* (Indian Grey Hornbill)** (Mohan and Sondhi 2024). According to IUCN (2020), among these, the ***Buceros bicornis*** is classified as ***Vulnerable***, while the other two the ***Anthracoceros albirostris*** and the ***Ocyceros birostris*** are categorised as ***Least Concern***, though their populations are locally threatened (Mohan and Sondhi 2024; Bhatnagar et al. 2020; eBird).

Many forest tree species depend on hornbills for dispersing their seeds (Kitamura 2011). They play a significant ecological role, which is crucial to preserving forest biodiversity (Datta et al. 2018). Because of their big size, distinctive bill, and strong cultural significance hornbills are one of the most renowned bird species among the state's tribal people in Arunachal Pradesh, (Datta and Rawat 2003; Nainwadekar et al. 2015).

The *Buceros bicornis* prefers mature forests that have tall emergent trees for their nesting locations. The *Anthracoceros albirostris* are frequently seen at the forest edges, along farming borders, and beside riverbanks (James and Kannan 2009). *Ocyceros birostris* adapt well to semi-urban and urban settings, as well as plantations and dispersed groves (Ali and Ripley 1987; Shukla et al. 2023). They nest in natural hollows of large trees and primarily consume fruits, showing a seasonal preference for figs and other fruit-producing trees (Shukla et al. 2023; Kemp 1995). These are often referred to as the **"Gardener of the forest"** due to their ecological role as seed dispersers. (Naniwadekar et al. 2021). Despite their ecological importance, habitat loss due to deforestation, fragmentation, hunting, and human disturbance pose significant threats to hornbill populations (Poonswad et al. 2013). This paper explores the ecology of hornbills in Uttarakhand and highlights the need for their conservation.

MATERIALS AND METHODS

Study area

Uttarakhand state, located in the northern part of India, is bordered by Nepal to the east, Himachal Pradesh to the west, Tibet (China) to the north, and Uttar Pradesh to the south. It lies between 28°43'N to 31°27'N latitude and 77°34'E to 81°02'E longitude. Known for its diverse geography, ranging from the snow-covered

Himalayas to subtropical forest regions, Uttarakhand provide diverse habitats for avian fauna. The state is the home of three hornbill species: *Buceros bicornis*, *Anthracoceros albirostris*, and *Ocyceros birostris*. These species are found across different forest types, including moist deciduous forests, Sal-dominated woodlands, riverine belts, and hill slopes with dense canopy cover.

Fig.1: Source: Google earth

Fig.2: Source: Google earth

Our study on status of hornbill species in Uttarakhand utilized both primary and secondary data collection techniques. Field surveys were carried out in important habitats such as Rajaji Tiger Reserve, Corbett Tiger Reserve, Dehradun, Haridwar, Rishikesh, Ramnagar, Kotdwar and nearby forest divisions, employing road transect walk methods during early mornings and late evenings to observe species presence, distribution, nesting, and feeding behaviours. Secondary data were sourced from published studies, biodiversity databases, peer-reviewed research articles, eBird records, the State of India's Birds (SoIB) report, and related publications. Photographic documentation enhanced the field observations.

Analysis

This dataset was carefully analysed to assess species distribution and conservation needs. The conservation status of each species was determined based on their inclusion in the schedules of Indian Wildlife Protection Act of 1972 (as amended in 2022) and the IUCN Red List (2020). In addition, we documented information on the nesting habitats based on the field work, and provided an overview of the state's conservation initiatives, along with an evaluation of their outcomes.

RESULTS AND DISCUSSION

Field observations and local sighting records from Rajaji Tiger Reserve, Corbett Tiger Reserve, and the forest divisions of Kalagarh, Ramnagar, Dehradun, and Haridwar provided important insights into hornbill distribution and ecology in Uttarakhand (Mohan and Sondhi 2024; Bhatnagar et al. 2020; eBird). The study reveals the presence of three hornbill species in Uttarakhand (Table 1).

Table. 1: Hornbill diversity of Uttarakhand

SN	Hornbill Species	Scientific Name	IUCN Status	Family
1.	Great Hornbill	*Buceros bicornis*	Vulnerable	Bucerotidae
2.	Oriental Pied Hornbill	*Anthracoceros albirostris*	Least Concern	Bucerotidae
3.	Indian Grey Hornbill	*Ocyceros birostris*	Least Concern	Bucerotidae

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1. *Buceros bicornis* (Great Hornbill)

IUCN Status: According to IUCN Red List (2020) the ***Buceros bicornis*** is classified as **Vulnerable**.

Fig. 3: *Buceros bicornis* (Male)
Rajaji Tiger Reserve (Uttarakhand)
Source: Photo by Rajeev Bisht

Fig. 4: *Buceros bicornis* (Female)
Corbett Tiger Reserve (Uttarakhand)
Source: Photo by Shrish Budakoti

Buceros bicornis is the largest and most distinctive hornbill species of the tropical forests of India and Southeast Asia, also known as the **'King of the Forest'** (India Bird Watching). Its range in India encompasses Terai region, Himalayan foothills, Northeast India, Western and Eastern Ghats (Rana et al. 2025; Kannan and James 1999).

Buceros bicornis, is characterized by a bright yellow beak, a distinctive yellow and black casque and a yellow band around their neck. Its **vibrant plumage** further enhances its appearance, making it a cultural symbol in many indigenous communities and a flagship species for forest conservation. Their population distribution is closely linked to habitat conditions, and individuals may be observed either alone or in small or large groups. Their deep loud calls and the distinctive sound made by their flapping wings enhance their powerful presence in forest environments (Rana et al. 2025; Kumar and Riba 2015). The *Buceros bicornis* is primarily frugivorous**,** feeding on variety of wild fruits, specifically figs (*Ficus* spp.), and also eats insects, birds, small animals, and reptiles (Ouithavon et al. 2005). This feeding behaviour plays a crucial role in supporting the structural integrity and biodiversity of tropical forest ecosystems.

In Uttarakhand *Buceros bicornis* is recorded in protected areas like, Rajaji Tiger Reserve (Shivalik), Corbett Tiger Reserve (Terai), and Jhilmil Jhil Conservation Reserve (Haridwar), along with nonprotected, urban and forested areas of Kotdwar, and Lansdowne (Garhwal), Rishikesh and Doon Valley (Dehradun), Ramnagar and Nainital (Kumaon), and Haridwar (eBird; Bhatnagar et al. 2020). In these habitats, the *Buceros bicornis* plays a critical ecological role as a seed disperser, particularly for fig trees Their preference for mature and dense forest environment can be seen in Fig: 3 and Fig: 4.

2. *Anthracoceros albirostris* (Oriental Pied Hornbill)

IUCN Status: According to IUCN Red List, (2020) the ***Anthracoceros albirostris*** is categorised as **Least Concern**.

Fig. 5: *Anthracoceros albirostris* (Female)
Kotdwar, Pauri garhwal, Uttarakhand
Source: Photo by Rajeev Bisht

Fig. 6 *Anthracoceros albirostris* (Male)
Rishikesh Uttarakhand
Source: Photo by Komal Rana

Anthracoceros albirostris a medium-sized member of the hornbill family, is one of the most widespread and adaptable hornbill species found in India and Southeast Asia. (Ali and Ripley 1987). It is a large canopy-dwelling bird belonging to the family Bucerotidea (Datta and Rawat 2004; Kemp 1995). Its range extends from West Bengal to the eastern slopes of the Himalayas, although it is mainly found in the north-eastern states of India, such as Assam, Arunachal Pradesh, Nagaland, Manipur, Meghalaya, and Tripura (Rana et al. 2025).

It has a distinctive black and white plumage, a large, curved bill and a small casque. It's diet range consists of fruits mainly of figs, along with small reptiles and insects, making it important agent in forest regeneration (indiabirdwatching; Kannan and James 1999). In Uttarakhand, the *Anthracoceros albirostris* has a relatively restricted but important distribution, preferring the Terai and Bhabar zones along the southern edge of the state.

Its sighting is common in Dehradun, Haridwar (Ganga Canal area), Jhilmil Jheel Conservation Reserve, and Rajaji Tiger Reserve and Corbett Tiger Reserve, which offer a mix of riverine forests. Seasonal sightings also occur in Rishikesh, Kotdwar, Haridwar and Lansdowne, especially during the fruiting seasons of *Ficus* spp. (eBird). Fig. 4 and Fig.5. Presence of *Anthracoceros albirostris* in two different habitats, the protected and nonprotected area of Uttarakhand is indicating its presence in both urban and forested ecosystems.

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3. *Ocyceros birostris* (Indian Grey Hornbill)

IUCN Status: The ***Ocyceros birostrisis*** is classified as **Least Concern** according to IUCN Red List, 2020.

Fig. 6: *Ocyceros birostris* (Male and Female)
Rajaji Tiger Reserve, Uttarakhand
Source: Photo by Smita Badola

Fig. 7: *Ocyceros birostris* (Female)
Rishikesh, Uttarakhand
Source: Photo by Komal Rana

Ocyceros birostris is found in Southern Nepal, Punjab in Pakistan, and north-western Bangladesh Himalayas (Ali and Ripley 1987). It's widely distributed across India, except in the north-eastern parts and at the higher elevation of the India (IndiaBirdwatching; Rana et al. 2025). Its sighting is commonest in the low- to mid-elevation areas of Rajaji Tiger Reserve, Corbett Tiger Reserve, Dehradun, Rishikesh, Haridwar, Lansdowne, Kotdwar, Kalagarh Forest Division, Ramnagar Forest Division, and adjacent forested areas. Urban parks, orchards, and foothill woodlands are home to Indian Grey Hornbills in Uttarakhand (Mohan and Sondhi 2024; eBird; Bhatnagar et al. 2020; Sinha et al. 2019).

Ocyceros birostris is a medium-sized hornbill, having grey feathers all over the body, and distinctive blackish casque top on curved bill. These are primarily frugivorous, mostly consume fig fruits (*Ficus* spp.). However, during the breeding season, its diet also includes animal prey such as insects, small reptiles, rodents, and nestlings. In Uttarakhand, the *Ocyceros birostris* is frequently observed in Dehradun, Rishikesh, and Haridwar, as well as in the urban and peri-urban belt of the Shivalik hills. They are commonly found in Sal (*Shorea robusta*) forests and planted groves. It is also occasionally recorded in Ramnagar, Kotdwar, Chilla and lower elevation zones of the Rajaji landscape, particularly in areas where green patches exist near human settlements (eBird; Sinha et al. 2019). Fig: 6 and Fig: 7 from Rajaji Tiger Reserve and urban landscape of Rishikesh respectively, indicate the presence of Ocyceros birostris in both urban and forested ecosystem of Uttarakhand.

Major Threats to Hornbill Species in Uttarakhand

Major threats to hornbill populations are deforestation, loss of nesting trees, habitat fragmentation due to expansion of roads and railways. Disturbances caused by humans near nesting sites and the fragmentation of forests also negatively affect breeding success. ((Rana et al. 2025).

Climate change, over exploitation of resources, natural disaster, hunting, poaching, and human disturbance etc. are the key factors affecting the population of hornbills (Kinnaird and O'Brien 2007; Vaid, 2021). According to Budakoti et al. (2024), climate-induced changes in temperature and precipitation can alter the flowering and fruiting patterns of trees, directly impacting the availability of food for primarily frugivorous birds. Moreover, rising temperatures and erratic monsoonal rainfall may lead to habitat loss, reduced fruit supply, and increased chick mortality. Illegal hunting for its casque and plumage, which are utilized in tribal jewellery and trade, presents a serious danger. In addition, hunting for bushmeat and the illicit pet trade further jeopardize population numbers. These various pressures have resulted in declining populations, highlighting the need for conservation efforts to ensure the survival of this iconic bird species (Poonswad et al. 2013).

Buceros bicornis is confronted by several significant threats, mainly due to habitat destruction caused by deforestation, logging, and the expansion of agriculture in Uttarakhand which diminishes areas for their nesting and feeding.

Anthracoceros albirostris is facing threats due to fragmentation, and human disturbance, especially in tourism-intensive urban landscapes of Uttarakhand, despite its adaptability to populated landscape.

Ocyceros birostris is listed as Least Concern on the IUCN Red List. However, localized populations declines have been noted primarily due to loss of nesting trees, forest fire, urbanization, and reduction in tree cover in cities in Uttarakhand.

Man has neglected the environment at every step. After COVID19 the time has come when we have to think about our environment. This epidemic has told the man that for taking care of his ecology and environment he will have to pay the price with his life (Badola and Mittal 2021).

Conservation Implication

Hornbills are considered a **"flagship bird species"** of the tropical forests, promoting Avitourism, advancing conservation advocacy, and ultimately maintaining ecosystem services (Vishwakarma et al. 2022).

Buceros bicornis rely on natural tree hollows for nesting, and these cavities are limited. Protecting existing nesting trees and promoting the growth of large, mature trees is essential. These are heavily reliant on fruit for food, especially figs and other specific species. Planting and protecting these trees, particularly within and around protected areas, is vital.

In spite of habitat loss in some areas, the *Anthracoceros albirostris* has adapted well to human-modified landscapes, making it one of the few hornbill species frequently seen outside dense forests.

Ocyceros birostris remains relatively common, its dependence on old trees for nesting makes it vulnerable to habitat thinning and roadside deforestation.

Conservation strategies for these species in should focus on protecting nesting and fruiting trees, creating artificial nest boxes, engaging local communities and raising awareness about its ecological importance of this species (Kannan & Jamess 1999). Effective conservation efforts should focus on preserving mature native trees in urban landscapes and promote public awareness about the hornbill's ecological role as a seed disperser and a key contributor to forest regeneration (Mudappa and Raman 2009). To ensure the survival of these iconic species and the ecosystems they live in, a strong commitment to cooperation, effective forest resource management, research, monitoring, and community involvement is not just necessary, but crucial (Rana et al. 2025). Along with putting in place effective educational programs and conservation breeding activities, our strategies must focus on habitat preservation, raising community awareness, and enforcing legal prohibitions against poaching. (Vaid 2021). Conservation programs, should prioritize community involvement, habitat protection, and preventive measures to stop habitat loss and hunting in order to address the issues faced by hornbills (Mudappa and Raman 2009).

In Uttarakhand, women are essential to managing natural resources by engaging in forest conservation. Their traditional expertise and active involvement in managing community resources, position them as significant players in preserving biodiversity and ensuring ecological sustainability in the Himalayan area (Mittal and Badola 2021). We can motivate women for nest adoption program.

We can successfully maintain hornbill populations in Uttarakhand's forests and highlight their ecological relevance by combining field research, community initiatives, and robust government assistance (Rana et al. 2025). Conservation efforts in Uttarakhand should emphasize habitat protection, public awareness programs, and field surveys to better understand and promote the long-term survival of this majestic species in the Himalayan foothills. Collaborative efforts between forest departments, local communities, researchers and conservation organizations are essential to ensure the long-term survival of hornbills in Uttarakhand.

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Conclusion

The present study highlights the hornbill species found in Uttarakhand and their ecological role as seed dispersers. The lower and mid elevation ranges in the state are suitable for hornbill sightings compared to the high elevations. The *Buceros bicornis* with a more restricted distribution and specific nesting needs render it especially more susceptible to various challenges. In contrast, the *Anthracoceros albirostris* and *Ocyceros birostris* are more adaptable, but they still rely on well-structured green areas with mature trees. Although hornbills are currently found in good number in forest habitats of Uttarakhand, they continue to face threats from habitat destruction and human disturbances. Regular and long-term monitoring of populations will help to protect their diversity and ensure the conservation of their feeding, roosting and nesting sites. Planting of native fruiting trees (especially *Ficus* spp.), Community-based awareness campaigns, protection of known nesting and roosting trees, and ongoing studies are essential for the understanding of their distribution and population trends. In addition, public figures and media can play an important role in spreading awareness about ecological significance of hornbills and the need for their conservation. To ensure the enduring survival of hornbills in Uttarakhand, a comprehensive strategy that includes scientific research, active community involvement, and habitat conservation with restoration is essential. Considering their ecological significance and cultural appeal, hornbills should be prioritized in biodiversity conservation initiatives in Uttarakhand state.

REFERENCES

Ali S, Ripley SD, Dick JH (1987). Compact handbook of the birds of India and Pakistan: together with those of Bangladesh, Nepal, Bhutan and Sri Lanka.

Badola S, & Mittal T (2021). Covid-19: Society and Environment: A Lesson for Future. In Negi S & Badola S (ed), Environmental Issues and Mitigation Strategies, 1st edn. Global Bookone Graphics, India, pp 1-21.

Bhatnagar P, Bhatt D, Rindani J, Arya AK, Rawat R (2020). A checklist of birds of Haridwar, Uttarakhand. Zoo's Print. (11), 31-41.

BirdLife International. 2020. *Buceros bicornis*. The IUCN Red List of Threatened Species 2020:e.T22682453A184603863.https://dx.doi.org/10.2305/IUCN.UK.20203.RLTS.T22682453A184603863.en

BirdLife International. 2020. *Anthracoceros albirostris*. The IUCN Red List of Threatened *Species* 2020:e.T22682437A184925767.https://dx.doi.org/10.2305/IUCN.UK.20203.RLTS.T22682437A184925767.en.

BirdLife International. 2020. *Ocyceros birostris*. The IUCN Red List of Threatened Species 2020:e.T22682429A184951065.https://dx.doi.org/10.2305/IUCN.UK.20203.RLTS.T22682429A184951065.en.

Budakoti SB, Saini D, Rana K, Bahuguna D, Mittal T (2024). Losing biodiversity: the impact of climate change. Annals of Science and Allied Research. 2(2), 27-34. https://doi.org/10.5281/zenodo.14643149.

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 GS (2003). Foraging patterns of sympatric hornbills during the nonbreeding season in Arunachal Pradesh, northeast India. Biotropica. 35(2), 208-18. https://doi.org/10.1111/j.1744-7429.2003.tb00280.x.

Datta A, Rawat GS (2004). Nest-site selection and nesting success of three hornbill species in Arunachal Pradesh, north-east India: Great Hornbill *Buceros bicornis*, Wreathed Hornbill *Aceros undulatus* and Oriental Pied Hornbill *Anthracoceros albirostris*. Bird Conservation International. 14(S1), S39-52. Doi:10.1017/S0959270905000213.

James DA, Kannan R (2009). Nesting habitat of the Great Hornbill (*Buceros bicornis*) in the Anaimalai Hills of southern India. The Wilson Journal of Ornithology. 121(3), 485-92.

Kannan R, James DA (1999). Fruiting phenology and the conservation of the Great Pied Hornbill (*Buceros bicornis*) in the Western Ghats of southern India 1. Biotropica. 31(1), 167-77.

Kemp AC, Woodcock M (1995). The hornbills: bucerotiformes. Oxford University Press.

Kinnaird MF, O'Brien TG (2007). The ecology and conservation of Asian hornbills: farmers of the forest. University of Chicago Press.

Kitamura S (2011). Frugivory and seed dispersal by hornbills (Bucerotidae) in tropical forests. *Acta Oecologica*. 37(6), 531-41. Https://doi.org/10.1016/j.actao.2011.01.015.

Kumar a, Riba b (2015). Assessment of effectiveness of conservation action adopted for hornbill species in Arunachal Pradesh, india: the great indian hornbill (*Buceros bicornis*). International journal of conservation science. 6(1), 125.

Mittal T, & Badola S (2021). The Role of Uttarakhand Women in Natural Resources Management With Reference to Pauri District. In Negi S & Badola S (ed), Biodiversity Sustainability & Environmental Education, 1st edn. Global Books Organisations, India, pp 80-93.

Mohan D, Sondhi S (2015). An updated checklist of the birds of Uttarakhand. Uttarakhand Forest Department.

Mudappa D, Raman TS (2009). A conservation status survey of hornbills (Bucerotidae) in the Western Ghats, India. Indian birds. 5(4), 90-102.

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), 1-11. https://doi.org/10.1111/jav.02748.

Naniwadekar R, Mishra C, Isvaran K, Madhusudan MD, Datta A (2015). Looking beyond parks: the conservation value of unprotected areas for hornbills in Arunachal Pradesh, Eastern Himalaya. Oryx. 49(2), 303-11. Doi:10.1017/S0030605313000781.

Ouithavon K, Poonswad P, Bhumbhakpan N, Laohajinda V (2005). A comparative study of the feeding ecology of two sympatric hornbill species (Aves: Bucerotidae) during their breeding season in Huai Kha Khaeng Wildlife Sanctuary, Thailand. InProceedings of the third hornbill workshop, The Ecology of Hornbills: Reproduction and Populations. 59-73.

Rana K, Badola S, Bahuguna D (2025). Farmers of the forest: Distribution of Hornbill species in India with their conservation status and strategic recommendation for conservation. Environment Conservation Journal. 26 (2), 667-676. https://doi.org/10.36953/ECJ.33622025.

Sinha A, Hariharan H, Adhikari BS, Krishnamurthy R (2019). Bird diversity along riverine areas in the Bhagirathi Valley, Uttarakhand, India. Biodiversity data journal. 7, e31588, 1-30. doi: 10.3897/BDJ.7.e31588.

SoIB (2023). State of India's Birds, 2023: Range, trends, and conservation status. Pp. 119. The SoIB Partnership. doi:10.5281/zenodo.11124590.

Vaid S (2021). Ways to Conserve Biodiversity with Sustainable Development of State. In Negi S. & Badola S. (ed), Environmental Issues and Mitigation Strategies, 1st edn. Global Bookone Graphics, India pp 50-57.

Vishwakarma A, Kumar A, Krishna M (2022). Hornbills: A flagship species in Pakke Tiger Reserve, Arunachal Pradesh, India. International Journal of Ecology and Environmental Sciences. 48(5), 663-9. https://doi.org/10.55863/ijees.2022.0663.