# STATE OF INDIA'S BIRDS 2023

*Range, trends, and conservation status*

PARTNER ORGANISATIONS:

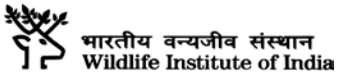








*South India Centre of WII*





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Range, trends, and conservation status

www.stateofindiasbirds.in

*The State of India's Birds report is a periodic assessment of the distribution range, trends in abundance, and conservation status for most of the bird species that regularly occur in India. With their ubiquity and ecological importance, birds are excellent indicators of the state of our natural world and are potent cultural symbols of nature. As a comprehensive, national-level assessment, the report points the way towards conservation needs of India's birds.*

STATE OF INDIA'S BIRDS

# Contents

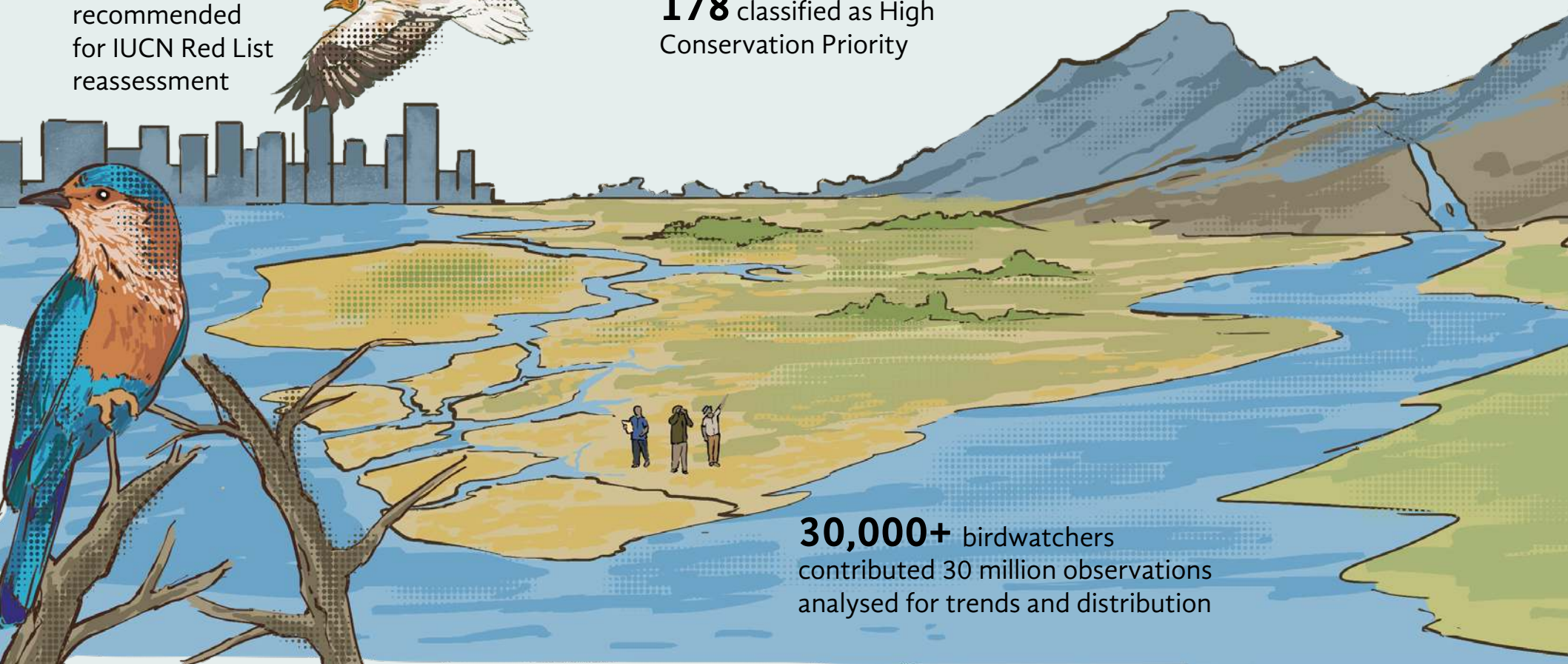
# HIGHLIGHTS *from the* REPORT

**942** Indian birds assessed for conservation priority

**217** species stable or increasing in the last eight years

**14** species, including Indian Roller, recommended for IUCN Red List reassessment

**178** classified as High Conservation Priority



**30,000+** birdwatchers contributed 30 million observations analysed for trends and distribution

**Case studies from sites across India** illustrate the vital role of systematic bird monitoring

**Policy and action** must align to highlight species of high conservation priority, address problems of neglected habitats, and promote research and monitoring

**Raptors, migratory shorebirds,** and **ducks** have declined the most

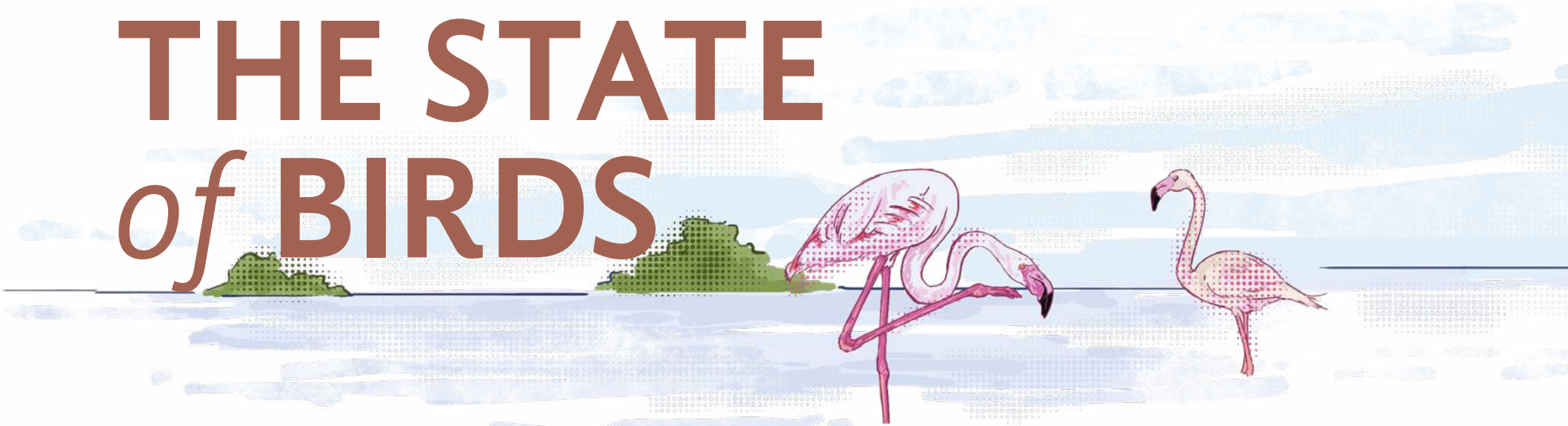
Eight **major threats to bird**s in India are synthesised

Birds that live in key habitats like **open ecosystems, rivers,** and **coasts** have declined

**Indian Peafowl** continues to thrive

**Asian Koel** has increased in the past three decades

# THE STATE *of* BIRDS



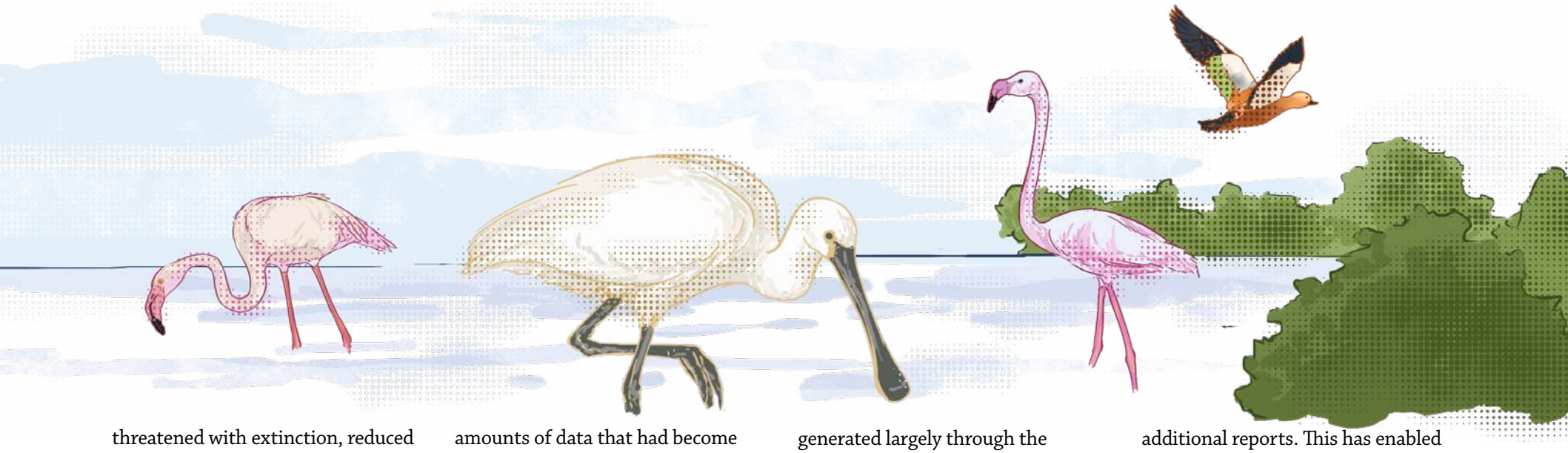
The world's biodiversity is in a grim state. The global Red List assessments conducted by the International Union for Conservation of Nature (IUCN) show declines in the conservation status of all facets of biodiversity[1]. The latest Living Planet report[2] concludes that populations of mammals, birds, reptiles, amphibians, and fishes have declined by an average of 69% since 1970. At a broad level, the major causes for these declines are destructive land use, direct exploitation, climate change, pollution, and invasive species.

Recognising that these trends not only harm biodiversity, but thereby also threaten human well-being, the Global Biodiversity Framework (GBF), adopted in December 2022, pledges to halt biodiversity loss and restore ecosystems. One of its four goals is to halt human-induced extinction of threatened species. The GBF is one of several commitments that the world's countries, India included, have made towards the well-being of people as well as the planet.

In order to achieve the targets they have set, countries need a way of assessing the health of their biodiversity, but this can be a tremendous challenge. One aspect of biodiversity that has received considerable attention is birds. Birds are everywhere, they can be identified relatively easily, and they have deep cultural significance. They can also act as indicators of biodiversity as a whole because they are mobile and responsive to change; contain enough species to show meaningful patterns, their trends generally reflect those of other groups, and they are relatively easily monitored.

For these reasons, many efforts, in diverse regions and countries, as well as globally, have attempted to assess the State of Birds. Such assessments are typically based on a combination of information generated from large-scale citizen science monitoring, supplemented by more specialised monitoring schemes that are more limited in geographic or taxonomic scope. For example, the UK Breeding Bird Survey results are based on annual monitoring carried out by over 2,500 volunteer birdwatchers at nearly 4,000 pre-defined 1×1 sq. km squares, together with dedicated surveys for species that are particularly rare, cryptic, or remotely distributed.

These assessments show that the birds are faring much as other forms of biodiversity. The IUCN Red List shows that 49% of bird species worldwide are declining in population, compared with only 6% increasing[3]. Many of the declining species are common and widespread, and although they may not yet be



threatened with extinction, reduced populations are likely to have significant ecological consequences. Long-term surveys have estimated that there are nearly one-third fewer birds in North America than there were in 1970—which translates into a loss of 2.9 billion individual birds[4]. Similarly, it is estimated that Europe lost one-quarter of its birds between 1980 and 2016[5].

In 2020, India joined the set of countries that regularly assess the status of their birds, with the launch of the first report on the State of India's Birds (SoIB)[6] at the Conference of Parties to the Convention on Migratory Species in Gandhinagar. Leveraging vast amounts of data that had become available in the previous few years to assess abundance trend and range size, SoIB 2020 assessed 867 species out of the roughly 1,200 species that regularly occur in India. The report classified 101 species as being of high conservation concern in India, including 34 species not considered globally threatened by the IUCN Red List. The current report updates and expands the assessments from 2020, adding case studies of systematic monitoring and reviews of threats to India's birds.

As is the case with all other such assessments across the world, the information behind the large-scale assessments has been generated largely through the efforts of birdwatchers and nature enthusiasts—passionate individuals who spend time and effort watching birds, recording their observations, and contributing them to public platforms like eBird[7]. This kind of citizen science, which may be less or more coordinated, is the only way in which information can be generated for biodiversity assessments at the required scale. The assessments in this report are thus built on c. 30 million records from c. 30,000 birdwatchers across the country.

This report extends and updates the assessments presented in SoIB 2020 by adding four years of data uploads, amounting to 20 million additional reports. This has enabled a larger number of species to be evaluated (867 in 2020 vs 942 in this report), and has been accompanied by several refinements in analytical methodology (described in the Methods chapter).

The overall outcome of these assessments largely reflects the global trend: several species are doing well, while a number of others show various degrees of decline. The report summarises implications that flow from the findings, and makes broad recommendations for bird conservation in the country.

# INDIA-WIDE RESULTS

*This report assesses the status of 942 bird species largely using data uploaded by birdwatchers to the online platform eBird. The assessments are based on three indices. Two are indices of change in abundance (Table 1): Long-term Trend (i.e., change over c. 30 years) and Current Annual Trend (i.e., annual change over the past eight years); the third is a measure of Distribution Range Size within India (Table 2).*

*Table 1: Abundance Trend Indices*

| CATEGORY | CRITERIA: LONG-TERM | CRITERIA: CURRENT |
|---|---|---|
| Insufficient Data* | too few reports | too few reports |
| Trend Inconclusive* | 95% confidence interval > 25% | 95% confidence interval > 2% |
| Rapid Decline | decline > 50% | decline > 2.7% |
| Decline | decline > 25% | decline > 1.1% |
| Stable | others | others |
| Increase | increase > 25% | increase > 0.9% |
| Rapid Increase | increase > 50% | increase > 1.6% |

**For explanations and additional sensitivity checks, see Methods (p102).*

*Table 2: Distribution Range Size within India*

| CATEGORY | CRITERIA |
|---|---|
| Historical | data deficient, but historical range described in the literature |
| Very Restricted* | < 7,500 sq. km |
| Restricted | 7,500–42,500 sq. km |
| Moderate | 42,500–250,000 sq. km |
| Large | 250,000–1,000,000 sq. km |
| Very Large | > 1,000,000 sq. km |

**Island species are classified as Very Restricted if their range is < 625 sq. km, else as Restricted.*

Of the total of 942 species, 523 had sufficient data for estimating Long-term Trends (the remaining 419 had insufficient data for this purpose). Among the 523, Long-term Trends could be determined for 338 species (the remaining 185 had trends categorised as inconclusive trends). Of these 338 species, 204 have declined in the long term, 98 show a trend that is indistinguishable from stable (hereinafter 'stable'), and 36 have increased (Table 3).

Similarly, from the 942 species, 643 had sufficient data for estimating Current Annual Trends (the remaining 299 had insufficient data). Among the 643, Current Annual Trends could be determined for 359 species (284 were Trend Inconclusive), of which 142 are declining (64 in Rapid Decline), 189 are stable, and 28 are increasing (Table 3).

*Table 3: Trend in Abundance Index*

| | NO. OF SPECIES | |
|---|---|---|
| **Trend Status** | **Long-term Trend** | **Current Annual Trend** |
| Rapid Decline | 98 | 64 |
| Decline | 106 | 78 |
| Stable | 98 | 189 |
| Increase | 19 | 17 |
| Rapid Increase | 17 | 11 |
| Trend Inconclusive | 185 | 284 |
| Insufficient Data | 419 | 299 |
| Total | 942 | 942 |

*Table 4: Distribution Range Size*

| RANGE STATUS | NO. OF SPECIES |
|---|---|
| Historical | 4 |
| Very Restricted | 46 |
| Restricted | 220 |
| Moderate | 363 |
| Large | 178 |
| Very Large | 131 |

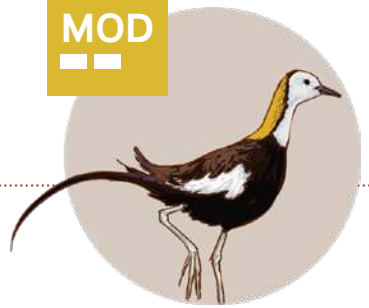
Range Sizes of all 942 species were estimated and classified. Range Size of most species (39%) is Moderate, while that of 28% is Restricted or Very Restricted, and that of a further 33% is Large or Very Large (Table 4).

CONSERVATION PRIORITY STATUS

HIGH

178

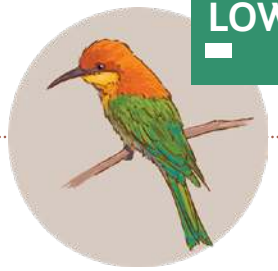
MOD



323

441

LOW



Using these three indices together with the IUCN global Red List of Threatened Species 2022 (hereinafter 'IUCN Red List'), species were classified into categories of Conservation Priority for India: 178 as High Priority, 323 as Moderate Priority and 441 as Low Priority. Species of High Priority include those whose abundance indices have declined considerably in the long term and continue to decline today. Species were also categorised as High Priority species for India, if their current range is Very Restricted, or if their abundance trend could not be assessed but they are classified as Globally Threatened in the IUCN Red List.

*Table 5: Correspondence between IUCN Red List Categories and SoIB Categories of Conservation Priority*

| IUCN RED LIST | SoIB 2023 CATEGORIES OF CONSERVATION PRIORITY | | |
|---|---|---|---|
| | HIGH | MOD | LOW |
| CR | 14 | 0 | 0 |
| EN | 15 | 0 | 1 |
| VU | 42 | 8 | 2 |
| NT | 17 | 39 | 11 |
| LC | 90 | 268 | 423 |
| Not Recognised* | 0 | 8 | 4 |

**Some species analysed in this report are not recognised by the IUCN (see, p113).*

Of the High Priority species, about 51% (90 species) are classified as globally of Least Concern by the IUCN Red List 2022 (Table 5). Seventeen of them would qualify for a different IUCN threat status nationally (Table 6). On the other hand, 14 species considered globally Endangered, Vulnerable, or Near Threatened are classified as being of Low Priority in India through this assessment (Table 7).

This report contains highlights of the analyses for species of national interest, habitats in focus, and for ecological and taxonomic groups of birds. Nomenclature throughout this report follows the India Checklist v7.1 (indianbirds.in/india). Additional details, including a full listing of species with scientific names, are available at stateofindiasbirds.in.

*Table 6: Correspondence between current IUCN Global Status and India input derived from this report (see details, p100)*

| IUCN Criterion | Global Status | India Input | No. of species |
|---|---|---|---|
| A (Trends) | LC | EN | 2 |
| A (Trends) | LC | VU | 11 |
| A (Trends) | LC | NT | 2 |
| B (Range size) | VU | EN | 1 |
| B (Range size) | EN | NT | 1 |

*Table 7: Species considered Threatened or Near Threatened in the IUCN Red List, but classified as Low Priority in SoIB 2023*

| CATEGORY | IUCN |
|---|---|
| Steppe Eagle | EN |
| Greater Spotted Eagle | VU |
| Great Hornbill | VU |
| Green Imperial Pigeon | NT |
| River Lapwing | NT |
| Painted Stork | NT |
| Oriental Darter | NT |
| Black-headed Ibis | NT |
| Mountain Hawk Eagle | NT |
| Rufous-bellied Eagle | NT |
| Lesser Fish Eagle | NT |
| Alexandrine Parakeet | NT |
| Red-breasted Parakeet | NT |
| Grey-headed Bulbul | NT |

# SPECIES *of* HIGH PRIORITY

*In all, 178 species are categorised as of High Conservation Priority: 94 based on both abundance trends and range, 45 based on range being Very Restricted, and an additional 39 based on a combination of their range and IUCN Red List status. They are listed in three tables along with their IUCN status and protection status in the schedules of the Wild Life (Protection) Amendment Act, 2022. Indian endemics are highlighted in green.*

A majority of species in this criterion is declining in both Long-term and Current Annual Trends, and there is an urgent need to research the reasons in order to formulate mitigation strategies to arrest the declines.

Based on Abundance Trends and Range

| | DISTRIBUTION RANGE SIZE | LONG-TERM TREND | CURRENT TREND | IUCN RED LIST | WLPA SCHEDULE |
|---|---|---|---|---|---|
| **Ruddy Shelduck** | Large | Decline | Rapid Decline | LC | II |
| **Garganey** | Large | Rapid Decline | Rapid Decline | LC | II |
| **Northern Shoveler** | Very Large | Rapid Decline | Rapid Decline | LC | II |
| **Northern Pintail** | Very Large | Rapid Decline | Rapid Decline | LC | II |
| **Common Teal** | Large | Rapid Decline | Rapid Decline | LC | II |
| **Common Pochard** | Large | Rapid Decline | Decline | VU | I |
| **Tufted Duck** | Large | Rapid Decline | Decline | LC | II |
| **Common Merganser** | Moderate | Rapid Decline | Rapid Decline | LC | II |
| **Greater Flamingo** | Large | Rapid Decline | Rapid Decline | LC | II |
| **Great Crested Grebe** | Moderate | Rapid Decline | Decline | LC | II |

Based on Abundance Trends and Range

| | DISTRIBUTION RANGE SIZE | LONG-TERM TREND | CURRENT TREND | IUCN RED LIST | WLPA SCHEDULE |
|---|---|---|---|---|---|
| **Sirkeer Malkoha** | Large | Rapid Decline | Rapid Decline | LC | II |
| **Demoiselle Crane** | Moderate | Decline | Decline | LC | I |
| **Sarus Crane** | Large | Rapid Decline | Rapid Decline | VU | I |
| **Common Crane** | Moderate | Rapid Decline | Decline | LC | I |
| **Great Thick-knee** | Large | Rapid Decline | Rapid Decline | NT | II |
| **Pied Avocet** | Large | Rapid Decline | Decline | LC | II |
| **Eurasian Oystercatcher** | Restricted | Insufficient Data | Rapid Decline | NT | II |
| **Grey Plover** | Moderate | Rapid Decline | Decline | LC | II |
| **Lesser Sand Plover** | Moderate | Rapid Decline | Decline | LC | II |
| **Kentish Plover** | Large | Rapid Decline | Rapid Decline | LC | II |
| **Little Ringed Plover** | Very Large | Rapid Decline | Rapid Decline | LC | II |
| **Eurasian Curlew** | Moderate | Rapid Decline | Rapid Decline | NT | II |
| **Black-tailed Godwit** | Large | Rapid Decline | Rapid Decline | NT | II |
| **Ruff** | Large | Decline | Rapid Decline | LC | II |
| **Curlew Sandpiper** | Moderate | Rapid Decline | Decline | NT | II |
| **Sanderling** | Restricted | Insufficient Data | Decline | LC | II |

| | DISTRIBUTION RANGE SIZE | LONG-TERM TREND | CURRENT TREND | IUCN RED LIST | WLPA SCHEDULE |
|---|---|---|---|---|---|
| **Dunlin** | Moderate | Rapid Decline | Rapid Decline | LC | II |
| **Little Stint** | Large | Rapid Decline | Rapid Decline | LC | II |
| **Pintail Snipe** | Moderate | Decline | Rapid Decline | LC | II |
| **Terek Sandpiper** | Moderate | Rapid Decline | Rapid Decline | LC | II |
| **Spotted Redshank** | Large | Rapid Decline | Rapid Decline | LC | II |
| **Common Greenshank** | Very Large | Rapid Decline | Rapid Decline | LC | I |
| **Marsh Sandpiper** | Large | Rapid Decline | Rapid Decline | LC | II |
| **Common Redshank** | Large | Rapid Decline | Decline | LC | II |
| **Indian Courser** | Large | Rapid Decline | Decline | LC | I |
| **Slender-billed Gull** | Moderate | Rapid Decline | Rapid Decline | LC | II |
| **Black-headed Gull** | Large | Rapid Decline | Decline | LC | II |
| **Brown-headed Gull** | Large | Rapid Decline | Decline | LC | II |
| **Little Tern** | Moderate | Rapid Decline | Decline | LC | II |
| **Gull-billed Tern** | Moderate | Rapid Decline | Rapid Decline | LC | I |
| **Caspian Tern** | Moderate | Rapid Decline | Decline | LC | II |
| **Whiskered Tern** | Large | Rapid Decline | Rapid Decline | LC | II |
| **Common Tern** | Restricted | Rapid Decline | Rapid Decline | LC | II |

Based on Abundance Trends and Range

| | DISTRIBUTION RANGE SIZE | LONG-TERM TREND | CURRENT TREND | IUCN RED LIST | WLPA SCHEDULE |
|---|---|---|---|---|---|
| **Sandwich Tern** | Restricted | Insufficient Data | Rapid Decline | LC | II |
| **Indian Skimmer** | Restricted | Insufficient Data | Decline | EN | I |
| **Great White Pelican** | Moderate | Decline | Decline | LC | II |
| **Western Reef Egret** | Moderate | Rapid Decline | Decline | LC | II |
| **Eurasian Spoonbill** | Large | Rapid Decline | Rapid Decline | LC | I |
| **Osprey** | Large | Rapid Decline | Rapid Decline | LC | I |
| **Bearded Vulture** | Moderate | Rapid Decline | Rapid Decline | NT | I |
| **Egyptian Vulture** | Large | Rapid Decline | Decline | EN | I |
| **Red-headed Vulture** | Moderate | Rapid Decline | Rapid Decline | CR | I |
| **White-rumped Vulture** | Moderate | Rapid Decline | Decline | CR | I |
| **Indian Vulture** | Moderate | Rapid Decline | Rapid Decline | CR | I |
| **Griffon Vulture** | Moderate | Rapid Decline | Decline | LC | I |
| **Andaman Serpent Eagle** | Restricted | Insufficient Data | Rapid Decline | VU | I |
| **Short-toed Snake Eagle** | Very Large | Rapid Decline | Rapid Decline | LC | I |
| **Tawny Eagle** | Moderate | Rapid Decline | Rapid Decline | VU | I |
| **Western Marsh-Harrier** | Large | Rapid Decline | Decline | LC | I |
| **Pallid Harrier** | Large | Rapid Decline | Decline | NT | I |

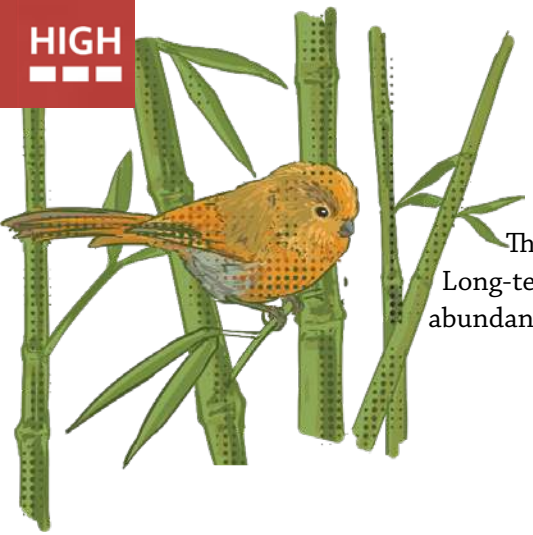
| | DISTRIBUTION RANGE SIZE | LONG-TERM TREND | CURRENT TREND | IUCN RED LIST | WLPA SCHEDULE |
|---|---|---|---|---|---|
| **Montagu's Harrier** | Large | Rapid Decline | Decline | LC | I |
| **Pallas's Fish Eagle** | Restricted | Rapid Decline | Trend Inconclusive | EN | I |
| **Black-capped Kingfisher** | Moderate | Rapid Decline | Rapid Decline | VU | II |
| **Yellow-crowned Woodpecker** | Large | Rapid Decline | Decline | LC | I |
| **Common Kestrel** | Very Large | Rapid Decline | Rapid Decline | LC | II |
| **Andaman Drongo** | Restricted | Insufficient Data | Rapid Decline | LC | II |
| **Isabelline Shrike** | Large | Decline | Rapid Decline | LC | II |
| **Great Grey Shrike** | Large | Rapid Decline | Decline | LC | II |
| **Rufous-vented Tit** | Restricted | Insufficient Data | Rapid Decline | LC | II |
| **Grey-crested Tit** | Restricted | Insufficient Data | Decline | LC | II |
| **Rufous-tailed Lark** | Very Large | Rapid Decline | Rapid Decline | LC | II |
| **Oriental Skylark** | Large | Rapid Decline | Rapid Decline | LC | II |
| **Eurasian Crag Martin** | Moderate | Rapid Decline | Decline | LC | II |
| **Sulphur-bellied Warbler** | Large | Decline | Rapid Decline | LC | II |
| **Jerdon's Babbler** | Restricted | eBird Data Iconclusive | Rapid Decline | VU | I |
| **Nilgiri Laughingthrush** | Very Restricted | Decline | Trend Inconclusive | EN | I |
| **Hoary-throated Barwing** | Restricted | Decline | Trend Inconclusive | LC | II |

Based on Abundance Trends and Range

| | DISTRIBUTION RANGE SIZE | LONG-TERM TREND | CURRENT TREND | IUCN RED LIST | WLPA SCHEDULE |
|---|---|---|---|---|---|
| **Wallcreeper** | Moderate | Rapid Decline | Decline | LC | II |
| **Brown Dipper** | Moderate | Decline | Decline | LC | II |
| **White-headed Starling** | Restricted | Insufficient Data | Rapid Decline | LC | II |
| **Bank Myna** | Large | Decline | Rapid Decline | LC | II |
| **Spot-winged Starling** | Restricted | Insufficient Data | Rapid Decline | LC | II |
| **White-bellied Blue Flycatcher** | Moderate | Rapid Decline | Decline | LC | II |
| **Rufous-gorgeted Flycatcher** | Moderate | Decline | Decline | LC | II |
| **Plumbeous Water Redstart** | Moderate | Decline | Decline | LC | II |
| **Blue-capped Rock Thrush** | Moderate | Decline | Rapid Decline | LC | II |
| **Blue Rock Thrush** | Large | Rapid Decline | Rapid Decline | LC | II |
| **Isabelline Wheatear** | Moderate | Rapid Decline | Decline | LC | II |
| **Desert Wheatear** | Large | Rapid Decline | Decline | LC | II |
| **Variable Wheatear** | Large | Rapid Decline | Decline | LC | II |
| **Thick-billed Flowerpecker** | Large | Decline | Rapid Decline | LC | II |
| **Forest Wagtail** | Moderate | Rapid Decline | Rapid Decline | LC | I |
| **Tawny Pipit** | Large | Rapid Decline | Rapid Decline | LC | II |
| **Olive-backed Pipit** | Large | Rapid Decline | Decline | LC | II |

*Trends and range derived from eBird data*

HIGH



These species are categorised as High Priority by virtue of their range within India being Very Restricted. Their Long-term and Current Annual Trends are either inconclusive or there is not sufficient data to calculate trends in abundance. Hence, more monitoring is needed to understand the trends of these species with small range sizes.

Based on Very Restricted Range

| | IUCN RED LIST | WLPA SCHEDULE |
|---|---|---|
| Marbled Duck | NT | I |
| White-winged Wood Duck | EN | I |
| Baer's Pochard | CR | I |
| Blood Pheasant | LC | I |
| Western Tragopan | VU | I |
| Blyth's Tragopan | VU | I |
| Temminck's Tragopan | LC | I |
| Sclater's Monal | VU | I |
| Bengal Florican | CR | I |
| White-bellied Heron | CR | I |
| Nicobar Sparrowhawk | VU | I |
| Narcondam Hornbill | VU | I |

| | IUCN RED LIST | WLPA SCHEDULE |
|---|---|---|
| Brown-winged Kingfisher | NT | II |
| Mangrove Pitta | NT | II |
| Slender-billed Oriole | LC | II |
| Grey-crowned Prinia | VU | I |
| Long-billed Bush Warbler | NT | II |
| Nicobar Bulbul | NT | II |
| Pale-footed Bush Warbler | LC | II |
| Brown-throated Fulvetta | LC | II |
| Manipur Fulvetta | LC | II |
| Great Parrotbill | LC | II |
| Fulvous Parrotbill | LC | II |
| Mishmi Wren Babbler | VU | I |

Based on Very Restricted Range

| | IUCN RED LIST | WLPA SCHEDULE |
|---|---|---|
| Bar-winged Wren Babbler | LC | I |
| Naga Wren Babbler | VU | I |
| Chin Hills Wren Babbler | LC | II |
| Tawny-breasted Wren Babbler | NT | I |
| Sikkim Wedge-billed Babbler | NT | I |
| Cachar Wedge-billed Babbler | NT | II |
| Snowy-throated Babbler | VU | I |
| Swamp Grass Babbler | EN | I |
| Bhutan Laughingthrush | LC | II |
| Banasura Laughingthrush | EN | I |
| Ashambu Laughingthrush | VU | I |
| Bugun Liocichla | CR | I |
| Rufous-vented Laughingthrush | LC | II |
| Chestnut-backed Laughingthrush | NT | I |
| Mount Victoria Babax | LC | II |
| Pied Thrush | LC | II |

| | IUCN RED LIST | WLPA SCHEDULE |
|---|---|---|
| Tibetan Blackbird | LC | II |
| Large Blue Flycatcher | NT | I |
| Hodgson's Bushchat | VU | I |
| Jerdon's Bushchat | LC | II |
| Nilgiri Pipit | VU | I |

*Trends and range derived from eBird data*

HIGH

These species are categorised as High Priority by a combination of their Red List status and their range within India being Restricted or Historical. Their Long-term and Current Annual Trends are either inconclusive or there is insufficient data to calculate their abundance trends.

Based on Range and IUCN Status

| | IUCN RED LIST | WLPA SCHEDULE |
|---|---|---|
| Andaman Teal | VU | I |
| Nicobar Megapode | VU | I |
| Cheer Pheasant | VU | I |
| Swamp Francolin | VU | I |
| Manipur Bush Quail | EN | I |
| Himalayan Quail | CR | I |
| Yellow-eyed Pigeon | VU | I |
| Pale-capped Pigeon | VU | I |
| Great Indian Bustard | CR | I |
| Macqueen's Bustard | VU | I |
| Lesser Florican | CR | I |
| Dark-rumped Swift | VU | I |

| | IUCN RED LIST | WLPA SCHEDULE |
|---|---|---|
| Sociable Lapwing | CR | I |
| Great Knot | EN | I |
| Jerdon's Courser | CR | I |
| Black-bellied Tern | EN | I |
| Greater Adjutant | EN | I |
| Slender-billed Vulture | CR | I |
| Forest Owlet | EN | I |
| Rufous-necked Hornbill | VU | I |
| Wreathed Hornbill | VU | I |
| Great Slaty Woodpecker | VU | I |
| Andaman Woodpecker | VU | I |
| Saker Falcon | EN | I |

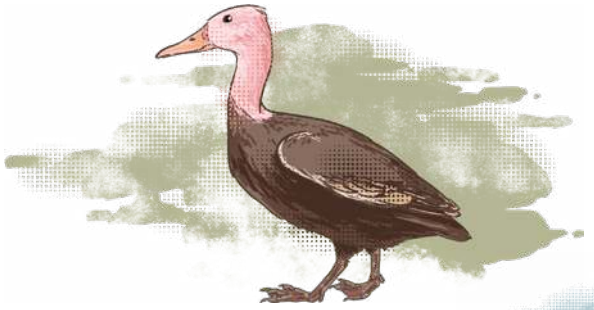
Based on Range and IUCN Status

| | IUCN RED LIST | WLPA SCHEDULE |
|---|---|---|
| Long-tailed Parakeet | VU | II |
| Andaman Treepie | VU | I |
| Broad-tailed Grassbird | VU | I |
| Bristled Grassbird | VU | I |
| Black-breasted Parrotbill | VU | I |
| Marsh Babbler | VU | I |
| Slender-billed Babbler | VU | I |
| Beautiful Nuthatch | VU | I |
| Nilgiri Sholakili | EN | I |
| White-bellied Sholakili | VU | I |
| Kashmir Flycatcher | VU | I |
| Stoliczka's Bushchat | VU | II |
| Finn's Weaver | EN | I |
| Green Munia | VU | I |
| Yellow-breasted Bunting | CR | I |

*Trends and range derived from eBird data*

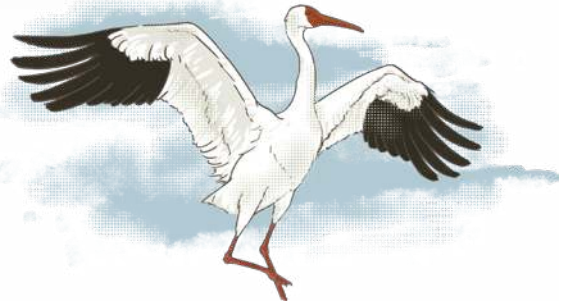
***Pink-headed Duck:***

*Last verifiable report in 1923*



***Siberian Crane:***

*Last verifiable report in 2002*

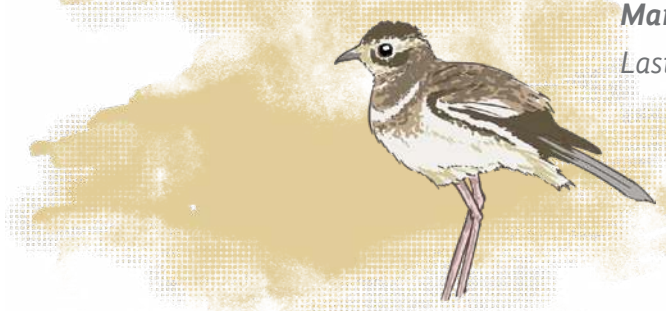


***Himalayan Quail:***

*Last verifiable report in 1876*

***Manipur Bush Quail:***

*Last verifiable report in 1907*



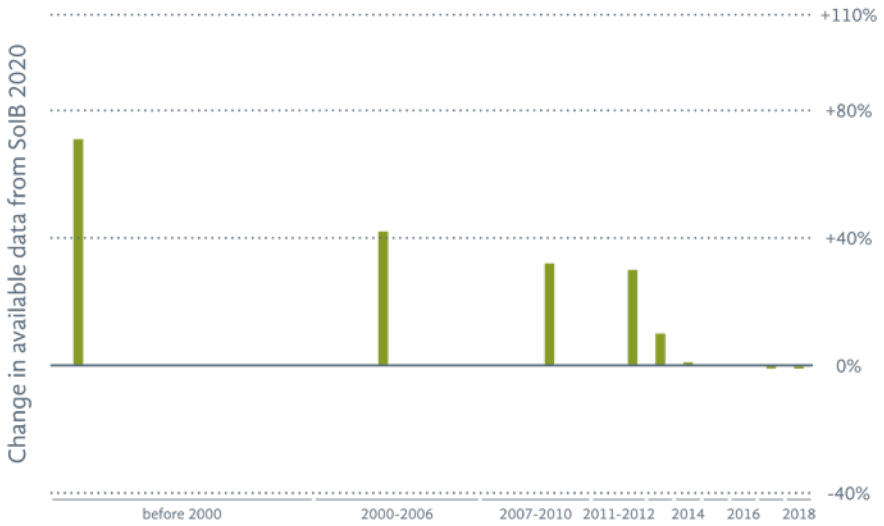
***Jerdon's Courser:***

*Last verifiable report in 2004*



## COMPARISON WITH STATE OF INDIA'S BIRDS 2020

Out of the 101 birds categorised as High Concern (i.e., Priority) in 2020, 74 remain in the same category. An additional 104 species have been newly listed as High Priority in 2023. The majority of these additions (68% of the 104 species) have resulted from the increased amount of trend data, resulting in one or both trends being calculated more precisely where they were Insufficient or Inconclusive earlier. This implies that unavailability or imprecision of trends is often associated with an ongoing decline, and hence should be treated with concern. While 16 High Priority species were assessed for the first time, 88 were uplisted from 2020, including 32 species with a first-time trend and ten species that moved to a more restricted range category largely due to tighter quality control. Among the 25 High Concern (Priority) species that got downlisted to lower priority, nine showed a more encouraging trend than previously, while eight had an increase in their estimated range, likely due to increased availability of data. Four species that were earlier categorised as Declining and of High Concern (i.e., Priority) this time did not have conclusive trends. The IUCN assessment of Black-necked Crane changed from Vulnerable to Near Threatened, resulting in a corresponding lowering of SoIB Priority. The Endangered Steppe Eagle, which previously did not show conclusive trends this time showed a Stable Current Annual Trend, resulting in a lowering of its Priority.




*Long-term Trend assessments in SoIB 2023 have benefitted from a wealth of historical data uploaded after SoIB 2020, particularly for the period before 2013. Tighter quality control has resulted in a slight drop in the number of usable complete checklists in later years.*

# HIGHEST PRIORITY SPECIES

## for States

*Species of highest Conservation Priority were determined for each State and Union Territory (UT) based on multiple factors, including the proportion of the Indian range of each High Priority species that lies within that State/UT. From these, the top four species are listed here in taxonomic order. The full list of species for each State/UT is on p23. Scan the QR code to visit the website (stateofindiasbirds.in) to obtain their range maps, and for more details about how these species were listed.*

**Andaman & Nicobar Islands**

Nicobar Megapode
Nicobar Sparrowhawk
Narcondam Hornbill
White-headed Starling

**Andhra Pradesh**

Lesser Florican
Terek Sandpiper
Jerdon's Courser
Green Munia

**Arunachal Pradesh**

Sclater's Monal
White-bellied Heron
Snowy-throated Babbler
Bugun Liocichla

**Assam**

White-winged Wood Duck
Baer's Pochard
Bengal Florican
Swamp Grass Babbler

**Bihar**

Northern Pintail
Lesser Adjutant
Greater Adjutant
Bank Myna

**Chandigarh**

Sirkeer Malkoha
Common Redshank
Sulphur-bellied Warbler
Spot-winged Starling

**Chhattisgarh**

Tufted Duck
Great Crested Grebe
Yellow-crowned Woodpecker
Thick-billed Flowerpecker

**Dadra & Nagar Haveli**

Forest Owlet
Sulphur-bellied Warbler
Blue-capped Rock Thrush
Thick-billed Flowerpecker

**Daman & Diu**

Grey Plover
Eurasian Curlew
Slender-billed Gull
Caspian Tern

**NCT of Delhi**

Black-bellied Tern
Indian Skimmer
Great White Pelican
Isabelline Shrike

**Goa**

Eurasian Oystercatcher
Sandwich Tern
Malabar Grey Hornbill
Black-capped Kingfisher

**Gujarat**

Greater Flamingo
Macqueen's Bustard
Common Crane
Sociable Lapwing

**Haryana**

Pied Avocet
Egyptian Vulture
Eastern Imperial Eagle
White-naped Tit

**Himachal Pradesh**

Ruddy Shelduck
Western Tragopan
Slender-billed Vulture
Brown Dipper

**Jammu & Kashmir**

Wallcreeper
Tibetan Blackbird
Kashmir Flycatcher
Plumbeous Water Redstart

**Jharkhand**

Tufted Duck
Black-headed Gull
White-rumped Vulture
Indian Vulture

**Karnataka**

Malabar Grey Hornbill
Yellow-throated Bulbul
Nilgiri Sholakili
White-bellied Blue Flycatcher

**Kerala**

Garganey
Broad-tailed Grassbird
Banasura Laughingthrush
Ashambu Laughingthrush

**Ladakh**

Common Merganser
Bearded Vulture
Saker Falcon
Eurasian Crag Martin

**Lakshadweep**

Grey Plover
Lesser Sand Plover
Common Greenshank
Western Reef Egret

**Madhya Pradesh**

Lesser Florican
Indian Skimmer
Red-headed Vulture
Indian Vulture

**Maharashtra**

Nilgiri Wood Pigeon
Indian Courser
Pallid Harrier
Forest Owlet

**Manipur**

Manipur Bush Quail
Slender-billed Oriole
Naga Wren Babbler
Jerdon's Bushchat

**Meghalaya**

Dark-rumped Swift
Tawny-breasted Wren Babbler
Rufous-gorgeted Flycatcher
Olive-backed Pipit

**Mizoram**

Wreathed Hornbill
Great Slaty Woodpecker
Chin Hills Wren Babbler
Mount Victoria Babax

**Nagaland**

Blyth's Tragopan
Dark-rumped Swift
Naga Wren Babbler
Chestnut-backed Laughingthrush

**Odisha**

Pale-capped Pigeon
Black-bellied Tern
Indian Skimmer
Mangrove Pitta

**Puducherry**

Pintail Snipe
Caspian Tern
Common Tern
Sandwich Tern

**Punjab**

Black-bellied Tern
Egyptian Vulture
Bristled Grassbird
Jerdon's Babbler

**Rajasthan**

Yellow-eyed Pigeon
Great Indian Bustard
Lesser Florican
Variable Wheatear

**Sikkim**

Blood Pheasant
Great Parrotbill
Fulvous Parrotbill
Hoary-throated Barwing

**Tamil Nadu**

Nilgiri Laughingthrush
Ashambu Laughingthrush
White-bellied Sholakili
Nilgiri Pipit

**Telangana**

Little Tern
Black-bellied Tern
River Tern
Yellow-throated Bulbul

**Tripura**

Pale-capped Pigeon
Pintail Snipe
White-rumped Vulture
Great Slaty Woodpecker

**Uttar Pradesh**

Sarus Crane
Indian Skimmer
Egyptian Vulture
Jerdon's Bushchat

**Uttarakhand**

Cheer Pheasant
Pallas's Fish Eagle
Grey-crowned Prinia
Finn's Weaver

**West Bengal**

Rufous-necked Hornbill
Brown-winged Kingfisher
Great Parrotbill
Yellow-breasted Bunting

*Species of highest Conservation Priority were determined for each State and Union Territory (UT) based on multiple factors, including the proportion of the Indian range of each High Priority species that lies within that State/UT. From these, up to 20 species are listed here for each State/UT in taxonomic order. Visit the website (stateofindiasbirds.in) to obtain their range maps, and for more details about how these species were listed.*

**Andaman & Nicobar Islands:** Andaman Teal, Nicobar Megapode, Lesser Sand Plover, Eurasian Curlew, Pintail Snipe, Terek Sandpiper, Andaman Serpent Eagle, Nicobar Sparrowhawk, Narcondam Hornbill, Black-capped Kingfisher, Andaman Woodpecker, Long-tailed Parakeet, Andaman Drongo, Andaman Treepie, Nicobar Bulbul, Pale-footed Bush Warbler, White-headed Starling, Forest Wagtail

**Andhra Pradesh:** Pale-capped Pigeon, Lesser Florican, Pied Avocet, Eurasian Oystercatcher, Grey Plover, Lesser Sand Plover, Great Knot, Terek Sandpiper, Jerdon's Courser, Brown-headed Gull, Caspian Tern, Common Tern, Black-bellied Tern, Indian Skimmer, Western Reef Egret, Short-toed Snake Eagle, Black-capped Kingfisher, Oriental Skylark, Yellow-throated Bulbul, Green Munia

**Arunachal Pradesh:** Blood Pheasant, Blyth's Tragopan, Temminck's Tragopan, Sclater's Monal, White-bellied Heron, Rufous-necked Hornbill, Wreathed Hornbill, Slender-billed Oriole, Brown-throated Fulvetta, Manipur Fulvetta, Mishmi Wren Babbler, Bar-winged Wren Babbler, Sikkim Wedge-billed Babbler, Cachar Wedge-billed Babbler, Snowy-throated Babbler, Bhutan Laughingthrush, Bugun Liocichla, Rufous-vented Laughingthrush, Beautiful Nuthatch, Large Blue Flycatcher

**Assam:** White-winged Wood Duck, Baer's Pochard, Swamp Francolin, Bengal Florican, Lesser Adjutant, Greater Adjutant, White-bellied Heron, Slender-billed Vulture, Pallas's Fish Eagle, Wreathed Hornbill, Pale-footed Bush Warbler, Jerdon's Babbler, Black-breasted Parrotbill, Marsh Babbler, Swamp Grass Babbler, Slender-billed Babbler, Chestnut-backed Laughingthrush, Spot-winged Starling, Jerdon's Bushchat, Finn's Weaver

**Bihar:** Northern Pintail, Great Crested Grebe, Lesser Adjutant, Greater Adjutant, Bank Myna

**Chandigarh:** Sirkeer Malkoha, Common Redshank, Sulphur-bellied Warbler, Spot-winged Starling

**Chhattisgarh:** Common Pochard, Tufted Duck, Great Crested Grebe, Kentish Plover, Little Ringed Plover, Indian Courser, Osprey, Short-toed Snake Eagle, Yellow-crowned Woodpecker, Great Grey Shrike, Rufous-tailed Lark, Sulphur-bellied Warbler, Thick-billed Flowerpecker, Tawny Pipit, Olive-backed Pipit

**Dadra & Nagar Haveli:** Forest Owlet, Sulphur-bellied Warbler, Blue-capped Rock Thrush, Thick-billed Flowerpecker

**Daman & Diu:** Grey Plover, Eurasian Curlew, Slender-billed Gull, Caspian Tern

**Delhi**: Black-bellied Tern, Indian Skimmer, Great White Pelican, Isabelline Shrike

**Goa:** Nilgiri Wood Pigeon, Eurasian Oystercatcher, Sanderling, Terek Sandpiper, Slender-billed Gull, Brown-headed Gull, Sandwich Tern, Malabar Grey Hornbill, Black-capped Kingfisher, White-bellied Blue Flycatcher

**Gujarat:** Ruddy Shelduck, Northern Pintail, Greater Flamingo, Macqueen's Bustard, Demoiselle Crane, Sarus Crane, Common Crane, Pied Avocet, Sociable Lapwing, Kentish Plover, Ruff, Common Redshank, Slender-billed Gull, Brown-headed Gull, River Tern, Indian Skimmer, Great White Pelican, Western Reef Egret, Stoliczka's Bushchat, Isabelline Wheatear

**Haryana:** Northern Pintail, Tufted Duck, Pied Avocet, Eurasian Curlew, Black-tailed Godwit, Ruff, Curlew Sandpiper, Dunlin, Spotted Redshank, Marsh Sandpiper, Common Redshank, Egyptian Vulture, Eastern Imperial Eagle, Isabelline Shrike, Great Grey Shrike, White-naped Tit, Bristled Grassbird, Bank Myna, Stoliczka's Bushchat, Isabelline Wheatear

**Himachal Pradesh:** Ruddy Shelduck, Common Merganser, Western Tragopan, Cheer Pheasant, Bearded Vulture, Egyptian Vulture, White-rumped Vulture, Slender-billed Vulture, Griffon Vulture, Rufous-vented Tit, Grey-crested Tit, Eurasian Crag Martin, Wallcreeper,

Brown Dipper, Spot-winged Starling, Tibetan Blackbird, Rufous-gorgeted Flycatcher, Plumbeous Water Redstart, Blue-capped Rock Thrush, Olive-backed Pipit

**Jammu & Kashmir:** Ruddy Shelduck, Northern Pintail, Western Tragopan, Cheer Pheasant, Bearded Vulture, White-rumped Vulture, Sulphur-bellied Warbler, Wallcreeper, Brown Dipper, Tibetan Blackbird, Kashmir Flycatcher, Plumbeous Water Redstart, Blue-capped Rock Thrush

**Jharkhand:** Tufted Duck, Great Crested Grebe, Black-headed Gull, Lesser Adjutant, White-rumped Vulture, Indian Vulture

**Karnataka:** Nilgiri Wood Pigeon, Demoiselle Crane, Pintail Snipe, Whiskered Tern, River Tern, Sandwich Tern, Indian Spotted Eagle, Tawny Eagle, Pallid Harrier, Montagu's Harrier, Malabar Grey Hornbill, Black-capped Kingfisher, Broad-tailed Grassbird, Yellow-throated Bulbul, Pied Thrush, Nilgiri Sholakili, White-bellied Blue Flycatcher, Blue-capped Rock Thrush, Thick-billed Flowerpecker, Forest Wagtail

**Kerala:** Garganey, Northern Pintail, Nilgiri Wood Pigeon, Eurasian Oystercatcher, Great Knot, Ruff, Sanderling, Marsh Sandpiper, Brown-headed Gull, Sandwich Tern, Malabar Grey Hornbill, Black-capped Kingfisher, Broad-tailed Grassbird, Banasura Laughingthrush, Nilgiri Laughingthrush, Ashambu Laughingthrush, Nilgiri Sholakili, White-bellied Sholakili, White-bellied Blue Flycatcher, Nilgiri Pipit

**Ladakh:** Common Merganser, Great Crested Grebe, Lesser Sand Plover, Brown-headed Gull, Common Tern, Bearded Vulture, Saker Falcon, Eurasian Crag Martin, Sulphur-bellied Warbler, Wallcreeper, Brown Dipper, Plumbeous Water Redstart, Blue Rock Thrush, Isabelline Wheatear, Desert Wheatear, Variable Wheatear

**Lakshadweep:** Grey Plover, Lesser Sand Plover, Common Greenshank, Western Reef Egret

**Madhya Pradesh:** Ruddy Shelduck, Lesser Florican, Sirkeer Malkoha, Sarus Crane, Great Thick-knee, Indian Courser, Black-bellied Tern, River Tern, Indian Skimmer, Lesser Adjutant, Egyptian Vulture, Red-headed Vulture, White-rumped Vulture, Indian Vulture, Griffon Vulture, Yellow-crowned Woodpecker, Rufous-tailed Lark, Sulphur-bellied Warbler, Bank Myna, Thick-billed Flowerpecker

**Maharashtra:** Ruddy Shelduck, Common Pochard, Nilgiri Wood Pigeon, Pied Avocet, Kentish Plover, Indian Courser, Brown-headed Gull, Little Tern, River Tern, Eurasian Spoonbill, Pallid Harrier, Montagu's Harrier, Forest Owlet, Malabar Grey Hornbill, Yellow-crowned Woodpecker, Rufous-tailed Lark, Eurasian Crag Martin, Sulphur-bellied Warbler, Thick-billed Flowerpecker, Tawny Pipit

**Manipur:** Manipur Bush Quail, Dark-rumped Swift, Slender-billed Oriole, Manipur Fulvetta, Black-breasted Parrotbill, Naga Wren Babbler, Cachar Wedge-billed Babbler, Slender-billed Babbler, Beautiful Nuthatch, Rufous-gorgeted Flycatcher, Plumbeous Water Redstart, Jerdon's Bushchat, Yellow-breasted Bunting

**Meghalaya:** Dark-rumped Swift, Great Slaty Woodpecker, Tawny-breasted Wren Babbler, Rufous-gorgeted Flycatcher, Plumbeous Water Redstart, Olive-backed Pipit

**Mizoram:** Wreathed Hornbill, Great Slaty Woodpecker, Chin Hills Wren Babbler, Mount Victoria Babax

**Nagaland:** Naga Wren Babbler, Blyth's Tragopan, Dark-rumped Swift, Manipur Fulvetta, Chestnut-backed Laughingthrush

**Odisha:** Ruddy Shelduck, Tufted Duck, Great Crested Grebe, Pale-capped Pigeon, Great Thick-knee, Pied Avocet, Lesser Sand Plover, Eurasian Curlew, Terek Sandpiper, Brown-headed Gull, Black-bellied Tern, Indian Skimmer, Brown-winged Kingfisher, Black-capped Kingfisher, Mangrove Pitta, Oriental Skylark, Thick-billed Flowerpecker, Green Munia, Forest Wagtail

**Puducherry:** Pintail Snipe, Caspian Tern, Common Tern, Sandwich Tern

**Punjab:** Ruddy Shelduck, Spotted Redshank, Common Redshank, Black-bellied Tern, Egyptian Vulture, Isabelline Shrike, Bristled Grassbird, Jerdon's Babbler, Bank Myna

**Rajasthan:** Yellow-eyed Pigeon, Great Indian Bustard, Macqueen's Bustard, Lesser Florican, Demoiselle Crane, Pied Avocet, River Tern, Indian Skimmer, Great White Pelican, Indian Vulture, Griffon Vulture, Tawny Eagle, Eastern Imperial Eagle, Great Grey Shrike, White-naped Tit, Stoliczka's Bushchat, Isabelline Wheatear, Desert Wheatear, Variable Wheatear, Green Munia

**Sikkim:** Common Merganser, Blood Pheasant, Rufous-necked Hornbill, Rufous-vented Tit, Grey-crested Tit, Great Parrotbill, Fulvous Parrotbill, Hoary-throated Barwing, Wallcreeper, Brown Dipper, Rufous-gorgeted Flycatcher, Plumbeous Water Redstart

**Tamil Nadu:** Nilgiri Wood Pigeon, Grey Plover, Pintail Snipe, Brown-headed Gull, Gull-billed Tern, Caspian Tern, Whiskered Tern, Common Tern, Indian Spotted Eagle, Broad-tailed Grassbird, Yellow-throated Bulbul, Nilgiri Laughingthrush, Ashambu Laughingthrush, Pied Thrush, Nilgiri Sholakili, White-bellied Sholakili, White-bellied Blue Flycatcher, Kashmir Flycatcher, Forest Wagtail, Nilgiri Pipit

**Telangana:** Northern Pintail, Greater Flamingo, Pale-capped Pigeon, Indian Courser, Little Tern, Whiskered Tern, Black-bellied Tern, River Tern, Short-toed Snake Eagle, Pallid Harrier, Montagu's Harrier, Yellow-crowned Woodpecker, Rufous-tailed Lark, Yellow-throated Bulbul

**Tripura:** Pale-capped Pigeon, Pintail Snipe, White-rumped Vulture, Great Slaty Woodpecker

**Uttar Pradesh:** Ruddy Shelduck, Northern Pintail, Swamp Francolin, Great Crested Grebe, Sarus Crane, Pied Avocet, Ruff, Common Redshank, Black-bellied Tern, Indian Skimmer, Great White Pelican, Egyptian Vulture, Slender-billed Vulture, Indian Spotted Eagle, Pallas's Fish Eagle, Great Slaty Woodpecker, Bristled Grassbird, Bank Myna, Jerdon's Bushchat, Finn's Weaver

**Uttarakhand:** Ruddy Shelduck, Common Merganser, Cheer Pheasant, Great Crested Grebe, Bearded Vulture, Griffon Vulture, Pallas's Fish Eagle, Great Slaty Woodpecker, Rufous-vented Tit, Grey-crested Tit, Grey-crowned Prinia, Bristled Grassbird, Pale-footed Bush Warbler, Wallcreeper, Brown Dipper, Spot-winged Starling, Pied Thrush, Rufous-gorgeted Flycatcher, Plumbeous Water Redstart, Finn's Weaver

**West Bengal:** Ruddy Shelduck, Common Merganser, Great Crested Grebe, Pale-capped Pigeon, Lesser Sand Plover, Great Knot, Lesser Adjutant, Rufous-necked Hornbill, Brown-winged Kingfisher, Black-capped Kingfisher, Mangrove Pitta, Rufous-vented Tit, Bristled Grassbird, Great Parrotbill, Fulvous Parrotbill, Hoary-throated Barwing, Beautiful Nuthatch, Spot-winged Starling, Olive-backed Pipit, Yellow-breasted Bunting

# SPECIES ACCOUNTS

It can be illuminating to combine species into different groups, based on shared ecology, habitat, diet, and behaviour. Comparing the abundance trends across such groups can provide insights into the underlying mechanisms behind population changes and can help narrow down the kinds of conservation interventions required. For example, if insect-eating birds, as a whole, are declining much more than fruit-eating birds, this would be one piece of evidence to say that insect food might be decreasing in quantity (number of insects) or quality (e.g., due to the negative effects of environmental pollutants).

In this section, we examine birds within specific groupings:

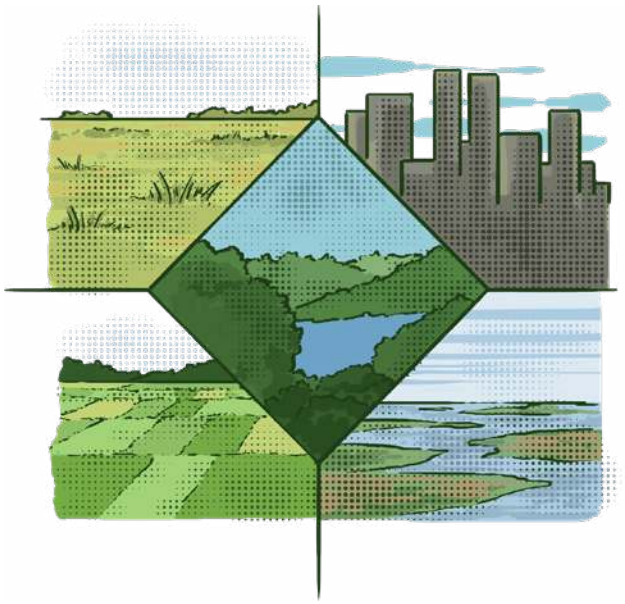
1. ecological groups, including diet and habitat specialisation
2. habitat groups, including open habitats and rivers
3. taxonomic groups, including raptors, woodpeckers, ducks, large waterbirds, and bustards

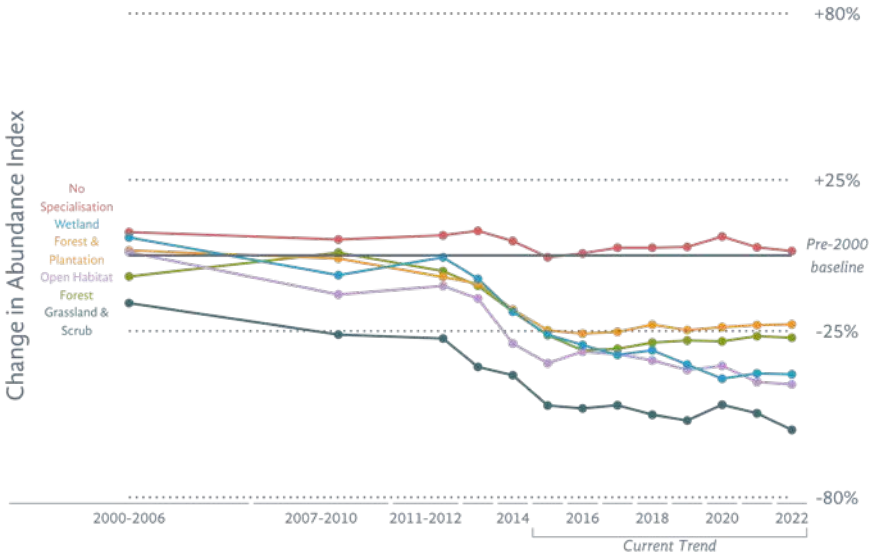
Apart from the groups, we also examine individual species that are thriving, like Indian Peafowl, and a set of other species that show interesting trends.

# Habitat Specialisation

India is home to a great diversity of natural habitats for birds, from tropical rainforests with hornbills and trogons, to grasslands with bustards and floricans, to rocky hills, deserts, mangroves, and many other natural ecosystems. Some birds are 'specialists' restricted to a narrow habitat type, but many others have adapted to live in a wide variety of habitats created and shaped by humans, such as plantations, agricultural fields, open fallow land, and even urban areas. Yellow-wattled Lapwing is an example of a species that can live in a wide variety of 'open' habitats including agriculture, fallow land and lawns, and natural grassland, but Indian Courser is more specialised and can typically live only in lightly grazed grasslands and adjacent fallow land. Similarly, White-bellied Woodpecker is specialised in its requirement of large trees, mostly found in the old-growth forests of the Western Ghats, but Greater Flameback can survive even in old plantations (see Woodpeckers, p46).

In good news, generalist birds that can live in multiple habitat types are doing well as a group and may require less conservation attention. Specialists, however, are more threatened than generalists. Grassland specialists have declined by more than 50%, indicating the importance of protecting and maintaining grassland ecosystems (see Open Ecosystems, p32). A steep decline of birds that live in a wide variety of open habitats in addition to grasslands suggests a need to investigate threats in, for example, open agricultural landscapes and fallow land. Birds that are woodland specialists (forests or plantations) have also declined more than generalists, indicating a need to conserve natural forest habitats so that they provide habitat to specialists.





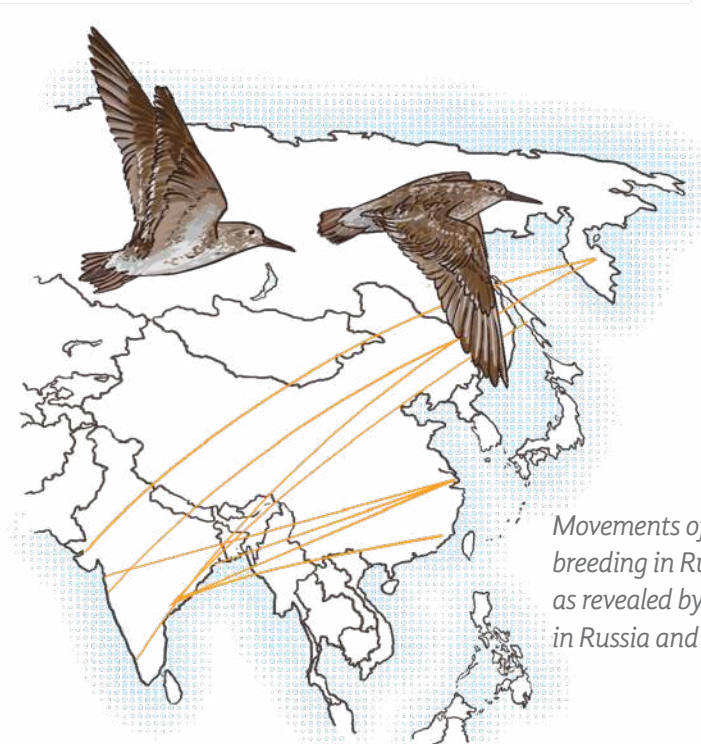

*Birds that specialise on any ecosystem (natural or human-made) have suffered steeper declines than those that can live in multiple ecosystems.*

# Migration

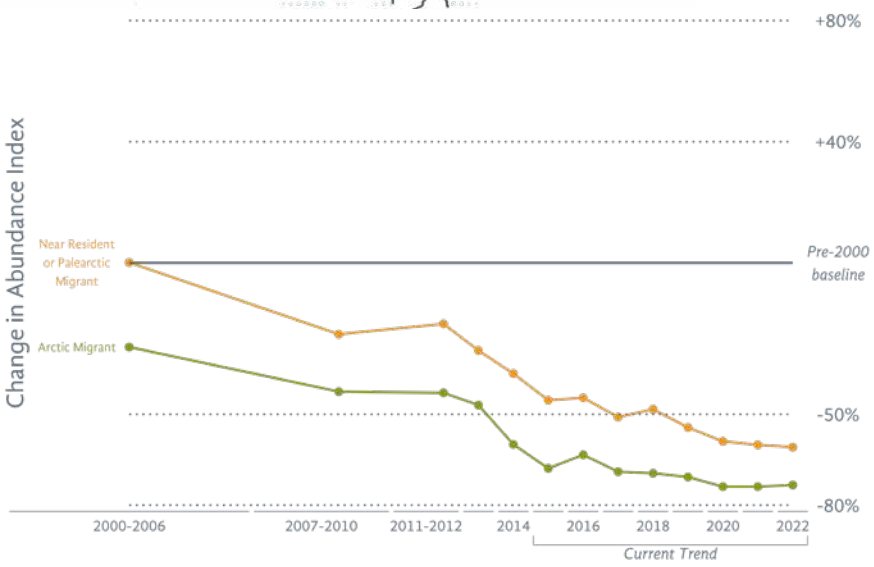
Migratory birds make awe-inspiring annual journeys between breeding and non-breeding grounds. India is a very important non-breeding destination for many widespread Eurasian bird species, some of whose entire global populations spend the northern or boreal winter in the Indian subcontinent. Some species migrate long distances of over 10,000 km to reach India from the Arctic. Many others migrate over shorter distances within the Indian subcontinent, like Indian Pitta, which migrates from northern and central India to southern India and Sri Lanka. Some species undertake elevational migration from the higher Himalaya to the foothills and plains, like Rufous-bellied Niltava and Grey-bellied Tesia. Other birds are resident, in that they are either sedentary or only make local movements.

Birds face many dangers during migration, from extreme weather events, to predation, starvation, and hunting/illegal killing (see Illegal Hunting and Trade, p86). Birds that breed in the Arctic face the most pronounced consequences of climate change. Abundance trends of migratory species show what might be expected: long-distance migrants have declined the most, by over 50% (see Coasts, p36), followed by short-distance migrants. Shorebirds that breed in the Arctic have been particularly affected, declining by close to 80% as a group. By contrast, resident species as a group have remained much more stable.

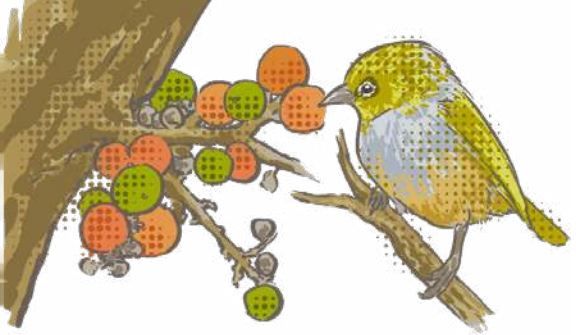
Conservation of long-distance migrants requires identifying and maintaining the health of critical habitats including intertidal mudflats, mangroves, grasslands, open wetlands, paddyfields, and reedbeds. This ensures that they are able to feed and build up resources for their arduous migration journeys. Previous initiatives to safeguard the quality of stopover sites have had encouraging conservation outcomes, notably for the Critically Endangered Spoon-billed Sandpiper in the Yellow Sea.



*Movements of Great Knot breeding in Russian Far East as revealed by colour marking in Russia and China.*

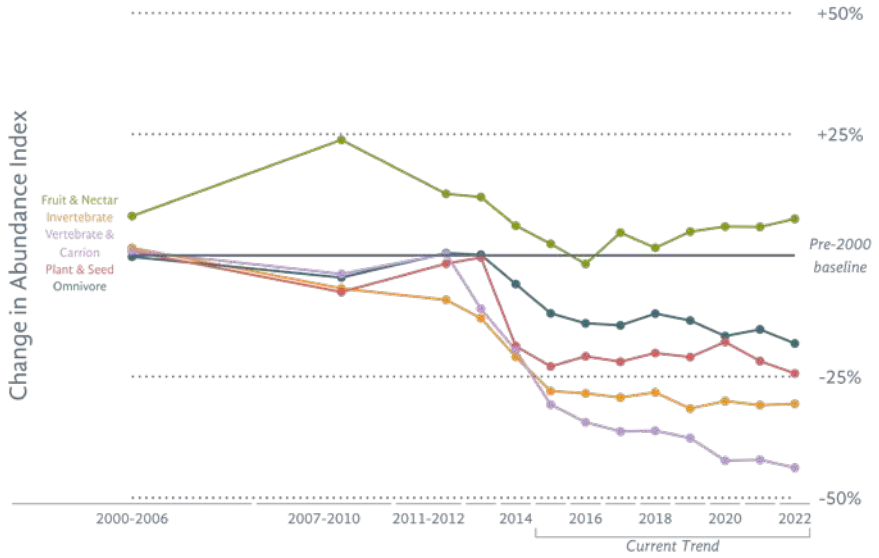



*Shorebirds that breed in the Arctic and migrate long distances have declined the most.*



# Diet

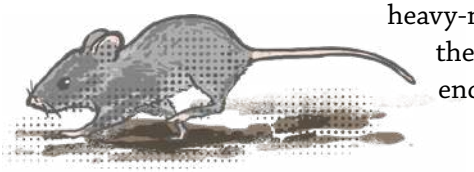
Birds feed on a variety of food. Some feed primarily on meat (e.g., vultures and other raptors), some on fruits and nectar (e.g., barbets and sunbirds), some on seeds (sparrows and doves), and some on invertebrates (e.g., warblers and flycatchers). Others, like crows, eat more than one type of food, and are omnivores. Bird populations are therefore not just influenced by direct threats and threats to their habitats, but also by the availability of food resources. A decline in insects, for example, could affect insectivorous birds. Mice in agricultural landscapes are food for a number of raptors, but these mice may carry pesticides and other agrochemicals that may be harmful for the birds that eat them (see Raptors, p38). Vultures were nearly driven to extinction by consuming carcasses contaminated with diclofenac (see Vultures, p40).

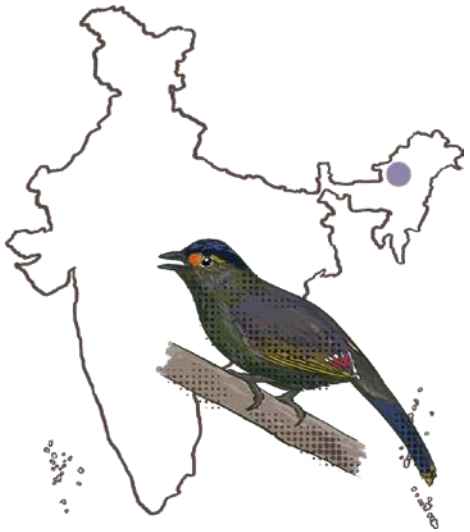



*Birds that feed on fruit and nectar are doing well, but insectivores and carnivores have sharply declined.*

In India, birds that feed on vertebrates and carrion have declined the most, suggesting that this food resource either contains harmful pollutants (see Environmental Pollutants, p76), or is declining in availability, or both. Strong evidence from other countries shows that agrochemicals lower survival rates in some raptors. We find that birds that feed on invertebrates (including insects) are declining rapidly. This needs to be taken together with recent findings that insect populations worldwide have reduced, and that pesticides are thought to be a main contributor to massive declines in European insectivorous birds. Research on this topic in India must be prioritised if we are to slow down the decline of raptors and insectivores, both important groups of birds that provide crucial ecosystem services such as pest control.

The trend analysis shows that birds that feed on fruits and nectar are doing well, maybe because these resources are readily available even in heavy-modified rural and urban landscapes. Continued availability of these resources even outside natural ecosystems can sustain this encouraging story.

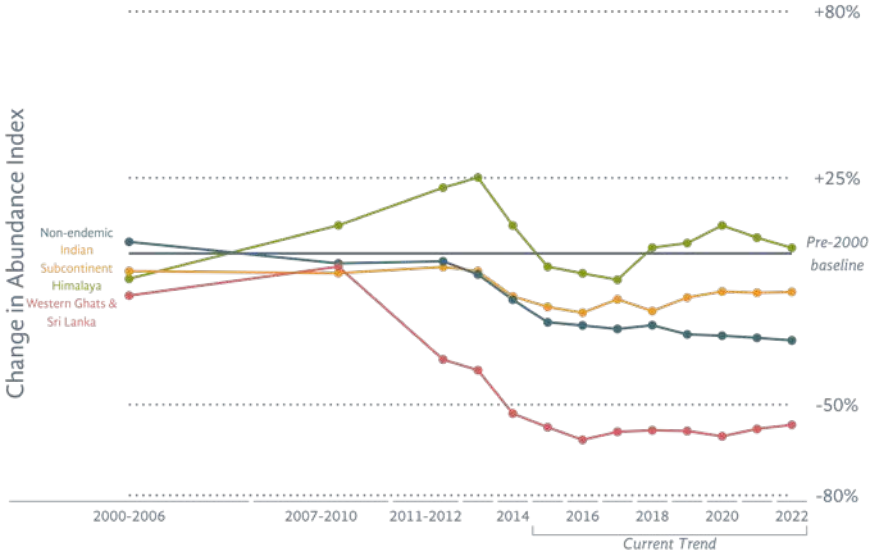




# Endemicity

South Asia is a global hotspot of endemism. It is home to 232 species of endemic birds, found nowhere else in the world. Of these, 30 are endemic to the Andaman & Nicobar Islands, 36 to the Western Ghats and Sri Lanka, and 95 to the Indian subcontinent as a whole (but not to any smaller region within). Within each endemic region, endemics represent certain eco-regions, and these ecosystems are in turn representative of the region itself. In the Western Ghats for example, most endemics are inhabitants of rainforest, such as White-bellied Treepie and Wayanad Laughingthrush. Birds that are endemic to the wider subcontinent but not to any smaller regions are largely inhabitants of grasslands, scrub, and deciduous forests, such as Indian Courser, White-naped Tit, and Forest Owlet.

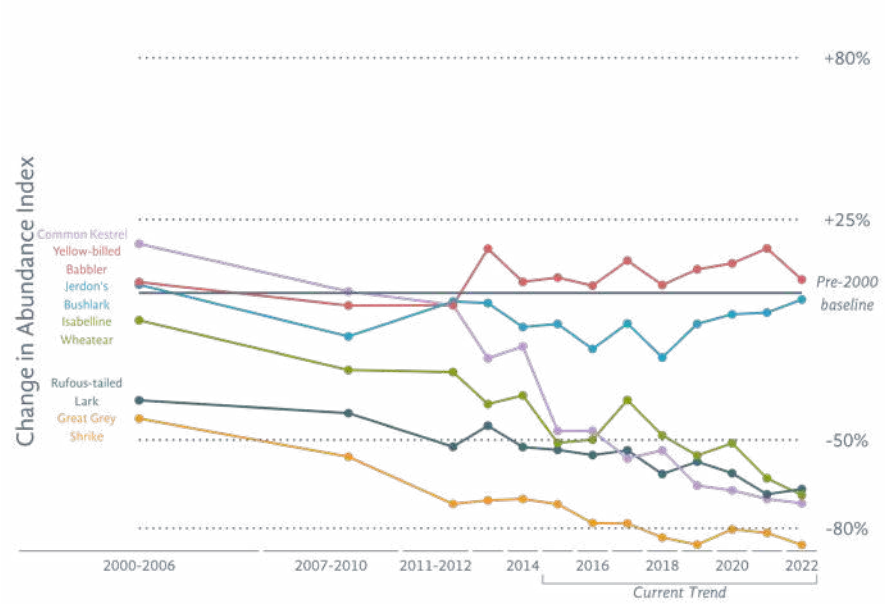
Birds that are endemic to the Western Ghats and Sri Lanka biodiversity hotspot have rapidly declined in India over the past few decades. The reasons behind this decline are not clear. Some possibilities include declining forest habitat, a reduction in food such as insects within the rainforests, and perturbations in weather and phenology induced by climate change (see Climate Change, p88). We must diagnose the problem by investigating these and other possibilities, in order to take directed steps to strengthen ongoing conservation efforts.




*Birds that are endemic to the Western Ghats and Sri Lanka are in decline.*

# Open Ecosystems

Open habitats represent a wide range of ecosystems that include open natural ecosystems (ONEs) such as grasslands, semi-arid landscapes, and deserts, but also human-created ecosystems like croplands, grazing lands, and fallow lands[8]. Perhaps more so than wooded areas/forests, open habitats are characterised by their long and continued history of human use, by livestock grazers, farmers, and others, resulting in a number of novel ecosystems and bird communities that have coexisted with people. Open habitats have also had a history of neglect and conversion into plantations or 'forests' that have been more valued.

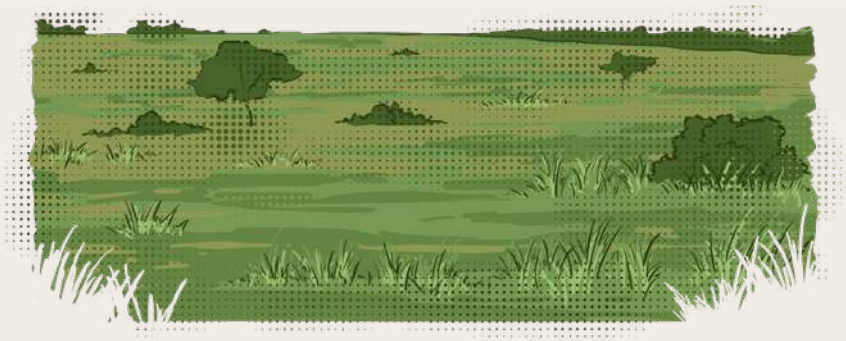



*A number of larks and grassland specialists have rapidly declined, but birds that are more flexible in their requirement of open habitats are doing better.*

## POPULATION STATUS

*Birds that live in open habitats have declined tremendously (see Habitat Specialisation, p28). We are all aware of the perilous status of bustards (see Bustards, p48), but a number of other open habitat birds are also in poor health. There are exceptions, though. Adaptable birds such as Yellow-billed Babbler and Jerdon's Bushlark are doing well. More specialised birds like Rufous-tailed Lark, Common Kestrel, and Isabelline Wheatear have declined more sharply, with Rufous-tailed Lark and Common Kestrel now categorised as species of High priority.*

Of particular note is Great Grey Shrike, because it has suffered a particularly worrisome long-term decline of more than 80%. This species and other grassland specialists like Chestnut-bellied Sandgrouse have done better in regions rich in ONEs compared to the country as a whole, indicating the importance of conserving ONEs. But the needs of open habitat species can be more complex. An example is Indian Courser, a species that typically persists in closely cropped grazing land and agriculture, and is currently most stable in cropland-dominated landscapes in dry regions.



## THREATS

Birds in open habitats have to navigate a number of threats that are often unique to such landscapes. Broadly, these birds face two categories of threats: those from conversion of open to closed habitat, and those that directly cause mortality and lower survival.

The 'openness' of open habitats is severely compromised by the spread of invasive, drought tolerant woody plants, as well as wind turbines and power lines (see Energy Infrastructure, p82). Of note is *Prosopis juliflora*, a prolific thorny invasive from South America, which has rendered vast areas unsuitable for open habitat specialists. Another threat to 'openness' is the concept of planting woody species—native and non-native. In the high-altitude grasslands of the Western Ghats, some planted exotic trees like Wattle are now invasive, threatening the future of birds like Nilgiri Pipit[9].

Birds of these habitats also face many direct threats to survival, including those from energy infrastructure such as power lines and wind turbines. Ground-nesting birds, characteristic of open habitats, are vulnerable to predation by free-ranging dogs and other human-subsidised predators.

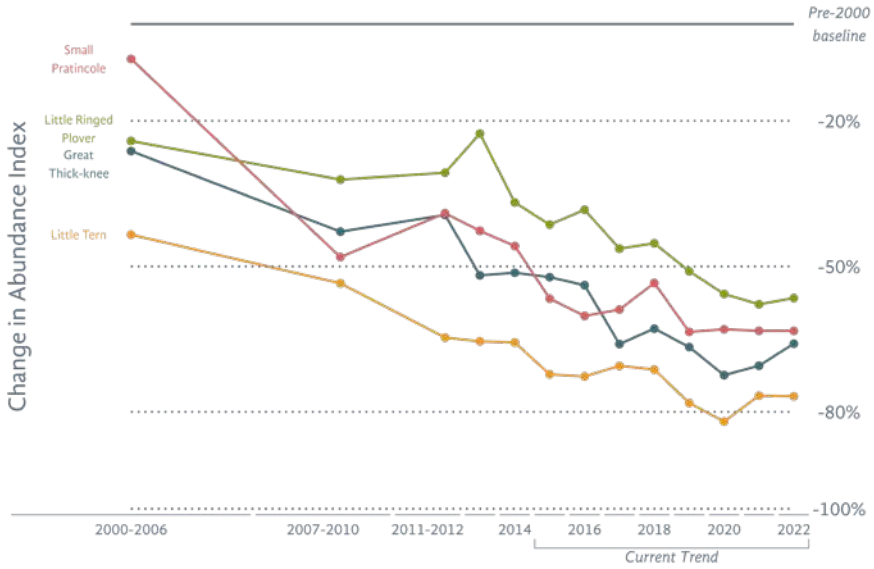
*Singing Bushlark, one of the best vocal mimics among birds of India, almost entirely persists within croplands within the country. Why is the species so patchy in its distribution and why is it so partial to croplands?*

## CONSERVATION RESEARCH & POLICY

Open habitats require management practices that allow them to retain their 'openness'. We need a policy change that discourages the large-scale planting of any woody plants in ONEs. Grazing by livestock is often a critical service that maintains many ONEs, and any absolute ban on grazing as a means of protection can have detrimental consequences—as may have been the case for Jerdon's Courser[10]. Additionally, croplands constitute a vast proportion of India's open habitats, and these too can and should be managed for the health of birds and other biodiversity.

# Rivers

A number of species use open sandbars, rocks, and islets on rivers for their breeding. They include terns (Black-bellied, River, and Little), pratincoles (Small and Oriental), Indian Skimmer, Great Thick-knee, River Lapwing, and Little Ringed Plover. Although the breeding sites of these birds are in specific areas, the remoteness of these sites and the timing of breeding (mostly in hot summers) makes monitoring difficult.




*Multiple riverine ground-nesting birds show 50–80% decline over the long term and some continue to decline even now.*

## POPULATION STATUS

*Indian Skimmer and Black-bellied Tern are well known to be endangered and are the subject of dedicated monitoring studies. As a consequence, most important breeding sites of these species are known, although rigorous population trends are unavailable.*

### Indian Skimmer

Although no trend data is available for this species for the long term, it shows a 4% current mean annual decline, matching the IUCN estimate of 30–49% decline in three generations. Chambal, Ganga, Mahanadi, Yamuna, and Son are the important rivers for this species.


### Black-bellied Tern

No trend data is available for this species from SoIB nor from IUCN. Chambal, Mahanadi, Ganga, Son, Godavari, and Yamuna are the important rivers for this species.

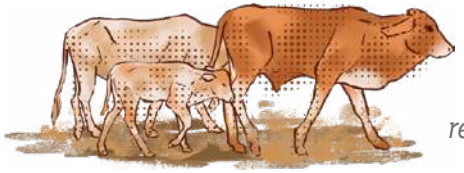

### River Tern

It is widespread across all peninsular Indian rivers and reservoirs. Still, SoIB estimates a decline of at least 33% in the long term, consistent with IUCN's estimate of 30–49% decline over three generations.

## THREATS

The decline of riverine sandbar-nesting birds is attributed to widespread pressures on rivers from irrigation schemes, transportation, human disturbance, domestic use, and pollution from agricultural and industrial chemicals (see Environmental Pollutants, p76). For many of these species the most critical factor is the variation in water level during the breeding season due to greater control of, and demand for, water for human use. As a result, the birds are subject to a number of associated threats.

*Direct flooding and inundation of eggs and chicks resulting from the operation of sluice gates in reservoirs along rivers.*



*Trampling by grazing livestock that gain access to islets when water levels reduce, resulting in 9–20% loss of eggs[11].*

*Predation by dogs and jackals that access islands when river banks get connected to the nesting islands, resulting in 32–35% loss of eggs[11].*

*Summer (breeding season) cultivation on river banks and sand islands along many large rivers and reservoirs.*

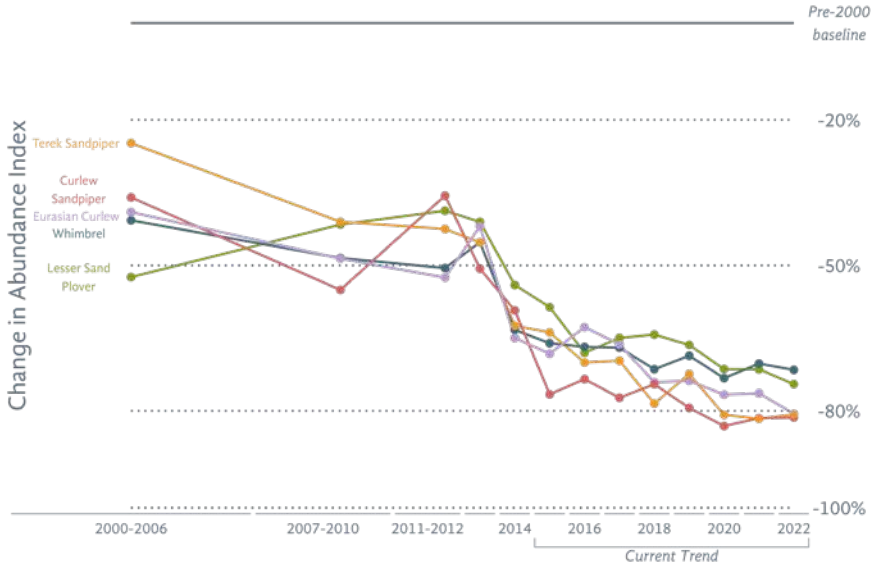
## CONSERVATION RESEARCH & POLICY

Although some IUCN Threatened species are protected by law (listed in Schedule I of the Wild Life Protection Act), it is a different situation for their habitats, with large stretches of riverine nesting habitat lacking protection. In particular, there is an urgent need to identify and protect breeding sites of Indian Skimmer and Black-bellied Tern. Monitoring of such sites during the breeding season should be done through partnerships among local communities, NGOs, forest departments, researchers, and citizen scientists. The National Water Policy recognises that the ecological needs of the river require release of water proportional to the natural flow regime. The revised National River Conservation Plan must include measures to protect sandbars and nesting islands during the breeding season.

Sand mining is a further threat for these nesting colonies, both directly (through disturbance and disruption) as well as through possible long-term effects on the formation of nesting sandbars. Coupled with these threats, extreme weather events (e.g., sand storms, heavy pre-monsoon showers, and tropical cyclones) can destroy breeding colonies en masse, resulting in a failed breeding season.

# Coasts

Coastal habitats like estuaries, mudflats, sandbars, mangroves, and rocky beaches are crucial for the survival of a wide variety of birds like gulls, terns, and waders. In this account, we focus on shorebirds (often used synonymously with the term 'wader') as they are a key group in these habitats, with many species in decline. Species like Lesser Sand Plover, Eurasian Curlew, Curlew Sandpiper, Terek Sandpiper, and Little Stint are among the common migratory shorebirds that winter in large numbers across the country. Others include globally threatened species like Great Knot and Nordmann's Greenshank. Most of India's wintering shorebirds follow migratory routes along the Central Asian Flyway and to some extent the East Asian–Australasian Flyway[12].




*Coastal shorebirds have rapidly declined as a group.*

## POPULATION STATUS

*The populations of several species of shorebird are in decline, both globally and in India. Shorebird numbers in key sites have been showing a declining trend. This report shows that a number of once-common species are steadily reducing.*

### Curlew Sandpiper

Considered globally Near Threatened, this species used to be observed in large numbers in key Indian wintering sites like Point Calimere and Pulicat Lake. However, it has undergone a decline over the years.

NT II HIGH

### Eurasian Curlew

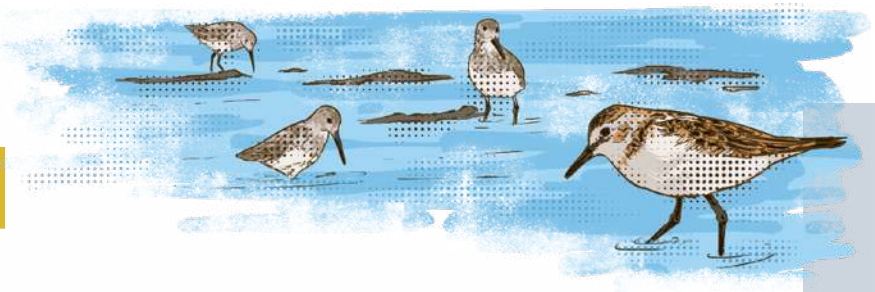
This Near Threatened species is undergoing a rapid decline in key habitats. The main threats are disturbance on intertidal mudflats and development on high-tide roosting sites. Illegal trapping is likely to impose an additional pressure.

NT II HIGH

### Great Knot

Great Knot is an Endangered species and is under strong decline globally. In India, the species was earlier considered a vagrant. Recent sightings of Great Knot in considerable numbers in certain key sites like Coringa and Point Calimere may be due to population changes in the East Asian–Australasian Flyway.

EN I HIGH

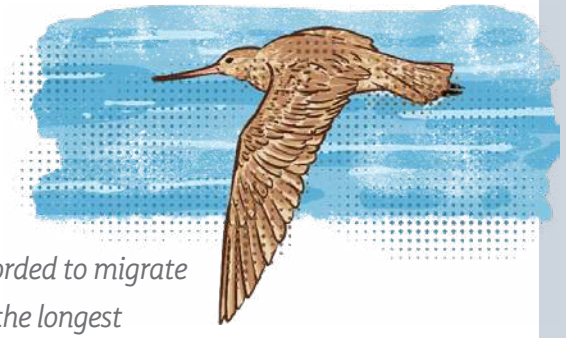


## THREATS

Major threats to shorebirds in India include habitat degradation, changes in land use, blocking of river mouths, aquaculture, and non-conventional salt production and illegal killing (see Illegal Hunting and Trade, p86).

Habitat loss and degradation is one of the major problems in key sites for shorebirds. Crucial shorebird habitats like Pulicat Lake, Gulf of Khambhat and Gulf of Kachchh, Thane Creek and adjoining mudflats in Mumbai, and Pallikaranai Marsh in Chennai are under threat of encroachment[13]. A number of wetlands especially mudflats of avian importance on India's East coast have been converted to shrimp farms and mangrove plantations.

In many wintering sites, illegal killing of shorebirds alongside other waterbirds is reported[14]. Pollution is another major issue for wetland habitats (see Environmental Pollutants, p76), with high organic residues due to sewage and other pollutants reported in wetlands such as Odiyur–Mudhaliyarkuppam lagoon, Pulicat.



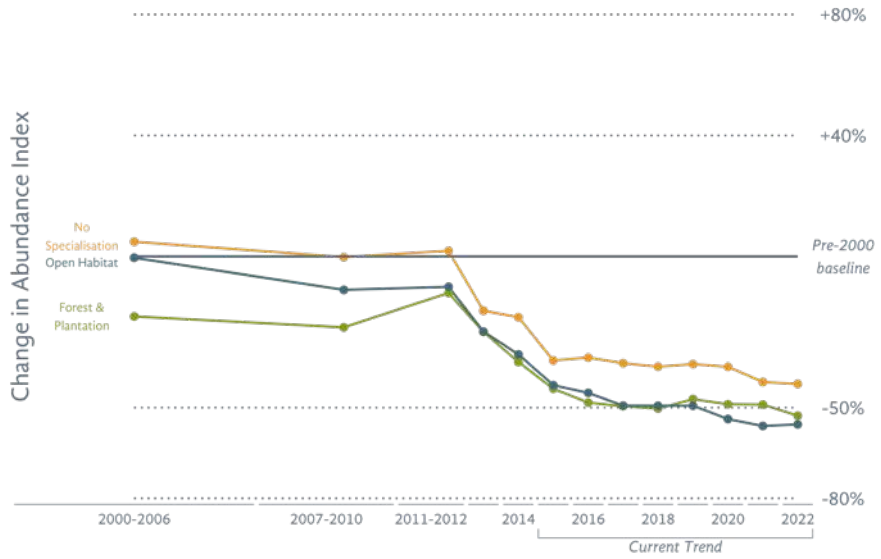
*Bar-tailed Godwit has been recorded to migrate non-stop for over 13,000 km—the longest known continuous journey by a vertebrate. The Indian coastline is an important wintering zone for this Arctic breeder, but abundance trends are inconclusive.*

## CONSERVATION RESEARCH & POLICY

Research on tagged individuals is needed to understand key migratory pathways of shorebirds, including their stopover sites and the main intertidal mudflats that harbour wintering populations. A detailed mapping of these areas is required, keeping in mind that foraging and roosting sites may not be the same. Habitat alteration of coastal ecosystems needs careful regulation and monitoring, with key sites needing protection through the full set of conservation instruments available. Care must be taken that management for other purposes (e.g., dredging or planting mangroves) does not harm coastal habitats; for this, interdepartmental communication and cooperation is required. Illegal killing of shorebirds needs to be controlled.

# Raptors

Raptors, or birds of prey, inspire awe in all of us. Some, such as falcons, are fearsome hunters and find a place in art and culture. Others live closely among us, like Black Kite, which has adapted to feed on discarded waste, or Peregrine Falcon, which preys on pigeons that flourish around humans. Generalist raptors, such as Shikra and Brahminy Kite, continue to do well today, but specialist species that depend on open habitats or on forests need urgent attention.

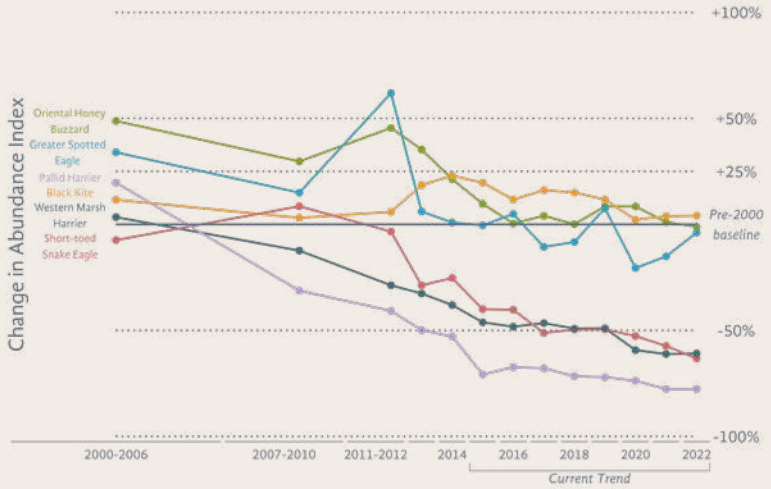



*Raptors that specialise on either forests or open habitats are more threatened than those that are generalists.*

## POPULATION STATUS

*Raptors are declining globally, as well as in India. Pallid Harrier and Western Marsh Harrier have suffered considerable declines in their Eurasian breeding range. They winter in India, where we see similar declines (e.g., over 70% in Pallid Harrier). Declines in resident open habitat raptors like Short-toed Snake Eagle, Black-winged Kite, and Red-necked Falcon hint at the conservation challenges ahead (see Open Ecosystems, p32).*

But not all news is discouraging. Booted Eagle and the Vulnerable Greater Spotted Eagle, both habitat generalists, do not show any evidence of decline, indicating that the populations visiting India may be in relatively good health. What aspects set them apart from their declining relatives is not understood.

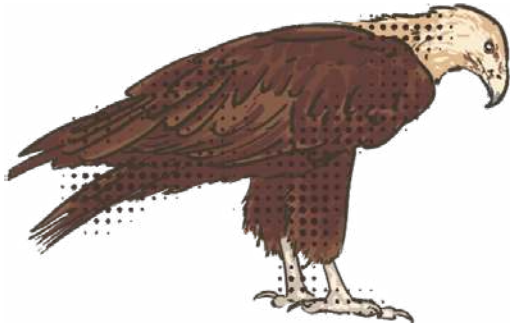



*While adaptable raptors like Oriental Honey Buzzard and Black Kite are doing well, some groups such as harriers are in decline.*

## THREATS

Most raptors are at the top of the food chain, and their populations depend on the quality and quantity of their food. Declines of harriers in their breeding range in Europe, for example, are attributed to lowered survival due to pesticide accumulation in their prey (among other reasons). In India, many raptors of open habitats feed in agricultural landscapes, where pesticides and other chemicals are used with unknown consequences.

Some large raptors require large tracts of high-quality habitat to serve their dietary needs. But habitats in India, especially open natural ecosystems (ONEs), are now severely fragmented by conversion to land uses that are unsuitable for large raptors such as Tawny Eagle.



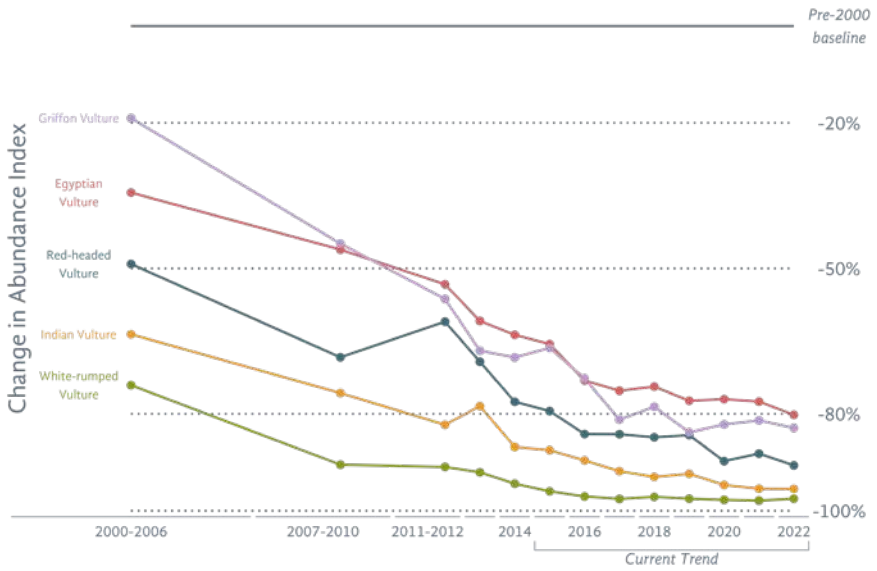
*Pallas's Fish Eagle is one of the few raptors in India that breed here during winter and migrate north to Mongolia and the Tibetan Plateau for the summer. Sadly, the species shows evidence of rapid decline.*

## CONSERVATION RESEARCH & POLICY

Around the world, raptors are thought to be declining through the loss of habitat, pesticide accumulation, as well as targeted killing in some countries. In India, specific causes of decline are poorly understood for all raptors except vultures (see Vultures, p40). To develop policies to conserve raptors as a group, there is an immediate need for research to diagnose specific threats and measure their impact. When it comes to environmental pollutants, levels of toxic chemicals in the environment and in prey must be investigated, as well as how these accumulate in the tissues of the raptors themselves and the clinical and population consequences (see Environmental Pollutants, p76). Tackling this will require innovative and interdisciplinary programmes involving a number of stakeholders. Paradoxically, high protection status of most raptors under Indian law can make such work difficult or impossible[15], and this problem must be addressed for research to be recognised and prioritised (see Research, p96).

# Vultures

Although vultures are raptors, their situation warrants a separate section devoted to them. Decades ago, vultures were among the most numerous birds in the Indian skies. Then, without warning, the populations of several species crashed to nearly zero in the late 1990s and early 2000s—among the most rapid declines of any vertebrate ever recorded. After years of careful research, the cause was uncovered: the veterinary anti-inflammatory drug diclofenac, which is fatal to vultures that feed on carcasses of livestock that have been administered this drug. Several years later still, in 2008, the veterinary usage of diclofenac was banned in India, giving some hope for remnant vulture populations.

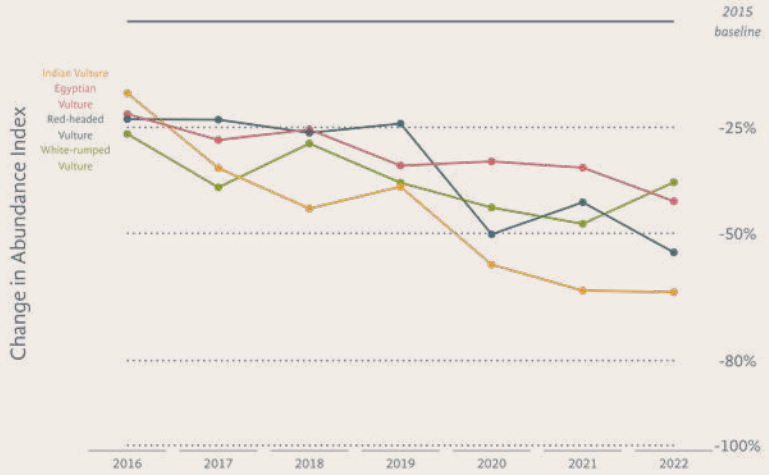



*Vultures have catastrophically declined in India since the 1990s.*

## POPULATION STATUS

*White-rumped Vulture, Indian Vulture, and Red-headed Vulture have suffered the greatest long-term declines (98%, 95%, and 91% respectively). Egyptian Vulture and the migratory Griffon Vulture have also declined considerably, but not as catastrophically. Today, remnant vulture populations occur in and around Protected Areas, where their diet consists more of dead wildlife than (possibly contaminated) livestock.*

The diclofenac ban may have slowed vulture declines in some places[16], but the analyses in this report show that, countrywide, vultures continue to decline: Indian Vulture by over 8% every year, and Red-headed and White-rumped Vultures by over 5% and 4% respectively. Such continuing declines suggest ongoing threats for vultures, which is of particular concern given that vulture declines have negatively affected human well-being[17].




*Vultures continue to decline rapidly even today.*

## THREATS

Diclofenac and other veterinary drugs remain a major threat to vultures even today. The ban reduced, but did not eliminate, the usage of diclofenac. A small percentage of livestock carcasses (1–5% depending on the State[18]) still contained traces of this deadly drug many years after the ban. There is now evidence that vultures are at risk from other non-steroidal anti-inflammatory drugs (NSAIDs) including aceclofenac, ketoprofen, and nimesulide, that were introduced as alternatives to diclofenac. Accordingly, aceclofenac and ketoprofen were recently banned for animal use. However, several NSAIDs, including diclofenac and aceclofenac, continue to be produced for human use and are therefore easy to obtain for use in livestock as well.

Additional threats to vultures include the dwindling availability of food, with carcasses increasingly being buried, and competition at carcass dumps from feral dogs. Another driver of decline is deliberate poisoning of carcasses, intended to kill dogs and other carnivores, but with vultures as collateral damage. For the cliff-nesting Indian Vulture, nesting habitats can be destroyed by quarrying and mining.

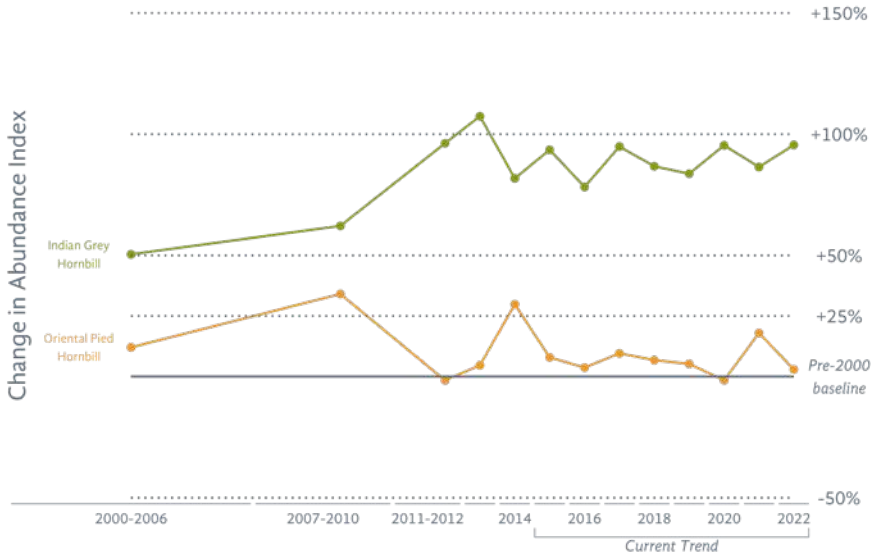
*Slender-billed Vulture is a lesser known and severely threatened inhabitant of the Himalayan Terai and the Brahmaputra floodplains. Deliberate carcass poisoning is a particular threat for this species.*

## CONSERVATION RESEARCH & POLICY

If vulture declines are to be halted and reversed, we urgently require measures that stop the veterinary use of toxic NSAIDs. A combination of bans, education, and alternatives may be needed for this. Free-ranging dogs cause problems for vultures (and other wildlife), and this threat needs to be acknowledged and managed. Vultures are slow breeders, and therefore these in situ conservation measures will need to be supplemented by continued efforts towards ex situ interventions in breeding centres, creating a stock that can be gradually released to supplement wild populations under the right conditions.

# Hornbills

Hornbills are a charismatic group of large birds that eat fruits and disperse seeds, thereby playing a vital role in maintaining the integrity of forest ecosystems. India is home to nine species of hornbills, most of which live in the evergreen forests of northeastern India and the Western Ghats. Hornbills are particularly sensitive to disturbance due to their large size and peculiar nesting behaviour, and have suffered rapid declines in many parts of their range. But their elusive nature means that hornbills are difficult to find, and countrywide trends are known only for widespread species.




*Unlike most Indian hornbills that are globally threatened, the species that are not entirely dependent on forests show encouraging trends.*

## POPULATION STATUS

*The threatened hornbills of India are some of the least represented in the available large-scale data. However, in the Valparai plateau of the Western Ghats alone, Malabar Grey Hornbill has declined by 56% between 2004 and 2018[19], resulting in an uplisting of its Red List category to Vulnerable.*

### Great Hornbill

Great Hornbill occurs in two separate populations, one in the Western Ghats and the other along the Himalayan foothills. It has been locally extirpated in many sites in northeastern India and hence is highly protection dependent. However, recent trends show that it is stable.

VU I LOW

### Rufous-necked Hornbill

Once distributed across northeastern India, this naturally uncommon species is now restricted to a few Protected Areas like Mahananda, Neora Valley, Buxa, Eaglenest, and Namdapha. Its global trend is estimated by IUCN at a 30–49% decline since before 2000.

VU I HIGH

### Wreathed Hornbill

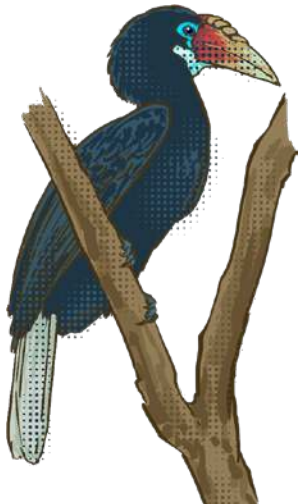
Wreathed Hornbill is faring relatively well, and occurs at a few sites along the Himalayan foothills like Buxa, Nameri, Pakke, Kaziranga, Kamlang, and Namdapha. However, its range is restricted and it is estimated by IUCN to be declining at 30–49%.

VU I HIGH

## THREATS

Hunting poses a substantial threat to Great Hornbill, Rufous-necked Hornbill, and Wreathed Hornbill in parts of the eastern Himalaya (see Illegal Hunting and Trade, p86). These species are targeted for meat as well as their casque and feathers, which are used as adornments by indigenous communities. Hornbill fat is used for its perceived medicinal value and for polishing guns. Hornbills are also captured for the pet trade in southern India, and in other South and Southeast Asian countries. This trade is both local and international.

Forests are being lost to illegal logging and land conversion for settlements, agriculture, and cash crop monoculture plantations (see Monocultures, p74). In northeast India, only 5% of the landscape offers suitable habitat. Past proposals to construct a radar station on Narcondam Island were eventually dropped in the interest of conserving the endemic Narcondam Hornbill and the island habitat—a welcome reversal of a potentially serious threat.



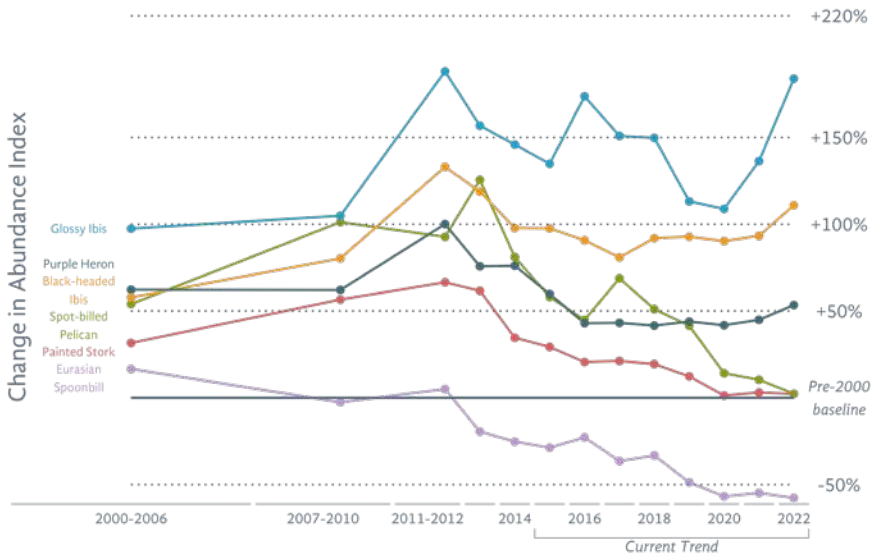
*Narcondam Hornbill is endemic to the tiny Narcondam Island in the Andaman Islands. Recent studies indicate that its population is stable for now.*

## CONSERVATION RESEARCH & POLICY

A national level assessment and action plan is required for hornbills. Applied research is needed to understand the drivers of decline for Malabar Grey Hornbill, to identify important breeding populations, to obtain population estimates at a country-wide scale, and to determine movement patterns in key sites. While Protected Areas are important for these species, hornbills are mobile birds, needing larger landscapes for long-term survival. This necessitates a collaborative and inclusive approach and policies that safeguard wildlife-friendly land management. Engagement with indigenous communities is required to address the threat of hunting. One approach to follow is awareness and sensitisation, through which former hunters have become guardians of hornbill nests in some areas in Arunachal Pradesh.

# Large Waterbirds

Large and conspicuous waterbirds like storks, cormorants and pelicans are a delight for birdwatchers and the general public alike, so much so that a 'bird sanctuary' in India is often synonymous with a nesting colony of large waterbirds. This is part of what lends places like Ranganathittu Bird Sanctuary and Keoladeo National Park their fame and their charm. But these birds are not restricted to sanctuaries; rather, they are conspicuous all around us, in both rural and urban landscapes. This makes them excellent flagship species for wetland productivity.

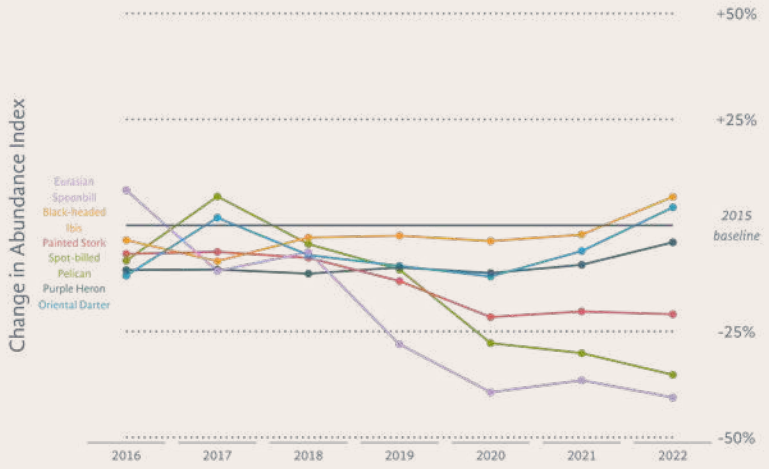



*Large resident waterbirds like cormorants, ibises and pelicans show encouraging long-term trends but Eurasian Spoonbill is declining.*

## POPULATION STATUS

*In welcome news, large waterbirds have done well as a group in the long term.*

Glossy Ibis and Black-headed Ibis (globally Near Threatened) have increased dramatically in abundance over the past three decades in India, by over 130% and 80% respectively. For Glossy Ibis, this mirrors its global expansion. Painted Stork and Spot-billed Pelican show a trajectory of increase and then more recent decrease of 2-4% per year to reach historical levels. But one waterbird stands out from the rest—Eurasian Spoonbill—having declined by more than 50% in the long term and by over 6% annually since 2015. Woolly-necked Stork, and Lesser Adjutant are declining currently by over 1.5% annually. Fortunately, such ongoing declines seem to be specific to pelicans, storks and cranes, and are not widespread among other large waterbirds such as ibises, cormorants and herons.




*Eurasian Spoonbill, Spot-billed Pelican, and Painted Stork are currently undergoing a steep and worrying decline.*

## THREATS

Spot-billed Pelican, a species suffering a rapid ongoing decline, is affected by nematode and trematode parasites that infest its alimentary canal, potentially causing infected birds to starve to death[20]. Such infestation may have been the main cause of death for hundreds of pelicans found dead between 2015 and 2023 in Karnataka and Andhra Pradesh (both States being strongholds for the species). Other large waterbirds like Painted Stork and cormorants so far have not been reported to be affected by these parasites, though cormorant deaths have been attributed to other pathogen-driven diseases such as botulism (see Avian Diseases, p84).

Other threats for large waterbirds include habitat loss, dwindling fish populations, changing agricultural practices, and, once again, free-ranging dogs. In urban areas, habitat loss is often driven by poor planning and a lack of public or scientific consultation when wetlands are developed by civic bodies. Dogs are now known to be regular predators of large waterbirds like cormorants. Additionally, wetlands today are home to a number of invasive and non-native plants, fish, snails, and other organisms that may eventually impact waterbird populations in unknown ways.

*Greater Adjutant, or* hargila *in Assamese, is a scavenger that was once widely disliked but has benefited greatly from a change in perception and community-based conservation.*

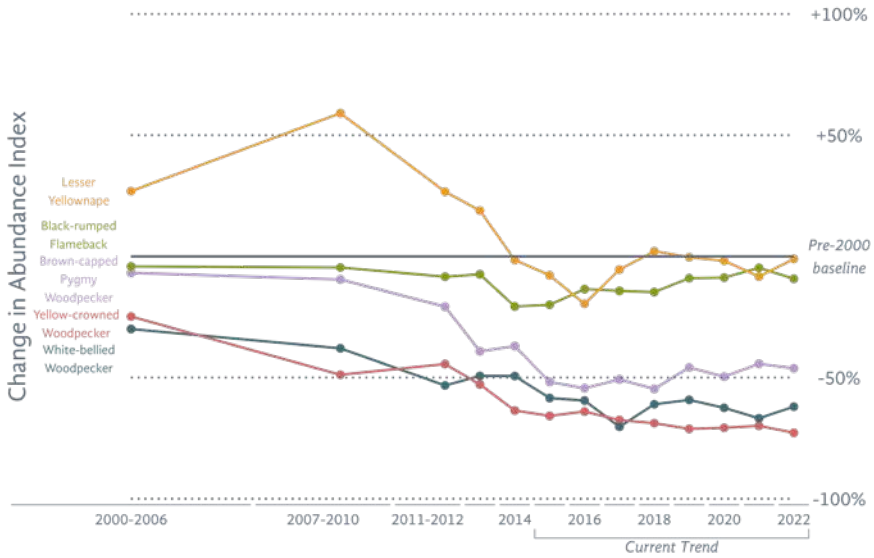
## CONSERVATION RESEARCH & POLICY

Wetlands that large waterbirds use are complex ecosystems that serve a number of human purposes. These include the provisioning of water for irrigation and drinking, transportation, fishing, livestock grazing, and generally providing a public space for recreation and nature appreciation. Wetlands around the country are often developed by civic bodies to achieve one or more of these objectives but the process often lacks transparency. As a result, 'developed' wetlands sometimes cease to serve their intended purposes in supporting biodiversity. Wetland development should ideally include transparent public and scientific consultation, as well as a plan for long-term monitoring and management of biodiversity, ecological functioning (including pollutants), and bird health (including parasite loads).

# Woodpeckers

Woodpeckers (Family Picidae) are obligate cavity-builders and bark-gleaning insectivores of the forest. Since woodpeckers excavate fresh cavities every year, they provide nesting niches for a diversity of other cavity-nesters including hornbills and owls. Woodpeckers are also useful indicators for prioritising conservation sites and for ecological monitoring[21].

The Himalayan region and northeastern India house the majority of our country's woodpecker species. Many of these species are not represented by sufficient data to analyse in this report. However, based on current knowledge, several are likely at risk of decline, such as Rufous-bellied Woodpecker[22].




*Several species of woodpecker have declined since 2000, although some like Lesser Yellownape and Black-rumped Flameback—a widespread generalist species—appear to be stable.*

## POPULATION STATUS

*Of the 11 species of woodpeckers for which clear long-term trends could be obtained, seven appear stable, two are declining, and a further two are in rapid decline.*

### White-bellied Woodpecker

Restricted to tall rainforest and moist deciduous forest, this woodpecker has declined to less than 50% of its historic baseline during the last three decades.

LC II MOD

### Yellow-crowned Woodpecker

This widespread thorn and scrub forest specialist has declined by more than 70% in the last three decades.

LC I HIGH

### Brown-capped Pygmy Woodpecker

Although widespread in deciduous forest across the country, its abundance has decreased by nearly 50% in the long term.

LC II MOD

## THREATS

The principal threats to woodpeckers are forest degradation, fragmentation, and conversion to monocultures[23,21] (see Monocultures, p74 and Forest Degradation, p78). Degradation is an outcome of selective logging and over-exploitation of forest products. Over time, such activities result in loss of large, old forest trees, which reduces the space available for woodpeckers to construct cavities and to find insects. Loss of large-canopied trees also reduces niches for smaller woodpeckers, such as Brown-capped Pygmy Woodpecker, which largely forage along leafy branch tips of tall trees. Field studies confirm that the local diversity of woodpecker species increases significantly with increased canopy cover, basal area, and density of snags, signifying the importance of protected forest stands[23,21].

Forest fragmentation due to roads, dams, and industry further increase the risk faced by woodpeckers. For instance, a viable population of the large-sized White-bellied Woodpecker may need a contiguous forest area of 1000–1500 sq. km[24], and widespread forest fragmentation is a clear threat in this situation.

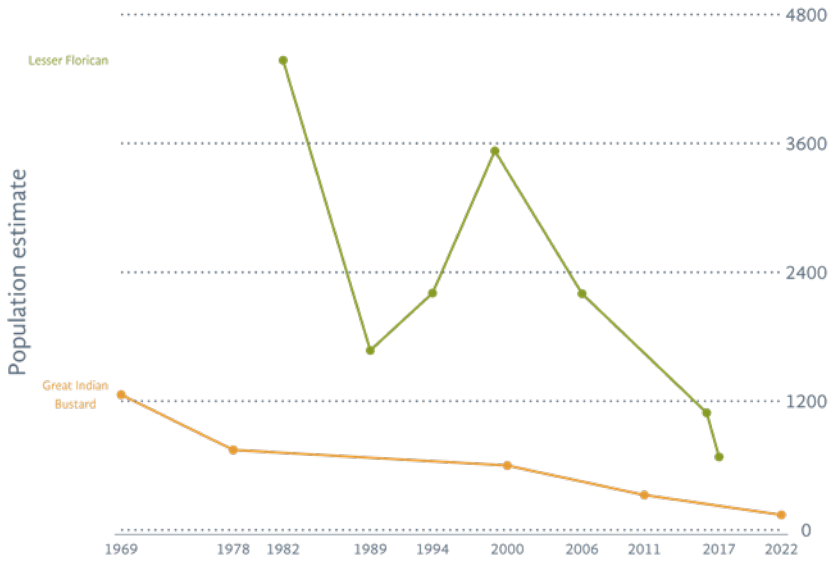
*Great Slaty Woodpecker is a cooperatively breeding species. It is extremely vulnerable to forest degradation due to its large home range and its dependence on large old trees for nesting and foraging[25].*

## CONSERVATION RESEARCH & POLICY

Long-term monitoring of both woodpecker numbers and their nesting is needed, particularly in remaining old-growth forests such as in the eastern and western Himalaya and the Andaman & Nicobar Islands. Species at risk but for which insufficient data are available, such as Great Slaty Woodpecker and Greater Yellownape, require field studies to understand their ecology and conservation requirements. For all woodpeckers, habitat is key: large stretches of old-growth forest need to be preserved, as also forest fragments within mosaics of production landscapes. The decline of Yellow-crowned Woodpecker is puzzling, and needs study.

# Bustards

Bustards are a group of iconic grassland birds, four of which are found in India. While all four species are specialised to open natural ecosystems (ONEs), their distributions are segregated along a gradient of aridity. Macqueen's Bustard (a non-breeding migrant from Central Asia) visits the hyperarid–arid desert scrub of western India during October–March. India holds breeding populations of the other three species. Great Indian Bustard occupies arid–semiarid agro-grasslands of western India and the Deccan. Lesser Florican inhabits semi-arid agro-grasslands, moving between its breeding grounds in northwest India and non-breeding grounds in the Deccan. Finally, Bengal Florican is found in sub-humid tall grasslands of riverine floodplains in north India and the Brahmaputra plains.




*Lesser Florican has been declining more precipitously than Great Indian Bustard, but has not received the same conservation attention[26,27].*

## POPULATION STATUS

*Bustards are disproportionately endangered due to their slow life-history traits and specialised ecological needs. While half of all bustards worldwide are threatened[1], the three species that breed in India face imminent extinction.*

### Great Indian Bustard

Great Indian Bustard has only 100–150 individuals, with most surviving in Desert National Park of Rajasthan, where captive breeding has been started.

CR I HIGH

### Lesser Florican

Once distributed across India, Lesser Florican breeds in fragments of grasslands, and its population is less than 900 individuals.

CR I HIGH

### Bengal Florican

Bengal Florican is restricted to the Himalayan Terai and grasslands of northeastern India, with a South Asian population of not more than 400 individuals.

CR I HIGH

## THREATS

Historically, the three bustard species that breed in India have been subject to considerable hunting pressure and consequent population reduction. Today, the main threats are habitat loss and inadvertent mortality when flying into power lines. Habitats for all species are under threat, firstly because grasslands are often considered wasteland and not of conservation value. Less than 1% of grassland is protected, and where legal protection does exist, it is often not effective. Bustard landscapes have undergone severe loss and alteration since the 1980s due to agricultural expansion and mechanisation, expansion of infrastructure such as irrigation, power lines, renewable energy, and roads, and also earlier habitat mismanagement in which considerable grassland areas were converted to monoculture shrub/tree plantations that are incompatible with species adapted to open habitats[28]. More recently, mortality from collisions with power lines is a major concern, especially for Great Indian Bustard in Rajasthan and Gujarat (see Energy Infrastructure, p82). An estimated 15% of the single viable population in the Thar of Rajasthan dies due to power line collisions each year, and this single threat can lead to extinction[27].

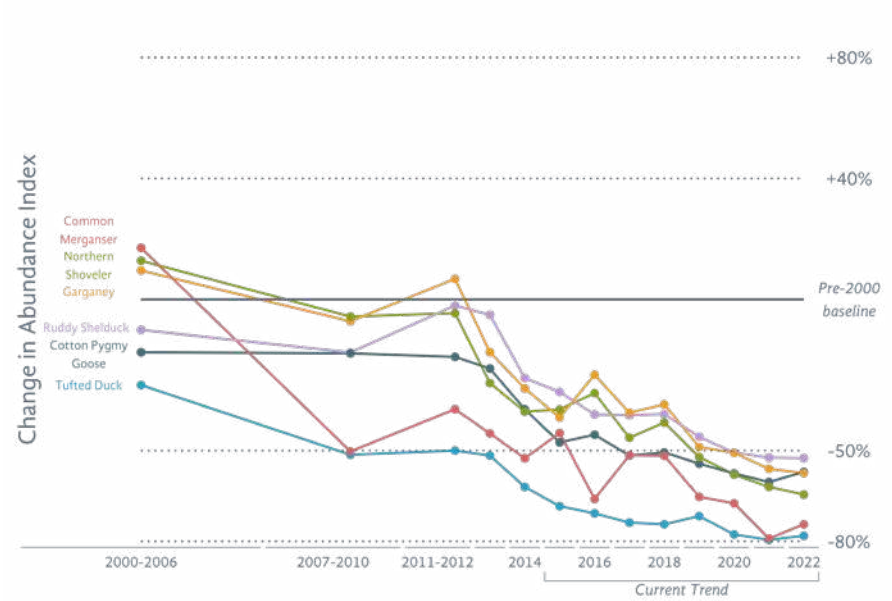
*The male Lesser Florican leaps vertically up in the air on fluttering wings, making rapid knocking calls during its breeding display, advertising its presence to prospective mates.*

## CONSERVATION RESEARCH & POLICY

The natural histories of all three breeding species of bustards of India have been studied in depth[29–31]. More recently, telemetry together with ground validation has greatly advanced our ecological and conservation understanding. Ongoing telemetry research is revealing vital insights into breeding, behaviour, space use, seasonal movements, mortality agents, and flight patterns—all of which inform conservation. Monitoring protocols are in place for Great Indian Bustard and Lesser Florican. More research is needed on what affects key aspects including survival and reproduction, as well as to evaluate the effectiveness of threat mitigation measures. Initial successes in conservation breeding of Great Indian Bustard and Lesser Florican need to be strengthened. This must be supplemented with greater efforts to secure and restore key habitats and to minimise existing threats.

# Ducks

Ducks are typically flocking waterbirds that need mainly submerged habitats. India hosts eight resident and 35 migratory species. These occupy a range of habitats, including inland lakes and tanks, submerged paddyfields, rivers, forest pools, and coastal lagoons. Large congregations of ducks occur in Chilika, Pulicat, Rann of Kachchh, Maguri, Loktak, Sambhar, and Keoladeo. Their flocking nature makes ducks susceptible to disturbances, habitat loss, and illegal killing (see Illegal Hunting and Trade, p86).




*Both migratory and resident ducks, occupying different types of wetlands, are experiencing long-term and continued declines.*

## POPULATION STATUS

*Ducks are typically flocking species. However, trends of ducks reported here are only based on presence or absence. Declines may therefore be even higher than reported.*

### Baer's Pochard

Formerly occurring all across eastern India, the global population has severely depleted to less than 1,700 birds[32]. Very few individuals migrate to India now from northeast Asia, and they are restricted to wetlands of Assam and Manipur.

CR I HIGH

### Common Pochard

Once widespread in peninsular India, the population continues to decline by at least 2.5% annually. In Chilika, winter counts plummeted from 90,000 in 2001–02 to 2,000 by 2014–15[33]. The latest count is only 4,500[34].

VU I HIGH

### Andaman Teal

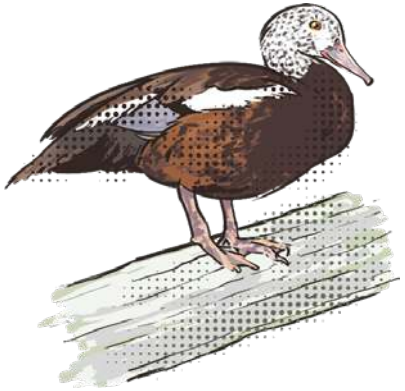
This species is endemic to the Andaman Islands, showing considerable local movement. The population is estimated to be less than 1,000 birds but is currently stable or possibly even slightly increasing[35]. It might have benefitted from wetlands created during the 2004 tsunami[36].

VU I HIGH

## THREATS

There are no systematic studies on the causes of decline of wide-ranging ducks in the country. For winter migrants, key threats could be in their breeding and/or staging grounds. However, several resident species are also in decline, and there is reason to believe that multiple threats could be in operation:

- Ducks have traditionally been hunted for consumption. They are shot or are trapped using various traditional techniques[37].
- Reclamation of wetlands for agriculture, housing, and other land uses.
- Intentional as well as unintentional poisoning has reportedly caused mass deaths in ducks.
- H5N1 Highly Pathogenic Avian Influenza outbreaks, botulism, and other diseases pose a risk (see Avian Diseases, p84). Wild birds are often assumed to be the cause of outbreaks, although they may actually often be caused by pathogens circulating within poultry farms.



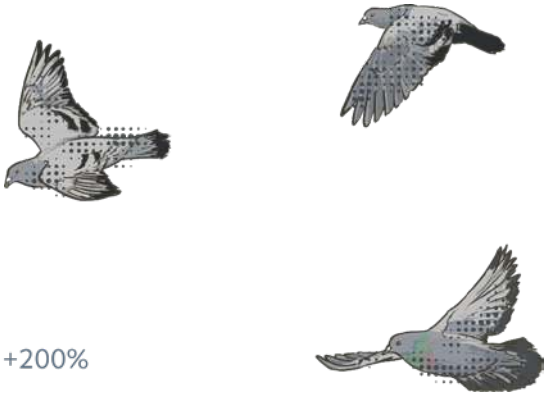
*The Endangered White-winged Wood Duck, the state bird of Assam, is restricted to undisturbed forest pools in northeast India and some countries of Southeast Asia.*

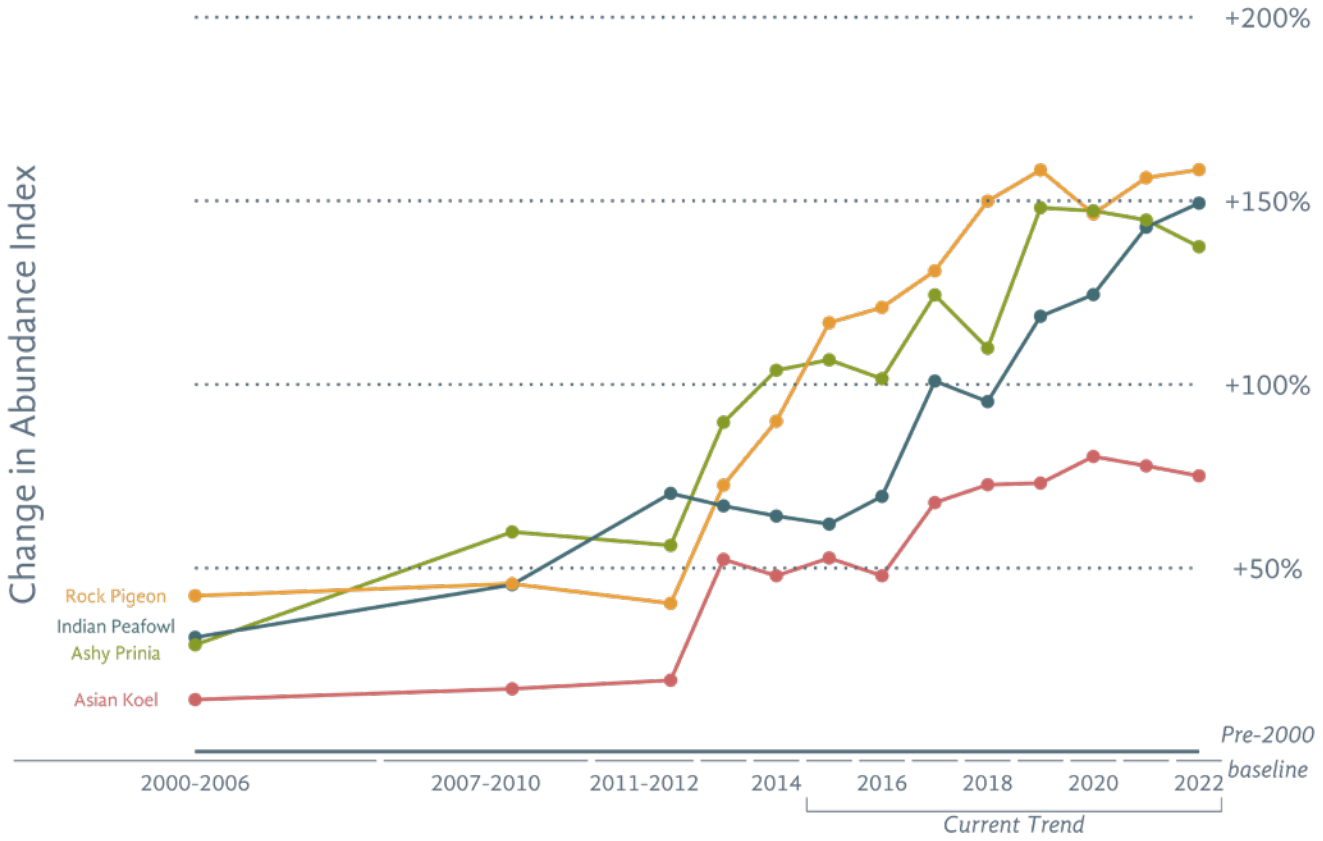
## CONSERVATION RESEARCH & POLICY

Despite being prohibited under the Wildlife Protection Act, illegal killing of ducks (and other species) does occur. Whether the magnitude is large enough to explain population declines needs detailed research and monitoring. In the meantime, attention must be focused on reducing illegal killing. Development and ecotourism activities in large wetlands can be regulated, for example by implementing no-go zones for tourists, to protect feeding and resting areas of ducks. Factors impacting the decline of different duck species may be different and hence focussed research may be needed to identify hitherto undiscovered threats. More research is also needed to understand the causes of outbreaks of avian diseases and the consequences for waterbirds.

# THRIVING BIRDS

*Amidst a worldwide decline in birds, a few adaptable species live and thrive in human-modified landscapes. Here are four such species that are doing well.*



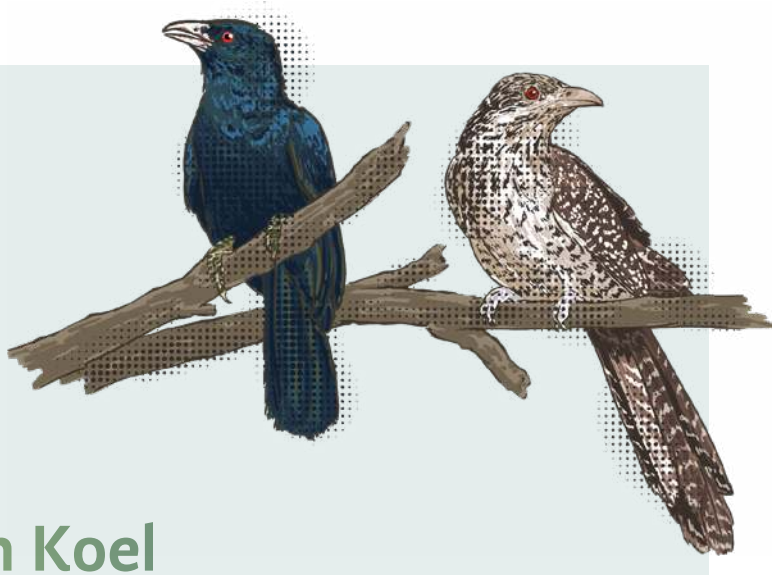



*Ashy Prinia, Rock Pigeon, Asian Koel, and Indian Peafowl have increased dramatically.*

# Ashy Prinia

Ashy Prinia is a small, long-tailed bird that is heard more often than seen. It is widespread across peninsular India and thrives in urban areas—in parks, gardens, and empty plots—and you may sometimes find its nest with brick-red eggs. Perhaps due to its ability to live in scrubby vegetation, this unassuming bird has rapidly increased in abundance since 2000, and continues to do so even today.

But Ashy Prinia is not widespread everywhere in the country. In northeastern India, it is restricted to narrow pockets in low-lying regions with grasslands, like those around Manas National Park. Further eastwards in Assam, it occurs along the Brahmaputra river where it becomes increasingly rare and localised.



# Asian Koel

With its loud and distinct song, together with its brood parasitic behaviour, Asian Koel is prominent in folklore, poetry, and art in India. It is among the few birds whose song most Indians are likely to immediately recognise. It mostly parasitises crows, laying eggs that are thought to partly mimic crow eggs. While crows accept koel chicks as their own, they are fiercely aggressive towards adult koels in the breeding season, chasing and sometimes even killing them.

Asian Koels occupy a variety of habitats, wherever crows or mynas are found. They appear to prefer House Crow nests in most of the country and accordingly are at high densities in cities, towns and villages. Compared with the pre-2000 baseline, Asian Koel has shown a rapid increase in abundance of c. 75%, with an annual current increase of 2.7% per year. Possible reasons for such an increase remain unclear, and may not be related to host availability. House Crow abundance hints at an increasing trend since 2000, albeit with low statistical support. Rather, Asian Koel increases may be related to food availability, as suggested by the finding that fruit-eating birds, as a whole, are doing well.


*Expanding range of Indian Peafowl in Kerala. Darker shades indicate higher reporting frequency.*

## Indian Peafowl

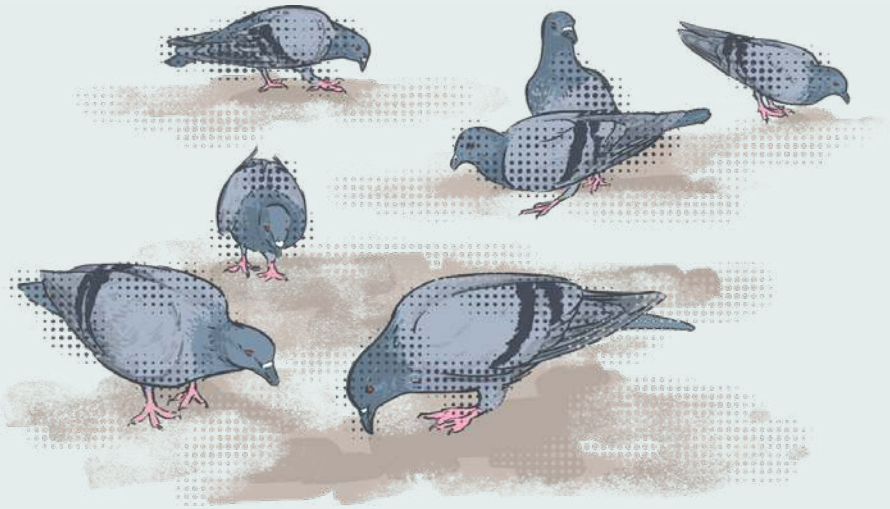
Our stunning national bird is one of the most rapidly increasing species in the country today, expanding into habitats where it has never occurred previously. In the last 20+ years, Indian Peafowl has expanded into the high Himalaya and the rainforests of the Western Ghats. It now occurs in every district in Kerala, a State where it was once extremely rare. Apart from expanding its range, it also appears to be increasing in population density in areas where it occurred earlier. Reasons for these changes are not fully understood. They are likely to include protection through religio-cultural beliefs and the law, a reduction in wild predators (although free-ranging dogs are increasing), and a possible drying of 'wet' ecosystems due to habitat degradation and climate change.

The good news of the increase in peafowl must be tempered by a recognition of increased reports of crop damage (and consequent retaliatory poisoning) in different parts of the country, and the speculation that rising peafowl populations may have negative impacts on snakes and other reptiles. While conservation tends to focus on rare and declining species, it is important to investigate the impacts of this peafowl boom on both people and ecosystems.

## Rock Pigeon

Rock Pigeon is the ultimate commensal with humans. All over the world, it has successfully adapted to live in human habitation, to nest on human structures, and to feed on whatever humans provide. It is so abundant in urban India today that it is often viewed as a major inconvenience and even as a potential health risk. Many articles in popular media discuss the potential consequences of the deliberate as well as inadvertent subsidies that pigeons enjoy in urban India.

Since wild populations have historically interbred with domestic pigeons, a large majority of Rock Pigeons we encounter are in fact 'feral'. In India, 'wild' Rock Pigeons are poorly understood, but appear to persist only in remote gorges and cliffs, like those along rivers and in the Himalaya. If we were to restrict our analysis to such 'wild' populations, it might well turn out to be considerably threatened.



VU II HIGH

**Black-capped Kingfisher**

This Vulnerable migrant to our wetlands is declining globally and also shows a rapid decline in Long-term and Current Annual Trends.

VU I HIGH

**Sarus Crane**

This iconic towering bird, which is widely believed to pair for life, has rapidly declined over the long term and continues to do so.

NT II LOW

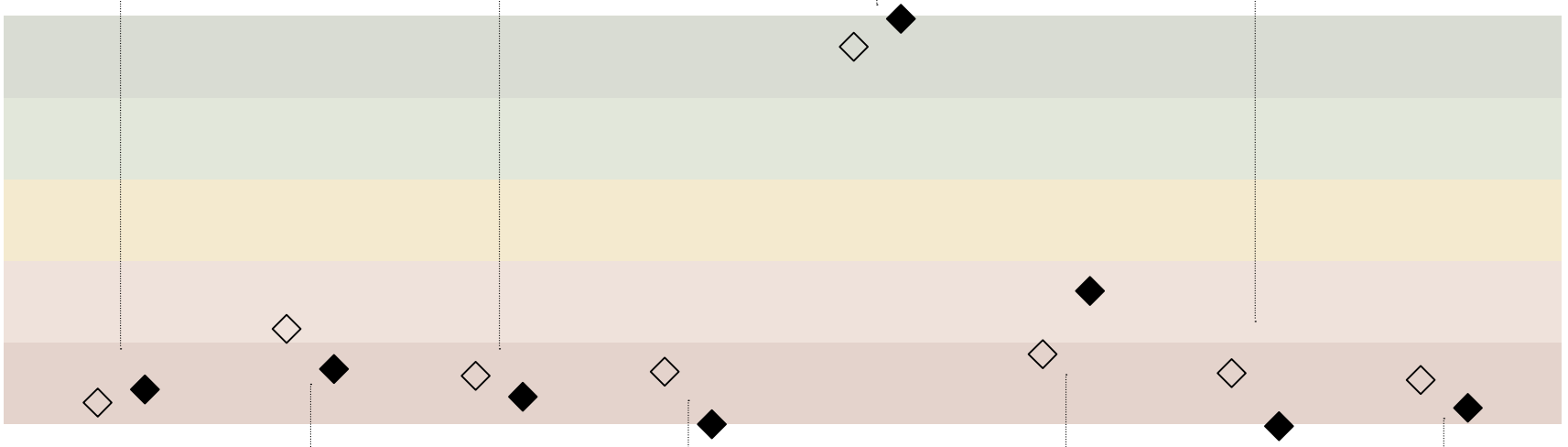
**Alexandrine Parakeet**

Although declining globally due to the pet trade, this parakeet has established new populations in several Indian cities, expanding its range.

LC I HIGH

**Forest Wagtail**

Rapid declines highlighted in SoIB 2020 continue even today for this woodland migrant; the causes of decline are not understood.




LC II MOD

**Pied Kingfisher**

This widespread kingfisher that prefers clear waterbodies appears to be declining both in the long term as well as in recent years.

LC II HIGH

**Kentish Plover**

This wader, which has both migratory and resident populations, has declined rapidly over the long term and more recently too. An independent assessment is needed for the breeding population.

LC I HIGH

**Common Crane**

The large flocks that migrate to northwest India from Central Asia have declined rapidly in the long term and continue to decline even now.

LC II HIGH

**Sirkeer Malkoha**

This dry scrub forest species has declined rapidly in the long term as well as in recent years; its habitat has received little conservation attention.

# OTHER SPECIES *of* INTEREST

LC II MOD

**Baillon's Crake**

This reedbed-loving migrant has been rapidly declining after 2015, although its long-term trends are inconclusive.

LC II LOW

**White-rumped Shama**

Although shamas are extensively traded as pets in other countries, their population in India has been stable over decades and continues to be so.

LC II LOW

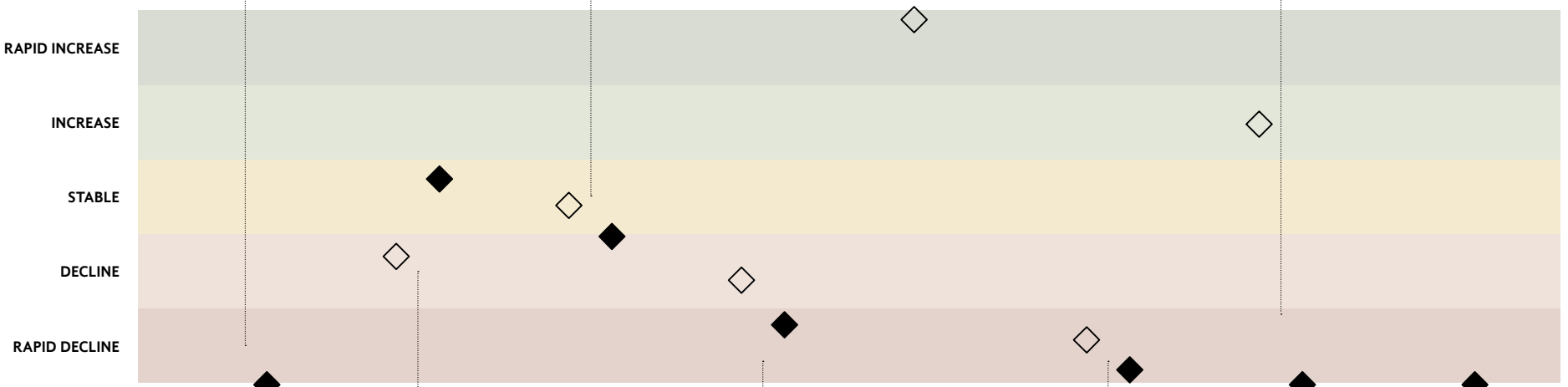
**Spot-breasted Fantail**

In contrast with other birds that occupy similar habitats, this species has shown a rapid increase over the long term.

LC II MOD

**Rosy Starling**

This remarkable migrant winters exclusively in the Indian subcontinent; its abundance has increased in the long term but has declined rapidly in recent years.




LC I LOW

**Small Minivet**

SoIB 2020 found rapid declines and classified this species as High Priority, but its current trend has been re-evaluated as stable and it is hence classified as a Low Priority species.

LC II MOD

**Grey Wagtail**

Celebrated by many as marking the beginning of the winter migration season, this species has unfortunately shown rapid decline in recent years.

LC II HIGH

**Blue Rock Thrush**

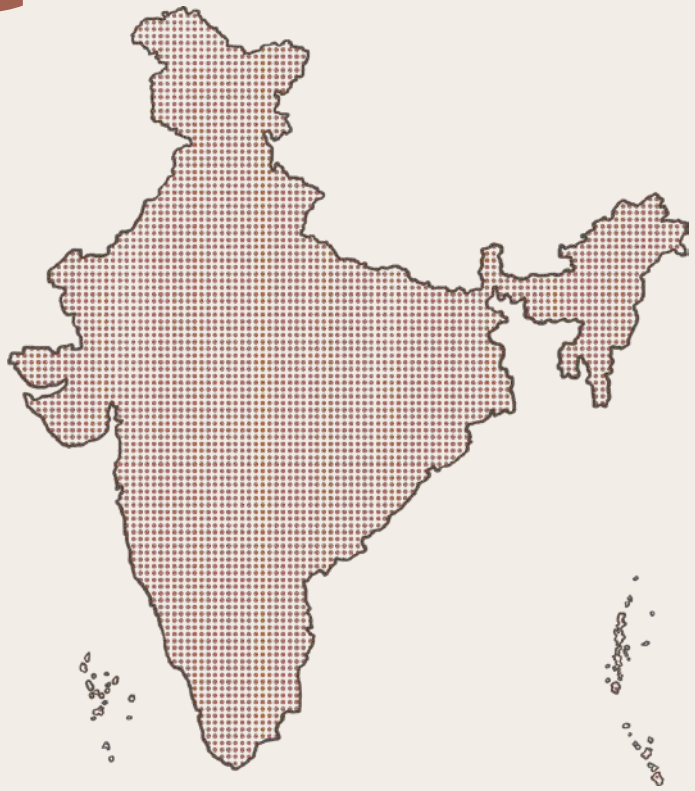
An open landscape species that has received little conservation attention, it mysteriously shows rapid declines over the long term as well as in recent years.

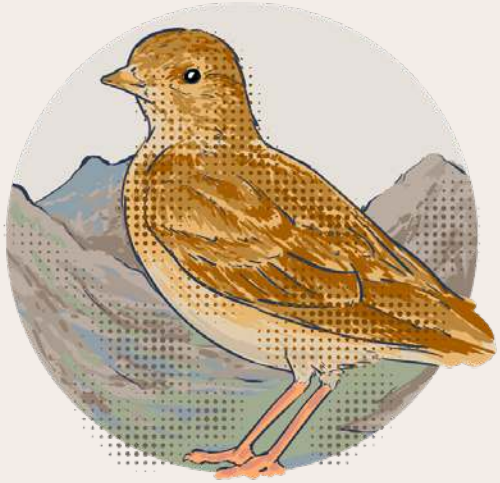
LC II HIGH

**Spot-winged Starling**

Breeding in Uttarakhand and wintering in northeast India, this east–west migrant has strangely declined rapidly in recent years.

# SYSTEMATIC MONITORING





So far, this report has presented trends in bird populations using data contributed by citizen scientists and enthusiasts at the scale of the entire country. However, questions regarding small-scale changes in bird populations and their causes require a deeper investigation of local systems. It is therefore important to carry out targeted, systematic, periodic monitoring of bird populations, using consistent methods, over long periods of time. Moreover, monitoring changes in other factors such as disturbance, climate, and land-use is also crucial to building a deeper understanding.

In this chapter, we highlight six such systematic monitoring efforts in the country—differing in geographical location, ecosystem, and species focus—to bring attention to the importance of such dedicated programmes. This chapter illustrates several methods for systematic bird monitoring. As you will see, the answers to why bird populations are changing—whether increasing or declining—are often not easy to arrive at, and problems, challenges, and solutions are often unique and context-specific.

# ARUNACHAL'S HORNBILLS

*Monitoring hornbills in Arunachal Pradesh*

## HISTORY OF THE EFFORT

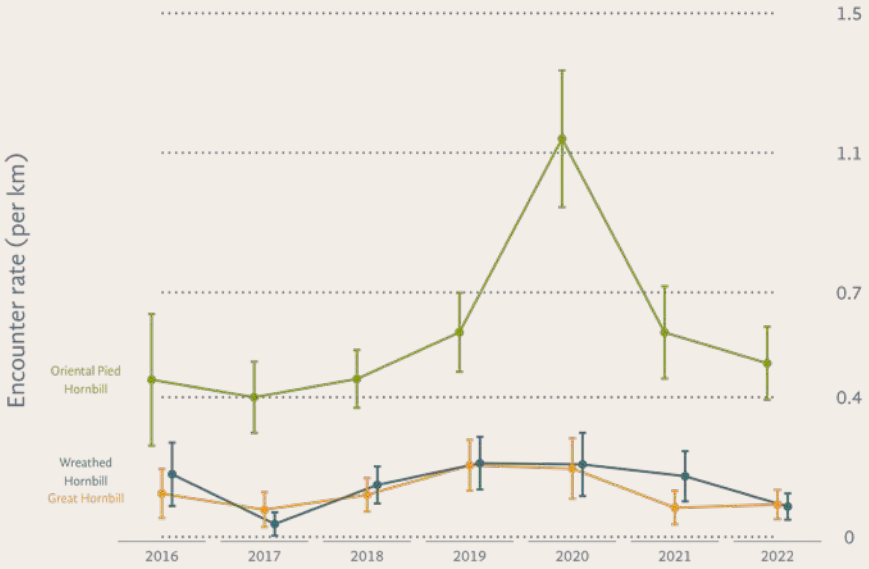
The Hornbill Nest Adoption Program (HNAP) was initiated in January 2012 with a goal to protect and monitor hornbill nests and habitat in the reserved forests that are contiguous with Pakke Tiger Reserve in western Arunachal Pradesh. Nests of three hornbill species—Great Hornbill, Wreathed Hornbill, and Oriental Pied Hornbill—are located and monitored by the team of nest protectors to determine nest occupancy, nesting success, and length of nesting cycles over the years. Alongside this, transects were established to estimate hornbill encounter rates and densities in the non-breeding season (August–February). These transect surveys were initiated in 2016 and continue till date.

## STUDY SITE AND ITS SIGNIFICANCE

This work was carried out in Papum Reserved Forest, an area of 1,064 sq. km of semi-evergreen forest. The Pakke river and Tiger Reserve are to the west of the Reserved Forest; to the north are the community forests of Pakke Kessang. Assam and Papum Pare district lie to the south and east respectively of Papum Reserved Forest. The area was constituted as a Reserved Forest in 1960, when all extractive activities were prohibited unless legally permitted. There are 19 villages in the Reserved Forest, with a population of around 4,000. Sheth et al.[38] found that 4.6% of forest cover loss occurred from 2013 to 2017, at the rate of 8.2 sq. km per year. From 2011 to 2019, a total of 16.61 sq. km of forest cover was lost within a 1 km radius of hornbill nest trees. Illegal logging and conversion to rubber plantations are the main causes for the loss of forest cover.

## DISTURBANCE AND HORNBILL DETECTIONS

The fluctuations seen in hornbill encounter rates correspond to changes in logging pressures in Papum Reserved Forest. In 2017, illegal logging activities and disturbance was high, which may have resulted in lower detections. A decline is also seen in 2022, when logging activities restarted. Limited human activity in 2020, due to the COVID-19 pandemic and lockdown, may have resulted in more hornbill detections. The two larger species are more affected by disturbances than Oriental Pied Hornbill which is more common in secondary forests. While comparable data are not available for the same period from within Pakke Tiger Reserve, past studies have estimated encounter rates comparable with current estimates from Papum Reserved Forest. The results suggest that despite habitat degradation, hornbill encounter rates have remained roughly stable in the Reserved Forest.




*Encounter rates (detections per km with 95% CI) of three species of hornbills from 2016 to 2022 in Papum Reserved Forest outside Pakke Tiger Reserve in western Arunachal Pradesh.*

# IMPORTANT TRENDS

The total effort over a seven-year period from August 2016 to January 2023 was 1,056.64 km walked along transects.

Overall, encounter rates appear to have remained stable for Great Hornbill and Wreathed Hornbill, although some years have shown a dip in numbers, with a small increase in 2019 and 2020.

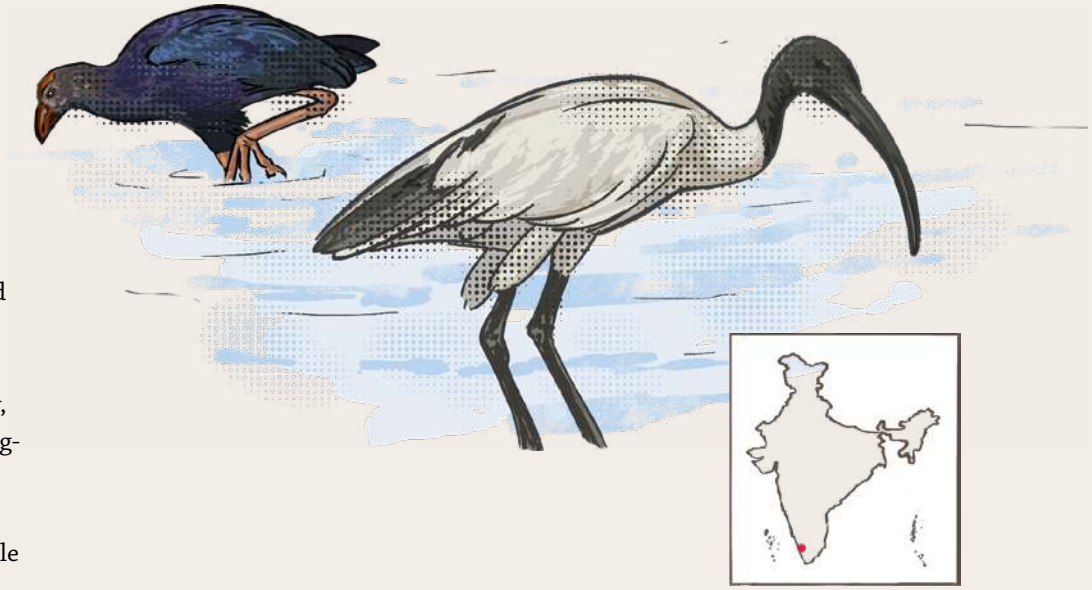
Oriental Pied Hornbill encounters have been more than double of the two large hornbill species, while encounter rates were five times higher in 2020 than in other years.

# VEMBANAD BIRD COUNT

*Monitoring waterbirds through the Asian Waterbird Census*

## THE ASIAN WATERBIRD CENSUS

The Asian Waterbird Census (AWC) is the longest-running citizen science programme that systematically monitors waterbird numbers and wetland conditions across India. AWC began in the Indian subcontinent in 1987 and now covers a large proportion of the East Asian–Australasian Flyway and the Central Asian Flyway. Birdwatchers in Kerala have been active in AWC since its inception. Under the AWC umbrella, the Kottayam Nature Society has initiated and consistently conducted systematic bird counts at the Vembanad wetlands since 2001, with volunteer birdwatchers. Within Vembanad, ten counting units (also called sub-sites), were selected based on factors such as accessibility, representation of natural and human-modified habitats, and suitability for long-term monitoring. Counts have been conducted annually at each sub-site from 2001 to 2023. In addition to being a monitoring exercise, this effort has also generated interest among various stakeholders in the conservation of the fragile ecosystem of Vembanad.

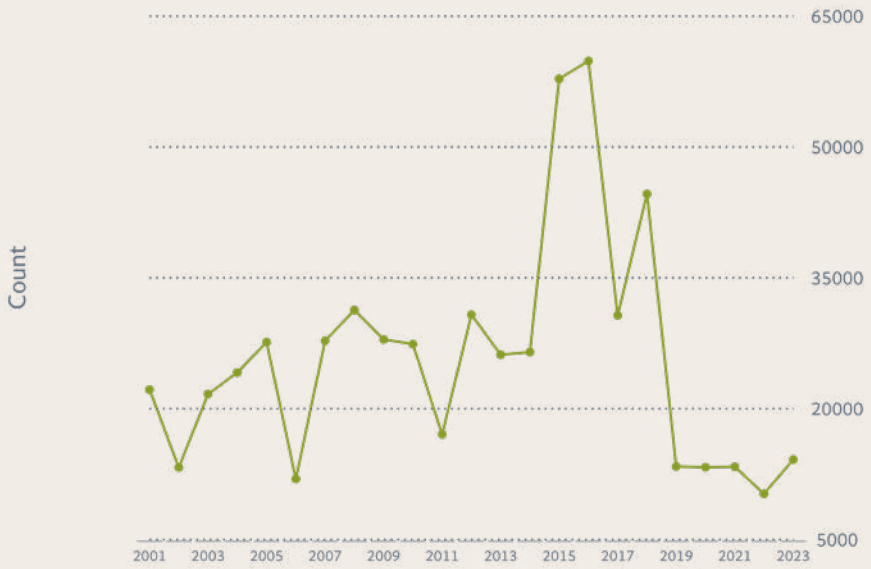


## THE VEMBANAD ESTUARY

The Vembanad estuary, along with the adjacent Kuttanad paddy fields, forms an integral part of the largest wetland ecosystem on the west coast of India, spanning 1,520 sq. km. The total area of the Kuttanad region is around 1,100 sq. km, comprising dry land, wetlands, and other water bodies such as lakes, rivers, and channels[39]. This area is under water almost throughout the year, by flooding during the monsoon and through saline water ingression during the summer. Being the largest estuary on the southwest coast of India, this wetland was declared as the Vembanad–Kole Ramsar Site in 2002 and is also an Important Bird and Biodiversity Area (IBA). However, reclamation of the wetland in the last few decades has led to shrinking of the area of the wetland suitable for waterbirds.

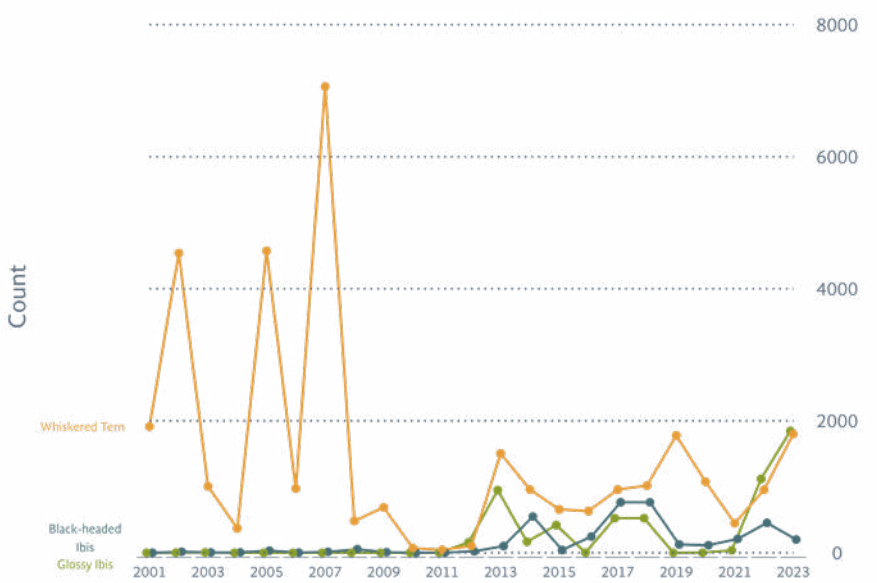
## FINDINGS AND CHALLENGES IN MONITORING

The number of volunteers conducting this annual count has increased over the years, from as few as 30 birders in 2001 to a maximum of 192 in 2020. However, long-term monitoring of large wetlands like Vembanad is challenging. The landscape is dominated by agriculture, and bird assemblages and abundances fluctuate with the monsoon and subsequent cropping patterns. Additionally, the proximity to other large wetlands such as Upper Kuttanad and North Kuttanad, and the apparent exchange of birds between them, renders a single-day monitoring exercise insufficient. These variations are especially noticeable amongst ducks and waders. To overcome this issue, it would be best to conduct synchronous counts across adjacent wetlands. It would also be useful to look at other large wetlands at the landscape level for better comparison across sites.




*Total counts of waterbirds in Vembanad wetlands from 2001 to 2023.*

# IMPORTANT TRENDS

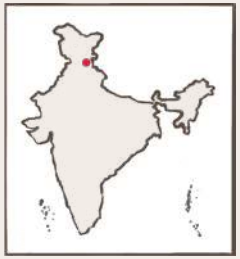



Some patterns of increase in total counts can be confidently inferred from regular annual waterbird counts. This pattern is especially stark where counts of zero have increased to several hundreds (e.g., ibises), in line with the general trend of increasing numbers of large waterbirds in other wetlands in Kerala.

Similar to national level trends, Whiskered Tern numbers have seen a decline in Vembanad.

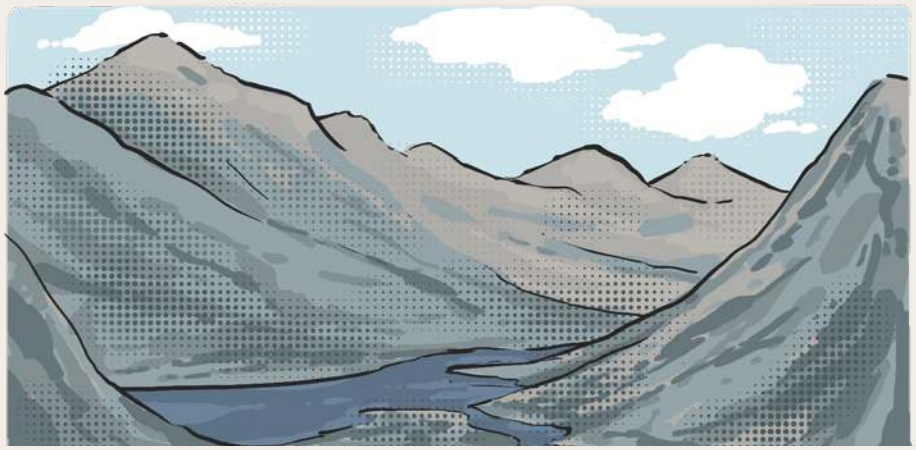
# BIRDS *of* SPITI VALLEY

*Bird monitoring in high-elevation rangelands*



## THE SPITI VALLEY LANDSCAPE

Spiti Valley comprises large areas of rangeland in the rain shadow of the Himalaya, extending north onto the Tibetan Plateau. These Trans-Himalayan mountains had people grazing livestock and cultivating crops for thousands of years. The rangelands of Spiti are mainly used for grazing of livestock species including sheep, goat, cow, donkey, horse, yak, and cow-yak hybrids. Small parcels of land are cultivated mainly with barley and green peas. These rangelands are also home to a wide variety of wild mammals and birds. Some of the charismatic avifauna of the region include Golden Eagle and Bearded Vulture. Long-term monitoring of birds was started in Spiti Valley of Himachal Pradesh to study the effect of changing livestock grazing and agricultural practices[40].

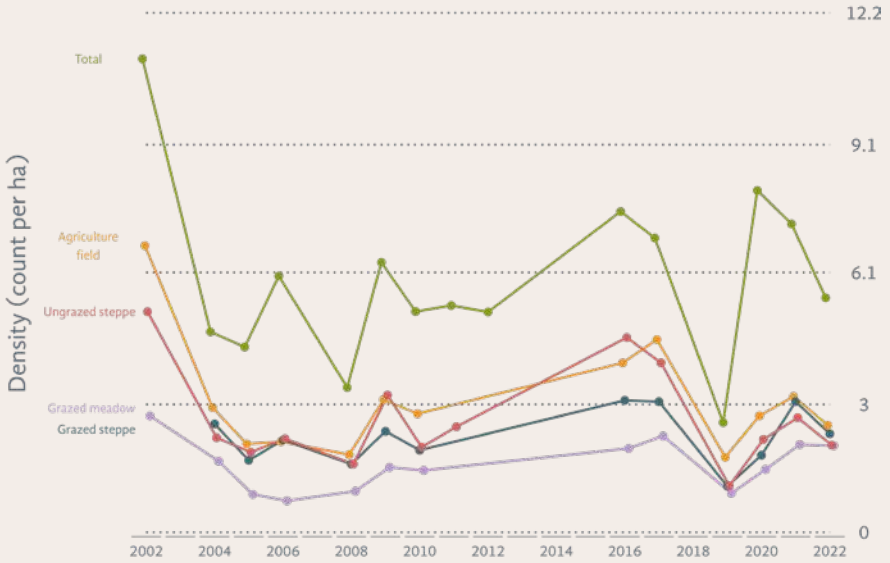


## STUDY SITE AND ITS SIGNIFICANCE

The long-term bird monitoring programme of Spiti began in Kibber village in 2002 and has continued through the pandemic into 2023, with a break between 2012 and 2015, and occasional gap years when it was logistically challenging. Since 2004, all the observers have been trained locals from the village of Kibber. Birds were recorded along straight-line transects distributed across the four main habitat types in the region: agricultural fields, grazed meadows, grazed steppe (added in 2004), and protected ungrazed steppe. Spiti is at the southwestern limit for many birds occurring on the Tibetan Plateau such as Black-winged Snowfinch and Brandt's Mountain Finch. It also is home to species that breed in the high Himalaya or beyond and winter across the plains of mainland India (e.g., Black Redstart).

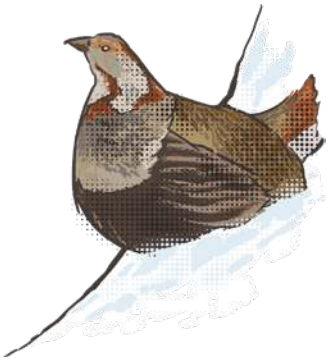
## VARIABILITY IN BIRD DENSITIES OVER THE LONG TERM

As expected for an arid region, there is large variation in bird densities from year to year; in general, years with low bird density have lower densities across all habitat types. Barley cultivation has been declining in the region and the disappearance of Hume's Short-toed Lark is likely to be linked to this change. This bird was mainly found in agricultural fields in 2004–2009. Ungrazed steppe consistently had higher densities of birds than grazed steppe, suggesting that livestock grazing might reduce bird densities. Agricultural fields had the highest densities of birds as a whole, but the bird community in this habitat is dominated by generalist species such as feral Rock Pigeon and House Sparrow. Specialist species such as Himalayan Snowcock mainly occur in ungrazed steppe habitat.




*Bird densities in different habitats in Spiti.*

# IMPORTANT TRENDS



There are no clear increasing or decreasing trends in bird densities, and large year-to-year variation is evident.

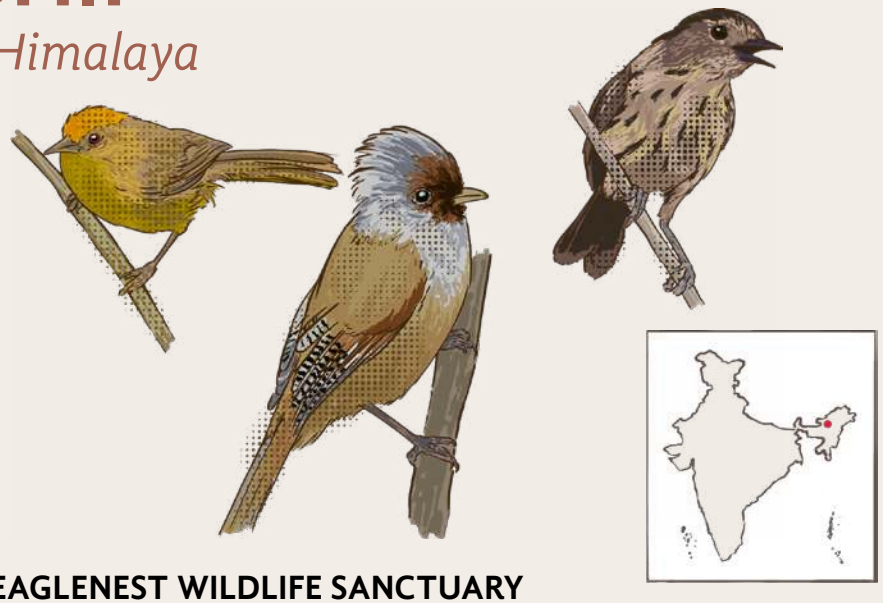
Agricultural fields and ungrazed steppe habitats had the highest densities of birds.

Dominant nesting species such as Black Redstart had stable densities across years.

Hume's Short-toed Lark is the only species that shows a clear decline, having occurred in significant numbers in the early years but vanished since 2009.

# TRENDS IN SURVIVORSHIP

*Monitoring survival of birds in the eastern Himalaya*



## LAND-USE CHANGE AND CLIMATE

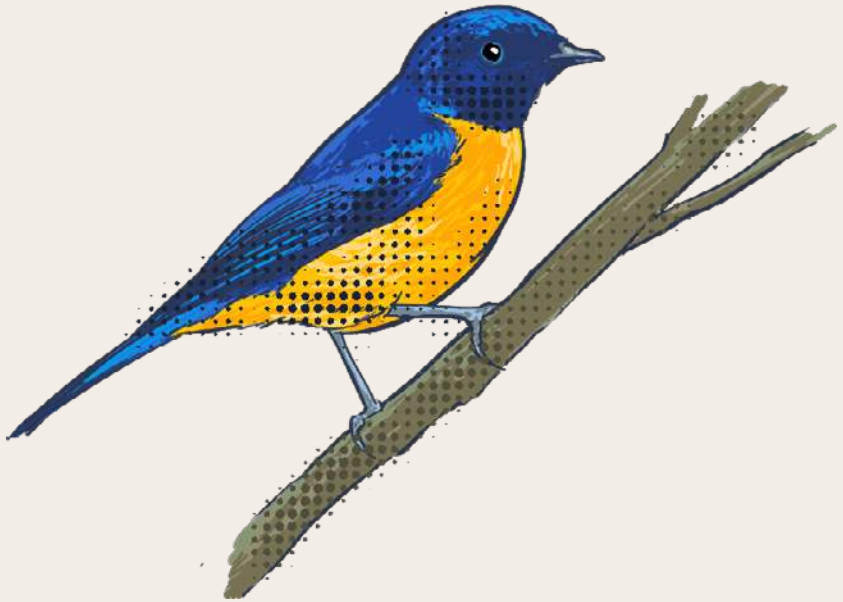
Land-use change and climate change are thought to be the two main causes for global biodiversity decline. Most studies focus on the effects of one or the other, but it is important to look at them together. As species shift their elevational ranges upslope because of climate change, does it matter what quality of habitat they move into? This project was set up in 2011 to compare the demography of species in primary forest (high quality habitat) and selectively logged forest (lower quality habitat), and bird populations have been assessed every year since then in the early breeding season (April–May), except for 2020 because of COVID-19.

## EAGLENEST WILDLIFE SANCTUARY

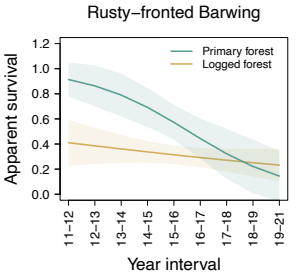
The study site is Bongpu Blangsa, situated at an elevation of 2,000 m asl in Eaglenest Wildlife Sanctuary, West Kameng, Arunachal Pradesh. Eaglenest was declared a Wildlife Sanctuary in 1989, but because of its strategic border location, the Indian Army maintained a fair-weather road through the sanctuary until the early 2000s. Therefore, large road maintenance crews were stationed within the Sanctuary, and they would cut down select trees for fuelwood. This has led to the creation of patches of selectively logged forest embedded within old-growth montane wet temperate forest. In these logged forest patches, the proliferation of bamboo in the understorey prevents tree regeneration, while browsing by elephants on bamboo keeps the height of the bamboo in check. Logged forest is, on average, 3°C hotter at midday than primary forest and 20% less humid consistently. This has caused changes to arthropod abundances and communities with logging, likely changing the prey base for a majority of bird species in the study site. In this study, survival rates of birds were estimated by capturing them using mist nets, attaching a numbered metal ring to each individual's leg, and then examining re-captures of the same bird at subsequent intervals.

## PREDICTING CORRELATIONS

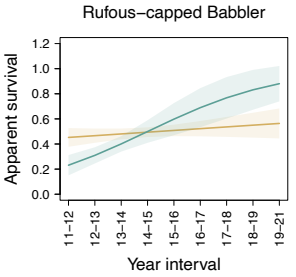
In primary forest, the direction and magnitude of survival trends is well correlated with the historical elevational ranges of species. In logged forest, however, survival trends are not consistent with upslope range shifts. This could be because of logging-induced changes in the habitat, such as differences in temperature and humidity and alterations in the composition and availability of insect resources.



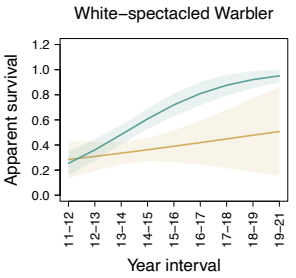
# IMPORTANT TRENDS




At the study site (elevation of 2,000 m asl), higher elevation species like Rusty-fronted Barwing (which are expected to 'leave' this elevation band), are showing declines (sometimes steep) in survival rates in primary forest.



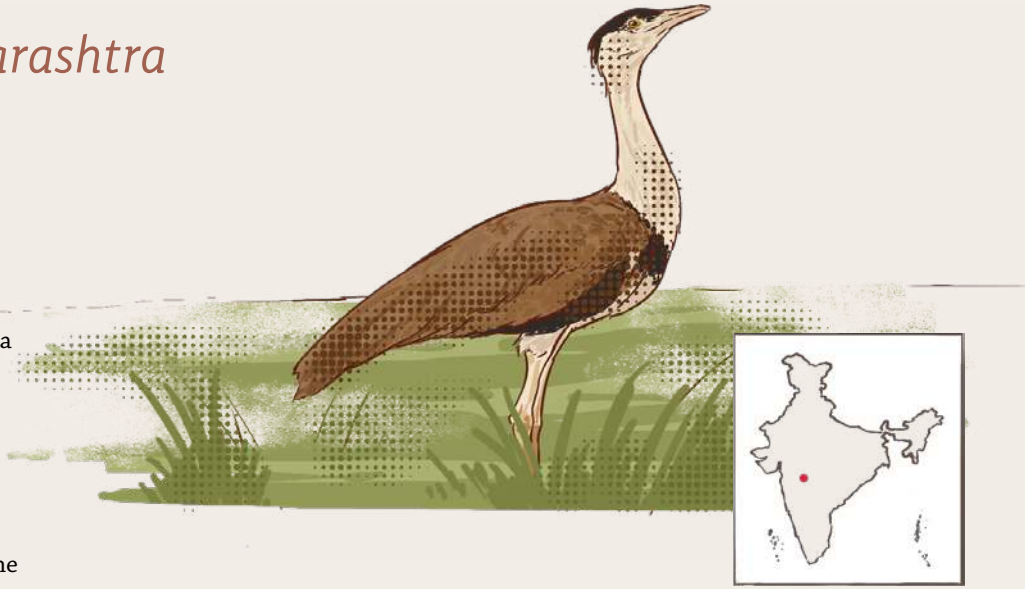

Lower elevation species such as Rufous-capped Babbler (expected to shift to higher elevations from below) are showing increases in survival over time.




White-spectacled Warbler, also a low elevation species, shows an increase in survival at 2,000 m asl—a higher elevation compared with its historical elevational range.

# GRASSLAND BIRDS

*Monitoring birds around Nannaj, Maharashtra*



## GRASSLAND ECOSYSTEMS

Grassland ecosystems are one of the most rapidly changing ecosystems in India that support unique bird communities. The grasslands and scrub forest in the Nannaj landscape in central Maharashtra are a classic example of an open natural ecosystem (ONE), facing various threats from land-use change and developmental pressures. The area supports several species of plants as well as birds and other animals unique to these grasslands, and has an interesting social and ecological history owing to the Great Indian Bustard Sanctuary in the landscape. With the intention to understand bird population trends over the long term in this landscape, this effort to systematically monitor the birds in this area was started in 2013. Since then, this effort has been ongoing for the last nine years (with some breaks during the COVID-19 years).

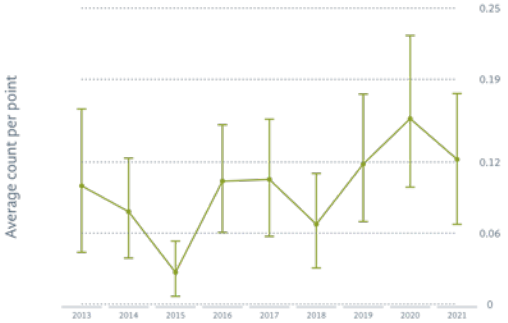
## NANNAJ LANDSCAPE

The semiarid landscape of Nannaj is a mosaic of protected natural grasslands, agriculture, plantations under afforestation schemes of the forest department, grazing lands, and human settlements. The study area includes parts of the Great Indian Bustard Sanctuary in Solapur district, a Protected Area that aims to conserve the local flora and fauna and specifically some of the last standing Great Indian Bustard populations in Maharashtra. The sanctuary encompasses both native grasslands and plantations. The unprotected areas are often used as grazing lands, and privately owned lands for agriculture and grazing pastures. Historically, the Sanctuary encompassed a very large area of the district, which restricted the activity of local people within the Protected Area. In 2011, the Supreme Court denotified a part of the sanctuary to retain a small protected region.

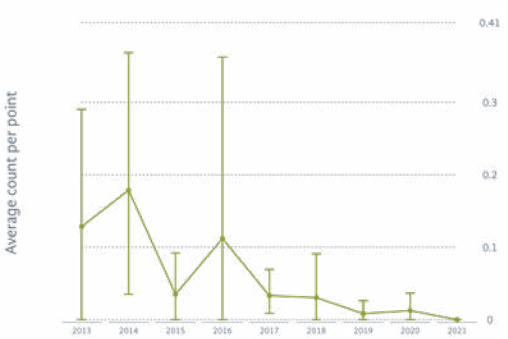
## CONSERVING GRASSLAND BIRDS

Like Yellow-wattled Lapwing, some other species such as Eurasian Collared Dove and Indian Silverbill show an increasing trend in average count in Nannaj. While it is reassuring to see some increasing trends in bird numbers in the landscape for these species, it is not all good news. Some species such as Western Marsh Harrier show a steady decline in the landscape, as is the case in the rest of the country. Great Indian Bustard, which Nannaj is well known and recognised for, has experienced severe declines in the last few years, although the area of protected grassland has not reduced. Bustard sightings in the point counts in our study are too few to demonstrate trends. However, a different method of monitoring, using daily checklists, has demonstrated a steep decline in numbers of these birds in the study area[41]. As the development and land-use change pressures on birds in this area are increasing due to expanding agriculture, upcoming solar farms, grazing, etc., population monitoring of grassland birds can provide crucial information for conservation management in the area.

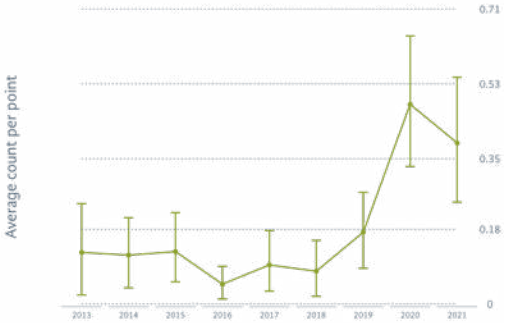
# IMPORTANT TRENDS




Black-winged Kite, a grassland raptor species, shows no consistent trend.




Western Marsh Harrier, on the other hand, has shown consistent declines over the years, with zero sightings of the bird in the study area in 2021.




Some other grassland species such as Yellow-wattled Lapwing show an increase in numbers.

**Arriving** at causes for declines in bird populations is often tricky. Are we building infrastructure, draining lakes, damming rivers, clearing forests, and planting trees in grasslands at such a scale and rate that birds are disappearing? Or are they decreasing due to climate change that is too rapid for birds to adapt? Or, is it a combination of the two, where habitat changes render birds more vulnerable to changing climate? Local factors and trends may further complicate things. Such questions with implications for management and conservation are very complex, but grounded systematic monitoring studies provide a way to answer some of these.

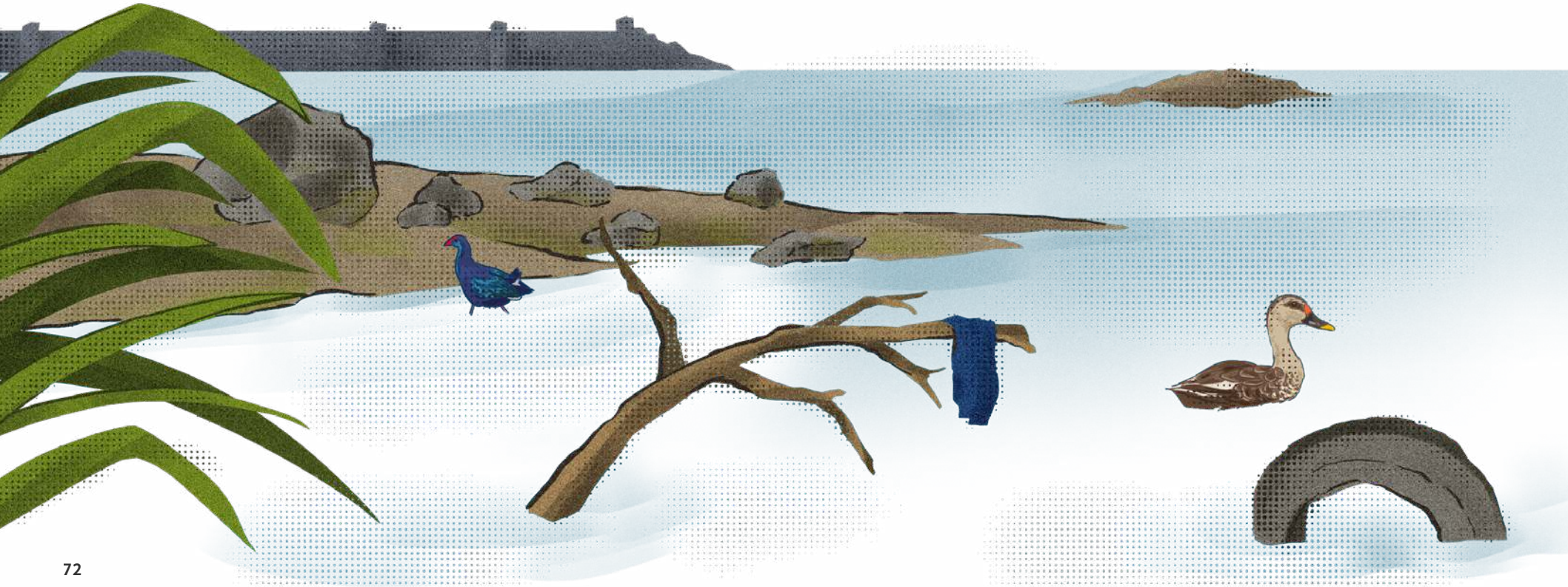
It may seem to us that the overwhelming threat to birds is proximate: threats that are nearby and operate in the short term, like changes in land use, rapid land modification, spread of invasive species, changing agriculture patterns, effects of removing timber trees, or fragmentation of habitat. However, more distant and long-term changes in climate also occur simultaneously, and as some studies reveal, these broader changes are adding to the more imminent threats to bird populations.

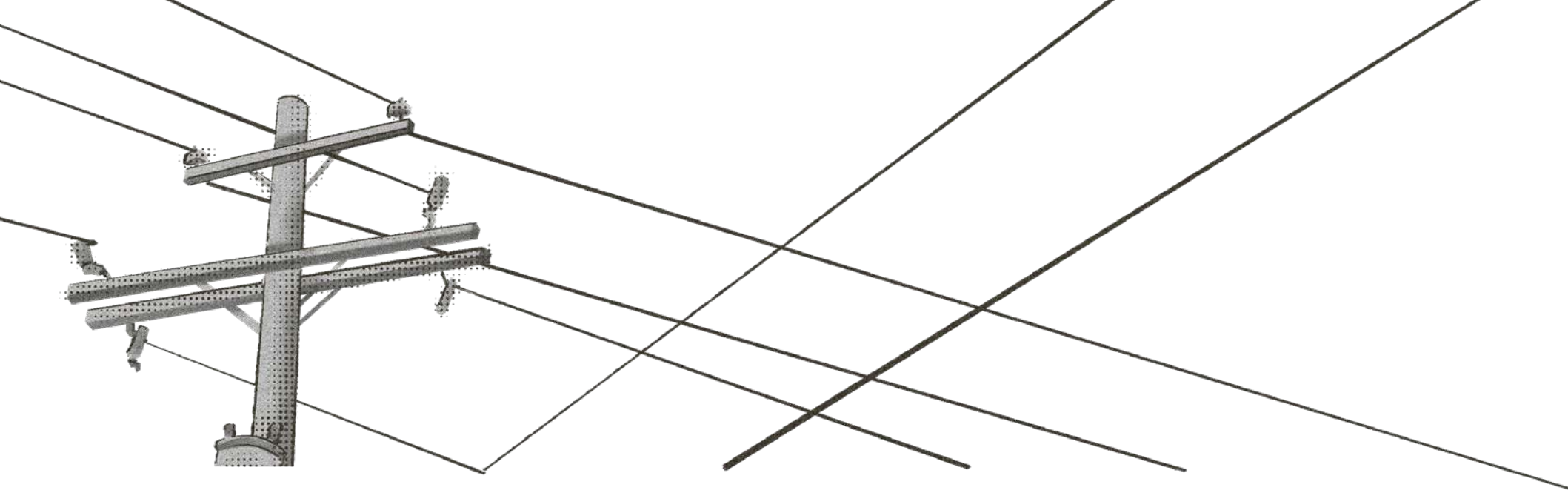
Unlike some countries such as in North America and Europe, India lacks a countrywide systematic monitoring scheme, but as we present in this chapter, several groups across the country are running bird monitoring programmes locally. Some of these have been in place for over 10–15 years and there is an increasing interest in starting new efforts. These efforts use varying methodologies depending on their monitoring goals and species focus. Some use methods such as transects, point counts, and complete counts of birds, while others use more intensive monitoring techniques such as mist netting and ringing that provide vital information about survivorship in bird populations.

There are several more upcoming efforts for long-term monitoring of bird populations in the country that will, over time, provide a wealth of information. Moreover, with the growing network of citizen scientists in India, the developing skills and trained personnel, and the knowledge and understanding gained from individual isolated efforts from across the country, we as a community can soon think about a countrywide systematic bird monitoring programme, which is one of the final missing pieces for bird monitoring in India.

# MAJOR THREATS

## *to birds in India*





This report analyses and showcases the trends in bird species over the long term as well as in recent years. But what are the factors underlying these trends? What are possible causes behind the declines that we see? This chapter discusses some of the major known human-caused threats to birds.

A number of factors are thought to affect birds in India, encompassing land-use change (including urbanisation), ecosystem degradation, infrastructural development, environmental pollutants, and climate change. Many species are harmed by these changes. By contrast, other species thrive in highly altered landscapes like cities and monocultures, and spread as these habitats expand, leading to a homogenisation of bird communities across regions. Further, infrastructure designed to reduce carbon emissions, such as wind and solar farms, and the power lines that connect them to grids, can pose a major threat to birds and other wildlife. Avian disease is also emerging as a significant problem, heightened by changing climate, by escalating international trade in birds, and expansion of poultry farming. In addition to these general threats, there are more targeted threats like illegal hunting and bird trade, which affect common as well as endangered species.

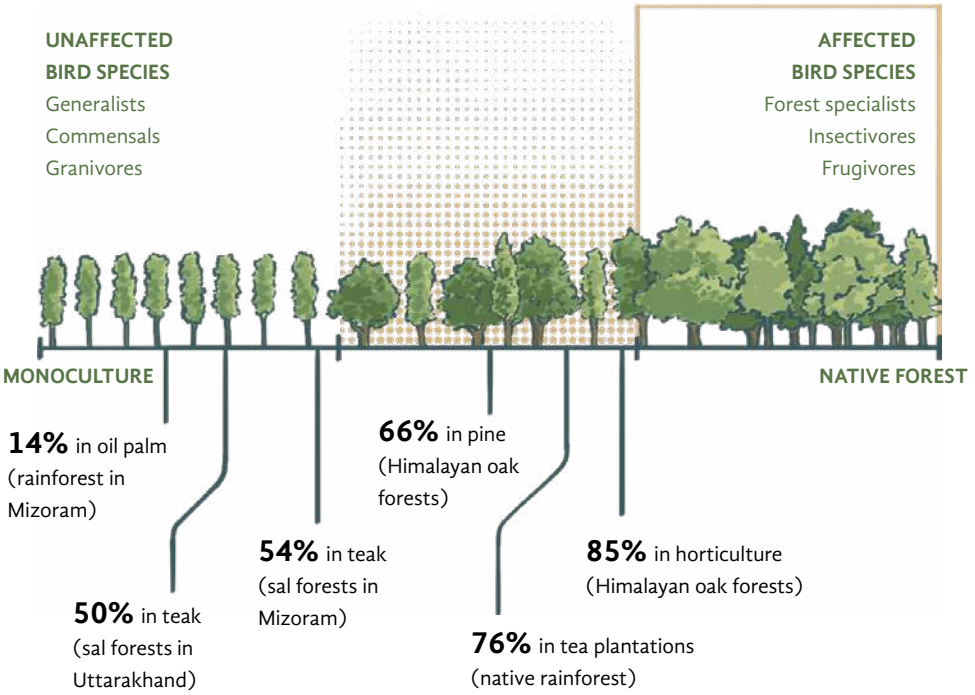
This chapter throws a spotlight on some of these significant threats to birdlife in India, reviewing the extent and severity of each threat, the mechanisms by which it affects birds, and its visible consequences. Please note that the chapter does not cover all known threats in a comprehensive manner. Nor does it go into the complex social and institutional origins of these threats. Rather, we review a subset of historically important threats as well as recently emerging issues for which sufficient information is available.

While reviewing threats to birds, it has become clear that in many cases research evidence is still inadequate to link bird population trends with specific threats. In the reviews in this chapter, we therefore also suggest key areas for urgent research and action.

# MONOCULTURES

*Monoculture plantations (or monocultures) include commercial plantations of coffee, tea, arecanut, cardamom, rubber, teak, or other species, which are created by large-scale clearance or modification of natural habitats like forests and grasslands. Apart from commercial plantations, reforestation programmes across India have ironically also often created low diversity monocultures such as those of the exotic eucalyptus and* Prosopis juliflora *which have been planted across vast swathes of deserts, grasslands, and tropical dry forest.*

*Plantation of tea, teak, coffee, and rubber continues to expand. For instance, tea has grown from 5,214 sq. km to 6,366 sq. km from 2003 to 2020 (Tea Board statistics quoted in Raman et al.[42]). Certain other historic plantations, such as that of wattle (*Acacia melanoxylon*) in the southern Western Ghats, have expanded considerably in the 20th century by invasion rather than planting. The area under oil palm plantations has expanded 30-fold from 1991 to 2015, and most of this expansion is taking place in the tropical rainforest biome[43]. Ongoing expansion of oil palm in biodiversity hotspots such as the Andaman & Nicobar Islands and the northeastern Himalaya threatens numerous endemic bird species and habitat specialists of such open ecosystems.*




The numbers indicate the percentage of bird diversity found in comparable natural forests

## Mechanisms

Bird species diversity and composition are impacted by a simplification of forest structure in monocultures, as well as by the accompanying management practices. Plantations lack vertical and horizontal vegetation complexity because they maintain even-aged stands of a single tree species for ease of harvest. This usually leads to loss of large-sized trees and reduction in canopy shade and shrubbery. In addition to thinning and weeding, the use of herbicides and pesticides intensifies the adverse impacts on birds. Regular harvest operations reduce niches and resources for birds apart from creating physical disturbances.

## *Consequences for birds*

Commercial monocultures are known to harbour fewer bird species than natural forests within the same biome. Oil palm supports only 14% of the bird species that are seen in comparable rainforests in Mizoram[44]. Teak plantations harbour just 54% of rainforest bird species in Mizoram[44] and 50% of the total woodpecker species in old-growth stands of sal forests in Uttarakhand[23]. Bird species richness in conventional tea plantations is 76% of that seen in adjoining native rainforest patches[42]. However, certain management practices can mitigate some of the adverse effects of monocultures. For instance, tea plantations with diverse cover of native shade trees are far richer in birds than conventional tea plantations with a single shade tree species[42].

Apart from species loss, the kinds of species that persist in plantations are often very different from those in adjoining forests. In the Himalaya, horticultural landscapes have only 15% fewer bird species than those in natural forest, but these are a radically different set of species, dominated by open area generalists and forest edge species[45]. Similarly, rainforest insectivore specialists are largely absent from tea plantations in the Western Ghats[42]. On the other hand, generalist species, such as the Red-whiskered Bulbul, do well in monocultures[42].

## FUTURE RESEARCH & ACTION

- Field studies are required in a range of monoculture types across different biomes in India to better understand their impact.
- Management practices that are known to mitigate the worst effects of monocultures need to be identified and widely implemented.
- Conversion of natural habitats to monoculture, including poorly designed reforestation, needs better planning, irrespective of land ownership status (government, private, or community lands).

# ENVIRONMENTAL POLLUTANTS

*Heavy metals, pesticides and even veterinary drugs are on top of the list of known environmental pollutants endangering birds. Among pesticides, organochlorines are well known to have caused bird species declines. However, since the 1960s these have been largely replaced by organophosphate and carbamate insecticides that do not bio-accumulate in the food chain and are less persistent. Unfortunately this does not mean that they are benign, and the continued excessive use of pesticides in agriculture has both a direct impact on birds, as well as an indirect effect by reducing populations of their invertebrate and vertebrate prey.*

*Veterinary drugs are infamous for having caused large-scale death of several species of vultures in India from the early 1990s onwards[46] (see Vultures, p40). Sixteen years after India banned the veterinary use of diclofenac to save its vultures, three emerging non-steroidal anti-inflammatory drugs (NSAIDs) with toxic effects similar to diclofenac—aceclofenac, ketoprofen, and nimesulide—threaten to undo decades of progress. Heavy metal pollution, emanating from mining of metallic ores, refineries for metals, and thermal power plants, is also known to adversely affect birds. Plastics are coming under increasing scrutiny for causing direct deaths of birds (e.g., seabirds) or for their potential (in microplastic form) to affect their physiology and survival. We therefore need to understand 'pollutants' in a broad sense, including pesticides, rodenticides, heavy metals, certain medical drugs, and plastics.*

## *Mechanisms*

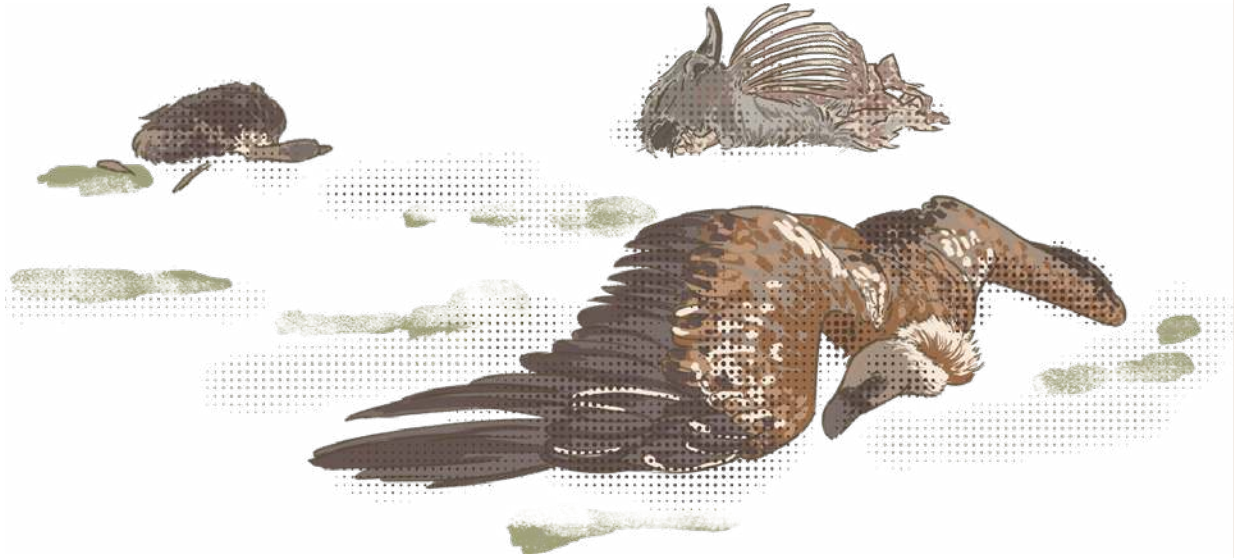
The scientific literature is clear about the strong connection between environmental pollution and reduced wild vertebrate populations. However, relationships between pollutant exposure and reduced reproduction or survival have been established for only a few species. This is particularly true in India where toxicology studies on wild species are still very limited.

Organophosphates like chlorpyrifos, and carbamates like aldicarb and carbaryl are known to severely affect birds. Both these classes of chemical inhibit the enzyme acetylcholinesterase. Sub-lethal effects of these pesticides include hormone disruption, alterations in feeding behaviour and compromised immune system which, in turn, affect reproduction and survival[47,37]. Exposure to toxic chemicals during reproductive stages can affect fertility, egg formation, eggshell thickness, and can lead to impaired incubation and chick rearing behaviours. All of this decreases hatching success and fledgling survival, and increases the possibility of reproductive failure.

While specific linkages between heavy metals and bird mortality are difficult to draw, a recent review found heavy metal contamination in a large number of bird species across Asia[48]. Unusually high quantities of the toxic metals zinc, nickel, cobalt, chromium, copper, lead, and mercury have been found in the feathers of 15 species of shorebirds at the Ramsar Site, Point Calimere Wildlife Sanctuary, and in Pichavaram Mangrove Forest[49]. Similarly, heavy metals were found in three owl species in Visakhapatnam. In another site, the levels of metals in the tissues, liver, kidney, and feathers of Indian Pond Heron and Black-crowned Night Heron as well as their prey species (crabs, prawns, and fish) were found to be over permissible limits[50], pointing to aquatic habitats as being particularly vulnerable to toxin accumulation.

## *Consequences for birds*

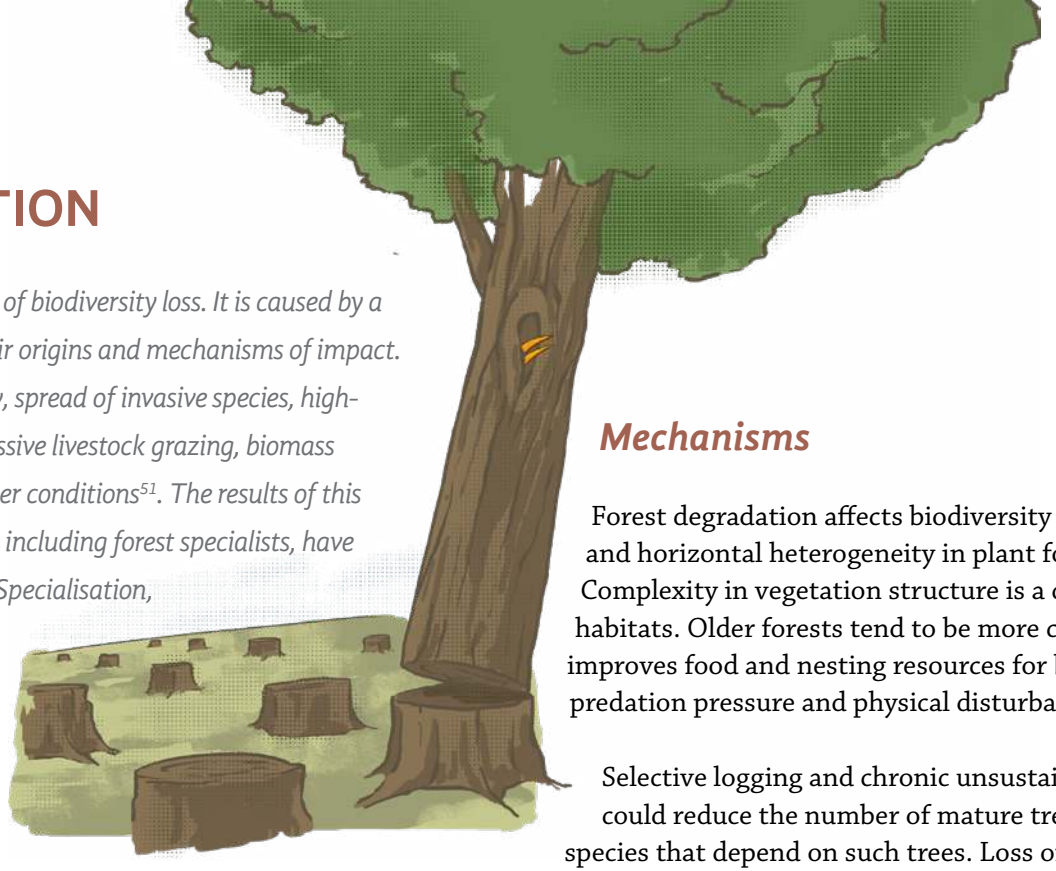
The evidence implicating environmental pollutants in the massive decline of vultures is clear[46]. However, the long-term consequences of other toxic chemicals for birds are still unclear in the absence of rigorous research that combines systematic sampling of pollutants in the environment together with toxicological studies on birds. Most of the information on the impact of pollutants in India comes from sites where opportunistic sampling is carried out following mass mortality of birds. Acute events like this may well be only the tip of the iceberg, with chronic effects gradually reducing bird populations to a much greater degree, although less dramatically. The long-term decline of specific groups, including raptors and insectivorous birds, hints at toxic chemicals (particularly pesticides) as a threat that requires serious attention. Recent work on bird declines in Europe directly points to agricultural intensification, particularly pesticide and fertiliser use, as a cause of a long-term mass decline in bird populations[5].



## FUTURE RESEARCH & ACTION

- There is an urgent need for widespread and systematic monitoring of specific pollutants in different habitats, followed by appropriate policy changes and management.
- Avian mass mortality events must be investigated and diagnosed by qualified laboratories, and steps taken to avoid recurrences.
- Bans on veterinary use of emerging toxic NSAID drugs like ketoprofen and aceclofenac, currently limited to a few States, should be replicated across the country if we are to save vultures from extinction.
- All options to reduce heavy metal pollution and use of toxic pesticides need to be explored and implemented. In an agricultural context, this could include organic farming and integrated pest management.
- The emerging threat of death by ingestion of plastics needs urgent investigation if we are to understand the scale of the problem and potential mitigation strategies.

# FOREST DEGRADATION



*Forest degradation is a well-known driver of biodiversity loss. It is caused by a variety of factors that range widely in their origins and mechanisms of impact. These include logging of varying intensity, spread of invasive species, high-intensity forest fires, fragmentation, excessive livestock grazing, biomass extraction, insect pests, and severe weather conditions[51]. The results of this report suggest that specialist bird species, including forest specialists, have suffered long-term declines (see Habitat Specialisation, p28). It is quite likely that habitat degradation has contributed to population declines of these forest specialist species.*

*Between 2015 and 2021, an estimated 74,000 sq. km of forest in India underwent observable degradation[52]. And in the two years from 2019 to 2021, an estimated 9,000 sq. km of forest was converted into barren lands and scrublands[52]. A report by the World Bank[53] estimates 41% of India's forest cover to be in a degraded state, resulting in a possible loss of one-third of its forest productivity. In India, a large part of the population (c. 250 million) still depends on forests for sustenance, firewood, and livelihood[53]. In addition, a large number of commercially important products continue to be extracted from forests across the country, including seeds, bark, resin, fruit and roots.*

## *Mechanisms*

Forest degradation affects biodiversity through reduced vertical and horizontal heterogeneity in plant form and composition. Complexity in vegetation structure is a crucial feature of forest habitats. Older forests tend to be more complex, and this in turn improves food and nesting resources for birds as well as reduces predation pressure and physical disturbance.

Selective logging and chronic unsustainable biomass extraction could reduce the number of mature trees in forests, affecting species that depend on such trees. Loss of terminal branches and canopy due to firewood and fodder collection directly affects food availability for birds that forage in the canopy and on thinner branches[54]. Studies in dry deciduous and tropical thorn forest of Rajasthan[55] as well as Himalayan oak forests[56] have found that reduced canopy cover, tree height, understorey density and tree basal area result in low bird diversity and composition.

Additionally, loss or thinning of the tree canopy could change microclimate, including temperature, relative humidity, light and wind, which could alter flower production, pollination, seed dispersal, and regeneration of native trees and shrubs. Increased sunlight reaching the ground can cause desiccation, reducing invertebrate abundance in the understorey and leaf litter[55]. These changes can also make natural habitats more vulnerable to invasion by non-native species of plants, further altering the habitat.

## *Consequences for birds*

The causes of forest degradation may vary, but the implications for birds are clear. One evident impact is a reduction in species richness and overall abundance in degraded forest in comparison with protected forest[55–57]. Further, species composition also changes, mainly due to the decline of forest specialists, large-bodied frugivores, and understorey insectivores, as seen in the studies listed above. Such functional guilds of birds tend to give way to generalist species. Degradation caused by invasion of exotic plants appears to negatively affect the guild of insectivorous birds, and such invasions are expected to increase in the future.

## FUTURE RESEARCH & ACTION

- While local studies indicate significant impacts of forest degradation on birds, research is needed on how such localised patterns translate to regional-scale bird population trends. Incorporating large-scale features (e.g., the surrounding matrix) into such studies will help in landscape-level planning and management.
- Forest restoration and recovery is required on a large scale to stem the decline in forest specialists, endemics, and endangered birds.
- Livestock grazing in forests needs to be better understood and managed.

# URBANISATION

*Urbanisation has become a key driver of global land-use change in the past 50 years. As roads and built-up areas increase, the resulting loss and fragmentation of natural habitat for birds exposes them to novel stressors such as elevated pollution levels, increased temperature, and increased density of free-ranging domestic predators like cats and dogs. Food subsidies in urban areas can result in the increase of behaviourally dominant species such as House Crows and feral Rock Pigeons, thereby crowding out other species (see Rock Pigeon, p55).*

*The United Nations declared 15 November 2022 as the 'Day of Eight Billion', and more than half of these eight billion humans live in urban areas. India is one of the three countries that together will account for 35% of the projected growth of the world's urban population between 2018 and 2050[58]. Urban growth often comes at the cost of natural habitats, as cities occupy more and more land. As an example, the Indian Himalayan region supports high bird diversity as well as a number of relatively small towns. However, towns in both the eastern and western Himalaya are urbanising rapidly at the cost of forests, water bodies, and agricultural habitats.*

## Mechanisms

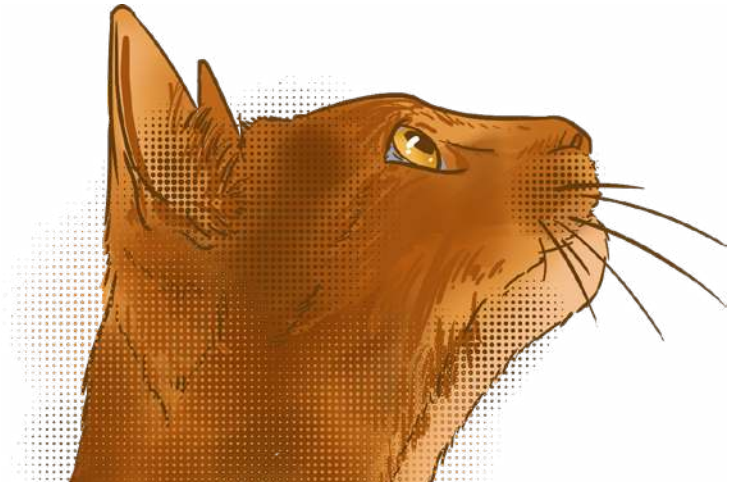
As urban housing and infrastructure in cities expand, natural habitats are lost. This directly affects the variety and numbers of birds, especially of habitat specialists. Any remaining natural areas exist as isolated fragments in the built-up matrix. Such areas are often then converted into manicured parks, dominated by lawns and exotic ornamental trees, and minimal native shrubs and herbs. Such an altered and homogenised habitat has a strong effect on birds. For instance, diminished canopy cover, plant species richness, and vegetation heterogeneity is associated with a decline in bird species richness in urban areas[59,60]. Individual plant species matter as well. For example, the exotic tree *Prosopis juliflora*, which often invades peri-urban areas, was found to be negatively related to insectivorous birds and overall bird diversity[60]. Similarly, avenues of planted non-native trees are often not ideal for native biodiversity.

Pets and other animals that accompany human presence add another layer of threat. Free-ranging cats and dogs affect birds directly through predation and indirectly by creating a 'landscape of fear'. While studies in other countries estimate that billions of wild birds are killed each year by free-ranging cats in urban landscapes, the extent of the problem in India is not yet known.

Urban noise is known to alter bird behaviour by compelling birds to sing louder, or at different frequencies, or, in the worst case, to abandon otherwise suitable habitat. Light pollution can confuse and disorient birds (particularly during migration), and increase their risk of crashing into buildings. During the day, glass facades of buildings are collision traps for birds that see the sky reflected in such surfaces.

## *Consequences for birds*

Urban habitats tend to be unsuitable for rare and specialist species, while promoting generalist and common species. Studies that investigate a gradient of urbanisation in Indian cities find that the most urbanised areas have the least number of species, the least number of rare species, and the fewest insectivorous species[61]. Within cities, the larger the size of the patch of natural habitat, the more birds persist[59]. Additionally, wooded streets can act as corridors by enhancing connectivity between green spaces. In central Delhi, fruiting trees offer resources for arboreal frugivorous birds such as Brown-headed Barbet and Yellow-footed Green Pigeon[62]. By and large, urbanisation leads to a homogenisation of bird communities due to the increased abundance of birds adept at exploiting ecological niches, including Rock Pigeon, Common Myna, and House Crow[59,62].



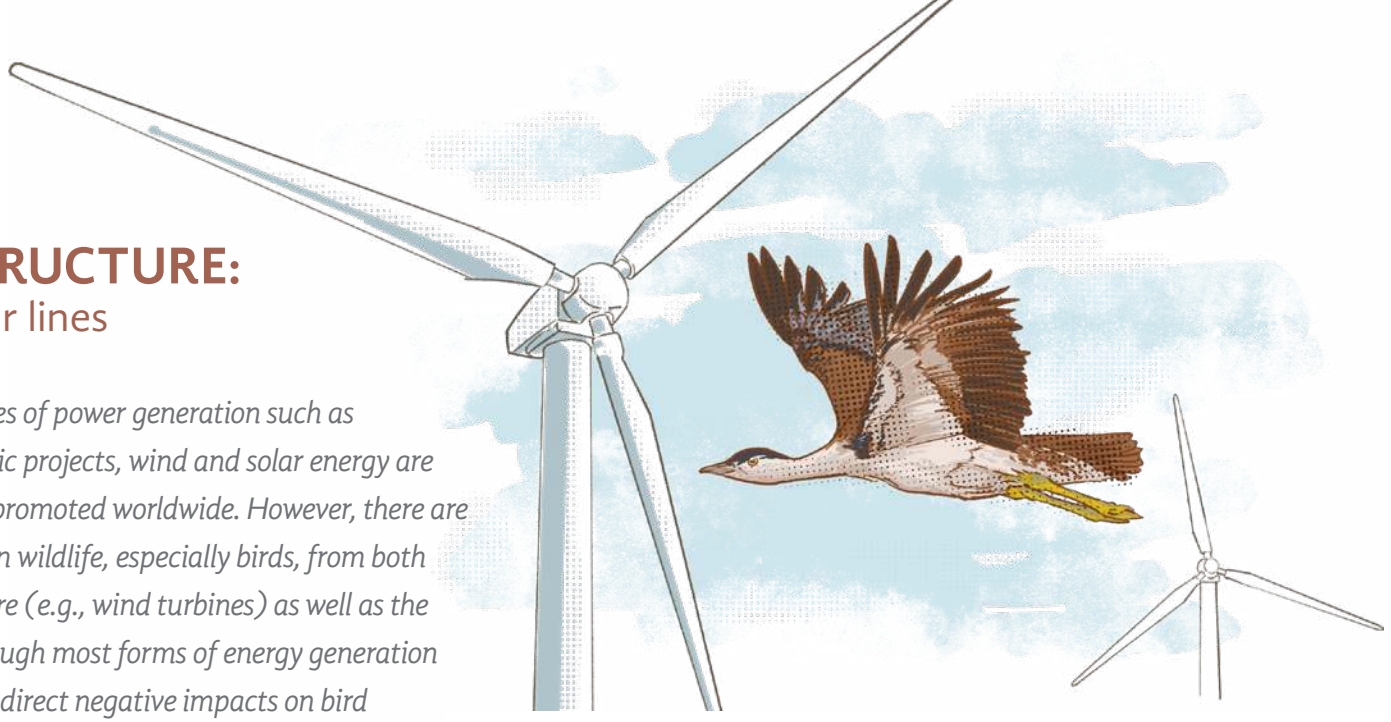
## FUTURE RESEARCH & ACTION

- Research on the effects of urbanisation on birds have focussed on large cities; long-term studies from smaller towns that are at the forefront of urban expansion will provide a more nuanced understanding of the effects of urbanisation on birds.

- Urban planners could use current understanding to enhance habitats for bird diversity by safeguarding natural habitats (including terrestrial and wetland habitats), and by maximising connectivity by promoting the planting of native trees and shrubs in parks, gardens and streets.

- Careful attention to the design of street lighting and building architecture could prevent the deaths of millions of birds each year.

- Urban wetlands have the potential to support rich birdlife, but are often redeveloped to suit other purposes. Studies are needed to evolve good practices in managing urban wetlands for the benefit of birds and biodiversity.



# ENERGY INFRASTRUCTURE:
## Wind energy and power lines

*Compared with conventional modes of power generation such as thermal power or large hydroelectric projects, wind and solar energy are considered 'green energy' and are promoted worldwide. However, there are growing concerns about impacts on wildlife, especially birds, from both the power-generating infrastructure (e.g., wind turbines) as well as the accompanying power lines[27]. Although most forms of energy generation and distribution have direct and indirect negative impacts on bird populations, here we restrict our discussion to the effect of wind energy installations and transmission power lines.*

*India is the fourth-largest producer of wind energy in the world, with an installed capacity of nearly 40 GW as of 31 March 2021. The average land area required for wind energy in India has been estimated at around 200 sq. km/GW (calculated from a conservative estimate of 5 MW/sq. km by Chakravarty & Somanathan[63]). Wind turbines are installed in a wide range of landscapes including coastal areas, Western Ghats mountaintops, open arid lands, agricultural lands, and grasslands. The power lines increasingly criss-crossing these open habitats pose additional hazards for many birds.*

### *Mechanisms*

The major impacts of wind turbines on birds include:

1. Direct collision of birds with the rotating wind turbine blades
2. Displacement (loss of habitat) of birds from the turbine area due to disturbance
3. Barrier effects within habitats (obstacle to migration, or to other regular movements across feeding and roosting areas and breeding colonies)

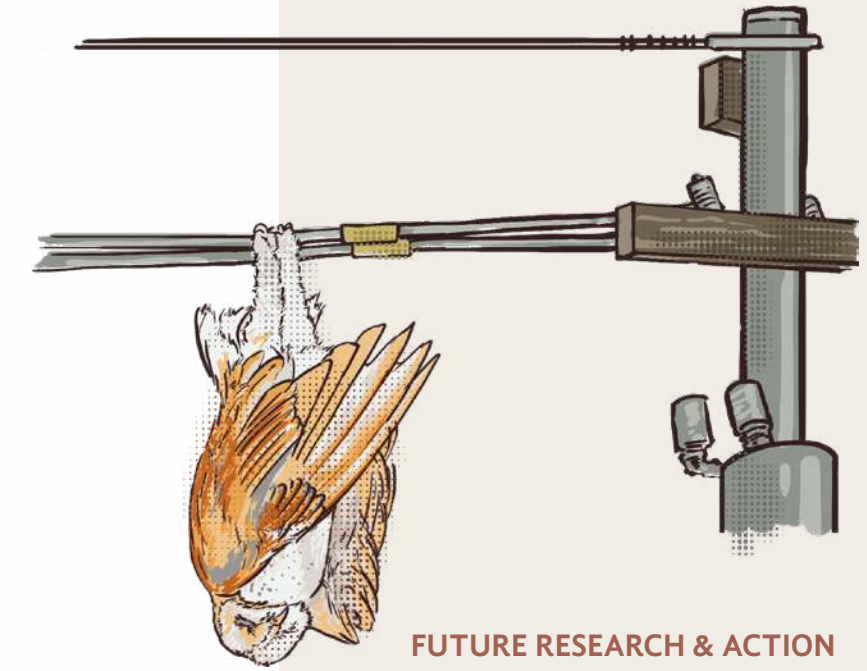
Additionally, transmission lines kill birds through two different mechanisms. For large-bodied species, collisions can be fatal, while for smaller species like passerines, the threat is from electrocution at distribution lines and pylons. These threats are known to have population-level effects, and sometimes even cause changes in migratory patterns.

## *Consequences for birds*

A wide range of bird species are known to be killed by collisions with wind turbines. The species most at risk appear to be large-bodied birds, such as storks, bustards, cranes, vultures, eagles, but other smaller species suffer collisions too.

In an agriculture-wetland matrix in Kachchh, waterbirds like Painted Stork, Dalmatian Pelican, and Black-crowned Night Heron were killed[64]. In the Western Ghats of Karnataka and Maharashtra, most victims were land birds such as Bonelli's Eagle, Changeable Hawk Eagle, Black Kite, Red-rumped Swallow, Dusky Crag Martin, Little Swift, and Indian Pitta. Across habitats in all three States that were studied (Karnataka, Maharashtra, and Gujarat), raptors showed particularly concerning signs. Such mortality, combined with birds avoiding wind turbines, is the likely reason why turbine areas show lower richness and diversity of birds compared with adjacent control areas[65]. Raptor density has also been found to be lower near wind turbines, leading to cascading effects down the food chain[66].

A literature review reveals that over 60 species from 33 families of birds are affected by collisions and electrocution at power lines in India. Families like Phasianidae, Phoenicopteridae, Accipitridae, Gruidae, Corvidae, and Coraciidae are the most affected. Long-term impacts of wind farms are likely to be most severe on large-bodied birds like raptors, which are slow-breeding and long-lived. Other large-bodied birds of open habitats, including Great Indian Bustard and Lesser Florican, are known to be severely affected by collisions with transmission lines, further endangering species that are already highly threatened[27]. For Great Indian Bustard, the presence of a large network of power lines in their prime habitats in Jaisalmer District of Rajasthan is a matter of great concern.

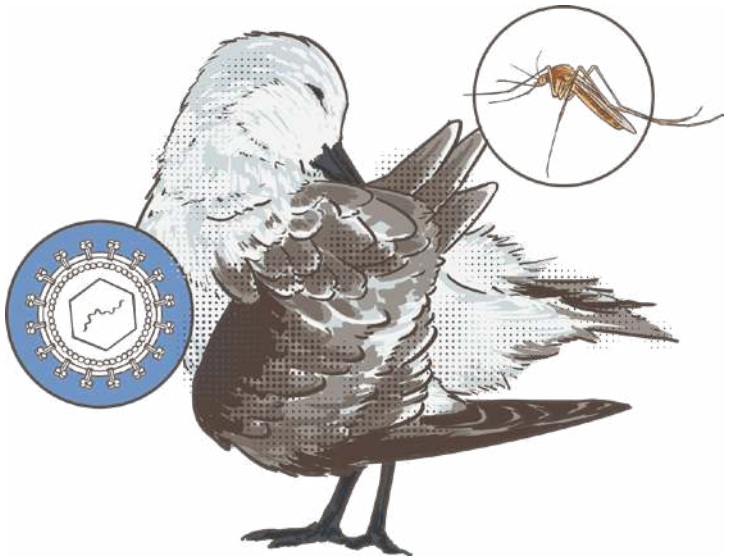


### FUTURE RESEARCH & ACTION

- Further studies of the impact of wind farms and associated power lines on birds are required in India.
- Underground cables can mitigate the worst effects of collisions and electrocution, particularly in the prime grassland habitats of endangered species like Great Indian Bustard and Lesser Florican.
- Planners and policymakers can use newly developed sensitivity mapping tools like Avistep (avistep.birdlife.org/) to select locations for new wind farms in a way that minimises their harmful impact on birds.

# AVIAN DISEASE

*Anthropogenic drivers such as land-use change, intensive livestock production, wildlife trade, and climate change are now known to have indirect effects on the emergence and cross-species transmission of pathogens. Globally, birds are hosts for an astonishing diversity of parasites such as* Plasmodium*, avian influenza virus and West Nile virus. Vector control together with socio-economic, cultural, and infrastructural changes can, however, dilute the effects of such pathogens. The impact of disease on avian population declines in India is poorly understood due to a lack of long-term studies. Here is an attempt to summarise our current understanding.*



## *Mechanisms*

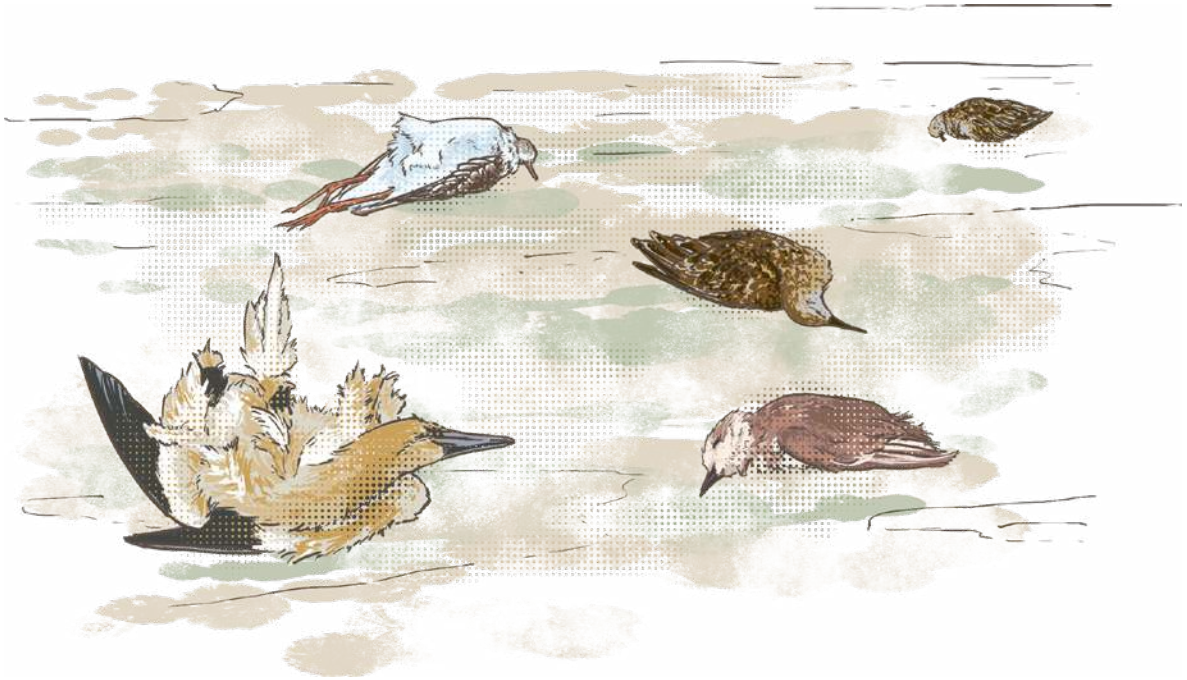
Although we think of malaria as a human disease, birds also contract malaria, as demonstrated for the first time in 1898 by Ronald Ross[67] in Kolkata using *Culex* mosquitoes carrying avian *Plasmodium* (*P. relictum*). In recent times, a number of studies have used both traditional microscopy and modern molecular methods to generate snapshots of the prevalence and diversity of avian haemosporidians (protozoan blood parasites) in the Indian subcontinent[68–71].

Avian malaria is a well-known threat to birds on isolated islands. For example, with the accidental introduction of the mosquito *Culex quinquefasciatus* together with non-native birds from Africa and India, *P. relictum* has been responsible for the endangerment and extinction of many native Hawaiian birds. Human-caused introduction aside, global climate change is expanding the distribution of vector-borne pathogens in both space and time, exposing host populations to longer transmission seasons, and immunologically naïve populations to newly introduced pathogens. For example, using climate models, it has predicted that by 2050, high elevation sites (above 2600 m) in western Himalayan will have a temperature range conducive for malaria transmission[72].

This becomes particularly relevant given that a study in the Himalayan foothills demonstrated that tropical climate facilitates the transmission of parasites throughout the year[69]. Gupta et al.[70] demonstrated that generalist parasites like *Plasmodium* can rapidly invade novel communities, while specialists like *Haemoproteus* are less capable of shifting across host species in the Western Ghats.

## *Consequences for birds*

Globally, infectious disease is thought to be a key driver of population dynamics in both free-living as well as domestic birds. Nearly 7% of globally threatened bird species have declined due to avian malaria[73]. Although none of these are Indian species, India is considered a hotspot for endemic vector-borne diseases. Avian influenza outbreaks in 2020–2021 swept through many Indian States, causing mass mortality of wild birds. While avian influenza outbreaks usually coincide with the peak migratory season, there are also reports of outbreaks outside the migratory season, suggesting endemic transmission within the poultry sector. Yet, the consequences of disease for bird population trends in India are still poorly known, principally due to a lack of detailed long-term studies that go beyond providing snapshots of prevalence and diversity of pathogens. Much more work is required in the Indian context to understand the role of infectious disease in population dynamics of wild birds.



## FUTURE RESEARCH & ACTION

- Study of disease ecology must be prioritised, given the increasing prevalence of zoonotic disease and its exacerbation due to climate and land use change. Year-round surveillance networks are needed, connecting monitoring of humans and animals in a shared environment, as suggested from a One Health framework. This is particularly urgent for sites that attract large congregations of wild birds in the vicinity of poultry farms.

- Disease surveillance is especially important in the context of climate change, which is causing changes in bird migration routes and seasons, and is likely to alter vector distribution. These changes, in turn, increase the probability of new pathogen variants emerging, with consequences for disease dynamics.

- Longitudinal studies of multi-host and multi-pathogen systems are needed to understand complexities of infection dynamics to feed into epidemiological models[74].

# ILLEGAL HUNTING AND TRADE

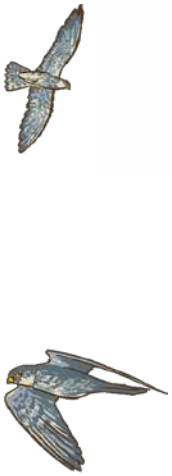
*Illegal hunting is the hunting or capture of wild species without legal sanction. Live birds are trapped for the pet trade, or hunted for their derivatives such as meat, eggs, feathers, claws, beak, and casque. Further, superstitious beliefs can lead to the illegal hunting of species like owls or Indian Roller. Fashion or hobbies can lead to a demand for feathers for hats, for fly-fishing, and other body parts for amulets or curios. Often, there may be seasonal peaks in illegal hunting, coinciding with migration of waterbirds or with certain festivals. Illegal hunting and trade pose a threat to both resident and migratory species.*

*Historically, India has been one of the major exporters of birds (live and dead) to the world. In the period 1970-80, some 14.8 million birds were exported, an average of nearly 13.5 lakh birds per year[75]. In 1991, an amendment to the Wildlife Protection Act (1972) listed all bird groups under various schedules of the Act, and prohibited hunting and trade of scheduled species and their derivatives. With these activities having become illegal, monitoring the overall prevalence of illegal hunting is largely based on surveys of illegal markets and on anecdotal reports from seizures.*

*A survey undertaken in 1997 recorded some 64,500 individual birds of nearly 250 species in illegal trade in northern Indian markets covering the States of Haryana, Punjab, Delhi, Rajasthan, erstwhile Jammu & Kashmir, and Uttar Pradesh[76]. Over 77% of these birds belonged to eight species: Rose-ringed Parakeet (27%), Tricoloured Munia (18%), Red Munia (11%), Scaly-breasted Munia (8%), Alexandrine Parakeet (7%), Plum-headed Parakeet (5%), and Indian Silverbill (3%)[76]. In 2020, reports of 37 seizure incidents across India indicated that species poached included parakeets, owls, hornbills, munias, vultures, francolins, quail, peafowl, and other pheasants[77].*

## Mechanisms

Illegal hunting, in the form of shooting, poisoning, or snaring directly removes individuals from wild populations. Nearly all forms of illegal hunting are indiscriminate and do not differentiate based on sex. A few exceptions exist, such as when particular feathers are targeted, as seen with the hackle feathers of male Grey Junglefowl or the selective trapping of male Red Junglefowl to invigorate the domestic fowl lineage, which is reported from some parts of India. Even when birds are caught alive for the pet trade, the stresses of transportation, crowded conditions, malnutrition and limited habituation leads to mortality rates up to 90%[78] due to disease, injury, food or water deprivation and so on. Whether they survive or not, traded birds are removed from their source populations.





*Amur Falcons used to be hunted and killed in large numbers, but conservation action in the form of awareness, enforcement and generating alternative livelihoods has considerably reduced this threat.*

## Consequences for birds

Illegal hunting and illegal trade of wild birds has been identified as a major threat to a number of bird species. In most cases, it is likely to act in synergy with other problems, such as habitat degradation and loss, which together can pose a threat for the species. But to tease out the synergistic effects of land-use change (habitat loss/alteration) and illegal hunting on a bird species may be difficult and extremely challenging, and hence hard to generalise. Within India, it is this combined effect that is likely to be the most critical, as exemplified by the decline of Manipur Bush Quail and Green Munia.

## FUTURE RESEARCH & ACTION

- Focussed studies to understand the intensity and population consequences of illegal hunting are needed on certain targeted species/groups, including waterfowl, waders, owls, parakeets, hill mynas, and pheasants and their relatives. Reducing illegal hunting and trade must be considered as a priority, given that an increasing number of wildlife crime cases are being reported.

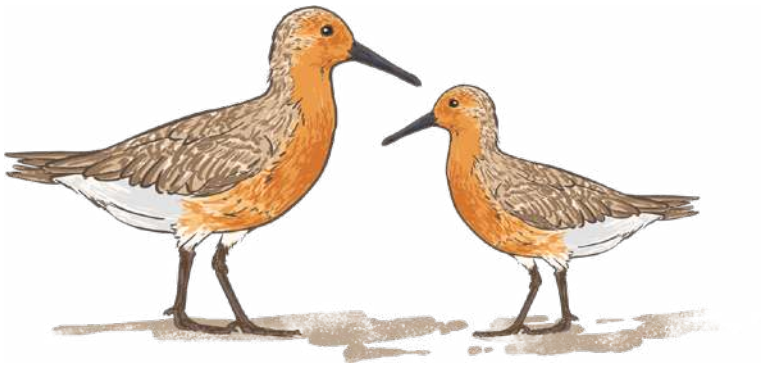
- While implementing existing laws, there is also a need to understand and engage with local reasons underlying illegal hunting, which may include poverty, nutrition, and subsistence.

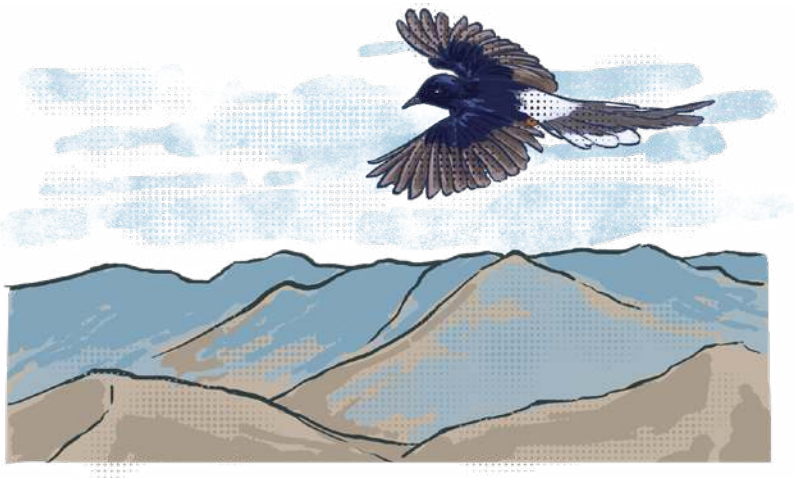
- On the demand side, awareness and behaviour change of pet owners may help to reduce illegal trade.

# CLIMATE CHANGE

*Since pre-industrial times (that is, since the mid-1800s), the mean global temperature has risen by a little over 1°C, primarily because of increased atmospheric $CO_2$ concentrations arising from the burning of fossil fuels such as coal, natural gas and petrol/diesel. $CO_2$ is a greenhouse gas that traps heat in the atmosphere, and has risen to an astonishingly high atmospheric concentration of 421 ppm, a ~50% increase since the beginning of the industrial age.*

*Limiting global heating to the 2015 Paris Agreement target of less than 2°C above pre-industrial times now appears impossible. Far more likely is a global average temperature rise of roughly 4°C by 2100, and this is likely to be accompanied by catastrophic impacts on human well-being and biodiversity. Apart from the average rise in temperature itself, extreme weather events such as cyclones, droughts, and floods are predicted to occur more frequently and with greater intensity. Further, natural seasonal cycles are themselves expected to change in timing and intensity. Globally, South Asia is among the regions projected to be hit the hardest by climate impacts.*





## *Mechanisms*

There are several ways in which changing climate affects birds.

1. Phenological mismatches occur when the timings of annual events (e.g., migration, nesting, insect emergence) become asynchronous.

2. For sedentary birds, dealing with climate change will require rapid adaptive changes. For instance, amongst Amazonian birds observed over a fifty-year period, all species showed decreases in mean body mass, consistent with the expectation that smaller individuals—because they can lose heat more effectively—would be evolutionarily selected by warmer conditions[79].

3. Higher temperatures also cause birds to alter their behaviour, making them more likely to seek shade and spend less time foraging, with negative impacts on survival and reproduction.

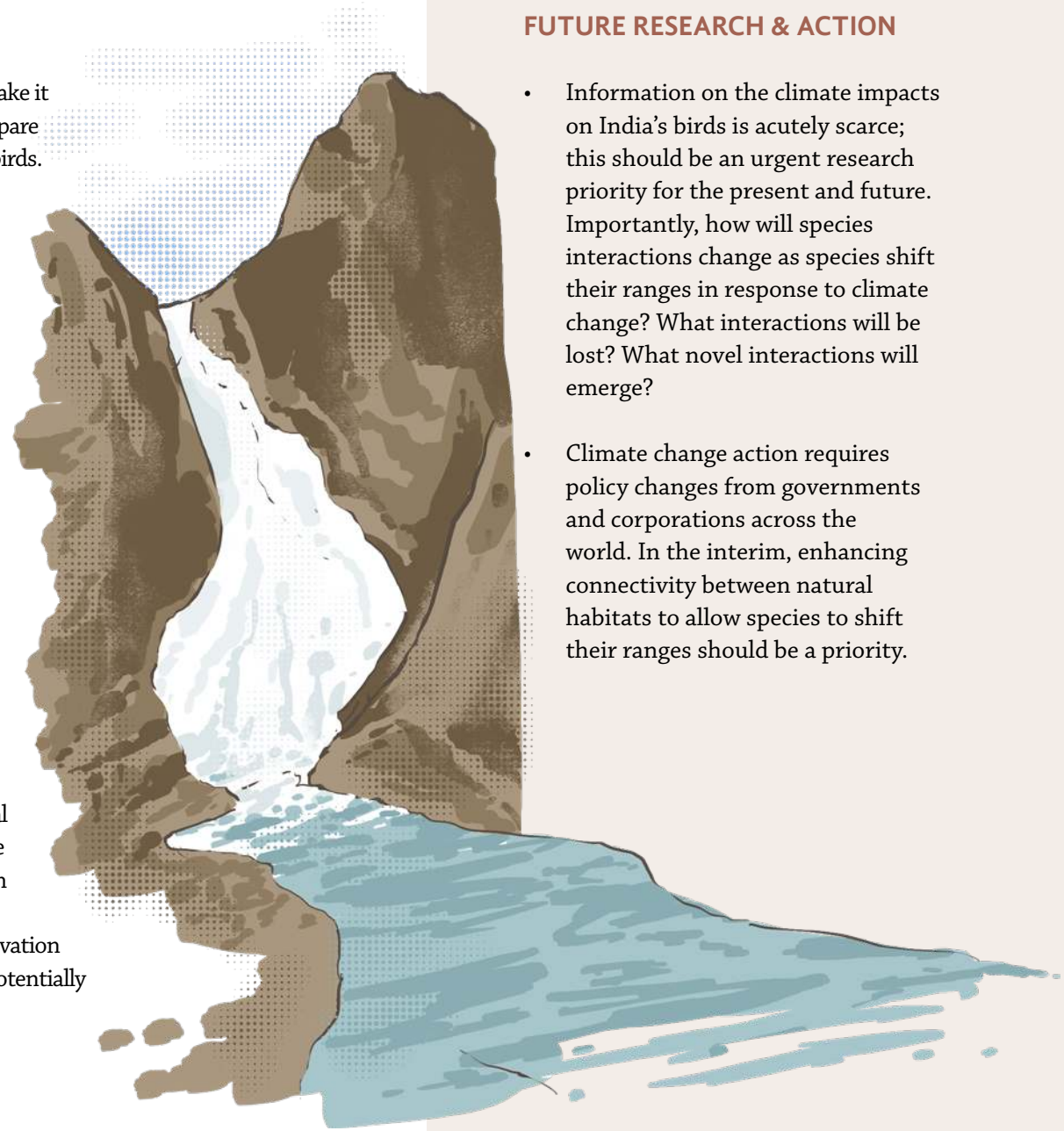
4. Bird species are also shifting their ranges to higher latitudes (i.e., away from the tropics and towards the poles) and in mountains, to higher elevations.

## *Consequences for birds*

To begin, we note that shifting baselines caused by climate change make it challenging to diagnose threats to birds. Researchers commonly compare disturbed and undisturbed habitats to infer degree of suitability for birds. However, climate-driven changes in avifauna make modern bird communities in undisturbed habitats different from historic ones. Without long-term data, the unknown extent of climate change impact on comparison benchmarks makes it difficult to assess land-use change effects on birds.

One way in which climate change affects bird survival and reproduction is through the disruption of species interactions by phenological mismatches and range shifts. Mismatches in seasonal timing (of migration, breeding, emergence) between birds and their prey can reduce survival and reproduction and also lead to fatal competition with other species[80]. In parallel, range shifts lead to the loss of overlap between species in space, and thereby loss of their interactions. Additionally, new and dangerous interactions might emerge. For instance, mosquitoes in Hawaii are colonising higher elevations, leading to the increased transmission of malaria in mountain birds that have never been exposed to malaria before.

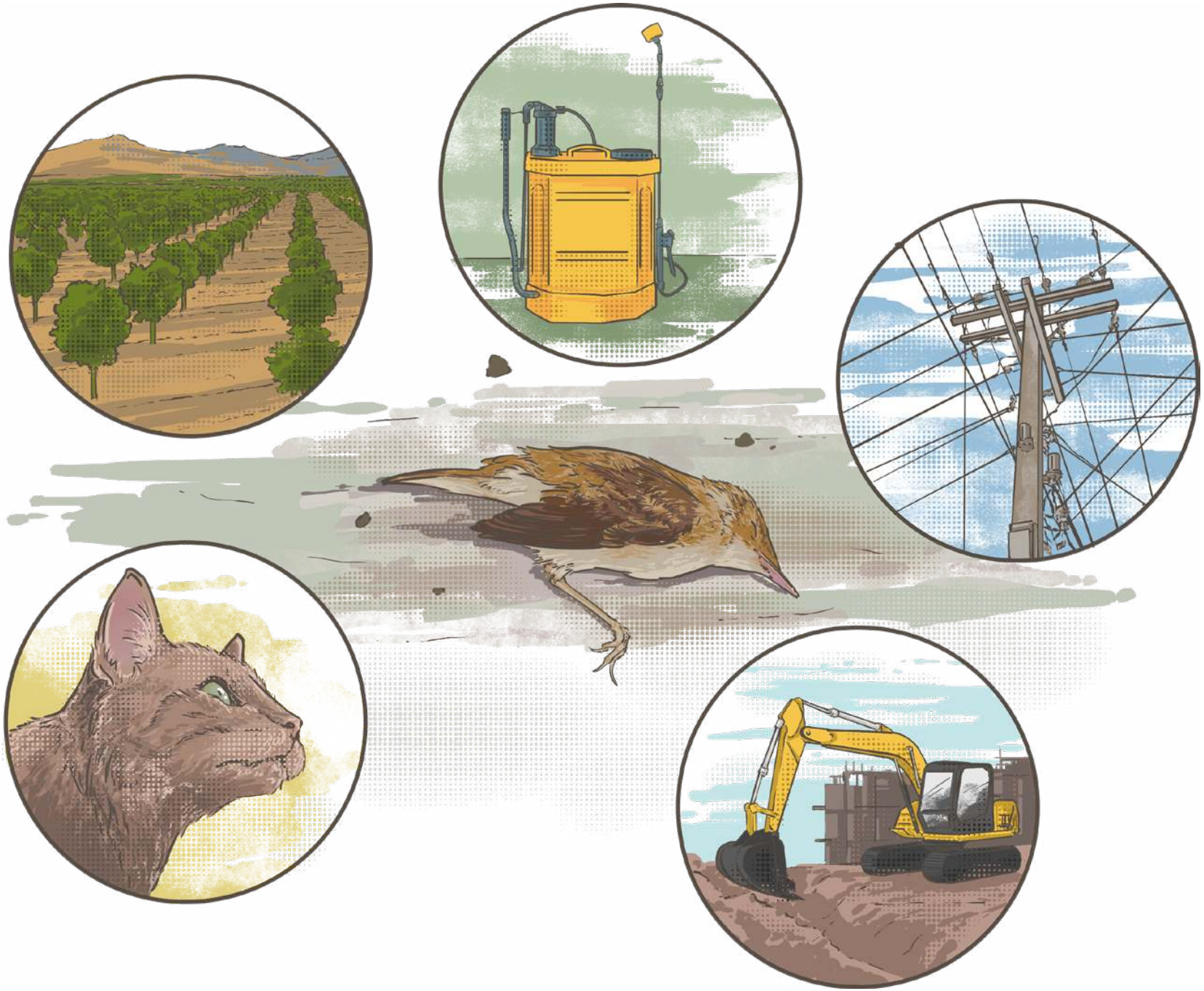
Climate change can also push mountain species directly towards extinction. Terrestrial bird species diversity is concentrated in tropical mountains, with each species adapted to a specific temperature range tied to altitude. The Himalaya and Western Ghats are particularly rich in bird diversity, with the latter being a hub for bird endemism (see Endemicity, p31). However, climate change poses a threat to high-elevation bird species as favourable conditions shrink at mountain summits, potentially causing local extinctions[81].



## FUTURE RESEARCH & ACTION

- Information on the climate impacts on India's birds is acutely scarce; this should be an urgent research priority for the present and future. Importantly, how will species interactions change as species shift their ranges in response to climate change? What interactions will be lost? What novel interactions will emerge?

- Climate change action requires policy changes from governments and corporations across the world. In the interim, enhancing connectivity between natural habitats to allow species to shift their ranges should be a priority.



**This report** analyses a range of threats based on available literature, within the limitations of the shockingly sparse scientific literature on most threats. In most cases, this lack of information impedes work to identify linkages of threats with species declines. In a megadiverse country like India, which is on a rapid development path, we require much more systematic work over large spatial scales, focussed on specific threats

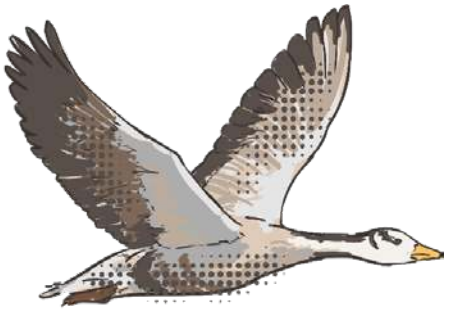
We are more confident about ascribing cause-and-effect relationships to certain threats like habitat loss, habitat degradation, and climate change. It is clear that habitat loss due to urbanisation, monocultures, and infrastructure development has had a considerable impact on India's birds over the last few decades. The loss and degradation of forests is relatively well studied; however, other threatened habitats such as deserts, grasslands, and marine and coastal habitats are scarcely researched. In the only study on climate change impacts on birds in the Himalaya, population-level effects are abundantly clear. Hunting and illegal trade are strongly implicated in the threat status of some species; for more common species, the effects are less understood.

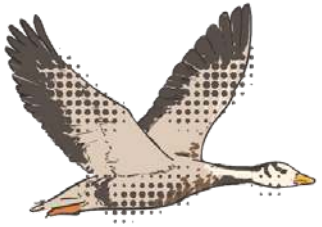
In the face of diverse developmental pressures, maintaining the size and integrity of natural habitats is crucial. Beyond this, where habitats have degraded over time, restoration efforts will be vital: not planting trees in monocultures, but rather ecological restoration of multiple habitats including non-forest habitats like grasslands. One particular challenge will be to mitigate the considerable negative effects of even small-scale infrastructure such as wind energy, often thought of as 'green energy'.

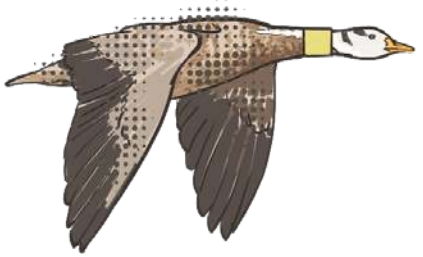
The specific effects of environmental pollutants and avian diseases are not yet properly understood. However, mass mortality events during the last decade indicate that avian pathogens and pollutants are considerable threats. Recent work in Europe has pointed to the major effects of toxic chemicals like fertilisers and pesticides in massive and long-term declines of bird populations. There is a need for increased monitoring of such threats, as well as epidemiological and clinical research on these causes of mortality.

Our review does not claim to cover all relevant threats to birds in India, nor does it take into account the multiplicative effects of different threats taken together. For instance, habitat loss is likely to exacerbate the effects of environmental pollutants, disease, climate change, and capture/hunting. Across India and the world, threats are increasing and bird populations are decreasing. Careful research and timely action is needed if we are to reverse this trend.

# IMPLICATIONS
## *and Recommendations*







As in all countries where bird populations have been monitored and assessed, birds in India are faring poorly overall. A few generalist species are doing well, notable among them being feral Rock Pigeon, Ashy Prinia, and Indian Peafowl. Other familiar species, including Baya Weaver and Pied Bushchat, are relatively stable. But the larger picture is grim: 60% of species show long-term declines (out of 348 species that could be assessed for Long-term Trend), and 40% species are declining currently (out of 359 species assessed for Current Annual Trend). The declines are not spread uniformly across different types of species; examining differences across groups of species that share common characteristics reveals informative patterns (see Species Accounts, p26).

Habitat specialists—particularly specialists of grasslands and other open habitats, wetlands, and woodlands—are declining rapidly. In terms of diet, carnivores, insectivores, and granivores are declining more rapidly than omnivores or fruit- and nectar-eaters. Separately, migratory species appear to be under greater threat than non-migrants. And species endemic to the Western Ghats–Sri Lanka region are faring worse than others. Certain groups of birds are faring particularly poorly, including open habitat species like bustards and coursers, riverine sandbar-nesting birds like skimmers and some terns, coastal shorebirds, open-country raptors, and a number of ducks. The finding that a large number of common species are in trouble is a cause for concern. Equally worrying is that a considerable number of species lack the data to be assessed. Insufficiency of data meant that of the 942 species covered in this report, Long-term Trend could not be calculated for 44% and Current Annual Trend could not be estimated for 31% of the species.

The findings presented in this report, concerning as they are, also provide an opportunity to identify key implications and recommendations for actions to be taken in order to achieve improved conservation outcomes.

## • Species and Species Groups •

One arm of conservation in India (and the world over) focusses on individual species or groups of species. Conservation actions are often directed at threatened species, but an equally important goal is to keep common species common, thereby preventing them from needing the crisis measures required to save threatened species.

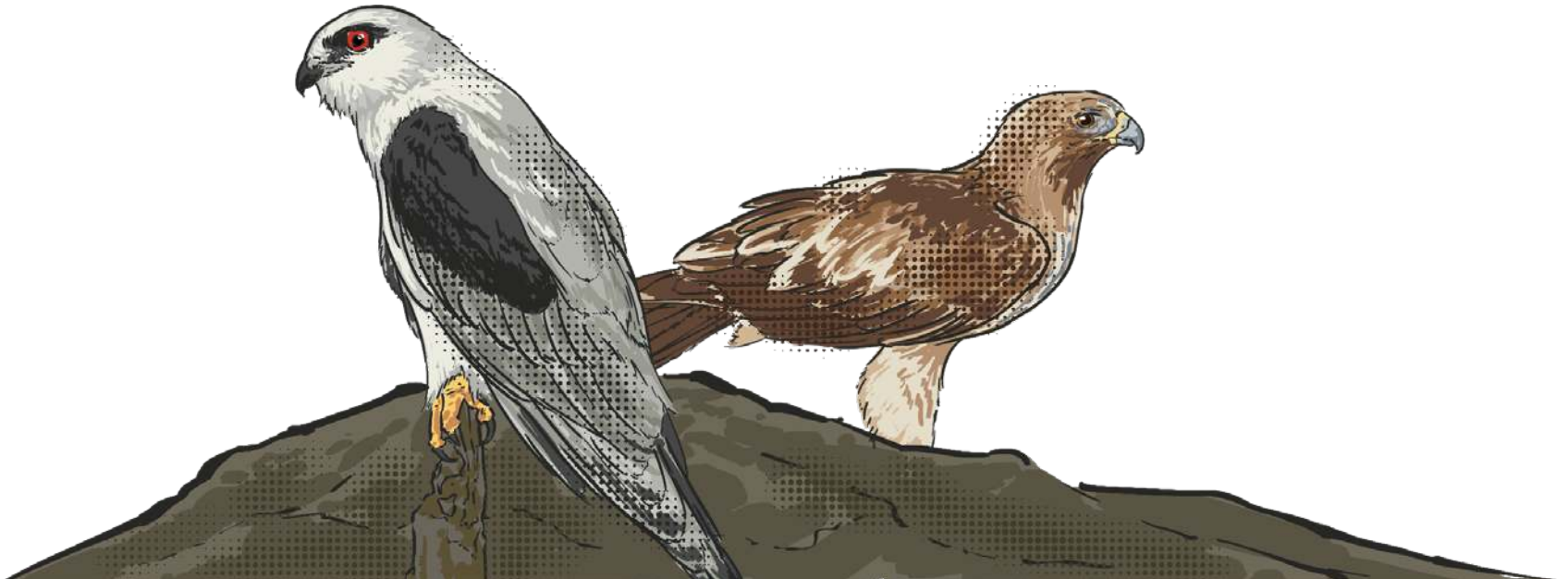
- Conservation action plans are needed for all 178 species identified as being of High Conservation Priority in this report. Such action plans would include an assessment of the adequacy of population monitoring, listing of key research gaps, identification of most likely causes of decline, and high-priority measures for mitigation.

- For the 323 species identified as being of moderate priority, plans are needed to identify early warning signals and what research, policy, and conservation actions such signals would trigger.

- Separately, key groups of species should be identified (e.g., on the basis of their ecosystem functions), followed by dedicated efforts to monitor their health and conduct research on what affects their population dynamics. Examples of groups with key ecosystem functions include carnivores and scavengers like kites, eagles, and vultures; dispersers of large-seeded fruit like hornbills; and invertebrate-eaters like drongos, rollers, and woodpeckers.

- Certain species groups like nocturnal birds (owls, nightjars), mountain pheasants, and seabirds are poorly represented in citizen science (or other) datasets for large scale analysis. Specialised networks focussed on monitoring these groups are needed to understand their trends at a national scale.

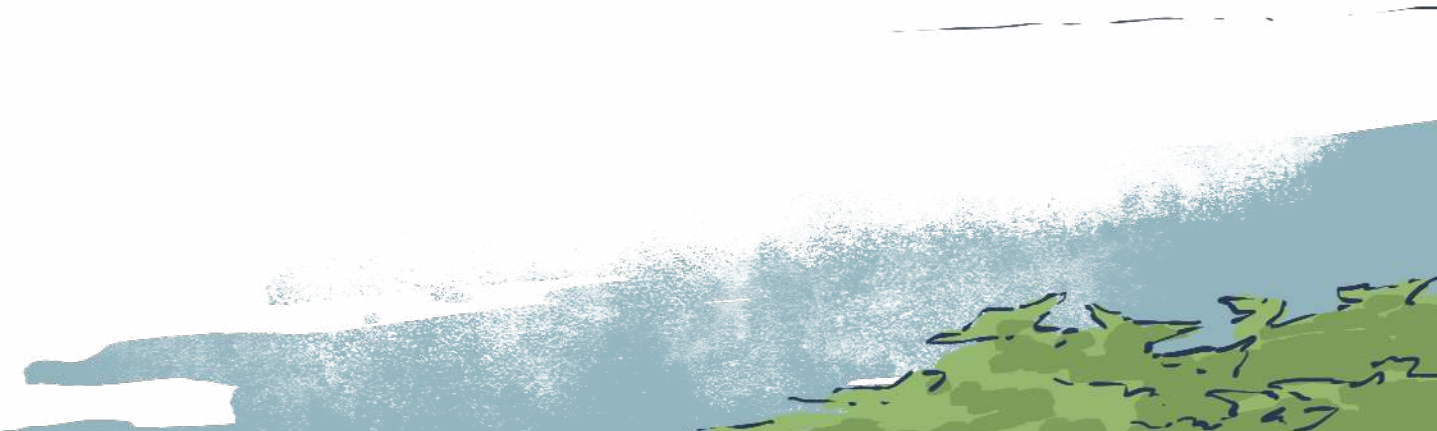
- Urgent conservation action is needed for the most critically threatened species in the country: Jerdon's Courser, Great Indian Bustard, White-bellied Heron, Bengal Florican, and Finn's Weaver.



## Habitats

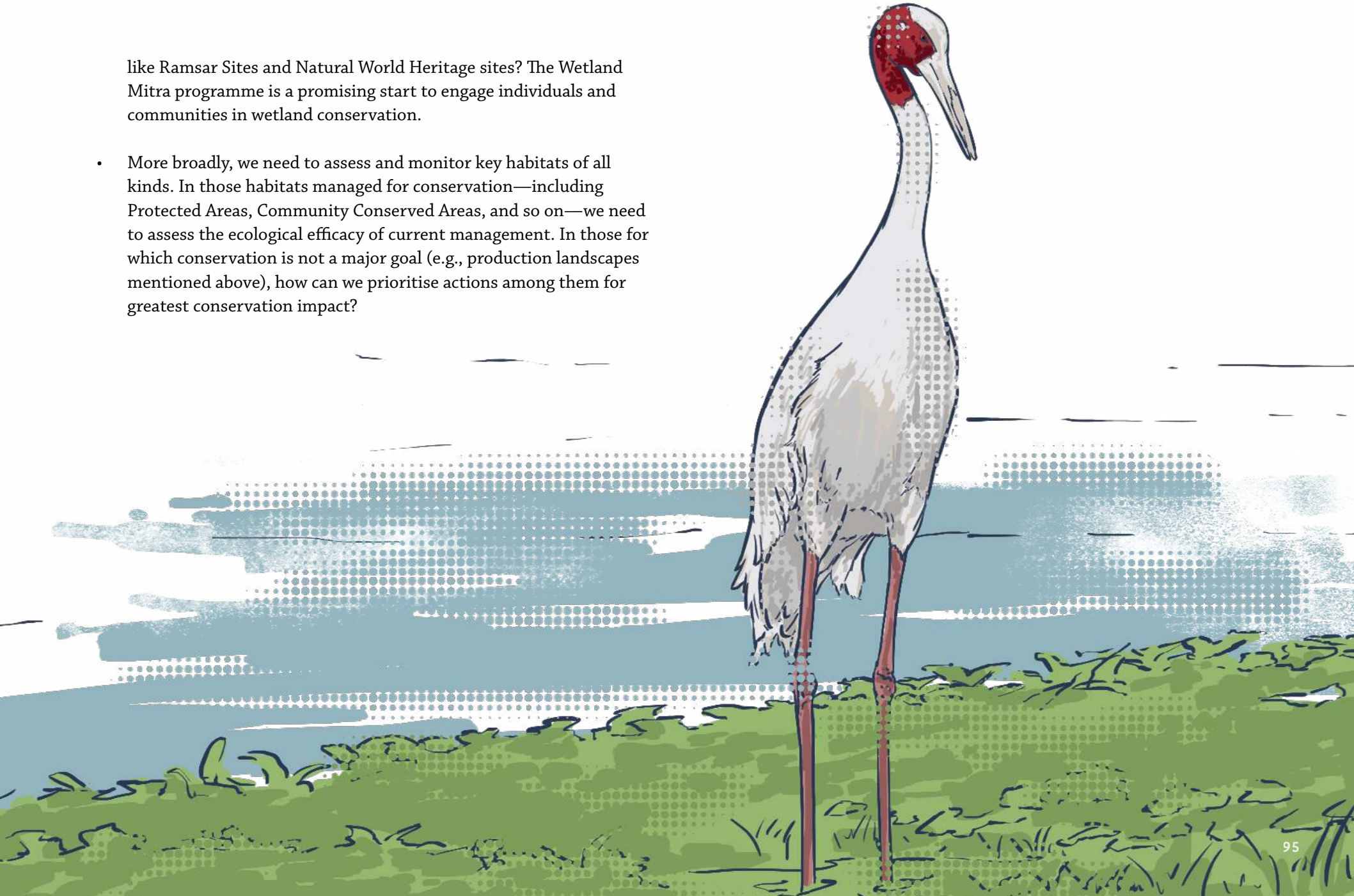
A second focus of conservation is habitat, since species cannot survive in the absence of the conditions they need. The establishment of Protected Areas and other conservation-focussed areas is based on this reasoning. However, conservation areas are often not representative enough nor are they sufficient for the larger goals of conservation.

- A number of ecological important habitats have historically been neglected from a conservation perspective. These include open natural ecosystems (ONEs) like grasslands and shrub-savannahs[8]; inland waters like rivers, streams, tanks, and lakes; key coastal habitats like mudflats; and areas that provide crucial habitat at certain times of the year, like seasonally flooded wetlands[82]. This historical neglect must be urgently redressed by taking steps to increase ecological understanding of the dynamics of and pressures on these habitats, by monitoring their health, and by using all possible instruments available for their conservation.
- Protected Areas, and other areas that are explicitly managed for conservation, cover a small fraction of India's expanse, and, by extension, a similarly small fraction of the population of most species. For example, the majority of the population of Sarus Crane, Black-necked Stork, and Great Grey Shrike exists outside Protected Areas. Most landscapes are not managed for conservation, but are still vital for the persistence and health of India's birds. This implies that we must carefully evaluate how such landscapes can contribute to conservation goals. For example, under what circumstances can production areas (e.g., coffee plantations) contribute to conservation, and what policy options and incentives are available to encourage such outcomes? Under what situations can policy instruments like declaring eco-sensitive zones (ESZs) be of use? How can Community Conserved Areas (CCAs) and Other Effective Area-based Conservation Measures (OECM) be encouraged and made sustainable? How can we increase the effectiveness of internationally designated areas



like Ramsar Sites and Natural World Heritage sites? The Wetland Mitra programme is a promising start to engage individuals and communities in wetland conservation.

- More broadly, we need to assess and monitor key habitats of all kinds. In those habitats managed for conservation—including Protected Areas, Community Conserved Areas, and so on—we need to assess the ecological efficacy of current management. In those for which conservation is not a major goal (e.g., production landscapes mentioned above), how can we prioritise actions among them for greatest conservation impact?



## Research

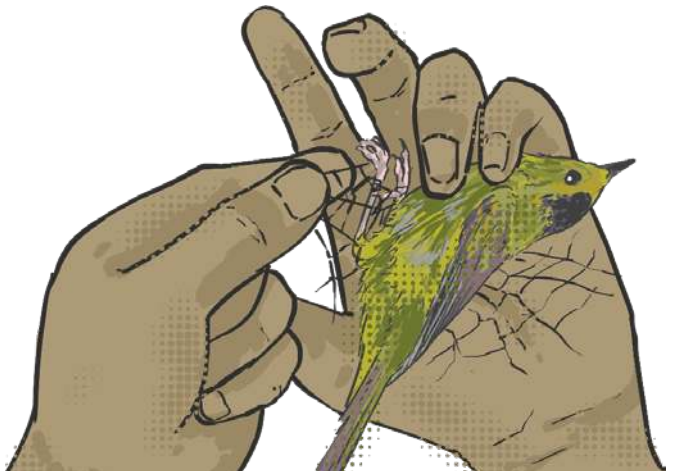
As is evident from the needs described above, gaps in our knowledge are large, and research is therefore a key requirement for conservation. Research on species, their habitats, the relationship between the two, and how humans affect these relationships is vital, and requires a supportive and enabling environment.

- Monitoring the state of biodiversity (including birds) is a fundamental research activity. Doing so effectively requires training, planning, and financial and logistical support.

- The world over, large-scale monitoring programmes necessarily depend on the participation of interested and skilled volunteers, in an effort that falls under the umbrella of 'citizen science'[6]. In India, documentation, survey, and monitoring projects based on citizen science include the Asian Waterbird Census, the Great Backyard Bird Count, a number of bird atlases (including of Mysore city, Coimbatore city, Kerala, and Goa), State-level events like Bihu, Onam, and Pongal Bird Counts (in Assam, Kerala, and Tamil Nadu respectively), and annual bird surveys in a number of Protected Areas. Much more can be accomplished with dedicated effort, encouragement, and promotion, especially towards long-term systematic monitoring in collaboration with volunteer birdwatchers.

- Research funding and infrastructure needs considerable strengthening. Funds are needed for research infrastructure like field stations, long-term bird observatories to study impact of climate change, and supporting laboratory services. Equal attention must be paid to building capacity for monitoring and research, and to encourage interdisciplinary efforts to tackle conservation problems.

- The policy and regulatory environment needs to become enabling for research. The following are examples of priority research activities that would flow from this report, but which are heavily regulated, such that permits may take years to obtain or may simply be denied: collecting carcasses (e.g., for disease investigations or assessing toxic chemicals in tissue); capturing birds and fitting them with satellite transmitters (to understand movements and migration, including key stopover sites during migration); capturing and ringing birds (to understand demographic processes of survival and reproduction); monitoring nests (to examine extent and causes of breeding failure); and capturing for blood, feather, and tissue collection (to understand heavy metal contamination as well as disease spread and connectivity across populations).



## • Law and Policy •

Laws and policies are meant to assist conservation of species and habitats both directly (e.g., providing a legal framework for CCAs; banning or regulating environmental pollutants) and indirectly (e.g., enabling and encouraging research on status, pressures, and responses to biodiversity loss; facilitating involvement of the larger public in conservation activities).

- This report shows that many species that are rapidly declining are those with a large range and occupy habitats largely outside the formal Protected Area network. This means that effective conservation requires policies that extend beyond territory under the jurisdiction of forest departments, to include various other landscapes, including production landscapes. Accordingly, effective conservation planning will require both interdepartmental communication and coordination, as well as close involvement of local communities and local government bodies (like panchayats).

- Following from this, diverse policies and plans must consider birds and biodiversity. For example, while the National Water Policy mentions the importance of maintaining ecological flows, it could include specific reference to the conservation needs of waterbirds. More wetlands could be identified and managed under the Wetlands (Conservation and Management Rules) 2017 keeping bird presence as criteria for identification (as already provisioned in the Act). Similarly, the Integrated Wastelands Development Programme should be careful not to notify ONEs as 'wastelands', and Compensatory Afforestation Programmes and various state Green Missions should avoid ONEs for tree planting.

- A further finding of this report is that large numbers of species are in decline, some still relatively abundant and others already threatened. Policies must recognise that the conservation needs of these species will differ from one another. Further, situations can be dynamic: species that are doing well may abruptly become imperilled, as was seen with vultures. Others, thought to be faring poorly, may need a revision of status based on new information. Conservation laws and policy instruments must recognise this and be flexible enough to change as best available information is updated.

- At a broad level, conservation policies and actions will need to be based on the extent to which they achieve the desired outcomes, and build in flexible *means* towards those *ends*. This may require a shift in emphasis from 'protection' alone to management, as well as increased emphasis on non-forest ecosystems together with a focus on 'hidden' problems, like toxic chemicals.

## THE WILD LIFE (PROTECTION) ACT (WLPA)

The WLPA is a powerful instrument for the preservation of India's wildlife, legislating protection of places and species. The Act accords two levels of protection to individual species by listing them either under Schedule I (i.e., higher protection) or Schedule II. However, conservation needs may not be met by blanket protection alone; a more dynamic approach involving science-based conservation management is equally important.

In 2022, when the revised Act (The Wild Life [Protection] Amendment Act 2022) came into force, 87 out of 206 bird species listed in Schedule I were classified as threatened according to the IUCN, and 96 were designated as having High Conservation Concern in the State of India's Birds 2020 report. Three years later, knowledge has advanced substantially, allowing us to assess many more species. Where causes of decline are well understood, protection and mitigation of threats may be required. In many other situations, urgent support and enabling of research is needed to uncover underlying pressures.

Thus, it becomes crucial to periodically review and update the Schedules based on a consultative process, using the latest scientific information, and carefully assessing conservation needs. Such a dynamic and science-based approach would enable more effective conservation management, tailored towards the needs of specific species, for example those that occur largely outside Protected Areas, or those reliant on brief, but crucial, stopovers at migratory staging sites.

Within areas managed for conservation, we have an opportunity for science-based management to be fully acted upon and evaluated. The amended section 33 of the Act calls for the creation of management plans for sanctuaries, and these plans should also include the needs of birds, with mechanisms for feedback and adaptive management.



**These different implications and recommendations** are not separate from each other; rather, they are intertwined and interwoven. Filling knowledge gaps (research) for species and habitats is essential to inform management practices, and both can only be effective under an enabling (as opposed to restrictive) policy environment. The actions described here will require close communication and coordination among various stakeholders (local communities, government departments, policymakers, research institutions, funding agencies, and corporations), as well as mechanisms for feedback and course adjustment.

The implications and recommendations listed here are not aimed at one or another specific audience. Rather, all stakeholders should be able to bring their interests and abilities into making positive change. Local communities are stewards of the biodiversity around them, and can be aided in this by researchers and civil society organisations. Enthusiasts and birding groups can participate in ongoing monitoring programmes, and can design survey and documentation projects for their own regions.

Researchers can aid in the development of formal monitoring schemes, and fill crucial knowledge gaps about the status of species and habitats as well as the pressures upon them. Civil society organisations can bring different stakeholders together in common cause. Government departments and agencies can provide financial and structural support for both relatively 'simple' (e.g., research) and relatively complex (e.g., on-ground conservation) efforts. Regulatory agencies should draw a distinction between activities whose goal is extraction (e.g., mining, hunting) and those whose goal is conservation (e.g., research, habitat management).

## IMPORTANCE OF RESEARCH IN CONSERVATION

Scientific research is critical for the exploration and understanding of India's birds and other biodiversity, as well as for its conservation. Across the world, both basic and applied research is unveiling the current diversity of life, its history, its state, the pressures it is under, and what conservation options might be most effective. For research to play an effective role in these outcomes, it must be encouraged and enabled.

Apart from the obvious requirement of funds, biodiversity research in particular requires access to study sites and study species, both of which can be a challenge to obtain. For example, obtaining permits to conduct research involving the capture of a species under Schedule I of the WLPA can be extremely difficult, even though such species are usually in most need of urgent research. These difficulties appear to stem from the definition of 'hunting' in Section 9 of the Act, which includes not only killing of wild animals for consumptive purposes, but also regulates capture of animals for research and even the examination and collection of feathers or carcasses for scientific purposes under the related Section 12.

Illegal hunting and research need to be clearly delinked from each other in the Act, with a provision for enabling research going forward. Placing scientific research at the forefront of a more informed understanding of wild species and their habitats will help to enable more effective conservation.

# INPUTS

## to international assessments and priorities

**IUCN Red List** *assessments based on decline in three generations (criterion A)*

**Northern Shoveler**

LC | EN

58% (14 years)

**Baillon's Crake**

LC | EN

51% (10 years)

**Terek Sandpiper**

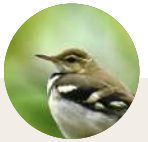
LC | VU

49% (12 years)

**Marsh Sandpiper**

LC | VU

46% (13 years)



**Forest Wagtail**

LC | VU

45% (10 years)

**Kentish Plover**

LC | VU

44% (12 years)

**Spot-winged Starling**

LC | VU

44% (10 years)

**Common Teal**

LC | VU

42% (13 years)

**Garganey**

LC | VU

38% (10 years)

**Great Grey Shrike**

LC | VU

37% (10 years)

**Blue Rock Thrush**

LC | VU

36% (10 years)

**Lesser Sand Plover**

LC | VU

34% (13 years)

**Little Ringed Plover**

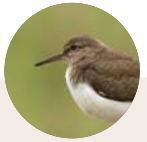
LC | VU

33% (11 years)

**Indian Roller**

LC | NT

30% (12 years)



**Common Sandpiper**

LC | NT

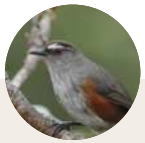
30% (13 years)

World Assessment

India Assessment

Decline in India

## IUCN Red List *assessments based on range size (criterion B)*



**Ashambu Laughingthrush**

VU EN

**EOO**
700–1,455 sq. km

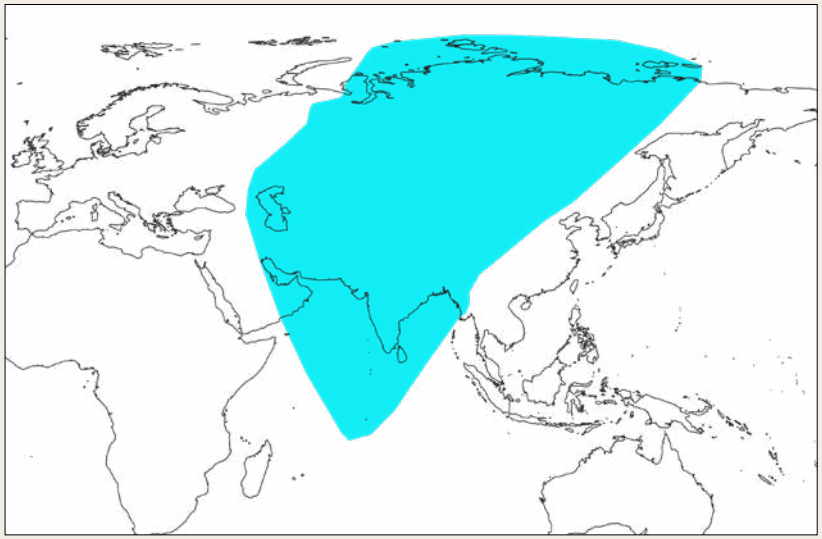
**Nilgiri Sholakili**

EN NT

**EOO**
20,000–25,000 sq. km

*Every year, BirdLife International and IUCN publishes a global Red List of birds, which places species into different categories depending on their estimated risk of extinction. This risk is, in turn, based on species' range size, population size, population trend, and the magnitude and nature of threats. Trends and range sizes (extent of occurrence or EOO) from India are important inputs into the annual Red List evaluations, particularly for those species in which the majority of the population spends all or part of the year in India. Final IUCN Red List assessments would integrate across multiple such inputs, from India as well as the global range of each species. Here, we depict changes in Red List categories that would ensue from using SoIB results alone.*

## Central Asian Flyway *priorities*



*The Central Asian Flyway (CAF) Situation Analysis report prepared by BirdLife International[83] to inform the development of the CAF Initiative under the UN Convention on Migratory Species lists over 600 migratory bird species for priority setting amongst the flyway range States. The SoIB 2023 report has analysed national trends of 387 species among these 600: 194 with Current Annual Trends (27 for the first time) and 182 with Long-term Trends (22 for the first time). The national trends presented can be used as input in prioritising the CAF priority species for India.*

# METHODS

## • India-wide Results •

We assessed large-scale abundance trends and range sizes of India's birds, primarily using data uploaded to eBird until 31 May 2023. Birdwatchers upload their observations to eBird in the form of checklists, which may be marked 'complete' or 'incomplete'. A complete checklist is a list of all species observed during the period of birding, and therefore implicitly includes information about which species were absent (or, more accurately, undetected). Using this, it is possible to create an index of abundance, termed 'frequency of reporting', for any species. This frequency of reporting is the proportion of all complete checklists in which the species was reported. We refer to this as an 'index' of abundance because frequency of reporting is related to, but does not directly measure, population size. By following changes in frequency of reporting over several years, an index of trend in abundance can be estimated.

This report presents three indices of status for each species for which there is sufficient data:

1. Long-term Trend: the proportional change in frequency of reporting in 2022 when compared with the frequency before the year 2000 (data from all years before 2000 combined).

2. Current Annual Trend: the average annual change in frequency of reporting during the last eight years (2015–2022).

3. Range Size: the area covered by all those 25×25 sq. km grid cells that are occupied (see definition below) by a species within the country during the last five years.

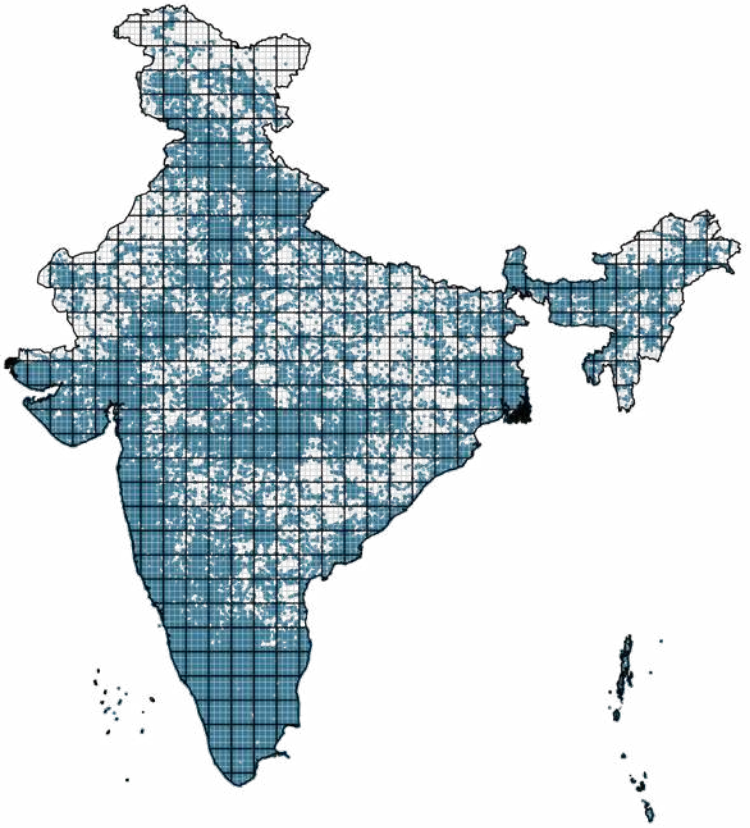
We include some first-time outputs in this edition of SoIB. Aside from the countrywide index, both trend indices were separately calculated within each of three habitat masks derived from the European Space Agency (open natural ecosystems [ONEs], cropland, and woodland), within Protected Areas, and for each State and Union Territory. Range Size was calculated for the whole country and also for each State and Union Territory separately. All these details are available in stateofindiasbirds.in.

Rather than organise observations into calendar years, we define a 'bird year' from 1 June of one year to 31 May of the next, because this spans a single migratory season for many bird species in India. Therefore, the year 2022 refers to the period 1 June 2022 to 31 May 2023. Because eBird data contains checklists of varying effort that are unevenly distributed across space and time, we used a statistical model to standardise frequency of reporting to the median effort (where total number of species, 'list length', is taken to be an index of birding effort). Effort was averaged across unique birding locations (a new addition in SoIB 2023), grid cells, and four seasons (Monsoon: June–August; Autumn: September–November; Winter: December–February; Summer: March–May). We used Generalised Linear Mixed-effects Models (GLMMs) to estimate the standardised frequency of reporting of each species, by modelling its

presence or absence in each checklist as a function of effort , season, and time period. We estimated frequencies for 14 time periods across the last several decades: before 2000, 2000–2006, 2007–2010, 2011–2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, and 2022. The span of each time period was determined by the volume of data available. Range Size (for the period 2018–2022) was estimated using occupancy models that calculate the probability of a species occurring in a grid cell where it is unreported, while accounting for varying sampling effort.

Several criteria were used to clean and filter the data (c. 30 million observations) used, as well as to select species for inclusion in the report. The final filtered dataset contained 1,496,558 unique 'complete' checklists, containing a total of 26,647,037 unique observations. Out of a total of 1,358 species reported from the country on eBird (as of 31 May 2023), 942 were selected for inclusion in the report, based on either the availability of data for trend calculations or their importance in the Indian context (for example, endemics). Out of the 942 species, 523 met the data requirement criteria to qualify for countrywide long term trend analyses, and 643 to qualify for current trend analyses. Species that are primarily nocturnal (including most owls and nightjars) were not assessed. We combined data for 17 species (see p113) that fall into sets of hard-to-identify taxa; for example Green and Greenish Warbler were combined to Greenish Warbler.

All species selected for the report were assigned categories for Long-term Trend, Current Annual Trend, and Range Size. For example, the Long-term Trend of a species was categorised as 'Rapid Decline' if it was less than half as likely to be reported in 2022 as it was before the year 2000. We further used a combination of the three indices to place each species in one of three categories of Conservation Priority: Low Priority, Moderate Priority, and High Priority. We additionally classified a species as High Priority if conclusive trends could not be derived from eBird data but it was classified as globally threatened (status CR, EN, or VU) on the IUCN Red List 2022.



*The country is divided into 100×100 sq. km grid cells, each of which is further subdivided into 25×25 sq. km subcells. To reduce the impact of particularly well-birded regions on the results, the statistical model is specified such that the calculations are effectively averaged across the various subcells within each 100×100 sq. km cell, and then across all relevant cells in the country.*

### Range: VERY RESTRICTED

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|---|---|---|---|---|---|---|---|
| X | HIGH | HIGH | HIGH | HIGH | LOW | LOW | LOW |
| ? | HIGH | HIGH | HIGH | HIGH | LOW | LOW | LOW |
| ↓↓ | HIGH | HIGH | HIGH | HIGH | HIGH | MOD | MOD |
| ↓ | HIGH | HIGH | HIGH | HIGH | MOD | MOD | MOD |
| — | LOW | LOW | MOD | MOD | MOD | MOD | MOD |
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### Range: RESTRICTED

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| X | ^MOD | ^MOD | HIGH | HIGH | LOW | LOW | LOW |
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### Range: MODERATE

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| ? | •LOW | •LOW | MOD | MOD | LOW | LOW | LOW |
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### Range: LARGE

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|---|---|---|---|---|---|---|---|
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| ? | •LOW | •LOW | MOD | MOD | LOW | LOW | LOW |
| ↓↓ | MOD | MOD | HIGH | MOD | MOD | MOD | LOW |
| ↓ | MOD | MOD | HIGH | MOD | LOW | LOW | LOW |
| — | LOW | LOW | MOD | LOW | LOW | LOW | LOW |
| ↑ | LOW | LOW | MOD | LOW | LOW | LOW | LOW |
| ↑↑ | LOW | LOW | MOD | LOW | LOW | LOW | LOW |

### Range: VERY LARGE

| CAT \ LTT | X | ? | ↓↓ | ↓ | — | ↑ | ↑↑ |
|---|---|---|---|---|---|---|---|
| X | •LOW* | •LOW | MOD | MOD | LOW | LOW | LOW |
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### Range: INSUFFICIENT DATA

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|---|---|---|---|---|---|---|---|
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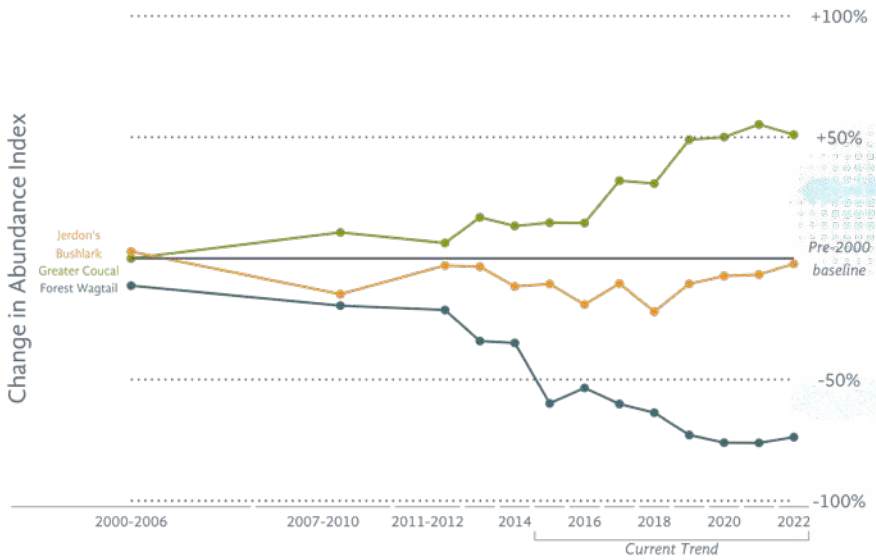
*These tables explain how a species is assigned a category of Conservation Priority based on the classifications of its Long-term Trend, Current Annual Trend, and Range Size. In cases where the trend classifications are either 'Insufficient Data' or 'Trend Inconclusive', the species's IUCN Red List status also figures in the priority categorisation. For species with range size as Historical, priority is High if its Red List status is VU or above, else Low.*

CAT Current Annual Trend
LTT Long-term Trend
^ indicates species is HIGH if it is VU or above in IUCN
• indicates species is HIGH if it is EN or above in IUCN and MOD if NT or above
* indicates species is MOD if it is endemic

| | |
|---|---|
| X | Insufficient Data |
| ? | Trend Inconclusive |
| ↓↓ | Rapid Decline |
| ↓ | Decline |
| — | Stable |
| ↑ | Increase |
| ↑↑ | Rapid Increase |




*This is a representative example of the abundance trend graphs used in the report. This graph has trend lines for three species: Greater Coucal, Jerdon's Bushlark, and Forest Wagtail. Every trend line tracks the mean percentage change in abundance (indicated on the Y-axis) from a pre-2000 baseline value to those in every subsequent time period (indicated as time intervals on the X-axis).*

*In this Long-term Trend graph, Greater Coucal has increased by around 50% in 2022 compared to its pre-2000 baseline value, Jerdon's Bushlark has been relatively stable, and Forest Wagtail has declined by more than 50%. The time period considered for estimation of Current Annual Trend is also indicated on the X-axis.*

Various published sources of information were used to classify species into groups based on their taxonomy, ecology, behaviour, and range. In addition to species-level trends, we used these classifications to also calculate composite trends, by geometrically averaging trends across species to produce a single trend within each group.

Detailed methods, as well as links to data and code, can be found on the website: stateofindiasbirds.in/#soib_methods

**Arunachal's Hornbills**

A small number (2–3) of observers walked transects of varying length (0.91–3 km) in the morning along existing trails in Papum Reserved Forest in the non-breeding season (August–February) from August 2016 to January 2023. Eighteen transects were walked over the seven-year duration of the study, of which ten were walked regularly. The observers recorded date, start and end time, weather, species, flock size, time of detection, activity, and perpendicular distance from each hornbill detected. Detections (sightings and calls) were used to calculate encounter rates (detections per km walked).

**Vembanad Bird Count**

These counts were conducted as part of the Asian Waterbird Census (AWC) and therefore strictly followed the AWC protocol[84]. The same ten count units were monitored by volunteers each year consistently along the same transect within each unit. The counting teams consisted of birdwatchers and sometimes forest department staff, and the same observers were not necessarily involved every year. Each team had at least one expert birdwatcher who could confidently identify all waterbirds. On the evening before the day of the count, volunteers received a briefing on the protocol and attended a short training session on waterbird identification. The counts were done on the third Sunday of every January. A single-day total count was conducted for each count unit between 0600 h and 1000 h. The team responsible for monitoring the lake used a motorboat, while others used bunds, dykes, or footpaths. Birds were counted individually, but large flocks were estimated using block counts.

**Birds of Spiti Valley**

Bird surveys were carried out across four main habitats: agricultural fields, grazed meadows, grazed steppe, and protected ungrazed steppe. Variable-width line transects were used, and each transect was marked from a randomly selected starting point within each site as a 500 m long straight line using a compass. The study attempted to uniformly sample all sites between the months of May and September in each year. Birds were surveyed along the transects in the morning hours between 0630 h and 1100 h on clear, relatively sunny days. The perpendicular distance to each detection was either measured (by pacing) or visually estimated, and recorded in the following distance classes: 0–5 m, 5–10 m, 10–20 m, 20–30 m, 30–50 m, and 50–100 m. The transects were surveyed by trained observers well-versed in identifying the local avifauna by sight and call. Measures of bird density (individual birds per hectare) were obtained using distance sampling density estimation.

**Trends in Survivorship**

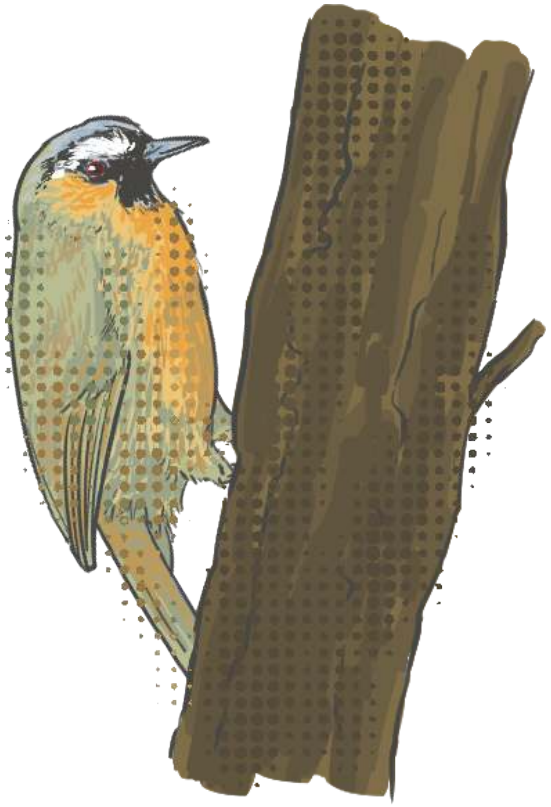
Sampling was carried out in April–May every year in six plots: three in primary forest and three in logged forest. Starting 2011, every year was sampled up to 2022—except 2020 because of the nationwide COVID-19 lockdown. Annually, three consecutive days of mist netting was carried out in each plot (i.e., 18 total days of netting per year). All birds that fell into the net were weighed and ringed with uniquely numbered aluminium rings, with utmost care by trained personnel. Apparent survival for each species was estimated using open capture-mark-recapture models (primarily Cormack-Jolly-Seber models).

**Grassland Birds**

Sampling was done in protected and non-protected grasslands at 33 points across the landscape. Birds were counted within a 100 m fixed radius at each point within a 15-minute interval. Sampling was carried out in the morning, between dawn and 1000 h, and each point was sampled every six weeks. A single observer, Sarang Mhamane, counted all birds that were seen or heard and ascertained to be within the 100 m radius. Data was collected by the same observer over the study period using the same protocol. Sampling was done every year from 2013 to 2021, except for a few months during the COVID-19 lockdown.

## • Threats •

The assessment of threats to birds in this report is based on review of existing literature: peer-reviewed scientific studies, key technical reports, and news articles. We assessed the prevalence of each of the threats in India, the biological mechanisms through which it is manifested in wild birds, and the consequences for bird populations and assemblages—both those that have been witnessed so far as well as those that can be predicted based on available information. This is not a comprehensive assessment of all threats to birds, and we depend on key studies and reports that have been published so far.



## • Implications and Recommendations •

Inputs for the Red List assessments are based on indices from trends (Red List criterion A, Population Trends) and range size (criterion B, Extent of Occurrence, hereinafter EOO). Only a change in threat level is reported here—if the SoIB evaluation is already the same as the current threat level, we do not report it. Note that SoIB inputs are just one amongst a variety of inputs that will need to be collated for ascertaining threat level at a global level in the Red Listing process.

**Trends:** The Current Annual Trend estimates were extrapolated for 10–14 years (based on a length of three-generation for each species) using an exponential model—ten years being the minimum required by criterion A of IUCN. As the Current Annual Trend is based on a seven-year interval, we extrapolated by at most the same interval into the future (i.e., a maximum of 14 total years from 2015). The extrapolated trends, which included both the past and the future, were matched against the Red List criterion A table of IUCN to arrive at SoIB evaluation of threat level.

**Range size:** EOO was calculated from the filtered dataset after removing vagrant records of migratory species. For species with both breeding and non-breeding ranges in India, EOO was assessed separately using seasonality filters, and the smaller value was taken. Likely EOO was calculated from the locations of checklists. Maximum EOO was calculated using tangents of the circle of uncertainty of each location—the uncertainty being the distance travelled in the checklist, capped at 10 km. For checklists with no distance information, 10 km was used as uncertainty. All species with likely EOO less than 30,000 sq. km were chosen for further assessment. If likely EOO was close to a Red List threshold value, maximum EOO was used as the classifier. The EOO was matched against criterion B to arrive at SoIB assessments. All uplisting assessments are reported here; downlisting assessments are only for species whose IUCN Red List categorisation is based on criterion B.

# LIST *of* SPECIES COMBINED FOR COMPOSITE TRENDS

*Species whose trends were averaged to form the composite results shown on pages 28–52. Species with insufficient data, and therefore not included in the composite groups, are not listed here.*

## DIET GUILD

### *Fruit & Nectar*

- **High (1)** Thick-billed Flowerpecker
- **Moderate (7)** Nilgiri Wood Pigeon, Malabar Imperial Pigeon, Flame-throated Bulbul, Square-tailed Bulbul, Crimson-backed Sunbird, Asian Fairy-bluebird, Orange-bellied Leafbird
- **Low (21)** Grey-fronted Green Pigeon, Yellow-footed Green Pigeon, Green Imperial Pigeon, Asian Koel, Indian Grey Hornbill, Oriental Pied Hornbill, Coppersmith Barbet, Great Barbet, Lineated Barbet, Brown-headed Barbet, Alexandrine Parakeet, Red-breasted Parakeet, Black-naped Oriole, Black-hooded Oriole, Black-crested Bulbul, Black Bulbul, Nepal Fulvetta, Fire-breasted Flowerpecker, Scarlet-backed Flowerpecker, Purple Sunbird, Jerdon's Leafbird

### *Invertebrate*

- **High (40)** Sirkeer Malkoha, Great Thick-knee, Pied Avocet, Grey Plover, Lesser Sand Plover, Kentish Plover, Little Ringed Plover, Black-tailed Godwit, Ruff, Curlew Sandpiper, Dunlin, Little Stint, Pintail Snipe, Terek Sandpiper, Spotted Redshank, Common Greenshank, Marsh Sandpiper, Common Redshank, Indian Courser, Western Reef Egret, Eurasian Spoonbill, Black-capped Kingfisher, Yellow-crowned Woodpecker, Isabelline Shrike, Eurasian Crag Martin, Sulphur-bellied Warbler, Nilgiri Laughingthrush, Hoary-throated Barwing, Wallcreeper, Brown Dipper, White-bellied Blue Flycatcher, Rufous-gorgeted Flycatcher, Plumbeous Water Redstart, Blue-capped Rock Thrush, Isabelline Wheatear, Desert Wheatear, Variable Wheatear, Forest Wagtail, Tawny Pipit, Olive-backed Pipit
- **Moderate (54)** Banded Bay Cuckoo, White-rumped Spinetail, Brown-backed Needletail, Himalayan Swiftlet, Crested Treeswift, Pacific Golden Plover, White-tailed Lapwing, Whimbrel, Temminck's Stint, Small Pratincole, Malabar Trogon, Eurasian Hoopoe, Heart-spotted Woodpecker, Brown-capped Pygmy Woodpecker, White-bellied Woodpecker, Short-billed Minivet, Orange Minivet, Large Cuckooshrike, Malabar Woodshrike, Large Woodshrike, Common Woodshrike, White-browed Fantail, White-bellied Drongo, Lesser Racket-tailed Drongo, Yellow-bellied Fantail, Grey-headed Canary-flycatcher, Yellow-browed Tit, Greater Short-toed Lark, Sand Lark, Rufous-fronted Prinia, Thick-billed Warbler, Grey-throated Martin, Dusky Crag Martin, Ashy-throated Warbler, Lemon-rumped Warbler, Large-billed Leaf Warbler, Western Crowned Warbler, Dark-fronted Babbler, Brown-cheeked Fulvetta, Rufous Babbler, Velvet-fronted Nuthatch, Rosy Starling, Indian Blue Robin, Malabar Whistling Thrush, Little Pied Flycatcher, Rusty-tailed Flycatcher, Blue-fronted Redstart, Blue-capped Redstart, Black Redstart, Rufous-breasted Accentor, Grey Wagtail, White Wagtail, Long-billed Pipit, Tree Pipit
- **Low (73)** Lesser Coucal, Blue-faced Malkoha, Green-billed Malkoha, Grey-bellied Cuckoo, Alpine Swift, Little Swift, Yellow-wattled Lapwing, Grey-headed Lapwing, Green Sandpiper, Asian Openbill, Great Egret, Intermediate Egret, Glossy Ibis, Jungle Owlet, Green Bee-eater, Blue-tailed Bee-eater, Chestnut-headed Bee-eater, Dollarbird, Speckled Piculet, Grey-capped Pygmy Woodpecker, Greater Flameback, Black-rumped Flameback, Lesser Yellownape, Streak-throated Woodpecker, Small Minivet, Scarlet Minivet, Black-winged Cuckooshrike, Black-headed Cuckooshrike, White-throated Fantail, Spot-breasted Fantail, Ashy Drongo, Bay-backed Shrike, Indian Black-lored Tit, Common Tailorbird, Himalayan Prinia, Jungle Prinia, Yellow-bellied Prinia, Ashy Prinia, Plain Prinia, Zitting Cisticola, Booted Warbler, Blyth's Reed Warbler, Striated Grassbird, Wire-tailed Swallow, Red-rumped Swallow, Hume's Warbler, Tickell's Leaf Warbler, Chestnut-headed Tesia, Black-throated Tit, Yellow-eyed Babbler, Indian Scimitar Babbler, Puff-throated Babbler, Chestnut-crowned Laughingthrush, Red-billed Leiothrix, White-crested Laughingthrush, White-throated Laughingthrush, Chestnut-bellied Nuthatch, Bar-tailed Treecreeper, Grey-winged Blackbird, Dark-sided Flycatcher, Asian Brown Flycatcher, Brown-breasted Flycatcher, Indian Robin, White-rumped Shama, Small Niltava, Rufous-bellied Niltava, Verditer Flycatcher, Blue Whistling Thrush, Red-breasted Flycatcher, Pied Bushchat, Grey Bushchat, Brown Rock Chat, Paddyfield Pipit

### *Omnivore*

- **High (10)** Tufted Duck, Greater Flamingo, Eurasian Curlew, Slender-billed Gull, Black-headed Gull, Brown-headed Gull, Rufous-tailed Lark, Oriental Skylark, Bank Myna, Blue Rock Thrush
- **Moderate (16)** Common Sandpiper, River Tern, Crested Kingfisher, Indian Roller, Hair-crested Drongo, Black-headed Jay, White-bellied Treepie, Indian Bushlark, Malabar Lark, Yellow-browed Bulbul, Mountain Bulbul, Common Babbler, Common Starling, Orange-headed Thrush, White-collared Blackbird, Little Spiderhunter
- **Low (21)** Painted Spurfowl, Greater Coucal, Common Moorhen, Grey-headed Swamphen, White-breasted Waterhen, Indian Pond Heron, Red-naped Ibis, Indochinese Roller, Yellow-billed Blue Magpie, Red-billed Blue Magpie, Grey Treepie, Green-backed Tit, Cinereous Tit, Jerdon's Bushlark, White-eared Bulbul, Himalayan Bulbul, Indian White-eye, Yellow-billed Babbler, Chestnut-tailed Starling, Jungle Myna, Crimson Sunbird

### *Plant & Seed*

- **High (9)** Ruddy Shelduck, Garganey, Northern Shoveler, Northern Pintail, Common Teal, Common Pochard, Demoiselle Crane, Sarus Crane, Common Crane
- **Moderate (11)** Cotton Pygmy Goose, Eurasian Wigeon, Rain Quail, Snow Pigeon, Ashy-crowned Sparrow Lark, Crested Lark, Streaked Weaver, Plain Mountain Finch, Yellow-breasted Greenfinch, Crested Bunting, Grey-necked Bunting
- **Low (17)** Lesser Whistling Duck, Red-crested Pochard, Hill Partridge, Indian Peafowl, Chukar Partridge, Jungle Bush Quail, Rock Pigeon, Chestnut-bellied Sandgrouse, Eurasian Coot, Slaty-headed Parakeet, Baya Weaver, Black-breasted Weaver, Indian Silverbill, Scaly-breasted Munia, White-rumped Munia, Tricoloured Munia, Fire-fronted Serin

### *Vertebrate & Carrion*

- **High (23)** Common Merganser, Great Crested Grebe, Little Tern, Gull-billed Tern, Caspian Tern, Whiskered Tern, Common Tern, Great White Pelican, Osprey, Bearded Vulture, Egyptian Vulture, Red-headed Vulture, White-rumped Vulture, Indian Vulture, Griffon Vulture, Short-toed Snake Eagle, Tawny Eagle, Western Marsh Harrier, Pallid Harrier, Montagu's Harrier, Pallas's Fish Eagle, Common Kestrel, Great Grey Shrike
- **Moderate (16)** Pallas's Gull, Lesser Black-backed Gull, Lesser Crested Tern, Black Stork, Woolly-necked Stork, Black-necked Stork, Spot-billed Pelican, Striated Heron, Black-winged Kite, Cinereous Vulture, Himalayan Vulture, Crested Goshawk, White-bellied Sea Eagle, Brown Fish Owl, Pied Kingfisher, Red-necked Falcon
- **Low (19)** Painted Stork, Little Cormorant, Indian Cormorant, Cinnamon Bittern, Purple Heron, Black-crowned Night Heron, Black-headed Ibis, Oriental Honey Buzzard, Changeable Hawk Eagle, Black Eagle, Greater Spotted Eagle, Booted Eagle, Bonelli's Eagle, Eurasian Sparrowhawk, Black Kite, Brahminy Kite, Lesser Fish Eagle, Common Buzzard, Peregrine Falcon

## HABITAT SPECIALISATIONS

### *Forest*

- **High (5)** Sirkeer Malkoha, Red-headed Vulture, Hoary-throated Barwing, White-bellied Blue Flycatcher, Blue-capped Rock Thrush
- **Moderate (27)** Nilgiri Wood Pigeon, Malabar Imperial Pigeon, White-rumped Spinetail, Brown-backed Needletail, Himalayan Swiftlet, Crested Treeswift, Crested Goshawk, Malabar Trogon, Heart-spotted Woodpecker, White-bellied Woodpecker, Short-billed Minivet, Orange Minivet, Malabar Woodshrike, Large Woodshrike, Lesser Racket-tailed Drongo, White-bellied Treepie, Yellow-browed Tit, Flame-throated Bulbul, Mountain Bulbul, Ashy-throated Warbler, Large-billed Leaf Warbler, Dark-fronted Babbler, Brown-cheeked Fulvetta, White-collared Blackbird, Rusty-tailed Flycatcher, Asian Fairy-bluebird, Orange-bellied Leafbird
- **Low (29)** Hill Partridge, Grey-fronted Green Pigeon, Green Imperial Pigeon, Green-billed Malkoha, Alpine Swift, Changeable Hawk Eagle, Black Eagle, Chestnut-headed Bee-eater, Dollarbird, Great Barbet, Speckled Piculet, Greater Flameback, Red-breasted Parakeet, Scarlet Minivet, Yellow-billed Blue Magpie, Grey Treepie, Jungle Prinia, Chestnut-headed Tesia, Indian Scimitar Babbler, Nepal Fulvetta, Chestnut-crowned Laughingthrush, Red-billed Leiothrix, White-crested Laughingthrush, White-throated Laughingthrush, Chestnut-bellied Nuthatch, Grey-winged Blackbird, Dark-sided Flycatcher, White-rumped Shama, Rufous-bellied Niltava

### *Forest & Plantation*

- **High (5) Ind**ian Vulture, Yellow-crowned Woodpecker, Nilgiri Laughingthrush, Thick-billed Flowerpecker, Forest Wagtail
- **Moderate (21)** Banded Bay Cuckoo, Brown-capped Pygmy Woodpecker, Large Cuckooshrike, Common Woodshrike, White-browed Fantail, White-bellied Drongo, Hair-crested Drongo, Black-headed Jay, Yellow-bellied Fantail, Grey-headed Canary-flycatcher, Yellow-browed Bulbul, Square-tailed Bulbul, Lemon-rumped Warbler, Western Crowned Warbler, Velvet-fronted Nuthatch, Orange-headed Thrush, Indian Blue Robin, Little Pied Flycatcher, Blue-capped Redstart, Crimson-backed Sunbird, Little Spiderhunter
- **Low (36)** Painted Spurfowl, Blue-faced Malkoha, Oriental Honey Buzzard, Jungle Owlet, Oriental Pied Hornbill, Coppersmith Barbet, Lineated Barbet, Grey-capped Pygmy Woodpecker, Lesser Yellownape, Streak-throated Woodpecker, Alexandrine Parakeet, Slaty-headed Parakeet, Small Minivet, Black-winged Cuckooshrike, Black-headed Cuckooshrike, Black-naped Oriole, Black-hooded Oriole, White-throated Fantail, Spot-breasted Fantail, Ashy Drongo, Indian Black-lored Tit, Black-crested Bulbul, Black Bulbul, Hume's Warbler, Black-throated Tit, Puff-throated Babbler, Bar-tailed Treecreeper, Chestnut-tailed Starling, Asian Brown Flycatcher, Brown-breasted Flycatcher, Small Niltava, Verditer Flycatcher, Red-breasted Flycatcher, Fire-breasted Flowerpecker, Scarlet-backed Flowerpecker, Jerdon's Leafbird

### *Grassland & Scrub*

- **High (5)** Indian Courser, Pallid Harrier, Montagu's Harrier, Great Grey Shrike, Isabelline Wheatear
- **Moderate (4)** Rufous-fronted Prinia, Rufous Babbler, Long-billed Pipit, Grey-necked Bunting
- **Low (4)** Jungle Bush Quail, Himalayan Prinia, Tricoloured Munia, Chestnut-bellied Sandgrouse

### *Open Habitat*

- **High (17)** Eurasian Crag Martin, Demoiselle Crane, Common Crane, Little Ringed Plover, Egyptian Vulture, Griffon Vulture, Short-toed Snake Eagle, Tawny Eagle, Western Marsh Harrier, Common Kestrel, Isabelline Shrike, Rufous-tailed Lark, Oriental Skylark, Wallcreeper, Desert Wheatear, Variable Wheatear, Tawny Pipit
- **Moderate (15)** Snow Pigeon, Plain Mountain Finch, Rain Quail, Woolly-necked Stork, Black-winged Kite, Cinereous Vulture, Indian Roller, Red-necked Falcon, Ashy-crowned Sparrow Lark, Indian Bushlark, Greater Short-toed Lark, Sand Lark, Crested Lark, Malabar Lark, Common Babbler
- **Low (13)** Chukar Partridge, Yellow-wattled Lapwing, Greater Spotted Eagle, Blue-tailed Bee-eater, Indochinese Roller, Peregrine Falcon, Bay-backed Shrike, Jerdon's Bushlark, Zitting Cisticola, Booted Warbler, Pied Bushchat, Indian Silverbill, Paddyfield Pipit

### *Wetland*

- **High (44)** Ruddy Shelduck, Garganey, Northern Shoveler, Northern Pintail, Common Teal, Common Pochard, Tufted Duck, Common Merganser, Greater Flamingo, Great Crested Grebe, Sarus Crane, Great Thick-knee, Pied Avocet, Grey Plover, Lesser Sand Plover, Kentish Plover, Eurasian Curlew, Black-tailed Godwit, Ruff, Curlew Sandpiper, Dunlin, Little Stint, Pintail Snipe, Terek Sandpiper, Spotted Redshank, Common Greenshank, Marsh Sandpiper, Common Redshank, Slender-billed Gull, Black-headed Gull, Brown-headed Gull, Little Tern, Gull-billed Tern, Caspian Tern, Whiskered Tern, Common Tern, Great White Pelican, Western Reef Egret, Eurasian Spoonbill, Osprey, Pallas's Fish Eagle, Black-capped Kingfisher, Brown Dipper, Plumbeous Water Redstart
- **Moderate (22)** Cotton Pygmy Goose, Eurasian Wigeon, Pacific Golden Plover, White-tailed Lapwing, Whimbrel, Temminck's Stint, Common Sandpiper, Small Pratincole, Pallas's Gull, Lesser Black-backed Gull, River Tern, Lesser Crested Tern, Black Stork, Black-necked Stork, Spot-billed Pelican, Striated Heron, White-bellied Sea Eagle, Crested Kingfisher, Pied Kingfisher, Grey-throated Martin, Streaked Weaver, White Wagtail
- **Low (24)** Lesser Whistling Duck, Red-crested Pochard, Lesser Coucal, Common Moorhen, Eurasian Coot, Grey-headed Swamphen, Grey-headed Lapwing, Green Sandpiper, Asian Openbill, Painted Stork, Little Cormorant, Indian Cormorant, Cinnamon Bittern, Purple Heron, Great Egret, Intermediate Egret, Black-crowned Night Heron, Glossy Ibis, Black-headed Ibis, Brahminy Kite, Lesser Fish Eagle, Yellow-bellied Prinia, Striated Grassbird, Black-breasted Weaver

### *No Specialisation*

- **High (7)** Bearded Vulture, White-rumped Vulture, Sulphur-bellied Warbler, Bank Myna, Rufous-gorgeted Flycatcher, Blue Rock Thrush, Olive-backed Pipit
- **Moderate (15)** Himalayan Vulture, Brown Fish Owl, Eurasian Hoopoe, Thick-billed Warbler, Dusky Crag Martin, Common Starling, Rosy Starling, Malabar Whistling Thrush, Blue-fronted Redstart, Black Redstart, Rufous-breasted Accentor, Grey Wagtail, Tree Pipit, Yellow-breasted Greenfinch, Crested Bunting
- **Low (45)** Indian Peafowl, Rock Pigeon, Yellow-footed Green Pigeon, Greater Coucal, Asian Koel, Grey-bellied Cuckoo, Little Swift, White-breasted Waterhen, Indian Pond Heron, Red-naped Ibis, Booted Eagle, Bonelli's Eagle, Eurasian Sparrowhawk, Black Kite, Common Buzzard, Indian Grey Hornbill, Green Bee-eater, Brown-headed Barbet, Black-rumped Flameback, Red-billed Blue Magpie, Green-backed Tit, Cinereous Tit, Common Tailorbird, Ashy Prinia, Plain Prinia, Blyth's Reed Warbler, Wire-tailed Swallow, Red-rumped Swallow, White-eared Bulbul, Himalayan Bulbul, Tickell's Leaf Warbler, Yellow-eyed Babbler, Indian White-eye, Yellow-billed Babbler, Jungle Myna, Indian Robin, Blue Whistling Thrush, Grey Bushchat, Brown Rock Chat, Purple Sunbird, Crimson Sunbird, Baya Weaver, Scaly-breasted Munia, White-rumped Munia, Fire-fronted Serin

## ENDEMIC REGIONS

### *Himalaya*

- **High (1)** Hoary-throated Barwing
- **Moderate (3)** White-collared Blackbird, Yellow-breasted Greenfinch, Black-headed Jay
- **Low (4)** Hill Partridge, Yellow-billed Blue Magpie, Himalayan Bulbul, Chestnut-crowned Laughingthrush

### *Indian Subcontinent*

- **High (5)** Sirkeer Malkoha, Indian Courser, Indian Vulture, Rufous-tailed Lark, Bank Myna
- **Moderate (11)** White-rumped Spinetail, Malabar Trogon, Brown-capped Pygmy Woodpecker, Orange Minivet, White-bellied Drongo, Ashy-crowned Sparrow Lark, Indian Bushlark, Rufous-fronted Prinia, Common Babbler, Malabar Lark, Malabar Whistling Thrush
- **Low (25)** Indian Peafowl, Jungle Bush Quail, Blue-faced Malkoha, Grey-bellied Cuckoo, Yellow-wattled Lapwing, Red-naped Ibis, Jungle Owlet, Indian Grey Hornbill, Brown-headed Barbet, Black-rumped Flameback, Slaty-headed Parakeet, Black-headed Cuckooshrike, Jerdon's Bushlark, Jungle Prinia, Ashy Prinia, Yellow-billed Babbler, Indian Robin, Brown Rock Chat, Jerdon's Leafbird, Black-breasted Weaver, Tricoloured Munia, Painted Spurfowl, Spot-breasted Fantail, Indian Black-lored Tit, Indian Scimitar Babbler

### *Non-endemic*

- **High (75)** Ruddy Shelduck, Garganey, Northern Shoveler, Northern Pintail, Common Teal, Common Pochard, Tufted Duck, Common Merganser, Greater Flamingo, Great Crested Grebe, Demoiselle Crane, Sarus Crane, Common Crane, Great Thick-knee, Pied Avocet, Grey Plover, Lesser Sand Plover, Kentish Plover, Little Ringed Plover, Eurasian Curlew, Black-tailed Godwit, Ruff, Curlew Sandpiper, Dunlin, Little Stint, Pintail Snipe, Terek Sandpiper, Spotted Redshank, Common Greenshank, Marsh Sandpiper, Common Redshank, Slender-billed Gull, Black-headed Gull, Brown-headed Gull, Little Tern, Gull-billed Tern, Caspian Tern, Whiskered Tern, Common Tern, Great White Pelican, Western Reef Egret, Eurasian Spoonbill, Osprey, Bearded Vulture, Egyptian Vulture, Red-headed Vulture, White-rumped Vulture, Griffon Vulture, Short-toed Snake Eagle, Tawny Eagle, Western Marsh Harrier, Pallid Harrier, Montagu's Harrier, Pallas's Fish Eagle, Black-capped Kingfisher, Yellow-crowned Woodpecker, Common Kestrel, Isabelline Shrike, Great Grey Shrike, Oriental Skylark, Eurasian Crag Martin, Sulphur-bellied Warbler, Wallcreeper, Brown Dipper, Rufous-gorgeted Flycatcher, Plumbeous Water Redstart, Blue-capped Rock Thrush, Blue Rock Thrush, Isabelline Wheatear, Desert Wheatear, Variable Wheatear, Thick-billed Flowerpecker, Forest Wagtail, Tawny Pipit, Olive-backed Pipit
- **Moderate (80)** Cotton Pygmy Goose, Eurasian Wigeon, Rain Quail, Snow Pigeon, Banded Bay Cuckoo, Brown-backed Needletail, Himalayan Swiftlet, Crested Treeswift, Pacific Golden Plover, White-tailed Lapwing, Whimbrel, Temminck's Stint, Common Sandpiper, Small Pratincole, Pallas's Gull, Lesser Black-backed Gull, River Tern, Lesser Crested Tern, Black Stork,

Woolly-necked Stork, Black-necked Stork, Spot-billed Pelican, Striated Heron, Black-winged Kite, Cinereous Vulture, Himalayan Vulture, Crested Goshawk, White-bellied Sea Eagle, Brown Fish Owl, Eurasian Hoopoe, Crested Kingfisher, Pied Kingfisher, Indian Roller, Heart-spotted Woodpecker, White-bellied Woodpecker, Red-necked Falcon, Short-billed Minivet, Large Cuckooshrike, Large Woodshrike, Common Woodshrike, White-browed Fantail, Lesser Racket-tailed Drongo, Hair-crested Drongo, Yellow-bellied Fantail, Grey-headed Canary-flycatcher, Yellow-browed Tit, Greater Short-toed Lark, Sand Lark, Crested Lark, Thick-billed Warbler, Grey-throated Martin, Dusky Crag Martin, Mountain Bulbul, Ashy-throated Warbler, Lemon-rumped Warbler, Large-billed Leaf Warbler, Western Crowned Warbler, Brown-cheeked Fulvetta, Velvet-fronted Nuthatch, Common Starling, Rosy Starling, Orange-headed Thrush, Indian Blue Robin, Little Pied Flycatcher, Rusty-tailed Flycatcher, Blue-fronted Redstart, Blue-capped Redstart, Black Redstart, Little Spiderhunter, Asian Fairy-bluebird, Orange-bellied Leafbird, Streaked Weaver, Rufous-breasted Accentor, Grey Wagtail, White Wagtail, Long-billed Pipit, Tree Pipit, Plain Mountain Finch, Crested Bunting, Grey-necked Bunting

- **Low (121)** Lesser Whistling Duck, Red-crested Pochard, Chukar Partridge, Rock Pigeon, Yellow-footed Green Pigeon, Green Imperial Pigeon, Chestnut-bellied Sandgrouse, Greater Coucal, Lesser Coucal, Green-billed Malkoha, Asian Koel, Alpine Swift, Little Swift, Common Moorhen, Eurasian Coot, Grey-headed Swamphen, White-breasted Waterhen, Grey-headed Lapwing, Green Sandpiper, Asian Openbill, Painted Stork, Little Cormorant, Indian Cormorant, Cinnamon Bittern, Purple Heron, Great Egret, Intermediate Egret, Indian Pond Heron, Black-crowned Night Heron, Glossy Ibis, Black-headed Ibis, Oriental Honey Buzzard, Changeable Hawk Eagle, Black Eagle, Greater Spotted Eagle, Booted Eagle, Bonelli's Eagle, Eurasian Sparrowhawk, Black Kite, Brahminy Kite, Lesser Fish Eagle, Common Buzzard, Oriental Pied Hornbill, Green Bee-eater, Blue-tailed Bee-eater, Chestnut-headed Bee-eater, Indochinese Roller, Dollarbird, Coppersmith Barbet, Great Barbet, Lineated Barbet, Speckled Piculet, Grey-capped Pygmy Woodpecker, Greater Flameback, Lesser Yellownape, Streak-throated Woodpecker, Peregrine Falcon, Alexandrine Parakeet, Red-breasted Parakeet, Small Minivet, Scarlet Minivet, Black-winged Cuckooshrike, Black-naped Oriole, Black-hooded Oriole, White-throated Fantail, Ashy Drongo, Bay-backed Shrike, Red-billed Blue Magpie, Grey Treepie, Green-backed Tit, Cinereous Tit, Common Tailorbird, Himalayan Prinia, Yellow-bellied Prinia, Plain Prinia, Zitting Cisticola, Booted Warbler, Blyth's Reed Warbler, Striated Grassbird, Wire-tailed Swallow, Red-rumped Swallow, Black-crested Bulbul, White-eared Bulbul, Black Bulbul, Hume's Warbler, Tickell's Leaf Warbler, Chestnut-headed Tesia, Black-throated Tit, Yellow-eyed Babbler, Indian White-eye, Puff-throated Babbler, Nepal Fulvetta, Red-billed Leiothrix, White-crested Laughingthrush, White-throated Laughingthrush, Chestnut-bellied Nuthatch, Bar-tailed Treecreeper, Chestnut-tailed Starling, Jungle Myna, Grey-winged Blackbird, Dark-sided Flycatcher, Asian Brown Flycatcher, Brown-breasted Flycatcher, White-rumped Shama, Small Niltava, Rufous-bellied Niltava, Verditer Flycatcher, Blue Whistling Thrush, Red-breasted Flycatcher, Pied Bushchat, Grey Bushchat, Fire-breasted Flowerpecker, Scarlet-backed Flowerpecker, Purple Sunbird, Crimson Sunbird, Baya Weaver, Indian Silverbill, Scaly-breasted Munia, White-rumped Munia, Paddyfield Pipit, Fire-fronted Serin

### *Western Ghats & Sri Lanka*

- **High (2)** Nilgiri Laughingthrush, White-bellied Blue Flycatcher
- **Moderate (10)** Nilgiri Wood Pigeon, Malabar Imperial Pigeon, Malabar Woodshrike, White-bellied Treepie, Flame-throated Bulbul, Rufous Babbler, Crimson-backed Sunbird, Yellow-browed Bulbul, Square-tailed Bulbul, Dark-fronted Babbler
- **Low (1)** Grey-fronted Green Pigeon

## SHOREBIRD MIGRATORY BEHAVIOURS

### *Arctic Migrant*

- **High (5)** Grey Plover, Curlew Sandpiper, Dunlin, Little Stint, Terek Sandpiper
- **Moderate (3)** Pacific Golden Plover, Whimbrel, Temminck's Stint
- **Low (0)**

*Near Resident or Palearctic Migrant*

- **High (14)** Great Thick-knee, Pied Avocet, Lesser Sand Plover, Kentish Plover, Little Ringed Plover, Eurasian Curlew, Black-tailed Godwit, Ruff, Pintail Snipe, Spotted Redshank, Common Greenshank, Marsh Sandpiper, Common Redshank, Indian Courser
- **Moderate (3)** White-tailed Lapwing, Common Sandpiper, Small Pratincole
- **Low (2)** Grey-headed Lapwing, Green Sandpiper

## RAPTOR HABITAT SPECIALISATIONS

*Forest & Plantation*

- **High (2)** Indian Vulture, Red-headed Vulture
- **Moderate (1)** Crested Goshawk
- **Low (3)** Oriental Honey Buzzard, Changeable Hawk Eagle, Black Eagle

*Open Habitat*

- **High (10)** Osprey, Pallas's Fish Eagle, Egyptian Vulture, Griffon Vulture, Short-toed Snake Eagle, Tawny Eagle, Western Marsh Harrier, Pallid Harrier, Montagu's Harrier, Common Kestrel
- **Moderate (4)** White-bellied Sea Eagle, Black-winged Kite, Cinereous Vulture, Red-necked Falcon
- **Low (4)** Brahminy Kite, Lesser Fish Eagle, Greater Spotted Eagle, Peregrine Falcon

*No Specialisation*

- **High (2)** Bearded Vulture, White-rumped Vulture
- **Moderate (1)** Himalayan Vulture
- **Low (5)** Booted Eagle, Bonelli's Eagle, Eurasian Sparrowhawk, Black Kite, Common Buzzard

# SIMILAR SPECIES THAT ARE COMBINED *in* SoIB

- Greenish and Green Warbler, Siberian and Amur Stonechat, Little and Red-necked Stint, Western and Eastern Yellow Wagtail, Common and Himalayan Buzzard, Western and Eastern Marsh Harrier, Lesser and Greater Sand Plover, Spotted and Baikal Bush Warbler, Lemon-rumped Warbler and Sichuan Leaf Warbler, Red-rumped and Striated Swallow, Grey-throated and Pale Martin, Greater and Mongolian Short-toed Lark, Red-breasted and Taiga Flycatcher, Tricoloured and Chestnut Munia, Little and House Swift, Pintail and Swinhoe's Snipe, Booted and Sykes's Warbler

# SoIB SPECIES NOT RECOGNISED *by* IUCN

- Blyth's Swift, Grey-headed Swamphen, Legge's Hawk Eagle, Scarlet Minivet, Delicate Prinia, Hill Swallow, Cachar Bulbul, Malabar Starling, Nilgiri Thrush, Indian Blackbird, Andaman Flowerpecker, and Blyth's Rosefinch

# REFERENCES


1. IUCN (2023). *The IUCN Red List of Threatened Species. Version 2022-2*.
2. WWF (2022). *Living Planet Report 2022—Building a nature-positive society*. (Eds. Almond, R. E. A., Grooten, M., Juffe Bignoli, D., et al.). Pp. 115. WWF, Gland, Switzerland.
3. BirdLife International (2022). *State of the World's Birds 2022: Insights and solutions for the biodiversity crisis*. Pp. 87. BirdLife International, Cambridge, UK.
4. Rosenberg, K. V., Dokter, A. M., Blancher, P. J., et al. (2019). Decline of the North American avifauna. *Science* **366** (6461), 120–124.
5. Rigal, S., Dakos, V., Alonso, H., et al. (2023). Farmland practices are driving bird population decline across Europe. *Proceedings of the National Academy of Sciences* **120** (21), e2216573120.
6. SoIB (2020). *State of India's Birds, 2020: Range, trends and conservation status.* Pp. 50. The SoIB Partnership.
7. Sullivan, B. L., Aycrigg, J. L., Barry, J. H., et al. (2014). The eBird enterprise: An integrated approach to development and application of citizen science. *Biological Conservation* **169**, 31–40.
8. Madhusudan, M. D., & Vanak, A. T. (2022). Mapping the distribution and extent of India's semi-arid open natural ecosystems. *Journal of Biogeography* **50** (8), 1377–1387.
9. Lele, A., Arasumani, M., Vishnudas, C. K., et al. (2020). Elevation and landscape change drive the distribution of a montane, endemic grassland bird. *Ecology and Evolution* **10** (14), 7755–7767.
10. Anon. (2010). *A Species Recovery Plan for Jerdon's Courser* Rhinoptilus bitorquatus. Pp. 1–30. Andhra Pradesh Forest Department, Government of Andhra Pradesh, Hyderabad.
11. Shaikh, P. A. (2020). *Status and distribution of Indian Skimmer* Rynchops albicollis *in India, with focus on breeding population in the National Chambal Sanctuary*, India. Pp. 28.
12. Balachandran, S., Katti, T., & Manakadan, R. (2018). *Indian bird migration atlas*. Pp. 216. Bombay Natural History Society & Oxford University Press, Mumbai.
13. Ramsar (2022). *Ramsar Information Sheet for Site no. 2481, Pallikaranai Marsh Reserve Forest, India*.
14. Silambarasan, K., & Sundaramanickam, A. (2017). Assessment of Anthropogenic Threats to the Biological Resources of Kaliveli Lake, India: A Coastal Wetland. in *Coastal Wetlands: Alteration and Remediation* (Eds. Finkl, C. W. & Makowski, C.). Pp. 393–409. Springer International Publishing, Cham. doi:10.1007/978-3-319-56179-0_12.
15. Pain, D. J., Bowden, C. G. R., Cunningham, A. A., et al. (2008). The race to prevent the extinction of South Asian vultures. *Bird Conservation International* **18** (S1), S30–S48.
16. Prakash, V., Galligan, T. H., Chakraborty, S. S., et al. (2019). Recent changes in populations of Critically Endangered *Gyps* vultures in India. *Bird Conservation International* **29** (1), 55–70.
17. Frank, E., & Sudarshan, A. (2023). The Social Costs of Keystone Species Collapse: Evidence from the Decline of Vultures in India. University of Chicago, Becker Friedman Institute for Economics Working Paper No. 2022-165 at https://doi.org/10.2139/ssrn.4318579.
18. MoEFCC (2020). *Action Plan for Vulture Conservation in India 2020-2025*. Pp. 96. Ministry of Environment, Forest and Climate Change, Government of India.
19. 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.
20. Kumar, S., Periyasamy, A., Ranga Rao, N. V., et al. (2019). Multiple infestations of gastrointestinal parasites – Probable cause for high mortality of Spot-billed Pelican (*Pelecanus philippensis*) at Kokrebellur Community Reserve, India. *International Journal for Parasitology: Parasites and Wildlife* **9**, 68–73.
21. Menon, T., & Shahabuddin, G. (2021). Assessing woodpeckers as indicators of bird diversity and habitat structure in managed forests. *Biodiversity and Conservation* **30** (6), 1689–1704.
22. Shahabuddin, G., Menon, T., Chanda, R., et al. (2018). Ecology of Rufous-bellied Woodpecker *Dendrocopos hyperythrus* in Himalayan oak forests. *Forktail* **34**, 58–64.

23. Kumar, R., Shahabuddin, G., & Kumar, A. (2011). How good are managed forests at conserving native woodpecker communities? A study in sub-Himalayan dipterocarp forests of northwest India. *Biological Conservation* **144** (6), 1876–1884.

24. Santharam, V. (2003). Distribution, ecology and conservation of the White-bellied Woodpecker *Dryocopus javensis* in the Western Ghats, India. *Forktail* **19**, 31–38.

25. Kumar, R., & Shahabuddin, G. (2012). Assessing the status and distribution of the Great Slaty Woodpecker *Mulleripicus pulverulentus* (Temminck 1826) in sub-Himalayan Uttarakhand, India. *Journal of Bombay Natural History Society* **109** (2), 17–22.

26. Dutta, S., Narwade, S., Bipin, C. M., et al. (2018). *Status of the Lesser Florican* Sypheotides indicus *and implications for its conservation*. Pp. 112. Wildlife Institute of India, Dehradun.

27. Uddin, M., Dutta, S., Kolipakam, V., et al. (2021). High bird mortality due to power lines invokes urgent environmental mitigation in a tropical desert. *Biological Conservation* **261**, 109262.

28. Dutta, S., Rahmani, A., Gautam, P., et al. (2013). *Guidelines for State Action Plan for Resident Bustards' Recovery Programme*. Pp. 67. Ministry of Environment and Forests, Government of India, New Delhi.

29. Rahmani, A. R., Narayan, G., Rosalind, L., et al. (1988). *Bengal florican* Houbaropsis bengalensis. *Status and ecology*. Bombay Natural History Society, Bombay.

30. Rahmani, A. R. (1989). *The Great Indian Bustard*. Pp. 234. Final report; Bombay Natural History Society.

31. Sankaran, R. (1991). Some aspects of the breeding behaviour of the Lesser Florican *Sypheotides indica* (JF Miller) and the Bengal Florican *Houbaropsis bengalensis* (Gmelin). PhD Thesis. University of Bombay.

32. Wetlands International (2023). Waterbird Populations Portal. Retrieved from https://wpp.wetlands.org/ (accessed on 16 June 2023).

33. Balachandran, S., Pattnaik, A. K., Gangaiamaran, P., et al. (2020). Avifauna of Chilika, Odisha: Assessment of Spatial and Temporal Changes. in *Ecology, Conservation, and Restoration of Chilika Lagoon, India* (Eds. Finlayson, C. M., Rastogi, G., Mishra, D. R., et al.). Pp. 335–363. Springer International Publishing, Cham. doi:10.1007/978-3-030-33424-6_13.

34. IWC (2023). International Waterbird Census Database. Available at: https://iwc.wetlands.org/ (accessed on 13 July 2023).

35. BirdLife International (2023). Species factsheet: *Anas albogularis*. Available at: http://datazone.birdlife.org/species/factsheet/andaman-teal-anas-albogularis (accessed on 26 July 2023).

36. Rajan, P., & Pramod, P. (2017). Bird community response to Tsunami-affected wetlands of South Andaman Island, India. *Indian Birds* **13** (5), 125–131.

37. Rahmani, A. R. (2012). *Threatened Birds of India: Their Conservation Requirements*. Pp. 864. Oxford University Press, Delhi.

38. Sheth, C., Datta, A., & Parashuram, D. (2020). Persistent loss of biologically-rich tropical forests in the Indian Eastern Himalaya. *Silva Fennica* **54** (3), 16.

39. Kurup, B. M., & Ranjeet, K. (2002). Integration of freshwater prawn culture with rice farming in Kuttanad, India. *Naga Worldfish Center Quarterly* **25** (3–4), 16–19.

40. Raman, T. R. S., Suryawanshi, K. R., & Mishra, C. (2017). Birds in Relation to Farming and Livestock Grazing in the Indian Trans-Himalayas. in *Bird Migration across the Himalayas: Wetland Functioning amidst Mountains and Glaciers* (Eds. Prins, H. H. T. & Namgail, T.). Pp. 359–372. Cambridge University Press, Cambridge. doi:10.1017/9781316335420.027.

41. Bharadwaj, A., Mhamane, S., Bangal, P., et al. (2022). Assessment of long-term trends in a threatened grassland bird community using daily bird lists. bioRxiv. Pp. 2022.10.31.514489. Preprint at https://doi.org/10.1101/2022.10.31.514489.

42. Raman, T. R. S., Gonsalves, C., Jeganathan, P., et al. (2021). Native shade trees aid bird conservation in tea plantations in southern India. *Current Science* **121** (2), 294–305.

43. Srinivasan, U., Velho, N., Lee, J. S. H., et al. (2021). Oil palm cultivation can be expanded while sparing biodiversity in India. *Nature Food* **2** (6), 442–447.

44. Mandal, J., & Raman, T. R. S. (2016). Shifting agriculture supports more tropical forest birds than oil palm or teak plantations in Mizoram, northeast India. *The Condor* **118** (2), 345–359.

45. Shahabuddin, G., Goswami, R., Krishnadas, M., et al. (2021). Decline in forest bird species and guilds due to land use change in the Western Himalaya. *Global Ecology and Conservation* **25**, e01447.

46. Prakash, V., Green, R. E., Rahmani, A. R., et al. (2005). Evidence to support that diclofenac caused catastrophic vulture population decline. *Current Science* **88** (10), 1533–1534.

47. Muralidharan, S., Dhananjayan, V., & Jayakumar, R. (2004). Environmental contaminants in a few species of raptorial birds in India. Presented at Workshop on Current Status of Vultures in Gujarat. Bird Conservation Society, Gujarat, Gujarat.

48. Varagiya, D., Jethva, B., & Pandya, D. (2022). Feather heavy metal contamination in various species of waterbirds from Asia: a review. *Environmental Monitoring and Assessment* **194** (1), 26.

49. Anbazhagan, V., Partheeban, E. C., Arumugam, G., et al. (2021). Avian feathers as a biomonitoring tool to assess heavy metal pollution in a wildlife and bird sanctuary from a tropical coastal ecosystem. *Environmental Science and Pollution Research* **28** (28), 38263–38273.

50. Pandiyan, J., Poiyamozhi, A., Mahboob, S., et al. (2022). Assessment of the Toxic Effects of Heavy Metals on Waterbirds and Their Prey Species in Freshwater Habitats. *Toxics* **10** (11), 641.

51. FAO & UNEP (2020). *The State of the World's Forests 2020: Forests, biodiversity and people*. Pp. 214. FAO & UNEP, Rome, Italy. doi:10.4060/ca8642en.

52. Rupavath, P. (2022). [Analysis] Indian forests around the size of Nagaland, thinned down in two years. *Mongabay-India*. Available at: https://india.mongabay.com/2022/01/analysis-indian-forests-around-the-size-of-nagaland-thinned-down-in-two-years/ (accessed on 26 July 2023).

53. Mundial, B. (2006). *Unlocking opportunities for forest-dependent people in India*. Pp. 107. Grant Milne, WB Report, 34481-IN.

54. Kaushik, M. (2016). Influence of extractive disturbances on forest bird communities in Shiwalik landscape, India. PhD Thesis. Saurashtra University, Rajkot, Gujarat.

55. Shahabuddin, G., & Kumar, R. (2007). Effects of extractive disturbance on bird assemblages, vegetation structure and floristics in tropical scrub forest, Sariska Tiger Reserve, India. *Forest Ecology and Management* **246** (2–3), 175–185.

56. Menon, T., Sridhar, H., & Shahabuddin, G. (2019). Effects of extractive use on forest birds in Western Himalayas: Role of local and landscape factors. *Forest Ecology and Management* **448**, 457–465.

57. Barhadiya, G., Sultana, A., Khudsar, F. A., et al. (2022). Is there any impact of non-native vegetation on bird communities in Delhi, India? *Tropical Ecology* **63** (1), 49–60.

58. UN DESA (2019). *World Urbanization Prospects: The 2018 Revision (ST/ESA/SER.A/420)*. Pp. 103. United Nations, New York.

59. Kaushik, M., Tiwari, S., & Manisha, K. (2022). Habitat patch size and tree species richness shape the bird community in urban green spaces of rapidly urbanizing Himalayan foothill region of India. *Urban Ecosystems* **25**, 423–436.

60. Khera, N., Mehta, V., & Sabata, B. C. (2009). Interrelationship of birds and habitat features in urban greenspaces in Delhi, India. *Urban Forestry & Urban Greening* **8** (3), 187–196.

61. Pal, M., Pop, P., Mahapatra, A., et al. (2019). Diversity and structure of bird assemblages along urban-rural gradient in Kolkata, India. *Urban Forestry & Urban Greening* **38**, 84–96.

62. Tiwary, N. K., & Urfi, A. J. (2016). Spatial variations of bird occupancy in Delhi: The significance of woodland habitat patches in urban centres. *Urban Forestry & Urban Greening* **20**, 338–347.

63. Chakravarty, S., & Somanathan, E. (2020). Is land a constraint for Modi govt's ambitious expansion programme for renewables? *Financial Express*.

64. Kumar, S. R., Anoop, V., Arun, P. R., et al. (2019). Avian mortalities from two wind farms at Kutch, Gujarat and Davangere, Karnataka, India. *Current Science* **116** (9), 1587–1592.

65. Kumar, S. R., Arun, P. R., & Ali, A. M. S. (2022). Effects of wind farm on land bird composition at Kachchh District, Gujarat, India. *Journal of Threatened Taxa* **14** (9), 21826–21835.

66. Thaker, M., Zambre, A., & Bhosale, H. (2018). Wind farms have cascading impacts on ecosystems across trophic levels. *Nature Ecology & Evolution* **2** (12), 1854–1858.

67. Ross, R. (1911). *The prevention of malaria*. Pp. 669. Murray, London, UK.

68. Ishtiaq, F., Gering, E., Rappole, J. H., et al. (2007). Prevalence and diversity of avian haematozoan parasites in Asia: A regional survey. *Journal of Wildlife Diseases* **43** (3), 382–398.

69. Ishtiaq, F., Bowden, C. G. R., & Jhala, Y. V. (2017). Seasonal dynamics in mosquito abundance and temperature do not influence avian malaria prevalence in the Himalayan foothills. *Ecology and Evolution* **7** (19), 8040–8057.

70. Gupta, P., Vishnudas, C. K., Ramakrishnan, U., et al. (2019). Geographical and host species barriers differentially affect generalist and specialist parasite community structure in a tropical sky-island archipelago. *Proceedings of the Royal Society B: Biological Sciences* **286** (1904), 20190439.

71. Menzies, R. K., Borah, J. R., Srinivasan, U., et al. (2021). The effect of habitat quality on the blood parasite assemblage in understorey avian insectivores in the Eastern Himalaya, India. *Ibis* **163** (3), 962–976.

72. Mozaffer, F., Menon, G. I., & Ishtiaq, F. (2022). Exploring the thermal limits of malaria transmission in the western Himalaya. *Ecology and Evolution* **12** (9), e9278.

73. BirdLife International (2018). *State of the World's Birds: Taking the pulse of the planet*. Pp. 76. BirdLife International, Cambridge, UK.

74. Buhnerkempe, M. G., Roberts, M. G., Dobson, A. P., et al. (2015). Eight challenges in modelling disease ecology in multi-host, multi-agent systems. *Epidemics* **10**, 26–30.

75. Inskipp, T. (1983). The Indian bird trade. *TRAFFIC Bulletin* **5**, 26–46.

76. Ahmed, A. (1997). Live bird trade in northern India. *TRAFFIC-India*.

77. Mendis, A., Mohan, N. V., Sengottuvel, R. R., et al. (2021). *Media-Reported Wildlife Poaching and Illegal Trade in India: 2020*. Pp. 1–83. Wildlife Conservation Society, India, Karnataka, India. doi:10.19121/2021.Report.40773.

78. Wyatt, T., Maher, J., Allen, D., et al. (2022). The welfare of wildlife: an interdisciplinary analysis of harm in the legal and illegal wildlife trades and possible ways forward. *Crime, Law and Social Change* **77** (1), 69–89.

79. Jirinec, V., Burner, R. C., Amaral, B. R., et al. (2021). Morphological consequences of climate change for resident birds in intact Amazonian rainforest. *Science Advances* **7** (46), eabk1743.

80. Samplonius, J. M., & Both, C. (2019). Climate change may affect fatal competition between two bird species. *Current Biology* **29** (2), 327–331.

81. Freeman, B. G., Scholer, M. N., Ruiz-Gutierrez, V., et al. (2018). Climate change causes upslope shifts and mountaintop extirpations in a tropical bird community. *Proceedings of the National Academy of Sciences* **115** (47), 11982–11987.

82. Szabo, J. K., & Mundkur, T. (2017). Conserving Wetlands for Migratory Waterbirds in South Asia. in *Wetland Science: Perspectives From South Asia* (Eds. Prusty, B. A. K., Chandra, R. & Azeez, P. A.). Pp. 105–127. Springer India, New Delhi. doi:10.1007/978-81-322-3715-0_6.

83. Mundkur, T., Ananzeh, A., Chaudhary, A., et al. (2023). *Central Asian Flyway Situation Analysis: Status of migratory birds and their habitats and recommendations for their conservation*. BirdLife International, Cambridge.

84. Wetlands International (2018). *Guidance on waterbird monitoring methodology: Field Protocol for waterbird counting*. Wetlands International, Ede, Netherlands.

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## *Methodology*

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## *Textual Content*

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**Overall report**
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## Data Sources and Contributors

Bird data from over 30,000 birdwatchers uploaded to eBird (ebird.org/india) and curated by over 200 volunteer editors (who are listed at ebird.org/india/about). Geospatial information from WorldCover 10 m v200 land cover map for 2021 by the European Space Agency (doi.org/10.5281/zenodo.7254221), Natural Earth vector map data at naturalearthdata.com, and Central Asian Flyway Situation Analysis report[83].

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## Photo Credits

**Abhijit Mishra:** Lesser Sand Plover (p100). **Abhishek Das:** Baillon's Crake (p57, p100); Common Teal (p100). **Albin Jacob:** River Tern (p34); Eurasian Curlew (p36); Brown-capped Pygmy Woodpecker (p46); Kentish Plover (p56, p100); White-rumped Shama, Small Minivet, Spot-breasted Fantail (p57). **Aparajita Datta:** Rufous-necked Hornbill, Wreathed Hornbill (p42). **Arpit Bansal:** Indian Skimmer (p34); Lesser Florican (p48). **Aseem Kothiala:** Bengal Florican (p48); Alexandrine Parakeet (p56). **Bhaarat Vyas:** Curlew Sandpiper (p36); Common Pochard (p50); Sarus Crane, Sirkeer Malkoha (p56); Marsh Sandpiper, Garganey (p100). **Hari K Patibanda:** Yellow-crowned Woodpecker (p46). **Novelkumar MS:** Terek Sandpiper, Little Ringed Plover, Common Sandpiper (p100); Blue Rock Thrush (p57, p100). **Rahul Singh:** Common Crane (p56); Rosy Starling (p57); Indian Roller (p100). **Renuka Vijayaraghavan:** Forest Wagtail (p56, p100); Nilgiri Sholakili (p101). **Rofikul Islam:** Baer's Pochard (p50). **Saswat Mishra:** Black-bellied Tern (p34); Black-capped Kingfisher (p56). **Subhadra Devi:** Great Knot (p36); Great Hornbill (p42); White-bellied Woodpecker (p46); Great Indian Bustard (p48); Pied Kingfisher (p56); Spot-winged Starling (p57, p100); Northern Shoveler, Great Grey Shrike (p100). **Sudip Simha:** Grey Wagtail (p57); Andaman Teal (p50). Vivek Chandran: Ashambu Laughingthrush (p101).

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