

BACKGROUND



OTTO PFISTER

More than 1,200 species of birds are found in India, including some spectacular species such as the Bar-headed Goose *Anser indicus*

INDIA: GENERAL INFORMATION

India is situated between latitudes 8° 4' and 37° N, and longitudes 68° 7' and 97° 25' E, and is bounded on the southwest by the Arabian Sea and on the southeast by the Bay of Bengal. To the north and northeast lies the mighty Himalayan range. To the west lies Pakistan and to the east, Bangladesh and Myanmar. In the north, Tibet, China, Nepal, and Bhutan share international boundaries with India. To the south Sri Lanka shares the maritime boundary and is separated from India by a narrow channel of the Bay of Bengal formed by the Palk Strait and the Gulf of Mannar (Mathew 2003).

India is one of the largest countries of the world and covers an area of about 3,287,263 sq. km. It extends 3,214 km from north to south and 2,933 km from east to west, with a land frontier of 15,200 km and a 7,516 km coastline. Mountain ranges such as the Himalaya in the north, the Aravallis in the west, the central highlands of the Vindhya and Satpura ranges and the Eastern and Western Ghats in the eastern and western parts of the peninsula, comprise several submontane tracts of varied lengths and heights that support diverse flora and fauna.

India is a vast country with varied climatic conditions. It has three climatic seasons in a year: monsoons (June–September: southwest monsoon; October–November: northeast monsoon), summer (April–July) and winter

(October–March). However, in south India, the winter is not as cold as in north India. It is marked by clear skies, hot days, and cool nights. This kind of weather prevails from September to March. The southwest monsoon sets in over Kerala in June, progresses towards the north and envelops the entire country by the end of July. The eastern coastal regions – the coasts of Andhra Pradesh and Tamil Nadu – experience the northeast monsoon between October and November. Along the east coast, this period is marked by cyclones due to severe atmospheric depressions in the Bay of Bengal and the Indian Ocean that move towards the mainland at a high speed, causing widespread destruction to life and property. The west coast rarely experiences such cyclonic effects. The annual average rainfall in India varies from a low of 50 mm in the extreme western parts of Jaisalmer bordering Pakistan, to a high of 11,000 mm in the Cherrapunjee region of Meghalaya. Similarly, the temperature also shows high variability – more than 50 °C in the Thar desert to minus 50 °C at Siachen in Jammu & Kashmir.

The first census of human population in India was conducted in 1872. Since then, 1881 onwards, this exercise has been carried out once in 10 years. At the time of India's Independence in 1947, the population was 340 million. By 1981, it rose to 685 million and by 1990, to 844 million.

Compared to 1971, the population had increased by 25%. In 1971, the human density was 216 per sq. km, with a high of 655 in Kerala and a low of 8 in Arunachal Pradesh. According to the 1991 census, the average human density had further risen to 273 persons per sq. km. By 2001, India's population had crossed the one billion mark! In 2011, India's population was 1.2 billion. The population has trebled in the 66 years of India's Independence, with an annual rise of about 18 million people. The projected human population growth by 2050 is between 1.5 and 1.6 billion.

Biodiversity

India, a mega-diversity country, is among the top ten nations endowed with the world's richest biodiversity. Its immense biological diversity represents about 7% of the

world's flora and 6.5% of the world's fauna. On a larger taxonomic scale we can say India has about 423 species of mammals, 868 species of amphibians and reptiles, 1,234 species of birds and about 45,000 species of plants of the world. India has four out of the 34 globally identified biodiversity hotspots: Himalaya, Indo-Burma, Western Ghats, and Nicobar island (part of the Sundaland hotspot). A large range of species inhabit the country's various habitats, from its crowded and colourful coral reefs to the icy alpine grasslands. We have very little information on the biology of the vast majority of these organisms. There are many species that have not even been named by science. Their value to India's human population, as sources of useful genes, as food or medicine, or as essential parts of ecological systems, has hardly been studied.

VEGETATION CHARACTERISTICS WITHIN VARIOUS BIOGEOGRAPHIC ZONES OF INDIA

By Dr. G.S. Rawat

The Indian region exhibits an enormous variation in climate, geomorphology, and surface topography. On the basis of physiography it is divisible into three zones, namely the Himalayan region, the Indo-Gangetic Plains and the Indian Peninsula. Each of these zones can be further classified based on the relief features and patterns of soil and water regimes. This has manifested in a great deal of floral and faunal diversity and interesting patterns of vegetation formations. Champion & Seth (1968) have classified India's vegetation into seven major groups, 16 sub-groups and over 150 sub-types and seral stages. This classification takes physiognomy, floristics, as well as local edaphic and biotic factors into consideration, hence it is used widely by foresters as well as ecologists. The description of wildlife habitats including the characterisation of major biomes and Important Bird Areas (IBAs) can best be done using Champion & Seth's categories.

This chapter deals with a general description of the vegetation within the various biogeographic zones of India. Although Rodgers & Panwar (1988) and Rodgers *et al.* (2000), have given broad characteristics of various regions, major biomes and habitats within these zones need further characterisation in terms of vegetation types and community composition. It has been noted that at least 24 distinct physiognomic units (including Champion & Seth's categories) are required to broadly describe the major biomes and biogeographic regions of India. These types, along with the characteristic floral elements, are shown in the Table on page xxx. In addition, a large number of herbaceous formations and associations at the local level characterise the habitats for various faunal groups including birds.

i. The Indian Trans-Himalaya

The Indian Trans-Himalaya, also known as the Indian cold desert, support very sparse vegetation. Based on the physiognomy, three categories of natural vegetation are clearly discernible namely, Alpine Arid Scrub (AAS) or Steppe formations, Alpine Arid Pastures (AAP), and Marsh Meadows (MM). The AAS vegetation is dominated by the *Artemisia-Caragana*, *Hippophae-Myricaria*, and *Ephedra gerardiana* communities. The AAPs are largely dominated by graminoids, while the MMs have a preponderance of sedges. The plant community structure and composition are strongly influenced by the microtopography and soil moisture. Accordingly, various habitats such as moist slopes, riverine areas, sandy plains, field borders, valley bottoms, rubble slopes, scree slopes, and marsh meadows exhibit distinct formations and communities. The characteristic species in the Trans-Himalaya are the species of *Saussurea*, *Potentilla*, *Corydalis*, *Astragalus*, and *Oxytropis*. In general, the Indian Trans-Himalaya is poorer in floral diversity compared to the moist alpine meadows of the Greater Himalaya. A small portion of the Indian Trans-Himalaya is represented in the Central Himalaya (Sikkim), which is relatively higher in terms of species diversity compared to the northwestern region. This region is characterised by low primary productivity, harsh climatic conditions, and specialised growth forms (Kachroo *et al.* 1977).

ii. The Himalayan Region

The Himalayan region is spread over an area of approximately 210,626 sq. km within India. This region as a whole is regarded as an important biodiversity hotspot.



ASAD R. RAHMANI

The cold deserts and wetlands of the Trans-Himalayas are ecologically very fragile and need imaginative conservation planning



ASAD R. RAHMANI

The Himalayas are famous for high cultural scenic, floral and faunal diversity

It supports a wide range of vegetation types ranging from the Tropical to the Alpine types. It is home to over 8,000 species of flowering plants and nearly 10,000 species of lower plants. The zone above the natural treeline (c. 3,300–3,600 msl in the Western Himalaya and c. 3,800–4,000 msl in the East) in the Himalaya supports alpine vegetation, which is characterised by alpine scrub, meadows, moss-lichen laden rocky slopes, and matted shrubs. Of all the categories, the meadows are of considerable ecological interest due to the adaptability of the plant forms and the great profusion of herbaceous species. The meadows are the repository of valuable fodder species as well as medicinal and aromatic plants. The alpine zone is generally separated by a distinct treeline characterized by birch-rhododendron (*Betula utilis-Rhododendron campanulatum*), fir (*Abies pindrow*) or brown oak (*Quercus semecarpifolia*) forests.

At a lower elevation (1,500–3,300 msl), the major vegetation types in the Northwest and Western Himalaya include Himalayan Dry Temperate (Coniferous), Himalayan Moist Temperate (Broadleaf), Temperate Grassy Slopes (secondary formations), and secondary scrub. These habitats provide breeding grounds for a large number of birds and mammals. On the south-facing, frequently burnt and exposed slopes there are temperate grasslands throughout the Western Himalaya. Dachigam National Park (an IBA) in Kashmir represents one such grassland habitat that supports a highly threatened subspecies of the Red Deer called Hangul *Cervus elaphus hanglu* and several grassland

birds. The Montane region of Sikkim and Arunachal Pradesh bears Temperate Broadleaf Forests, Temperate Coniferous Forests, Subalpine Forests and scrub.

The Shivaliks or the sub-Himalayan zone lies within the Indo-Gangetic Plains according to Rodgers & Panwar (1988). Subtropical climate, varied topography, rich alluvial soils, and intermingling of taxa from the Indo-Malayan and Palaeartic regions have given rise to very high biodiversity. The major forest types according to Champion & Seth (1968) from the west to the east along the increasing rainfall gradient include *Dodonaea* scrub, Subtropical Dry Evergreen Forests of *Olea cuspidata*, Subtropical Pine Forests, Northern Dry Mixed Deciduous Forest, Dry Shivalik Sal Forest, Moist Mixed Deciduous Forest, Subtropical Broadleaf Wet Hill Forest, Northern Tropical Semi-Evergreen Forest, and Northern Tropical Wet-Evergreen Forest. The Shivalik hills are best represented between the Ganga and Yamuna rivers in Uttaranchal. The entire belt covers an area of c. 40,000 sq. km, of which only <2100 sq. km falls under the protected area network. Ecologically, the entire Shivalik belt can be considered as a highly sensitive zone.

iii. The Indian Desert

The Indian Desert covers nearly 12% of the land, most of which (90%) is located in western India. Biogeographically, the Thar desert is the eastward extension of the Sahara-Arabian desert system which spreads through Iran, Afghanistan, and Baluchistan (Rodgers & Panwar 1988). It



M. ZAFAR-UL ISLAM

The Thar desert has more than 500 species of plants



DHIRTIMAN MUKHERJEE

Probably less than 1% of the original semi-arid dry grasslands survive

is estimated that the Indian Desert supports *c.* 500 species of vascular plants. Such a low species diversity compared to the other biogeographic zones is due to harsh climatic factors coupled with intense biotic pressure (anthropogenic factors). Despite uniformly adverse climatic conditions, the deserts exhibit distinctive microtopographic variations and highly specialised plant communities. For example, *Calligonum polygonoides* and *Lasiurus* spp. stands are found in typical sand dunes. Other associations are *Prosopis-Ziziphus-Capparis*, *Euphorbia-Salvadora-Acacia*, *Capparis-Prosopis-Salvadora*, and *Tamarix-Salvadora-Suaeda* in sandy plains, stony and hilly areas, gravel and compact areas, and saline soils respectively (Bhandari 1990). The growth forms of extreme arid environments include leafless perennials (6% taxa), spiny and thorny species (10% taxa), hairy or with trichomes (20% taxa), and with characteristic thick cuticles and sunken stomata (*c.* 60% taxa).

iv. The Semi-Arid Zone

This zone (*c.* 545,850 sq. km) lies between the isohyets 400–1000 mm (annual) and represents a characteristic Savannah Woodland, Dry Deciduous, and Tropical Thorn Forest zone in Western India. These vegetation types have been classified as Tropical Dry Deciduous and Tropical Thorn Forests by Champion & Seth (1968). The open and stunted vegetation (less than 6 m in height) is dominated by *Acacia* spp., *Balanites roxburghii*, *Cordia myxa*, *Phoenix*

sylvestris, *Anogeissus pendula*, *Capparis aphylla*, *Crotalaria* spp., and *Salvadora* spp. *Euphorbia* spp. and several other xerophytic species are common in the rocky habitats. The soil is usually bare, although some grassy growth may appear during the short monsoon (Puri *et al.* 1989). The Kathiawar region encompassing the Gir forest in Gujarat and the Aravalli hill ranges in eastern Rajasthan are also dominated by Tropical Dry Deciduous and Tropical Thorn Forests, the latter indicating semi-arid conditions. The flora of this zone is dominated by grasses and associated forbs, including legumes of African affinity.

v. The Western Ghats

The Western Ghats, a chain of ancient mountains along the west coast of the Indian Peninsula occupies only *c.* 5% of India's land area (about 132,606 sq. km), yet it harbours nearly 27% of its total flora. The Western Ghats, with a latitudinal range of more than 10 degrees, lies more or less parallel to the west coast of India. Its forests are some of the best representatives of Non-Equatorial Tropical Forests in the world (Pascal 1982). Wet Evergreen Forests are mostly confined to the windward side of the Western Ghats where the rainfall exceeds 2,000 mm. By taking into account the distribution pattern of certain characteristic species, which reflect the climatic variations, the forests are further subdivided into several floristic types. All these types are classified according to low (0–800 m), medium



ISAAC KEHINKAR

The Western Ghats, comprising only 5% of India's area, harbour 27% of its total flora

(800–1,450 m) and high (> 1,400 m) elevation types. Most of the Evergreen Forests are dominated by members of families Lauraceae, Myrtaceae, Ebenaceae, and Annonaceae. In the Nilgiri hills, which are slightly drier compared to the western slopes, the forest formations are dominated by the *Diospyros ovalifolia*-*Memecylon lushingtonii*-*Olea glandulifera* communities. Other floristic elements in the region include *Eurya japonica*, *Gaultheria fragrantissima*, *Ilex wightiana*, *Mahonia leschenaultii*, *Photinia notoniana*, *Rapanea* spp., *Rhododendron nilagiricum*, *Rhodomyrtus tomentosa*, *Symplocos* spp., and *Turpinia cochinchinensis*. Moist Deciduous forests are found mainly in the rainfall zone of 1,500 mm to 1,800 mm. They are largely found between the Wet Evergreen and Dry Deciduous types. The typical elements of such forests are *Dillenia pentagyna*, *Tabernaemontana heyneana*, *Lagerstroemia microcarpa*, and *Tectona grandis*. Dry Deciduous Forests are confined to the rain shadow areas of the Western Ghats, especially towards the northern parts of the Nilgiris, Palnis, and areas bordering the Mysore and Karnataka plateau. The typical floristic elements in these forests are *Albizia amara*, *Acacia* spp., *Gyrocarpus jacquinii*, *Tectona grandis*, *Anogeissus latifolia*, *Pterocarpus marsupium*, *Terminalia alata*, and a large number of grasses.

Areas above 1,800 msl in the Western Ghats are dominated by natural grasslands and adjacent pockets

of Montane Evergreen Forests frequently termed Shola-Grassland Complex. The common herbaceous elements among the grasses include *Anaphalis* spp., *Campanula fulgens*, *Cassia* spp., *Crotalaria notonii*, *Cyanotis* spp., *Impatiens* spp., *Indigofera pedicillata*, *Justicia simplex*, *Knoxia mollis*, *Leucas suffruticosa*, *Lilium neilgherrense*, *Oldenlandia articularis*, *Polygala sibirica*, *Striga asiatica*, *Viola patrinii*, and *Wahlenbergia gracilis*. In the swampy pockets *Commelina* spp., *Centella asiatica*, *Drosera peltata*, *Fimbristylis uliginosa*, *Andropogon foulksii*, *Anthistiria ciliata*, *Arundinella* spp., *Arundinaria villosa*, *Bothriochloa pertusa*, *Chrysopogon orientalis*, *Cymbopogon* spp., *Eragrostis nigra*, *Eulalia* spp., *Heteropogon contortus*, *Isachne* spp., *Themeda* spp., *Tripogon bromoides*, and *Zenkeria elegans* are found.

vi. The Deccan Peninsula

The Deccan Peninsula, the largest biogeographic zone of India, according to the classification of Rodgers & Panwar (1988), has extensive forested tracts. The zone is relatively homogenous and supports various vegetation types ranging from Tropical Thorn to Tropical Dry and Moist Deciduous Forest. There are five biogeographic provinces within this zone: Central Highlands comprising the Vindhya and Satpura hill ranges, Chota Nagpur Plateau, Eastern Ghats, Tamil Nadu Plains, and Karnataka Plateau.



NAYAN KHANOLKAR

The Deccan still has extensive tracts of Dry Deciduous forest, important for large vertebrates

Phytogeographically, these areas are quite similar and do not exhibit high level of endemism, yet the assemblages within the sub-zones represent very characteristic ecological conditions, relict vegetation patches, biotic formations, and edaphic formations. Much of the area falls under the Southern Moist Deciduous and Southern Dry Deciduous Forest categories of Champion & Seth (1968). These include sal and teak bearing forests, Moist Mixed Deciduous Forest without teak, and Secondary Moist Mixed Deciduous Forests of Madhya Pradesh, Andhra Pradesh, Maharashtra, and Karnataka. The thorn scrub vegetation has been described by Puri *et al.* (1989).

Typical species of the region, besides sal and teak, are species of *Acacia* (*A. caesia*, *A. catechuoides*, *A. leucophloea*, *A. pennata*, *A. racemosa*), *Aegle marmelos*, *Anogeissus acuminata*, *Bridelia retusa*, *Buchanania lanzan*, *Cochlospermum religiosum*, *Dalbergia paniculata*, *Elaeodendron glaucum*, *Emblica officinalis*, *Madhuca indica*, *Manilkara hexandra*, *Pterocarpus marsupium*, *Terminalia bellirica*, *Terminalia chebula*, and *Butea superba*. A few pockets in the Eastern Ghats support Evergreen Forests with characteristic species such as *Barringtonia acutangula*, *Syzygium cumini*, *Ficus hispida*, *Melastoma malabathricum*, *Homonoia riparia*, *Terminalia arjuna*, *Mangifera indica*, a tree fern *Cyathula spinulosa*, and a gymnosperm *Gnetum ula* (Rawat 1997).

vii. The Gangetic Plains

The Gangetic Plains (c. 354,782 sq. km) include the areas adjacent to the Terai-Bhabar tracts in Uttar Pradesh, Bihar, and West Bengal. The alluvial formations are divisible into drier Pleistocene alluvium (Bhangar), more recent wet silt (Khadar), limestone predominated pebbly grounds (Kankar), and elevated alluvial formations (Duar) of West Bengal. This area is dominated by hygrophilous grasslands and savannah woodlands. It is strongly influenced by frequent fires and floods, which deposit silt from the Himalayan foothills. Much of the area was settled by man during the past two centuries, especially after the large-scale eradication of a deadly strain of malaria during the late 1950s. The prominent species of grasses in the region include *Saccharum spontaneum*, *S. arundinaceum*, *Imperata cylindrica*, *Cymbopogon flexuosus*, and *Vetiveria zizanioides*. Some of the communities within these grasslands e.g., *Imperata cylindrica*-*Cymbopogon flexuosus*, are also reported to be the habitat of the threatened Bengal Florican *Houbaropsis bengalensis*. Most of these grasslands are seral in nature, which ultimately give rise to climax Sal *Shorea robusta* forest through the seral stages of *Dalbergia sissoo*-*Acacia catechu*, *Ziziphus mauritiana*-*Butea monosperma*, and *Lagerstroemia parviflora* among others. These forests have been categorized under the Northern Moist Deciduous Forests by Champion & Seth (1968).



DHRITIMAN MUKHERJEE

The Gangetic Plains have highly productive wetlands, important for people and birds

viii. The Coasts

The Indian coastline (from Gujarat to Sunderbans) is c. 7,500 km long. The typical coastal ecosystem covers an area of c. 82,813 sq. km. The area has mainly two types of vegetation, namely mangrove forests and dry sand dunes. However, on the Coromandel coast there is a typical Dry Evergreen formation close to the coast. The mangroves are essentially

semi-aquatic/wetland ecosystems, located along the estuaries of major rivers, characterised by salt tolerant species such as *Rhizophora mucronata*, *Bruguiera gymnorhiza*, *Ceriopetalum*, *Lumnitzera littorea*, *Avicennia officinalis*, *Heritiera littoralis*, *Acanthus ilicifolius*, and *Acrostichum aureum*. Today most of India's mangrove vegetation is confined to certain protected areas such as Sunderbans, Bhitarkanika, Coringa,



HIRA PUNJABI

The Sunderbans of India and Bangladesh are the largest mangrove forest in the world



ANWARUDDIN CHOUDHURY

Despite shifting cultivation (jhuming), the Northeast still has some of the most pristine forests left in India

Nelapattu, Point Calimere, and Pirotan (Marine) National Park (all IBAs).

The coastal sand dune vegetation is typically xerophytic, with species such as *Anthrocnemum indicum*, *Salvadora oleoides*, and *Spinifex littoreus*. Major problems in these areas include extraction of sand, developmental projects, and plantation of exotic species such as *Casuarina equisetifolia* and *Eucalyptus* spp.

ix. Northeast India

Northeast India, including Assam Valley and the adjacent hill ranges, exhibits a complex mosaic of vegetation types ranging from Northern Tropical Wet Evergreen to Montane and Wet Temperate types. The major categories of forests according to Champion and Seth (1968) include the Assam Valley Tropical Wet Evergreen Forest, Cachar Tropical Semi-Evergreen Forest, Cachar Tropical Evergreen Forest, Upper Assam Valley Tropical Evergreen Forest, Cane Brakes, Subtropical Broadleaf Wet Hill Forest, Assam Subtropical Pine Forest, Moist Bamboo Brakes, Naga Hills Wet Temperate Forest, and Eastern Hollock Forest (*Terminalia myriocarpa*). The characteristic species in the evergreen forests are *Dipterocarpus macrocarpus*, *Michelia doltsopa*, *Dipterocarpus turbinatus*, *Acer laevigatum*, *Terminalia chebula*, *Schima wallichii*, *Garcinia pedunculata*, *Alseodaphne owdenii*, *Dillenia indica*, *Castanopsis tribuloides*, *Aglaia hiernii*, *Artocarpus heterophyllus*, *Phrynium capitatum*, *Amomum linguiforme*,

Costus speciosus, *Hedychium bracteatum*, and *Aeginetia indica*. Towards the higher elevations the characteristic species include *Lithocarpus pachyphylla*, *Engelhardtia spicata*, *Castanopsis tribuloides*, *Erythrina arborescens*, *Eurya simplicina*, *Gmelina oblongifolia*, *Mahonia borealis*, *Melocanna bambusoides*, *Dendrocalamus hamiltonii*, and a large number of other bamboos. Owing to extensive shifting cultivation (jhumming) and invasion by exotic species, many of the original categories described by Champion & Seth (1968) are hardly discernible in the field at present.

x. The Islands

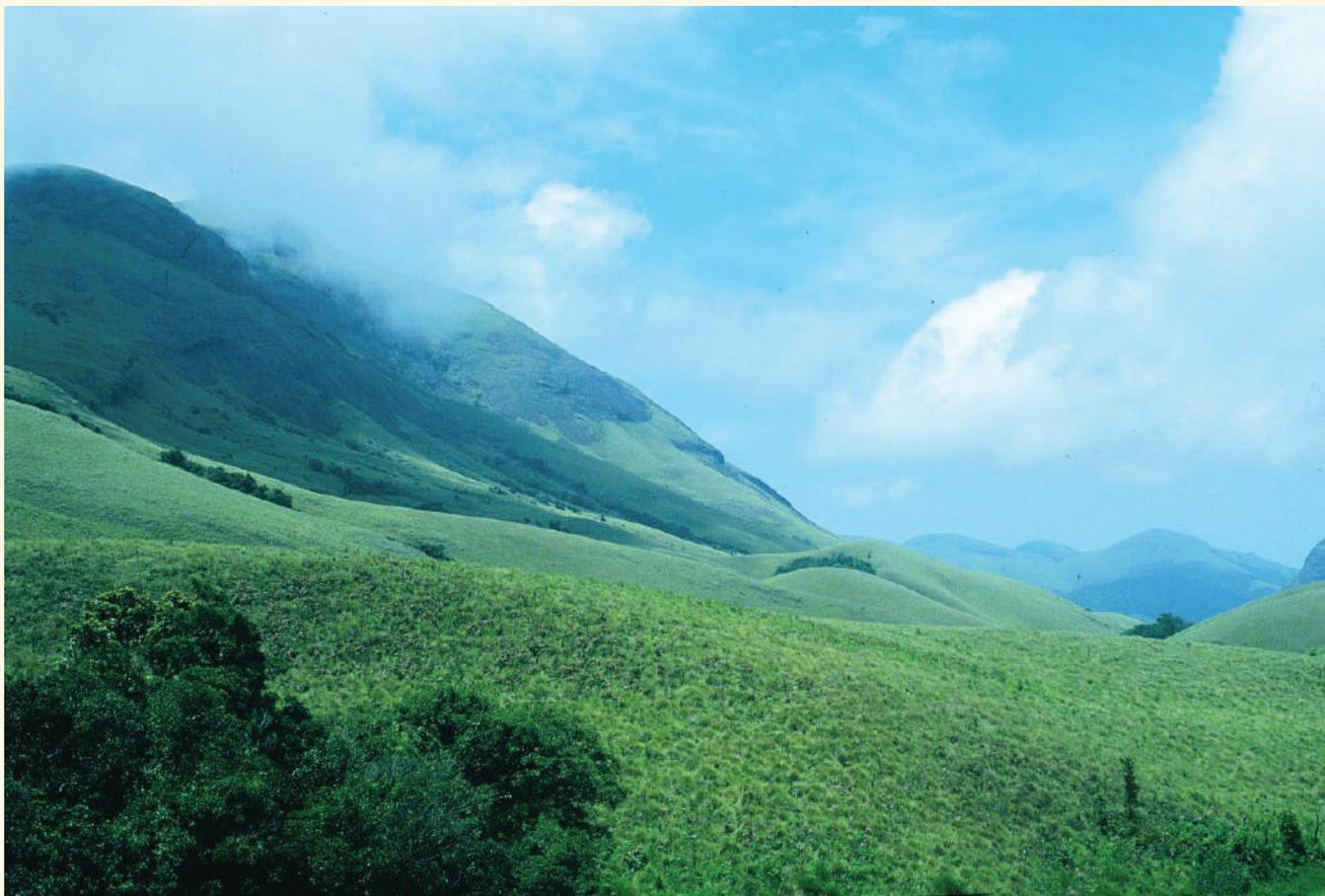
The total area under 'Islands' within Indian territory is c. 8,358 sq. km, of which the Andaman & Nicobar Islands occupy c. 8,249 sq. km and the Lakshadweep islands cover an area of 109 sq. km. These islands have c. 2,200 species of higher plants including c. 200 strict endemics. Approximately 1,300 species are not found elsewhere in India but are found in Myanmar, Malaysia, Indonesia, and Polynesia (Rodgers & Panwar 1988). Phytogeographically, the Andaman & Nicobar Islands exhibit different affinities. While the Andamans are closely related to Myanmar and Northeast India, the Nicobar Islands have closer affinities with Indonesia. The latter group of islands have no dipterocarps, but a higher diversity of tree ferns and palms. Champion & Seth (1968) have classified the Andaman & Nicobar forests into six types. Of these, three are of the

M. ZAFAR-UL ISLAM



Original primary forest is intact in some of the tribal reserves of Andaman and Nicobar Islands

ASAD R. RAHMANI



The Western Ghats is one of the biodiversity hotspots of the world

Major vegetation types of India and characteristic floral elements

Sr. No.	Vegetation Type and Geographical Location	Characteristic/Dominant Species
1.	TWE Andaman and Nicobar Islands	<i>Dipterocarpus</i> spp., <i>Calophyllum soulattri</i> , <i>Mangifera sylvatica</i> , <i>Myristica</i> sp., <i>Calamus palustris</i>
2.	TWE (Western Ghats)	<i>Dipterocarpus indicus</i> , <i>Humboldtia brunonis</i> , <i>Cullenia exarillata</i> , <i>Ficus</i> spp., <i>Palaquium ellipticum</i> , <i>Myristica malabarica</i>
3.	TWE (Northeast India)	<i>Dipterocarpus macrocarpus</i> , <i>Artocarpus chaplasha</i> <i>Livistona jenkinsiana</i> , <i>Ficus</i> spp., <i>Alpinia</i> spp., <i>Phrynium</i> sp.
4.	TSE (Transitional)	<i>Ficus</i> spp., <i>Dillenia pentagyna</i> , <i>Garuga pinnata</i> , <i>Toona ciliata</i>
5.	TMD (Moist Teak) Indian Peninsula	<i>Tectona grandis</i> , <i>Xylia xylocarpa</i> , <i>Terminalia crenulata</i>
6.	TMD (Moist Sal) Upper Gangetic Plains	<i>Shorea robusta</i> , <i>Terminalia alata</i> , <i>Dalbergia sissoo</i> , <i>Acacia catechuoides</i>
7.	TMD (Peninsular Sal) Deccan Plateau	<i>Shorea robusta</i> , <i>Madhuca indica</i> , <i>Syzygium operculatum</i> , <i>Symplocos</i> sp.
8.	Mangroves Coastal region	<i>Heriteria fomes</i> , <i>Avicennia marina</i> , <i>Nypa fruticans</i>
9.	TDD (Dry Teak) Deccan Plateau	<i>Tectona grandis</i> , <i>Terminalia alata</i> , <i>Anogeissus latifolia</i>
10.	TDD (Southern) Semi-arid	<i>Albizia amara</i> , <i>Hardwickia binata</i>
11.	TDD (Savannah) Semi-arid	<i>Prosopis cineraria</i> , <i>Ziziphus mauritiana</i> , <i>Butea monosperma</i>
12.	TDD (Northern) Semi-arid	<i>Acacia senegal</i> , <i>Anogeissus pendula</i> , <i>Ziziphus mauritiana</i>
13.	TTF (Southern) Deccan	<i>Acacia</i> spp., <i>Carissa opaca</i> , <i>Ixora</i> sp.
14.	TTF (Northern) Semi-arid	<i>Ziziphus nummularia</i> , <i>Salvadora oleoides</i>
15.	TDE East Coast	<i>Manilkara hexandra</i> , <i>Chloroxylon swietenia</i> , <i>Strychnos nux-vomica</i>
16.	MWT (Shola) Western Ghats	<i>Gordonia obtusa</i> , <i>Meliosma arnotiana</i> , <i>Schefflera</i> spp.
17.	SBH (Eastern Himalayan Foothills and NE Hills)	Lauraceae, Meliaceae, Annonaceae, <i>Dendrobium</i> spp., Tree ferns
18.	SPF Himalayan region	<i>Pinus roxburghii</i> , <i>Themeda anathera</i>
19.	HWT Eastern Himalaya	<i>Magnolia griffithii</i> , <i>Altingia exelsa</i> , Lauraceae, Meliaceae, <i>Begonia</i> spp.
20.	HMT (Broadleaf) Eastern Himalaya	<i>Quercus</i> spp, <i>Acer</i> , <i>Ilex</i> , Mosses and Lichens
21.	HDT (Conifer) Western Himalaya	<i>Pinus wallichiana</i> , <i>P. gerardiana</i> , <i>Juniperus macropoda</i>
22.	SAF Western Himalaya	<i>Betula utilis</i> , <i>Rhododendron campanulatum</i> , <i>Quercus semecarpifolia</i>
23.	AMS Western Himalaya	<i>Juniperus pseudosabina</i> , <i>Rhododendron anthopogon</i> , <i>Lonicera</i> spp., <i>Salix</i> spp.
24.	ADS Trans-Himalaya	<i>Caragana versicolor</i> , <i>Ephedra gerardiana</i> , <i>Tanacetum</i> spp.

TWE = Tropical Wet-Evergreen Forests, TSE = Tropical Semi-Evergreen, TMD = Tropical Moist Deciduous, L/S = Littoral/Swamp Forest, TDD = Tropical Dry Deciduous, TTF = Tropical Thorn Forest, TDE = Tropical Dry Evergreen, MWT = Montane Wet Temperate, SBH = Subtropical Broadleaf Hill, SPF = Subtropical Pine Forest, HWT = Himalayan Wet Temperate, HMT = Himalayan Moist Temperate, HDT = Himalayan Dry Temperate (Coniferous), SAF = Sub-Alpine Forests, AMS = Alpine Moist Scrub, ADS = Alpine Dry Scrub

evergreen type (Giant Andaman Evergreen Forest, Andaman Tropical Evergreens, and Andaman Hilltop Evergreen Forest) and the others are the Andaman Moist Deciduous Forest, Littoral Forest, and Mangrove Forest. Bamboo and cane brakes form local variations.

The tall Gurjan *Dipterocarpus alatus* forests of the Andaman Islands have almost vanished due to large-scale clearance of flat terrain for agriculture. The Andaman

Tropical Evergreens are multi-storeyed, closed canopy forests which grow on hilly terrain. They are less luxuriant than the Giant Evergreens, with less height and density. Mangroves in the Andaman & Nicobar Is. are estimated to occupy 115,000 ha, of which 50,000 ha are in the Andaman group. The coastline of these islands is irregular and deeply indented, thereby giving rise to a number of tidal creeks.

AVIFAUNA OF INDIA



The last wild pair of the Siberian Crane *Grus leucogeranus* was seen in the Keoladeo National Park, Rajasthan in the winter of 2000-2001. Attempts reintroduction have not been successful

The Indian subcontinent, a part of the vast Oriental biogeographic regions, is very rich in biodiversity. Out of the more than 10,000 birds of the world, the Indian subcontinent harbours about 1,300 species, or over 13% of the world's birds.

This subcontinent, rich in avifauna, also boasts of 106 bird families out of the total 213 families in the world. However, two families, Asiatic barbets Megalaimidae and Leafbirds Irenidae, occur in the Oriental region, the rest of the bird families are found in other biogeographical regions of the world too. The Oriental region is also the centre of radiation for many bird groups such as the pheasants, laughingthrushes, drongos, leafbirds, pittas, parrotbills, and flowerpeckers.

Being a physical part of Asia, India is least limited by geographical barriers, thus it has acted as a centre of dispersal of species, and has also received species from the Palaearctic, Ethiopian, Indo-Chinese and Indo-Malayan subregions. But the dominant groups of birds in India belong to what is sometimes called the 'Indo-Chinese' fauna, the birds adapted to life in the warm, moist tropical Southeast Asia, birds primarily of jungle or heavy forests (Ali & Ripley 1987). The geographical ramifications of southeast Asia,

the tangled patterns of mountain chains, river drainage systems, and a long period of stable climate seem to have been ideal for the evolution of a wide array of avian species (Ali & Ripley 1987).

Grimmett *et al.* (1998) have shown that the Indian peninsula is home to many bird families (or other distinctive groups of birds) where the majority of the species of the family or group are found in this subcontinent. For instance, 71% of all treecreepers (Certhiinae), 62% of accentors (Prunellinae), 55% of laughingthrushes (Garrulacinae) and 50% of ioras (Aegithininae) are found in the Indian subcontinent. Similarly, 37% of the barbet and 38% of the drongo species of the world are seen in India.

Recently, Rasmussen & Anderton (2005, 2012) have described nearly 120 new taxa from the Indian subcontinent, mostly subspecies were elevated to the species level. For instance, the two subspecies of the Indian Long-billed Vulture *Gyps indicus indicus* and *G. indicus tenuirostris* have been made full species, with the former now known as Long-billed vulture *G. indicus*, and the latter, Slender-billed Vulture, *G. tenuirostris*. Some of the upgraded species of Rasmussen & Anderton (2005, 2012) have very narrow and restricted range distribution, and some of them are

Critically Endangered, e.g., the Slender-billed Vulture (BirdLife International 2001).

One of the main reasons for high avian diversity in India is the presence of diverse habitats, from the arid cold desert of Ladakh and Sikkim to the steamy, tangled jungles of the Sunderbans to the wet, moist forests of the Western Ghats and Arunachal Pradesh. Rodgers & Panwar (1988) of the Wildlife Institute of India have divided India into ten major biogeographical zones: Trans-Himalaya, Himalaya, Desert, Semi-Arid, Western Ghats, Deccan Peninsula, Gangetic Plains, Northeast, Islands, and Coasts. This is not a strictly biogeographical classification as it was done for the sake of identifying new protected areas that are under-represented in the protected area system of India. As we have followed Rodgers and Panwar's classification for describing the vegetation cover of India, the same classification is used for describing the avifauna of India.

1. THE INDIAN TRANS-HIMALAYA

The Trans-Himalaya (4,500 to 6,000 m) consisting of Ladakh in Jammu & Kashmir, Lahaul-Spiti in Himachal Pradesh, and a small area of Sikkim, is a part of a much larger Tibetan plateau of Tibet and China, consisting of about 2.6 million sq. km. It has high mountains, deep valleys and flat, arid plains. Many major rivers, for example, the Brahmaputra, Sutlej, and Indus start from this region, but much of this area has internal drainage systems where the rivers end in vast lakes. Such lakes and marshes, mostly saline, are important as breeding grounds for birds such as the Black-necked Crane *Grus nigricollis*, Bar-headed Goose *Anser indicus*, Great Crested Grebe *Podiceps cristatus*, and others. While the flat plains provide habitats to the Tibetan Sandgrouse *Syrhaptes tibetanus*, Horned Lark *Eremophila alpestris*, and various species of wheatears *Oenanthe*. The Tibetan Snowcock *Tetraogallus tibetanus* and the Himalayan Snowcock *Tetraogallus himalayensis* can be seen on the treeless mountains, sometimes both the species occurring in the same area. There is no truly endemic or restricted-range bird species in this region. The Tibetan Eared-pheasant *Crossoptilon harmani*, often considered to be a subspecies of the White Eared-pheasant *Crossoptilon crossoptilon*, is found at the edges of mixed broadleaf-coniferous forests, rhododendron, juniper, and deciduous scrubs and grasslands, between 3,000 and 5,000 m. It is listed as Near Threatened (BirdLife International 2015). Rasmussen & Anderton (2005, 2012) consider this species as hypothetical in India as "no regional specimens traced". There is also a dispute about which subspecies occurs within Indian limits. Ali & Ripley (1987) reported that *Crossoptilon c. harmani* (now considered a full species *C. harmani*) was found in the extreme northern fringes of Siang, Subansiri and Lohit districts of what is now Arunachal Pradesh. Pratap Singh (*pers. comm.* 2010) reports that this species is found

in the Tawang area. Ludlow & Kinnear (1944) reported this species as quite common in the basin of the Subansiri river, east of 92° 30' E (outside Arunachal Pradesh). According to Choudhury (2006), there is a recent unconfirmed report from Dichu RF in Anjaw district. During a survey of Dibang-Dihang Biosphere Reserve, Choudhury (2008) interviewed hunters, but most of them could not recognise the species from colour visuals, indicating that it is either very rare or does not occur in the Reserve.

It has adapted to disturbed habitats (Ali & Ripley 1987, Grimmett *et al.* 1998). Where unmolested, it becomes exceedingly tame, coming to monasteries in the remoter areas to be fed by Buddhist lamas, even eating out of their hand (Ali & Ripley 1987).

Another species of some conservation concern is the Giant Babax *Babax waddelli*, considered Near Threatened by BirdLife International (2015). It is again not truly a Trans-Himalayan species as it occurs in the interface of the Upper Himalaya and Trans-Himalaya. It occurs in southern Tibet, mainland China, and extreme northeastern Sikkim, where it inhabits dense deciduous scrub above the treeline, particularly of *Hippophae rhamnoides*, and the edges of coniferous forests, from 2,800 to 4,500 m (Ali & Ripley 1987, Grimmett *et al.* 1998). Although Ali & Ripley (1971, Vol. 7, p. 238) say that it is a common resident of extreme northeast Sikkim, and possibly Tibetan facies of Arunachal Pradesh, Usha Lachungpa (*pers. comm.* 2010) has never come across this species during several birding trips to northeast Sikkim. Rasmussen & Anderton (2005) consider it hypothetical in the Indian subcontinent although it occurs in Tibet near the borders with Sikkim, Bhutan and Arunachal Pradesh. It is generally scarce across this range, although it may be locally common in suitable habitats (Birdlife International 2015).

Wetlands of Trans-Himalaya

The wetlands in the Trans-Himalaya are extremely important for the protection of birds, especially globally threatened species. Most of the wetlands are found in the Changthang region of Ladakh between 4,000 to 5,000 msl. The Changthang plains lie between the Leh and Nyoma blocks of Leh district in southeastern Ladakh, which is the western extension of Tibetan Changthang (Chatterjee *et al.* 2002). The Changthang Wilderness Area (Changthang Plateau) was notified in 1987 to provide a sanctuary for many species of mammals and birds, and also to protect the culture and language of this region. Some of the important high altitude lakes such as Tso Kar, Tso Morari, Pangong Tso, and marshes such as Hanle, Phoktse and Chushul are located in this region. Most of them have been identified as IBAs.

There is no Endemic Bird Area in the Indian part of the Trans-Himalaya, but a part of Biome 5: Eurasian High Montane (Alpine and Tibetan) falls in India. BirdLife

Globally Threatened and Near Threatened species of the Indian Trans-Himalaya			
Species	Scientific Names	IUCN Category	Number of IBAs
Black-necked Crane	<i>Grus nigricollis</i>	VU	11
Wood Snipe	<i>Gallinago nemoricola</i>	VU	19
Himalayan Griffon	<i>Gyps himalayensis</i>	NT	72
Bearded Vulture	<i>Gypaetus barbatus</i>	NT	18
Giant Babax	<i>Babax waddelli</i>	NT	3

VU = Vulnerable, NT = Near Threatened



The wetlands of Trans-Himalayas are important for the endangered Black-necked Cranes *Grus nigricollis*

OTTO PFISTER

International (undated) has listed 48 bird species that represent the bird assemblage of this biome. Most of them are common and widespread, and like other desert species, live in low density (e.g., Himalayan Griffon *Gyps himalayensis*, Snow Partridge *Lerwa lerwa*) but some of the smaller species move in large flocks, especially during their migration (e.g., Long-billed Calandra Lark *Melanocorypha maxima*, Hume's Short-toed Lark *Calandrella acutirostris*). During winter, many species of this region move down to other biomes, and even to the Indian plains (Brown-headed Gull *Chroicocephalus (= Larus) brunnicephalus*, Tickell's Warbler *Phylloscopus affinis*), while some species do not move or show small altitudinal movement (e.g., Tibetan Snowcock *Tetraogallus tibetanus*, Himalayan Snowcock *T. himalayensis*, Tibetan Sandgrouse *Syrrhaptes tibetanus*, Alpine Accentor *Prunella collaris*). Biome 5 is found mainly above the treeline, from c. 3,600 msl and above. The key habitats are alpine meadows and subalpine scrub, cliffs and boulder-strewn open habitats, gravel plains and wetlands.

In the Indian context, the Trans-Himalaya, particularly Ladakh, is very important as the breeding ground of

the Bar-headed Goose *Anser indicus*, Ruddy Shelduck *Tadorna ferruginea*, Brown-headed Gull *Chroicocephalus brunnicephalus*, and Great Crested Grebe *Podiceps cristatus*. None of them are in the threatened category but nonetheless important from the conservation point of view. Among the globally Threatened bird species of India, only two occur in the Trans-Himalaya (see table), while three more are listed as Near Threatened.

In India, the Trans-Himalaya covers about 184,823 sq. km, or 5.62% of India's geographical area. It has three national parks, covering a total area of 6,559 sq. km (i.e., 3.55%) and four wildlife sanctuaries covering an area of 10,443 sq. km. About 9% of the Trans-Himalaya is covered under the Protected Area network (Rodgers *et al.* 2000).

2. THE HIMALAYAN REGION

Nearly 6.41% of the total area of India consists of the Himalayan mountain ranges. This region shows extreme temperature and rainfall variation from the Western to Eastern Himalaya, with the Western Himalaya colder and drier than the Eastern Himalaya. Besides the east-

Endemic Bird Areas of the Western Himalaya

The Endemic Bird Areas of the Western Himalaya (including Northwest and Western Himalaya) extend along the mountain chain from western Nepal (west of the Kali Gandaki valley) through Uttarakhand, Himachal Pradesh, Jammu & Kashmir in northwest India, northern Pakistan, and then southwest along the mountains in the border region between Pakistan and Afghanistan (Stattersfield *et al.* 1998).

west gradation, there is also altitudinal gradation, both in temperature and rainfall, which again increases the habitat diversity. As the Western Himalaya merges with the Hindukush and then the mountains of Central Asia, and the Eastern Himalaya merges with the Indo-Chinese and Southeast Asian forests, there are not many endemic birds confined to the Himalaya, however, it is the centre of species radiation of pheasants. Out of the 52 species of pheasants in the world (del Hoyo *et al.* 1994), 16 are found in the Himalayan region. Important species found in India are the Western Tragopan *Tragopan melanocephalus*, Satyr Tragopan *T. satyra*, Blyth's Tragopan *T. blythii*, Temminck's Tragopan *T. temminckii*, Monal Pheasant *Lophophorus impejanus*, Sclater's Monal *L. sclateri*, Tibetan Eared-pheasant *Crossoptilon crossoptilon*, Cheer Pheasant *Catreus wallichii*, Blood Pheasant *Ithaginis cruentus*, Kalij (=Kaleej) Pheasant *Lophura leucomelanos*, Koklass Pheasant *Pucrasia macrolopha*, and Red Junglefowl *Gallus gallus*. The Himalaya also has a monotypic species (i.e. only one species in a genera), the Ibisbill *Ibidorhyncha struthersii*, an inhabitant of the shingle beds of streams and rivers in the Himalaya (and Trans-Himalaya also). This partridge-sized bird, with long red legs, downcurved red bill, and a black band across the breast, is found from 1,700 msl to 4,400 msl.

The Himalaya is geographically divided into four biotic provinces or sub-regions, namely the Northwest Himalaya, Western Himalaya, Central Himalaya (Nepal) and Eastern Himalaya (Rodger & Panwar 1988).

a) Northwest Himalaya

This part of the Himalaya (30° 18' to 32° 06' N; 72° 32' to 79° 04' E) can be said to extend from Kashmir to the River



ASHFAQ AHMED ZARRI

The breeding ecology of the Kashmir Flycatcher *Ficedula subrubra* is not fully known

Sutlej in Himachal Pradesh (Rodgers & Panwar 1988). The parallel mountain ranges from south to north comprise the Shivaliks, Lesser and Greater Himalayas, Trans-Himalayan Zaskar, Ladakh, and Karakoram. The principal ranges of this region are the Pir Panjal, Dhauladhar and Nag Tibba (Mehta & Julka 2002). To the north of the Pir Panjal ranges is situated the Kashmir valley, the largest valley in the entire Himalayan ranges, 135 km long and 40 km wide, with an area c. 4,865 sq. km.

There are a number of wetlands in this region and many of them are identified as IBAs for their bird congregations, such as Pong Dam in Himachal Pradesh, and Hokarsar, Wular, Shallabugh, and Mirgund in Jammu & Kashmir.

Restricted-Range species of the Western Himalaya EBA-128

Sr. no.	Species Name	Scientific Name	Status	Number of IBAs
1	Himalayan Quail (Extinct?)	<i>Ophrysia superciliosa</i>	CR	1
2	Western Tragopan	<i>Tragopan melanocephalus</i>	VU	20
3	Cheer Pheasant	<i>Catreus wallichii</i>	VU	25
4	Kashmir Flycatcher	<i>Ficedula subrubra</i>	VU	11
5	Tytler's Leaf-warbler	<i>Phylloscopus tytleri</i>	NT	17
6	White-throated Tit	<i>Aegithalos niveogularis</i>	LC	8*
7	White-cheeked Tit	<i>Aegithalos leucogenys</i>	LC	6*
8	Spectacled Finch or Red-browed Finch	<i>Callacanthus burtoni</i>	LC	3*
9	Brooks's Leaf-warbler	<i>Phylloscopus subviridis</i>	LC	1*
10	Orange Bullfinch	<i>Pyrrhula aurantiaca</i>	LC	5*
11	Kashmir Nuthatch	<i>Sitta cashmirensis</i>	LC	2*

*Likely to be widely distributed in more IBAs but information limited

b) Western Himalaya

The Western Himalaya (29° 5' to 31° 25' N; 77° 45' to 81° E), the smallest among the Himalayan regions, comprises areas east of Sutlej in Himachal Pradesh, and the Garhwal and Kumaon hills that includes eight hilly districts of Uttarakhand. Western Himalaya lies between Sutlej river in the west, and Kali river in the east (Nepal border), and covers an area of 51,124 sq. km, comprising 9.62% of the Himalayan region (Nandi *et al.* 2000). Some of the most important rivers of the Gangetic Plains originate in this area, i.e. Yamuna, Ganga, Bhagirathi, Ramganga, Kosi, Sharda, Surya, and their tributaries. Many of these rivers have been dammed for hydroelectric projects, and many more dams are planned and are under construction.

The avifauna of the Western Himalaya is rich and more than 680 species are reported from Uttarakhand alone. Some of the threatened species of the Western Himalaya are the Cheer Pheasant, Himalayan Quail *Ophrysia superciliosa* (believed to be extinct), Western Tragopan, and Satyr Tragopan, Grey-crowned Prinia *Prinia cinereocapilla* and Yellow-rumped Honeyguide *Indicator xanthonotus*.

Eleven restricted-range species are distributed in this EBA. Of these, six species are found in Temperate Forests. They are the Western Tragopan *Tragopan melanocephalus*, Tytler's Leaf-warbler *Phylloscopus tytleri*, Kashmir Flycatcher *Ficedula subrubra*, White-cheeked Tit *Aegithalos leucogenys*, Spectacled Finch *Callacanthus burtoni*, and Orange Bullfinch *Pyrrhula aurantiaca* (Stattersfield *et al.* 1998).

Two species, Brook's Leaf-warbler *Phylloscopus subviridis* and White-throated Tit are found in Dry Temperate Forests. Two other species, White-cheeked Tit *Aegithalos niveogularis* and Kashmir Nuthatch *Sitta cashmirensis*, are mainly found in Coniferous Forests, while the Cheer Pheasant *Catreus wallichii* and the Himalayan Quail *Ophrysia superciliosa* (known from Uttaranchal and last recorded in about 1889) are associated with open habitats, adjacent to forests.

Out of the 11 Restricted Range species, five are in the IUCN Red List category. Himalayan Quail is probably extinct or extremely rare, while Western Tragopan, Cheer Pheasant and Kashmir Flycatcher are in Vulnerable category, and Tytler's Leaf-warbler is listed as Near Threatened.

Due to the great altitudinal variation from less than 500 m to 3,600 m, the Himalaya shows three distinct biomes, based on bird assemblages (BirdLife International undated). (i) Biome 7: Sino-Himalayan Temperate Forest, mainly between c. 1,800 and 3,600 msl, having Broadleaf Evergreen, Broadleaf Deciduous, Mixed Broadleaf-Coniferous, and Coniferous Forests. It also has Montane Grasslands. A total of 112 bird species have been identified which represent this biome. Most of them are common and widespread in suitable habitats. Most show altitudinal movement, while some migrate long distances in winter to other biomes such as the Indo-Chinese Tropical Moist Forest, Indian Peninsula Tropical Moist

Forest and/or Indo-Malayan Tropical Dry Zone. (ii) Biome 8: Sino-Himalayan Subtropical Forest, found between c. 1,000 m and 2,000 m. The key habitats of this biome are Lower Montane Rain Forest, Hill Evergreen Forest, and Pine Forest (BirdLife International undated). Up to 95 species have been identified that represent the bird assemblages of this biome. Most of them are common and widespread. This biome is the domain of forest and understorey birds: eight species of laughingthrushes (*Trochalopteron* and *Ianthocincla* formerly under *Garrulax*), three species of scimitar-babblers (*Pomatorhinus*), four species of Parrotbills (*Paradoxornis*), and many warblers, tit-babblers, and wren-warblers. A small portion of the Himalaya also comes under Biome 9: Indo-Chinese Tropical Moist Forests, especially in the northeast region. This biome is below 1,000 m and is covered with Lowland Evergreen Rain Forest, Semi-evergreen Rain Forest and Moist Deciduous Forest (mainly occurring in the Eastern Himalaya). Birds of 19 species have been identified to represent the bird assemblages of this biome (BirdLife International undated), including some globally threatened (e.g., White-bellied Heron *Ardea insignis*, Pale-capped Pigeon *Columba punicea*, Masked Finfoot *Heliopais personata*), and Near Threatened (White-cheeked Hill-partridge *Arborophila atrogularis*), but none of them are found in the Western Himalaya. The other species are common in suitable habitats. It should be noted that most of the area of this biome would come in the Northeast region of India (as described by Rodgers & Panwar 1988).

c) Central Himalaya

As most of this region falls in Nepal, it is not being described here.

d) Eastern Himalaya

The Eastern Himalaya, consisting of the kingdom of Bhutan and the Indian states of Sikkim and Arunachal Pradesh, is one of the richest bird zones in the Subcontinent. Ali (1977) identified 536 bird species in this zone, which is c. 1,000 km long and 150–200 km wide, consisting of extremely rugged mountains, deep-forested valleys, and steamy tropical plains. The altitude varies from 300 msl to 4,500 msl and the region is a meeting point of Palaeartic, Indo-Chinese, and Indo-Malayan biogeographical regimes. This has created numerous biotopes or life zones, resulting in abundant plants, insects, and birdlife. As it is close to the Bay of Bengal, moisture-laden clouds are intercepted by abruptly rising chains of mountains, resulting in heavy precipitation.

Most of the birds of Eastern Himalaya are small passerines or perching birds which live in forests. As many as 18 species of pigeons and doves, 17 species of cuckoos, seven species of barbets, 26 species of woodpeckers, seven species of drongos, nine species of bulbuls, seven species

of scimitar-babblers, 13 species of wren-babblers, eight species of parrotbills, and many species of laughingthrushes make the Eastern Himalaya a centre of speciation for many groups of birds. In the Indian subcontinent, 34 species of laughingthrushes (formerly kept under *Garrulax* by Ripley 1982) are found, out of which 27 species are from the Eastern Himalaya (some are marginal to the area). All the seven species of scimitar-babblers are found in the jungles of the Eastern Himalaya. Another well represented group is the parrotbill *Paradoxornis* spp., of which we have eight species in the Indian subcontinent, and all are found in the Eastern Himalaya.

The Eastern Himalaya is one of the biodiversity hotspots of the world. It is also the least studied region of India, with perhaps many taxa awaiting discovery as proved by this discovery of Bugun Liocichla *Liocichla bugunorum* in 2006. As the human population density is low, this region still has good natural forest cover, and there is still time to select a well designed protected area system which adequately protects the range of biological and other natural resource values (Rodgers & Panwar 1988).

Endemic Bird Areas of Eastern Himalaya

This range starts from the Arun-Kosi valley of eastern Nepal, and runs through Bhutan, northeast India (Sikkim, northern West Bengal, and Arunachal Pradesh), southeast Tibet Autonomous Region and northeast Myanmar to southwest China (northwest Yunnan province) (Stattersfield *et al.* 1998). The Eastern Himalaya also includes the mountain ranges to the south of the Brahmaputra river, which extend through Nagaland, Manipur, southern Assam, Meghalaya, and Mizoram, to the Chin hills in western Myanmar, and the Chittagong hills in southeast Bangladesh. Rodgers & Panwar (1988) and Rodgers *et al.* (2000) have included the area south of the Brahmaputra river in their biogeographic zone Northeast, sub-province North-East Hills.

Some of the restricted range species of the Eastern Himalaya breed in mainly two types of forests, Subtropical Wet Hill Forests between 1,000 msl and 2,000 msl, and Wet Temperate Forests between 1,800 msl and 3,000 msl. Some of the species also breed in Moist Temperate and Subalpine Forests, and many are altitudinal migrants, moving during the breeding season into Tropical Lowland Evergreen and Semi-evergreen Rain Forests below 1,000 m (Stattersfield *et al.* 1998). This region is important for many globally Threatened, Near Threatened, and restricted-range species. These restricted-range species are found between the altitudes of 300 msl and 4,000 msl. Many of these species are altitudinal migrants and found outside their breeding areas. As the region is remote and little studied, the information available is inadequate. The genus *Sphenocichla* is endemic to this EBA. Two main habitats are important for these birds

to breed, namely the Subtropical Wet Hill Forest and the Wet Temperate Forest. The Tropical Lowland Evergreen and Semi-evergreen Rain Forests are used by many bird species outside the breeding season (Stattersfield *et al.* 1998).

Several species have particularly small ranges (Stattersfield *et al.* 1998). For example, the Rusty-throated Wren Babbler *Spelaeornis badeigularis* and Snowy-throated Babbler *Stachyris oglei* have been recorded only from the Lohit and Tirap Divisions of eastern Arunachal Pradesh, while the Tawny-breasted Wren-babbler *Spelaeornis longicaudatus* is restricted to the hills of Meghalaya, southern Assam, and western Manipur; and the Dark-rumped Swift *Apus acuticauda* is known to breed only in the Khasi Hills in Meghalaya and the Blue Mountains in Mizoram where around 30 birds were seen (Ahmed 2003). The Rusty-throated Wren-babbler, also called Mishmi Wren-babbler (Ali & Ripley 1987) has a type specimen collected at Dreyi, Mishmi Hills, at c. 1600 m. In February 2005, Ben King and Julian Donahue rediscovered the Rusty-throated Wren-babbler about 50 km from where the type-specimen was collected in 1947 in the Mishmi Hills of eastern Arunachal Pradesh (Butchart *et al.* 2005). In the same Mishmi Hills, two birds were heard/seen in November 2007 by Sumit Sen (*pers. comm.* 2010). This tiny (9 cm), skulking bird of the Subtropical Wet Forests is considered is uncommon but may be common in suitable areas.

Stattersfield *et al.* (1998) have listed 22 restricted-range species in this region, out of which 21 are found in India. Only *Sitta victoriae* is not found here. Out of the 21 restricted-range species found in this region, 11 are considered Threatened or Near Threatened (BirdLife International 2001, 2015), a number greater than in any other EBA of India (Stattersfield *et al.* 1998).

3. THE INDIAN DESERT (THAR)

The Thar desert occupies nearly 10% of India's geographical area and covers 208,751 sq. km in Rajasthan alone. To the north, it extends into Punjab in the Ferozpur, Sangrur, and Bhatinda districts (14,510 sq. km), and in the northeast it joins the arid areas of Haryana (12,840 sq. km) in parts of the Mahendragarh and Hissar districts. The Aravalli hills, starting from Champaner in north Gujarat and extending up to Delhi, form the eastern boundary of the Thar. In the west are the Thar-Parkar, Cholistan, and Thal deserts of Pakistan. To the south, it extends into Gujarat, mainly in the Kutch, Mehsana, and Banaskantha districts, and to some extent in the Saurashtra region. The total desert area in Gujarat is about 62,180 sq. km, or 20% of the Thar desert.

Depending upon the rainfall and edaphic factors, the Thar desert can be divided into four divisions: (i) the Luni basin comprising Pali, Jalore, the southeastern part of Barmer, eastern part of Jodhpur, western part of Ajmer, Sirohi, and the southern part of Nagaur district; (ii) the northern drainage

zone, comprising Sikar, Jhunjhunu, and northern Nagaur; (iii) the agriculturally rich district of Sri Ganganagar adjoining Punjab and Haryana; and (iv) the true desert or *Marusthali* consisting of the whole of Jaisalmer, northern Barmer, western parts of Jodhpur, Bikaner, and Churu districts.

The Thar Desert is one of the smallest deserts in the world, but it exhibits a wide variety of habitats and biodiversity (Sharma *et al.* 2013). It is the most thickly populated desert in the world, with an average density of 83 persons per sq. km, whereas in other deserts the average is only seven persons per sq. km (Baqri & Kankane 2001). It is considered an important desert in terms of its location, where Palaearctic, Oriental, and Saharan elements of biodiversity are found.

Avifauna of the Thar desert

Despite its comparatively small area, the Thar desert has a high avian diversity, from its location on the crossroads of the Palaearctic and Oriental biogeographic realms. As the Thar desert is not isolated, avian endemism is very low. To the west, it is connected through the Sind plains with the Persian and then the Arabian deserts, to the northeast with the Gangetic Plains, and to the east, it joins the Semi-Arid biogeographic zone. In the south, it merges with the Rann of Kutch. Therefore, most species of birds of the Thar are widely distributed.

Between 250 to 300 species have been reported from the Thar desert. This variation is mainly due to the fact that some authors include Kutch, parts of Saurashtra, and the western side of the Aravalli mountains in the Thar desert, while others have a more restrictive definition of the desert that includes only nine districts of western Rajasthan and Kutch in Gujarat. In the Rajasthan part of the Thar, nearly 250 species have been reported (Rahmani 1997a, 1997b). Tremendous changes in the avifaunal structure of the Thar desert are taking place due to the Indira Gandhi Nahar Project (IGNP) and species never seen earlier are now regularly found near the canal (Rahmani 1997a, 1997b; Rahmani & Soni 1997). However, this project is playing havoc with the desert ecosystem by changing the crop pattern, traditional grazing regime, and colonisation by newcomers who do not have the conservation value system which the desert people have. Due to easy availability of water everywhere, unsustainable livestock grazing is taking place and the famous Sewan grasslands which have survived for hundreds of years with low grazing are now under tremendous pressure. These grasslands are the major habitat of the Critically Endangered Great Indian Bustard *Ardeotis nigriceps*, and the winter migrant Houbara or Macqueen's Bustard *Chlamydotis macqueeni*.

Other important desert species are the Cream-coloured Courser *Cursorius cursor*, Greater Hoopoe-Lark *Alaemon alaudipes*, various species of sandgrouse, raptors, wheatears,

larks, pipits, and munias. In the Rann of Kutch in Gujarat, both Greater *Phoenicopterus roseus* and Lesser *Phoeniconaias minor* Flamingo breed when conditions are suitable. These nesting colonies are coming under increasing pressure due to tourist disturbance, and a large number of nests have been reported to be destroyed. As the sites of the nesting colonies shift, depending upon inundation, it is difficult to protect them. The famous 'Flamingo City' in the Great Rann is under grave threat due to a road that is under construction. It is feared that this road, which is about 6-10 km from the breeding area, will change the water regime, besides creating disturbance. In the Thar desert, Rodgers *et al.* (2000) have listed one national park of 3,162 sq. km. and five wildlife sanctuaries of 12,914 sq. km. On paper, 7.45% of the desert is under the PA network. However, the ground situation is very different. There are 70 villages in the Desert National Park, and more than half of the Little Rann Wildlife Sanctuary (4,953 sq. km) is under human occupation. Similarly, the Kutch Desert Sanctuary (7,506 sq. km) is under military occupation, being located in the border areas. There are only two PAs in the Thar desert with legally no human occupation: the seven sq. km Tal Chhapar Blackbuck Sanctuary in Rajasthan and the two sq. km Lala Bustard Sanctuary in Gujarat, both of which are IBAs.

Besides the globally threatened species mentioned above, the Thar desert hosts many Near Threatened species in significant numbers. The main Near Threatened species for which this desert is extremely important are: Lesser Flamingo *Phoeniconaias minor*, Cinereous Vulture *Aegypius monachus*, and Pallid Harrier *Circus macrourus*. There could be 970,000 to 990,000 Lesser Flamingos in Africa and Asia (BirdLife International 2014). In a study conducted by Shah and Qurieshi (2015) in Gujarat, Lesser Flamingo population was estimated to be between 200,000 and 250,000, while Greater Flamingo population was from 80,000 to 100,000, based on the sample study sites. They found that Greater and Lesser flamingos are largely distributed in the districts of Kutch, Surrindranagar, Jamnagar, Bhavnagar, Ahmedabad, Porbander, Anand, Navsari, Valsad, and Vadodara, within 17 km of the coastline as most of the saline lakes, and salt work are within this area. Kutch in Gujarat is the only district where both species of flamingo breed (Ali 1974, Ali & Ripley 1987, Grimmett & Inskipp 2003, Mundkur *et al.* 1989). Two IBAs, Flamingo City and Little Rann of Kutch have been identified on the basis of the breeding of flamingos, both Greater and Lesser. Earlier, it was known to nest only in the Greater Rann of Kutch (an IBA) (Ali 1974), but Mundkur *et al.* (1989) reported its nesting in the Little Rann also. Shah and Qurieshi (2015) found both species nesting in Little and Greater Rann. The Great Rann of Kutch has two major nesting sites: Flamingo City for only Greater Flamingo, and Lodrani-Kuda Rann for Lesser Flamingo to greater extent and Greater Flamingo to smaller extent.

Globally threatened and Restricted range species of the Eastern Himalaya				
Sr. no.	Species Name	Scientific Name	IUCN Status	Number of IBAs
1	Chestnut-breasted Hill-partridge	<i>Arborophila mandellii</i>	VU	12
2	Blyth's Tragopan	<i>Tragopan blythii</i>	VU	27
3	Sclater's Monal	<i>Lophophorus sclateri</i>	VU	8
4	Dark-rumped Swift or Khasi Hills swift	<i>Apus acuticauda</i>	VU	10
5	Snowy-throated Babbler	<i>Stachyris oglei</i>	VU	8
6	Tawny-breasted Wren Babbler	<i>Spelaeornis longicaudatus</i>	VU	5
7	Rusty-throated Wren Babbler or Mishmi Wren-babbler	<i>Spelaeornis badeigularis</i>	VU	5
8	Ward's Trogon	<i>Harpactes wardi</i>	NT	14
9	Rusty-bellied Shortwing	<i>Brachypteryx hyperythra</i>	NT	15
10	Blackish-breasted Babbler or Sikkim Wedge-billed Babbler	<i>Sphenocichla humei</i>	NT	15
11	Rufous-throated Wren Babbler	<i>Spelaeornis caudatus</i>	NT	11
12	Hoary-throated Barwing	<i>Ixops nipalensis</i>	LC	18
13	Streak-throated Barwing or Austens Barwing	<i>Ixops waldeni</i>	LC	17
14	Ludlow's Fulvetta or Brown-throated Fulvetta	<i>Fulvetta ludlowi</i>	LC	10
15	Brown-capped Laughingthrush	<i>Ianthocincla austeni</i>	LC	5
16	Striped Laughingthrush	<i>Trochalopteron virgatum</i>	LC	6
17	Grey Siberia	<i>Malacias gracilis</i>	LC	29
18	Beautiful Siberia	<i>Malacias pulchellus</i>	LC	25
19	Yellow-vented Warbler or Yellow-vented Leaf-warbler	<i>Phylloscopus cantator</i>	LC	23
20	Broad-billed Warbler	<i>Tickellia hodgsoni</i>	LC	19
21	White-naped Yuhina	<i>Yuhina bakeri</i>	LC	37

The Thar Desert is important for many vultures and raptors. For example, sometimes more than a thousand Egyptian Vulture *Neophron percnopterus* are seen on the carcass dump called Jor Beed near Bikaner. This is the area which host hundreds of Cinereous Vultures *Aegyptus monachus* and thousands of Griffon Vulture *Gyps fulvus*, and few dozen Himalayan Griffon *Gyps himalayensis*. Tawny Eagle *Aquila rapax* and Steppe Eagle *Aquila nipalensis* were also counted in large numbers.

The Thar desert lies in Biome 13 (Saharo-Sindian Desert) in which BirdLife International (undated) has identified 11 bird species representing the biome assemblage [one species, Sind Woodpecker *Dendrocopos assimilis* is found in Pakistan, with only one 19th century record from India: Hargitt (1890)]. Except for two (Great Indian Bustard and White-browed Bushchat), the remaining nine species are not threatened. For many species such as the Spotted Sandgrouse *Pterocles senegallus*, Desert Finch Lark *Ammomanes deserti*, Greater Hoopoe-lark *Alaemon alaudipes*, Grey Hypocolius *Hypocolius ampelinus*, and Trumpeter Finch *Rhodopechys githaginea*, the Thar Desert forms their extreme eastern winter distributional range. Many of them occur from the Thar desert westward in the whole of the Middle East, and then all the way up to Morocco in north Africa. Incidentally, the Thar Desert does not have any Endemic Bird Area or Secondary Area, as none of the species is wholly restricted to this biogeographic zone. Considering changes in the landscape of the Indian Thar

Desert and huge population decline of many desert birds, both resident and migratory, there is a need to reassess the status of many species such as the Imperial or Black-bellied Sandgrouse *Pterocles orientalis*, Spotted Sandgrouse *Pterocles senegallus*, Pin-tailed Sandgrouse *Pterocles alchata*, Grey Hypocolius *Hypocolius ampelinus*, and Indian Courser *Cursorius coramandelicus*.

4. THE SEMI-ARID REGION

This region has rainfall varying from 400 mm to 1,000 mm, and is dominated by grass and shrub species. The Semi-Arid region shows high avian numbers, especially granivorous species such as finches, munias, larks, doves, and pigeons. It has Dry Deciduous Forests and extensive tracts of grasslands on the Deccan plateau in central India, Malwa plateau in northwest India, and Saurashtra region in Gujarat. The Semi-Arid region merges with the Desert on the western side and with the Gangetic Plains in the north. More than 100 species of birds use the Semi-Arid grasslands for foraging and/or nesting (Rahmani 1996b). A majority of the species (83%) are present in other grassland types or even in small grassland patches within forests, but 17 species are exclusively present in this zone. Four species are found only in the Semi-Arid and Deccan regions and nowhere else. They are the Malabar Crested Lark *Galerida malabarica*, Sykes's Crested Lark *G. deva*, Green Munia *Amandava formosa*, and the Rock Bush-quail *Perdicula argoondah*. The Indian Chat or Brown Rock

Globally Threatened* species of the Indian Thar Desert				
Sr. no.	Species Name	Scientific Name	IUCN Status	Number of IBAs
1	White-rumped Vulture	<i>Gyps bengalensis</i>	CR	6
2	Long-billed Vulture or Indian Vulture	<i>Gyps indicus</i>	CR	6
3	Red-headed Vulture	<i>Aegypius calvus</i>	CR	4
4	Great Indian Bustard	<i>Ardeotis nigriceps</i>	CR	2
5	Sociable Lapwing or Social Plover	<i>Vanellus gregarius</i>	CR	1
6	Egyptian Vulture	<i>Neophron percnopterus</i>	VU	5
7	Asian Woollyneck	<i>Ciconia episcopus</i>	VU	1
8	Greater Spotted Eagle	<i>Clanga clanga</i>	VU	2
9	Eastern Imperial Eagle	<i>Aquila heliaca</i>	VU	2
10	Pallas's Fish-eagle	<i>Haliaeetus leucoryphus</i>	VU	1
11	Asian Houbara or Macqueen's Bustard	<i>Chlamydotis macqueeni</i>	VU	2
12	Yellow-eyed Pigeon	<i>Columba eversmanni</i>	VU	2
13	White-browed Bushchat	<i>Saxicola macrorhynchus</i>	NT	3
14	Oriental Darter	<i>Anhinga melanogaster</i>	NT	1
15	Painted Stork	<i>Mycteria leucocephala</i>	NT	1
16	Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	NT	1
17	Lesser Flamingo	<i>Phoeniconaias minor</i>	NT	1
18	Ferruginous Pochard (Duck)	<i>Aythya nyroca</i>	NT	1
19	Himalayan Vulture (Griffon)	<i>Gyps himalayensis</i>	NT	1
20	Cinereous Vulture	<i>Aegypius monachus</i>	NT	4
21	Pallid Harrier	<i>Circus macrourus</i>	NT	1
22	Laggar Falcon	<i>Falco jugger</i>	NT	1
23	Eurasian Curlew	<i>Numenius arquata</i>	NT	2
24	Black-tailed Godwit	<i>Limosa limosa</i>	NT	1
25	River Tern	<i>Sterna aurantia</i>	NT	2
26	European Roller	<i>Coracias garrulus</i>	NT	1

* Only those globally threatened species for which this biogeographic zone is very important are listed.

Chat *Cercomela fusca* is another endemic bird found in the Arid, Semi-Arid regions and the Gangetic Plains. Perhaps the most endangered species of the Semi-Arid Zone is the Lesser Florican *Sypheotides indicus*. Its main breeding areas used to be the grasslands of the Malwa plateau and Saurashtra, but due to the destruction of grasslands, this bird has disappeared from most of its range (Sankaran *et al.* 1992).

According to the biogeographic zone classification of Rodgers *et al.* (2000), the Semi-Arid Zone occurring in eastern Rajasthan, Gujarat (except Kutch which is in the Desert Zone), western Madhya Pradesh, parts of Uttar Pradesh, Haryana, Punjab, and southern parts of Jammu & Kashmir, constitutes about 548,850 sq. km or 16.60% of India's geographical area.

5. THE WESTERN GHATS

The Western Ghats on the northwest coast of India extend for about 1,600 km from the River Tapti (21° N) in the north to Kanyakumari (8° N) in the south. Except for the 25 km Palghat Gap, the Western Ghats stand unbroken but the peaks vary greatly. The highest peak is Anamudi (2,700 m).

The Western Ghats occupy only about 5% of India's land mass (about 132,606 sq. km), yet they harbour nearly 27%

of its total flora. Good forest still covers 30% of the Western Ghats region, particularly on the higher reaches. Rivers flowing from the Western Ghats irrigate almost 40% of land in India, and nearly 250 million people depend on them. Krishna, Godavari, and Kaveri are the three major rivers of south India that originate from the Western Ghats.

Nearly 510 species of birds have been identified from the Western Ghats. Despite the fact that birds are so mobile and some can travel thousands of kilometres during migration and dispersal, there are 26 bird species endemic or restricted to the Western Ghats. Some species such as the Malabar Grey Hornbill *Ocyrceros griseus* and Malabar Parakeet *Psittacula columboides* are found from Maharashtra to Kerala, while others like the Nilgiri Laughingthrush, now called Black-chinned Laughingthrush *Strophocincla* (= *Garrulax*) *cachinnans* are highly limited in their distribution, being restricted to the Nilgiris (Zari *et al.* 2008) Even here, they occupy less than 200 sq. km in highly fragmented sholas, at heights above 1,700 m. With such a narrow distribution, it is no wonder that IUCN has listed this bird as Endangered. The Nilgiri Pipit *Anthus nighiriensis* is endemic to the high-altitude grasslands of the Western Ghats in Kerala and Tamil Nadu, though it is



JEAN HOWMAN/WPA/BirdLife International

The Himalayas are the centre of radiation of many pheasant species

locally fairly common in its specialised habitat across its range, recent studies by Robin *et al.* (2014) shows that it is now confined only to two major mountain ranges (Nilgiris hills and Anamalai-Palni hills). The total area occupied by this bird is only 440 sq km.

Despite being tropical, the forests of the Western Ghats are poorer in birdlife compared to similar forests in northeast India or Southeast Asia. For instance, 12 species of pittas are found in Southeast Asia, but only a single species is seen in the Western Ghats (Daniels 1997). Only five species of sunbirds are reported from the Western Ghats, while 76 species are found in similar tropical forests in Africa. Nevertheless, the Western Ghats are one of the biodiversity hotspots of the world. Consider this. In India there are reports of about 320 species of amphibians and 520 species of reptiles, of which about 190 amphibian and 120 reptile species are endemic or confined to the Western Ghats. In the last decade, around 100 new species of amphibians and reptiles have been described from the Western Ghats. Among reptiles, eight endemic genera are found in the Western Ghats: *Brachyophidium*, *Dravidogecko*, *Melanophidium*, *Plectrurus*, *Ristella*, *Salea*, *Teretrurus*, and *Xylophis*. The amphibian fauna exhibits even greater levels of endemism: almost 50% of India's species are endemic to this region (Wikramanayake *et al.* 2002).

The Western Ghats can be divided into three regions, (a) northern; (b) central; and (c) southern. These divisions are appropriate in the context of birds as well (Daniels 1997). The major rivers which originate in the Western Ghats are the Godavari (1,500 km), Krishna (1,400 km), and Cauvery (805 km). All these rivers flow eastwards, while other rivers such as Gayatri, Kalinadi, Nethravathi, Sharavathi, Bharathapuzha, and Periyar flow westwards. These rivers are dependent on the monsoons, because the Western Ghats are chiefly monsoonal, with heavy rain between June and September. Rainfall also depends on the elevation and



ASAD R. RAHMANI

The Great Indian Bustard *Ardeotis nigriceps* has seen massive decline mainly due to habitat destruction and hunting

topography of the area. Kerala receives the maximum rainfall, c. 7,000–8,500 mm in some places.

Restricted-Range species in the Western Ghats

Stattersfield *et al.* (1988) had identified 16 restricted-range species in the Western Ghats, but now based on recent taxonomic changes (Rasmussen and Anderton 2005, 2012, del Hoya and Collar 2014), we have identified 26 species that are endemic to the Western Ghats.

The Western Ghats and isolated areas of Moist Forests in the Eastern Ghats and elsewhere in peninsular India constitute Biome 10: Indian Peninsula Tropical Moist Forest according to BirdLife International (undated). This biome is located mainly below c. 1,000 m and the key habitats are Lowland Evergreen Rain Forest, Semi-Evergreen Rain Forest, Moist Deciduous Forest, and Evergreen Hill Forest. Fifteen bird species have been identified that represent the bird assemblage of this biome. None of them are globally threatened, although some of them such as the Ceylon Frogmouth *Batrachostomus moniliger*, Malabar Trogon *Harpactes fasciatus*, Malabar Pied Hornbill *Anthracoceros coronatus*, Malabar Whistling Thrush *Myophonus horsfieldii* and the Black-headed Babbler *Rhopocichla atriceps* are confined to undisturbed forests, hence of some conservation concern as the forest habitats are restricted.

6. THE DECCAN PENINSULA

Deccan is derived from *Dakshina* (Sanskrit) which means south. The Deccan Peninsula covers c. 1,380,380 sq. km, or 42% of the total area of India (Rodgers *et al.* 2000). Much of the Peninsula is constituted by the Deccan plateau, which has a mean elevation of c. 600 msl, sometimes up to 900 msl. The plateau is flanked by a narrow coastal strip on the west and by a much broader coastal region on the east. The rivers flowing through the Peninsula have flat, shallow valleys with a low gradient. The main rivers of the Deccan Peninsula are the Narmada, Tapti, Mahanadi,

Globally Threatened* species of the Semi-Arid Zone			
Species Name	Scientific Nams	IUCN Status	No. of IBAs
Greater Spotted Eagle	<i>Aquila clanga</i>	VU	14
Eastern Imperial Eagle	<i>Aquila heliaca</i>	VU	10
White-backed Vulture	<i>Gyps bengalensis</i>	CR	31
Long-billed Vulture	<i>Gyps indicus</i>	CR	25
Red-headed Vulture	<i>Sarcogyps calvus</i>	CR	
Egyptian Vulture	<i>Neophron percnopterus</i>	EN	
Sarus Crane	<i>Grus antigone</i>	VU	29
Asian Woollyneck	<i>Ciconia episcopus</i>	VU	
Great Indian Bustard	<i>Ardeotis nigriceps</i>	CR	2
Lesser Florican	<i>Sypheotides indicus</i>	EN	6
Sociable Lapwing	<i>Vanellus gregarius</i>	CR	3
Indian Skimmer	<i>Rynchops albicollis</i>	VU	12
Black-bellied Tern	<i>Sterna acuticauda</i>	EN	
White-browed Bushchat	<i>Saxicola macrorhyncha</i>	VU	5
Pied Tit	<i>Parus nuchalis</i>	VU	6
Green Munia	<i>Amandava formosa</i>	VU	3

*Only those threatened species for which this biogeographic zone is very important are listed

CR = Critically Endangered, EN = Endangered, VU = Vulnerable

**As many species listed in this table are widespread, they are likely to be present in many more IBAs and in a wider landscape.

Godavari, Krishna, and Cauvery, and their tributaries and associated lakes.

The climate of the Deccan Plateau is dry. The Deccan Peninsula has five divisions: (1) Deccan plateau south; (2) Deccan plateau north; (3) Eastern highlands; (4) Chhota Nagpur and (5) Central highlands. The northern plateau is very dry, while the Eastern highlands is a small province but biologically the richest (Cherian 2000). This region (Eastern highlands) also consists of the Eastern Ghats and the moist hills and valleys of the Chhattisgarh-Dandakaranya areas. Chhota Nagpur is moist in the northwest, while its remaining parts are dry. The Central highlands include the Satpura and the Vindhya hill ranges.

The Deccan Peninsula has some of the finest Dry Deciduous Forests, particularly in Madhya Pradesh, Orissa, and Maharashtra. It also has some grasslands where relict populations of the Great Indian Bustard and Lesser Florican are found. The common endemic species (found in India only) are Grey Junglefowl *Gallus sonneratii*, Painted Francolin *Francolinus pictus*, Rock Bush-quail *Perdicula argoondah*, Painted Bush-quail *Perdicula erythrorhyncha*, and Sykes's Crested Lark *Galerida deva*. Some of these species are found in other biogeographical regions such as the Western Ghats, the Semi-Arid and Desert regions, and the Gangetic Plains.

Among the threatened species of birds in the Deccan Peninsula are endemic species, namely Yellow-throated Bulbul *Pycnonotus xantholaemus*, Forest Owlet *Heteroglaux blewitti*, Jerdon's Courser *Rhinoptilus bitorquatus*, and Green Munia *Amandava formosa*. The first three species

are birds of Secondary Areas as defined by Stattersfield *et al.* (1998). The other threatened birds are the Great Indian Bustard and Lesser Florican.

Secondary bird areas in the Deccan Peninsula

In this biogeographical zone (of Rodgers and Panwar's classification), we find two Secondary Areas as defined by BirdLife International (*A secondary area is an area which supports one or more restricted-range bird species, but does not qualify as an Endemic Bird Area because fewer than two species are entirely confined to it*). These Secondary Areas are (1) Southern Deccan plateau and (2) Central Indian Forest.

Southern Deccan Plateau (SA: s072)

This area lies in the states of Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, and possibly Orissa, where the Yellow-throated Bulbul *Pycnonotus xantholaemus* is distributed. This bird is uncommon and patchily distributed on boulder-strewn hills with vegetation ranging from Tropical Thorn Scrub and Dry Deciduous Forests to Moist Deciduous Forests between 600 msl and 1,200 msl (Ali & Ripley 1987; Subramanya *et al.* 1993, 1995). The main threats to this species are total clearance of vegetation, excessive wood-cutting, cattle-grazing, and quarrying on the hillocks (Subramanya *et al.* 1993, 1995). The IBAs occurring in the Secondary Area where this species is found are: Horsley Hills, Nandi Hills, Kaundinya, Sri Peninsula Narasimha WLS, Sri Venkateswara WLS, Hampi, Jogimatti State Forest, Ramanagara State Forest, and Chinnar WLS (Rahmani 2012). This species is very common

Globally threatened* species of the Deccan Biogeographic Zone

Species Name	Scientific Nams	IUCN Status	No. of IBAs
Spot-billed Pelican	<i>Pelecanus philippensis</i>	VU	23
Lesser Adjutant	<i>Leptoptilos javanicus</i>	VU	8
White-rumped Vulture	<i>Gyps bengalensis</i>	CR	42
Long-billed Vulture	<i>Gyps indicus</i>	CR	26
Greater Spotted Eagle	<i>Aquila clanga</i>	VU	17
Great Indian Bustard	<i>Ardeotis nigriceps</i>	CR	4
Lesser Florican	<i>Sypheotides indicus</i>	EN	5
Jerdon's Courser	<i>Rhinoptilus bitorquatus</i>	CR	2
Pale-capped Pigeon	<i>Columba punicea</i>	VU	3
Forest Owlet	<i>Heteroglaux blewitti</i>	CR	3
Yellow-throated Bulbul	<i>Pycnonotus xantholaemus</i>	VU	12
Broad-tailed Grassbird	<i>Schoenicola platyura</i>	VU	1
Pied Tit	<i>Parus nuchalis</i>	VU	1
Green Munia	<i>Amandava formosa</i>	VU	12

*Only those Threatened species for which this biogeographic zone is very important are listed

CR = Critically Endangered, EN = Endangered, VU = Vulnerable

in Ramanagaram, close to Bangalore. Shashank Dalvi (*pers. comm.* 2010) saw or heard at least 15 individuals in a single walk at this place in October 2008. It can be easily overlooked, as the call can be mistaken for that of the commoner White-browed Bulbul (Shashank Dalvi *pers. comm.* 2010). Rahmani (2012) has given all the latest records.

Central Indian Forests (SA: s075)

This Secondary Area is the habitat of the Critically Endangered Forest Owlet *Heteroglaux blewitti*, especially in eastern Madhya Pradesh, northwest Maharashtra, and northwest Orissa. This bird was thought to be extinct, but was rediscovered in 1997. Later studies revealed that it is found in Melghat Tiger Reserve, Gugamal, Taloda (Shahada), and Toranmal.

7. THE EASTERN GHATS

Although Rodgers & Panwar (1988) and Rodgers *et al.* (2000) have included the Eastern Ghats in the Deccan Peninsula biogeographic zone, we are describing the region separately as the Eastern Ghats are important from the avifaunal distribution point of view.

The Eastern Ghats (11° 31' to 21° 0' N; 77° 22' to 85° 21' E) are spread through Orissa, Andhra Pradesh, and Tamil Nadu, covering an area of c. 75,000 sq. km, with an average width of 200 km in the north and 100 km in the south. They extend over a length of 1,750 km between the Rivers Mahanadi in the north and Vaigai in the south, along the east coast of India (Pullaiah 2002). The northernmost boundary of the Eastern Ghats consists of the Mahanadi basin, while the Nilgiri hills form the southern boundary. Pullaiah (2002) also mentions that in the west, the Eastern Ghats merge with the tips of the Bastar, Telangana, and

Karnataka plateaux, and Tamil Nadu uplands, while the coastal area in the east limits the eastern part. The Eastern Ghats are not contiguous because the Rivers Mahanadi, Godavari, and Krishna cut across them (Pullaiah 2002). In the north, the highest peak is Mahendragiri (1,501 m) in the Ganjam district of Orissa. The average elevation in the northern Eastern Ghats is c. 400 m. There is a 130 km gap in the Ghats in Guntur district, and then the middle Eastern Ghats start and extend from the Krishna to near about Chennai, including the Nallamalais, Palakonda, Velikonda, and Seshachalam hills where the average elevation is c. 750 m (Pullaiah 2002). The southern Eastern Ghats run towards the Western Ghats and meet in the Nilgiris. This section includes the Javadi hills, Kollimalai, Pacchamalai, Kalrayan, and Biligirirangan hills. The highest peak in this region is 1,750 msl in the Biligirirangan hills, which forms the southern tip of the Eastern Ghats.

The climate of the Eastern Ghats is tropical. The region receives rainfall from the southwest monsoon, and the retreating northeast monsoon, ranging from 1,200 to 1,600 mm. The region also has semi-arid climate. Cyclonic storms are frequent during the rainy season, especially on the coastal plains. The temperature in January ranges between 20 °C and 25 °C, the maximum temperature shoots up to 41 °C during the summer months and the minimum is 5 °C in winter. The relative humidity varies from 70 to 75%.

The vegetation of the Eastern Ghats consists of Evergreen Forests, Tropical Semi-Evergreen Forests, Tropical Moist Deciduous Forests, Southern Tropical Dry Deciduous Forests, Northern Mixed Dry Deciduous forests, Dry Savannah Forests, Tropical Dry Evergreen Forests, and Tropical Dry Evergreen Scrub (Pullaiah 2002).

The Eastern Ghats are very rich in biodiversity, which consists of 2,500 species of angiosperms or about 13% of the

flowering plants of India (Pullaiah 2002). Regarding the fauna of the Eastern Ghats, adequate information is lacking. Nevertheless, 115 species of amphibians and reptiles have been reported from the Eastern Ghats (Daniels 2000). Golden Gecko *Calodactylodes aureus* was rediscovered from Chittoor in 1986 (Daniel *et al.* 1986).

The Eastern Ghats are rich in avifaunal diversity. However, they have received relatively little attention from biologists (Ripley *et al.* 1987–88). Only two systematic and comprehensive ornithological surveys have been undertaken so far in the entire Eastern Ghats region. They are the Vernay scientific survey of the Eastern Ghats (Whistler & Kinnear 1930–37) and the Hyderabad State Ornithological Survey (Ali 1933–34). Other significant studies on the birds of the Eastern Ghats were done by Abdulali (1945), Krishna Raju (1985), Trevor Price (1978, 1979), Ripley *et al.* (1987–88), and Bhushan (1994).

The Eastern Ghats support nearly 400 species and subspecies of birds (Bhushan 1994). The Critically Endangered Jerdon's Courser *Rhinoptilus bitorquatus* is found in the Eastern Ghats. The Yellow-throated Bulbul *Pycnonotus xantholaemus*, which is endemic to southern peninsular India, is also found in the southern part of the Eastern Ghats. Subramanya (2004) while travelling from Kharagpur to Chennai by train, found some hills between Kaluga and Gangadharpur in Orissa to be suitable for this species.

The occurrence of Tree Sparrow *Passer montanus*, Abbot's Babbler *Malacocincla abbotti*, and Little Spiderhunter *Arachnothera longirostra* in the northern parts of the Eastern Ghats is of zoogeographical interest since these species are considered as Himalayan/Southeast Asian relicts (Ripley *et al.* 1987–88). The Eastern Ghats in their southernmost part run in a southwest direction to meet the Western Ghats. Species such as the Yellow-browed Bulbul *Iole indica* and the White-bellied Treepie *Dendrocitta leucogastra*, which are mainly confined to the Western Ghats, are found in this region as well (Ali & Ripley 1987). Apart from these resident species, the Eastern Ghats are important flyways for winter visitors. Coastal wetlands and forested watershed in the Eastern Ghats hill ranges act as important wintering ranges for migrant birds (Bhushan 1994).

Earlier, the Pale-capped Pigeon *Columba punicea*, a bird of north-east Indian and South-east Asia, was reported from the Eastern Ghats (Mooney 1934; Jayakar 1967) but now it is reported from the coastal Bhitarkanika (Gopi and Pandav 2007) and Chandaka Sanctuary. Its main stronghold is the Similipal Tiger Reserve. There are several recent reports from Ekamra Kanan (bamboo scrub adjoining Chandaka Wildlife Sanctuary), Barbara Reserve Forest, Nandankanan Sanctuary and Hindol Reserve Forest near Dhenkanal (Rahmani and Nair 2015).



BILAL HABIB

The Syke's Crested Lark *Galerida deva* is one of the endemic species of the Indian plains

Secondary Bird Area in Eastern Andhra Pradesh (SA: s071)

This area is identified for the Endangered Jerdon's Courser *Rhinoptilus bitorquatus* which is a poorly known nocturnal bird, thought to be extinct for 86 years (King 1978–79) until its rediscovery in January 1986. Historically, the bird was found in the Penner and Godavari valleys in Andhra Pradesh (east-central India). The habitat of this bird is thin scrub on rocky and undulating ground including disturbed areas where regeneration is affected by grazing and firewood collection (Bhushan 1986a,b; Ali & Ripley 1987). The BNHS has conducted a major project on this bird to study its ecology and biology, and has recorded the species from three sites around the Lankamalai ranges (near the Penner valley) in southern Andhra Pradesh (Jeganathan *et al.* 2002, Jeganathan *et al.* 2004, Jeganathan & Wotton 2004).

Two IBAs identified for Jerdon's Courser are Sri Lankamalleswara and Sri Peninsula Narasimha WLSs.

8. THE GANGETIC PLAINS

About 354,800 sq. km in area, the Gangetic Plains are one of the most fertile areas of the world, with a 3,000 year history of human occupation. This is also one of the most densely populated areas of the world. The combination of a long history of human occupation and a dense, still growing human population has resulted in an almost complete conversion of the original vegetation into cropland and human settlements. The Gangetic Plains are drained by numerous rivers and streams, the most famous obviously is River Ganga.

This region is famous for its flood-plain wetlands – the result of copious rainfall in the Gangetic Plains and also in the Himalaya where most of the rivers originate. Large areas are annually flooded, and when the flood recedes,



CLEMENT FRANCIS M.

More studies are required to lesser known Nilgiri Flycatcher *Eumyias albicaudata* in Western Ghats

it leaves low-lying areas under water. These wetlands are extremely productive in terms of vegetation biomass and avian diversity (Howes 1995). Some of the most important wetland IBAs are found in this region with significant populations of waterfowl. Sultanpur in Gurgaon, Bhindawas in Rohtak, Patna Jheel in Etah, Lakh-Bahosi in Farrukhabad, Saman in Mainpuri, and Nawabganj in Unnao are some of the more spectacular wetlands for migratory waterfowl in winter.

The marshes and wetlands of the Gangetic drainage system show a long history of stability in the geological sense, thus a large number of marsh-dependent species are found such as the Striated Grassbird *Megalurus palustris*, Bristled Grassbird *Chaetornis striata*, Rufous-rumped Grassbird *Graminicola bengalensis*, Yellow-bellied Prinia *Prinia flaviventris*, Swamp Francolin *Francolinus gularis*, Bengal Florican *Houbaropsis bengalensis*, and various ducks. Unfortunately, one of the species, the Pink-headed Duck *Rhodonessa caryophyllacea*, has become extinct, not due to any geological upheaval but due to anthropogenic factors.

There is practically no natural vegetation left in the Gangetic Plains, except in the region known as the Terai, which is sandwiched between the *bhabhar* tract of the Sub-Himalaya and the main Gangetic Plains. The tall, moist grasslands of the Terai, interspersed with Sal *Shorea robusta* forest, contain some of the most endangered bird species of India (Rahmani 1988, Javed & Rahmani 1998) such as the Swamp Francolin, Bengal Florican, and Yellow Weaver or Finn's Weaver *Ploceus megarhynchus*. Javed &



PERWEZ IQUBAL

The Swamp Francolin *Francolinus gularis* survives in remnant wet grasslands of the Gangetic plains and Assam

Rahmani (1998) have recorded 330 species from Dudhwa National Park, which is perhaps the best *terai* forest remaining in north India. A total of 248 bird species was recorded in Sohagi Barwa Wildlife Sanctuary, including one Endangered, four Vulnerable and twelve Near Threatened



CLEMENT FRANCIS M.

The Yellow-throated Bulbul *Pycnonotus xantholaemus* needs boulder-strewn tropical thorn forest

species during the one year study between November 2013 and November 2014 (Rahmani *et al.* 2015a). About 281 bird species have been listed in one year study at Suheldeo (= Suhelwa) Wildlife Sanctuary (Rahmani *et al.* 2015b).

The Gangetic Plains Biogeographic Zone is also important for many Near Threatened species, especially Oriental Darter *Anhinga melanogaster*, Painted Stork *Mycteria leucocephala*, Black-necked Stork *Ephippiorhynchus asiaticus*, Black-headed Ibis *Threskiornis melanocephalus*, Ferruginous Duck *Aythya nyroca*, and Black-bellied Tern *Sterna acuticauda*.

The Gangetic Plains form almost 11% of the land surface of India. According to Rodgers *et al.* (2000) it has six national parks, covering 2,363.44 sq. km or 0.67% the total area, and 30 wildlife sanctuaries totalling 5,285.48 sq. km or 1.49%. Most of the PAs are rather small and may not have significant long-term viable populations of large mammals and birds. In Uttar Pradesh alone, there are 25 protected areas, mostly wetland areas. The Government of Uttar Pradesh has identified 133,000 wetlands, mostly

near villages, that are important for water and agricultural security of the State. Many of these wetlands are important for breeding of Sarus Crane. The Wildlife Trust of India has listed 27 Important Sarus Wetlands in eastern Uttar Pradesh.

9. NORTHEAST INDIA

Northeast India is one of the biodiversity hotspots of the world. There are various classifications of this region, but for this chapter we have followed Rodgers & Panwar (1988) and Rodgers *et al.* (2000). They have included the states of Assam, Meghalaya, Manipur, Mizoram, Nagaland, and Tripura, covering a total area of 171,341 sq. km. The Northeast is a poorly protected area, with only 1.13% (1,933 sq. km) under nine national parks, and 1.41% (2,421 sq. km) under 28 wildlife sanctuaries (see Eastern Himalaya, described under the Himalayan Region).

The Northeast is considered the ‘biological gateway’ for much of India’s fauna and flora, as Gondwanaland first touched this region, during the Tertiary period. It

Globally threatened bird species of the Gangetic Plains

Sr.	Species Name	Scientific Nams	IUCN Status	No. of IBAs
1.	Spot-billed Pelican	<i>Pelecanus philippensis</i>	VU	3
2.	Lesser Adjutant	<i>Leptoptilos javanicus</i>	VU	16
3.	Greater Adjutant	<i>Leptoptilos dubius</i>	EN	0
4.	White-headed Duck	<i>Oxyura leucocephala</i>	EN	0
5.	Lesser White-fronted Goose	<i>Anser erythropus</i>	VU	0
6.	Baikal Teal	<i>Anas formosa</i>	VU	0
7.	Marbled Teal	<i>Marmaronetta angustirostris</i>	VU	2
8.	Pink-headed Duck	<i>Rhodonessa caryophyllacea*</i>	EX	0
9.	Baer’s Pochard	<i>Aythya baeri</i>	VU	3
10.	Pallas’s Fish-eagle	<i>Haliaeetus leucoryphus</i>	VU	14
11.	White-rumped Vulture	<i>Gyps bengalensis</i>	CR	16
12.	Long-billed Vulture	<i>Gyps indicus</i>	CR	8
13.	Greater Spotted Eagle	<i>Aquila clanga</i>	VU	18
14.	Eastern Imperial Eagle	<i>Aquila heliaca</i>	VU	3
15.	Swamp Francolin	<i>Francolinus gularis</i>	VU	11
16.	Siberian Crane	<i>Grus leucogeranus**</i>	CR	0
17.	Sarus Crane	<i>Grus antigone</i>	VU	24
18.	Bengal Florican	<i>Houbaropsis bengalensis</i>	CR	4
19.	Indian Skimmer	<i>Rynchops albicollis</i>	VU	3
20.	White-browed Bushchat	<i>Saxicola insignis</i>	VU	0
21.	Marsh Babbler	<i>Pellorneum palustre</i>	VU	0
22.	Jerdon’s Babbler	<i>Chrysomma altirostre***</i>	VU	1
23.	Slender-billed Babbler	<i>Turdoides longirostris****</i>	VU	0
24.	Bristled Grassbird	<i>Chaetornis striatus</i>	VU	1
25.	Yellow Weaver	<i>Ploceus megarhynchus</i>	VU	4

CR = Critically Endangered, EN = Endangered, VU = Vulnerable

*Last authentic sight record from Darbhanga, Bihar in 1935.

**Not reported in India since 2002

***Most records from *terai* of Nepal, likely to occur in Bihar and Uttar Pradesh.

****Old record from Uttar Pradesh. Probably occurs in northern West Bengal.

Note: As many of the species listed in this table are widespread, they may be present in more IBAs, other suitable wetlands and/or a wider landscape.

represents the transition zone between the Indian, Indo-Malayan, and Indo-Chinese biogeographic regions. Rodgers & Panwar (1988) have divided this zone into two provinces: Brahmaputra Valley and the Assam Hills. Stattersfield *et al.* (1998) have identified the Assam Plains (Brahmaputra Valley) as one of the Endemic Bird Areas of India.

The Assam Plains Endemic Bird Area in Assam, lowlands of Sikkim, northern West Bengal, parts of Arunachal Pradesh, Nagaland, Manipur and Meghalaya, is essentially the floodplain of the mighty Brahmaputra and its tributaries. The main vegetation of the Assam Plains is floodplain forest and grassland, with adjacent strips of undulating land at the base of the foothills which are marshy and have tall elephant grass and forest (Stattersfield *et al.* 1998). The Assam Plains support some of the most threatened bird (and mammal) species of the world. They also support some restricted-range birds associated with the remaining grasslands and wetland habitats found below 1,000 msl. The Assam Plains adjoining the mountains of the Endemic Bird Area

of Eastern Himalaya have many species with overlapping distribution. Three species breed in this EBA and are found in grassland, scrub, and wetland habitats on the plains, often along rivers, and in the foothills (Stattersfield *et al.* 1998). The Manipur Bush-Quail *Perdica manipurensis* is confined to the foothills, and is supposed to have a stronghold in the Manipur basin, but no bird has been seen since 1932. The Black-breasted Parrotbill *Paradoxornis flavirostris* is now restricted to few protected grasslands in Kaziranga, Manas, Dibru-saikhwa and D'Ering. The Marsh Babbler *Pellorneum palustre* needs proper study to know its distributional range and breeding habitat.

The Manipur Bush-quail is endemic to north-east India. It was formerly reported from Chittagong, Chittagong Hill Tracts and Sylhet districts of Bangladesh but there is no recent record. Records from Bangladesh should be considered unconfirmed (BirdLife International 2001). Even in India, there are very few recent records. Since the last confirmed records by J.C. Higgins in early 1930s,

A2: Restricted Range Species

Endemic Bird Area 123: Western Ghats

Sr	New Common Name	New Scientific Name	IUCN Status	In Number of IBAs
1	Nilgiri Imperial-pigeon	* <i>Ducula cuprea</i>	-	15
2	Nilgiri Woodpigeon	<i>Columba elphinstonii</i>	VU	70
3	Grey-fronted Green-pigeon	<i>Treron affinis</i>	-	31
4	Malabar Parakeet (Blue-winged Parakeet)	<i>Psittacula columboides</i>	-	69
5	Malabar Grey Hornbill	<i>Ocyeros griseus</i>	-	61
6	Malabar Barbet (Crimson-fronted Barbet)	<i>Xantholaema malabarica (Megalaima rubricapillus)</i>	-	28
7	Nilgiri Pipit	<i>Anthus nilghiriensis</i>	VU	22
8	Malabar Woodshrike	<i>Tephrodornis sylvicola</i>	-	23
9	Flame-throated Bulbul (Ruby-throated Yellow Bulbul)	<i>Pycnonotus gularis (Rubigula gularis)</i>	-	20
10	Grey-headed Bulbul	<i>Pycnonotus priocephalus</i>	NT	57
11	Nilgiri Thrush	<i>Zoothera neilgherriensis</i>	-	14
12	White-bellied Blue Robin	<i>Miomela albiventris</i>	EN	20
13	Nilgiri Blue Robin	<i>Miomela major</i>	EN	16
14	Black-and-Orange Flycatcher (Black-and-rufous Flycatcher)	<i>Ficedula nigrorufa</i>	NT	41
15	Nilgiri Flycatcher	<i>Eumyias albicaudatus</i>	NT	49
16	White-bellied Blue-Flycatcher	<i>Cyornis pallipes</i>	-	64
17	Wynaad Laughingthrush	<i>Dryonastes (Garrulax) delesserti</i>	-	33
18	Black-chinned Laughingthrush	* <i>Strophocincla cachinnans</i>	EN	15
19	Kerala Laughingthrush	* <i>Strophocincla fairbanki</i>	NT	17
20	Indian Rufous Babbler	<i>Turdoides subrufa</i>	-	51
21	Indian Broad-tailed Grass-warbler	<i>Schoenicola platyururs</i>	VU	31
22	Plain (Nilgiri) Flowerpecker	<i>Dicaeum concolor</i>	-	29
23	Small Sunbird (Crimson-backed Sunbird)	<i>Leptocoma minima (Nectarinia minima)</i>	-	78
24	Vigor's Sunbird	<i>Aethopyga vigorsii</i>	-	6
25	Malabar White-headed Starling	<i>Sturnia blythii</i>	-	25
26	White-bellied Treepie	<i>Dendrocitta leucogastra</i>	-	46

*According to Rasmussen and Anderton (2012) the conspecificity of Nilgiri Imperial-pigeon *Ducula cuprea* require further study.

*Foot Note: Based on Rasmussen & Anderton (2012), BirdLife International (2011) have recognized two species *Strophocincla (Trochaloxyeron) fairbanki* (including *meridionalis*) and *S. cachinnans* (including *jerdoni*). The taxonomy of the montane laughingthrushes of the Western Ghats is disputed. Nameer and Praveen (2012) and Praveen and Nameer (2012) have identified four species in the Western Ghats. These include the Banasura Laughingthrush *Strophocincla jerdoni*, Nilgiri Laughingthrush *Strophocincla cachinnans*, Palni Laughingthrush *Strophocincla fairbanki*, Travancore Laughingthrush *Strophocincla meridionale*.

(Nomenclature as per Rasmussen and Anderton 2012, previous names are given in brackets, wherever changed)

Restricted range species of the Assam Plains Endemic Bird Area				
Sr.	Species Name	Scientific Name	IUCN Category	Number of IBAs
1.	Manipur Bush Quail	<i>Perdica manipurensis</i>	VU	1*
2.	Marsh Babbler	<i>Pellorneum palustre</i>	VU	8
3.	Black-breasted Parrotbill	<i>Paradoxornis flavirostris</i>	VU	8

VU = Vulnerable, *Likely to occur in at least one IBA



GIRISH JATHAR

Four IBAs have been identified based on the presence of the Critically Endangered Forest Owlet *Heteroglaux blewitti*

only in 2006, Dr Anwaruddin Choudhury saw a bird in Manas National Park. There is one unconfirmed records from Dibru-Saikhowa Wildlife Sanctuary, India, in March 1998 (Allen 1998). Choudhury (2009) during his surveys and discussions with locals from 1988 to 2001, then from October 2001 to February 2002 did not find any evidence of this species in Manipur.

Secondary Bird Areas of Northern Myanmar lowlands

This Secondary Area is defined by the range of Chestnut-backed Laughingthrush *Dryonastes (=Garrulax) nuchalis* which is found in the foothills of eastern Arunachal Pradesh, Nagaland, and Manipur, and in the upper Chindwan and Mali Hka watersheds in northeast Myanmar (Stattersfield *et al.* 1988). This bird has also recently been recorded from Upper Dihing (East Complex) in Tinsukia, Assam.

10. ISLANDS

The Andaman & Nicobar Islands, consisting of over 560 islands and rocks, covering about 8,249 sq. km, are the peaks of a submerged mountain range, arching from Myanmar to Sumatra. The vegetation is mainly tropical evergreen, with some grasslands in the inland areas. The 1,962 sq. km coastline is mainly covered by mangroves. About 270

species and subspecies of birds have been recorded from the Andaman and Nicobar Islands by various workers, of which 105 are endemic species and subspecies (Sankaran & Vijayan 1993). Thus, while the islands form only 0.25% of the landmass of the Subcontinent, they hold 12% of the endemic avifauna of the region (Sankaran 1998), making the islands priority areas for conservation.

The highest conservation priority species are the Nicobar Megapode or Scrubfowl *Megapodius nicobariensis*, Edible-nest Swiftlet *Collocalia fuciphaga inexpectata*, Andaman Teal *Anas albogularis*, and Narcondam Hornbill *Aceros narcondami*. There are two subspecies of the Nicobar Megapode: North Nicobar Megapode *Megapodius nicobariensis nicobariensis* and South Nicobar Megapode *M. n. abbotti*. SACON has been working on this species since 1995 (Sankaran 1995a, Sankaran & Sivakumar 1999, Vijayan *et al.* 2000, Sivakumar 2000), and the Wildlife Institute of India since 2004 (Sivakumar 2007). Following the tsunami in December 2004, populations have disappeared completely from two islands, Trak and Megapod, and the total number of breeding pairs is estimated to be between 395–790 (Sivakumar 2010), with the majority on Great Nicobar (405) and Little Nicobar (165) (Sivakumar 2007, 2010). It has declined by almost 70% as the littoral forests have been heavily destroyed. Rahmani (2012) has given latest status information. The species is now in IUCN Vulnerable category.

Edible-nest Swiftlets are widely distributed on the islands, with a population estimated at 2,500 to 3,600 breeding pairs (Sankaran 1995b). The major threat is excessive and unregulated nest collection. This species belongs to the ‘white nest swiftlet’ group, whose nests are made entirely of agglutinated saliva, and are of very high commercial value in the international market. At Port Blair, a kilogram of nests (one kg normally consists of 70–125 nests) fetches between Rs. 15,000 and 20,000 or more. Ravi Sankaran found that virtually all colonies are exploited, and nests are collected irrespective of whether there are eggs or chicks in them, with serious impact on the species. However, during the last ten years, the Forest Department has given very good protection of some major nesting colonies, with 24-hour vigilance during the breeding season.

The Narcondam Hornbill is endemic to the tiny (c. 7 sq. km) island of Narcondam, east of the Andaman Islands. The population was estimated between 330 and 360 birds

during the study in 1998 showing a decline (Sankaran 1998) from the record of 400 in 1972 as reported by Hussain (1984). However, during fieldwork in 2000 the population was estimated to be 432 individuals (Yahya & Zarri 2002). Another short-term study was carried out between January and March 2003 on roosting and nesting (Vivek & Vijayan 2003) and the population estimate was at 320-340 birds which was similar to that of the earlier study but lower than that of Yahya & Zarri (2002). Some of these differences could be due to different census techniques. In a detailed study in 2013-14, Shirish Manchi of SACON estimate the numbers could be between 700-900 individuals. The most serious threat to Narcondam Hornbill is now from the radar station that is under construction by the Government of India, despite stiff opposition by conservationists. This is being done ostensibly in the name of 'national security'.

According to Rodgers *et al.* (2000), the Islands which constitute only 0.25% of India's geographical area, have eight national parks and 94 wildlife sanctuaries, covering a total area of c. 1,529 sq. km. This is about 18.54% of the land surface. It should be noted that many of the larger PAs are tribal areas and not strictly free from human occupation. Nevertheless, as the tribal pressure is low and sustainable, some of the finest forests of India are seen in the Andaman & Nicobar Islands.

Among the globally threatened species in Andaman & Nicobar, there is one Critically Endangered species, Christmas Island Frigatebird *Fregata andrewsi* with one stray sight record, one Endangered species, Narcondam Hornbill, and three Vulnerable species (Andaman Teal *Anas albogularis*, Nicobar Sparrowhawk *Accipiter butleri*, and Nicobar Megapode. Besides this, 16-18 Near Threatened species are found, mostly endemic species. If detailed studies are conducted on each island, perhaps we may get better status information and some of the Near Threatened species may be uplisted, as many islands are under the threat of disturbance due to military and developmental activities.

Restricted Range species in the Andaman & Nicobar Islands

Stattersfield *et al.* (1988) had identified 13 restricted-range species in Andaman Islands and nine in the Nicobar Islands. Based on the taxonomic changes and identification of some new species, the list now stands as 19 species in Andaman and 12 species in Nicobar. Most of them are forest-dwelling species, but a few appear to be quite common in disturbed forest also. Many islands in Middle and South Andaman have limited access, so information about them is lacking. Four species of Andamans are shared with the Nicobar Islands, indicating the affinity between the two EBAs (see Ripley & Beehler 1989, Stattersfield *et al.* 1998).

The Lakshadweep (8° 15' to 11° 45' N; 72° 00' to 74° 00' E) archipelago is the smallest Union Territory and has a



The Jerdon's Courser *Rhinoptilus bitorquatus* is adapted to lightly grazed scrub area

SIMON COOK/BirdLife International

geographical area of 3,200 ha. It consists of a group of 36 coral islands covering 12 atolls, three reefs, and the rest periodically submerged sandbanks. Only 11 islands are inhabited, namely Agatti, Amini, Andrott, Bangaram, Bitra, Chetlat, Kadmat, Kalpeni, Kavaratti, Kiltan, and Minicoy. Minicoy is the southernmost island of this archipelago and is separated from the rest of the islands by a 9° Channel, about 180 km in width, and from the neighbouring Maldives to the south by an 8° Channel of about 120 km. These islands are irregularly scattered in the southern Arabian Sea and are about 280 to 480 km west of Kochi (=Cochin) on the Kerala coast (Das 2002).

Minicoy (4.37 sq. km) is the largest island, with a very high human population density of 1,513 per sq. km. Unlike the Andaman & Nicobar Islands which are continental, the Lakshadweep Islands are oceanic, thus the biodiversity is not so rich. Habitat diversity is also poor. According to Daniels (1991), till now only 67 species of birds have been authentically reported. Fifty per cent of these are migratory waders and typically oceanic birds such as terns, skuas, petrels, and boobies. Of the 34 species of land birds and inland waterbirds, only 14 are possibly resident in one or more of the islands (Daniels 1991). The uninhabited Pitti Island is a bird sanctuary where a very large colony of Sooty Tern *Sterna fuscata*, Great or Large Crested Tern *Sterna bergii*, and Noddy Tern *Anous stolidus* is found. Another colony is present in Cherbaniani Island. On some of the islands of the archipelago, Wedge-tailed Shearwater *Puffinus lherminieri* and boobies *Sula* spp. could be breeding.

A2: Restricted Range Species

Endemic Bird Area 125: Andaman Islands				
Sr.	Common Name	Scientific Name	IUCN Status	In Number of IBAs
1	Andaman Serpent-eagle	<i>Spilornis elgini</i>	NT	15
2	Nicobar Megapode	* <i>Megapodius nicobariensis</i>	VU	2
3	Andaman Teal	<i>Anas albogularis</i>	VU	7
4	Andaman Crake	<i>Rallina canningi</i>	NT	13
5	Andaman Green-pigeon	<i>Treron chloropterus</i>	NT	9
6	Andaman Woodpigeon	<i>Columba palumboides</i>	NT	16
7	Andaman Cuckoo-dove	<i>Macropygia rufipennis</i>	NT	16
8	Andaman Coucal	<i>Centropus andamanensis</i>	-	13
9	Andaman Scops-owl	<i>Otus balli</i>	NT	12
10	Andaman Hawk-owl (Andaman Boobook)	<i>Ninox affinis</i>	NT	16
11	Narcondam Hornbill	<i>Rhyticeros (Aceros) narcondami</i>	EN	1
12	Andaman Woodpecker	<i>Dryocopus hodgei</i>	NT	13
13	Andaman Cuckooshrike	<i>Coracina dobsoni</i>	-	1
14	Andaman Bulbul	<i>Microtarsus fuscoflavescens</i>	-	1
15	Andaman Shama	<i>Copsychus albiventris</i>	-	1
16	Andaman Flowerpecker	<i>Dicaeum virescens</i>	-	1
17	Andaman Drongo	<i>Dicrurus andamanensis</i>	NT	15
18	Andaman White-headed Starling	<i>Sturnus erythropygia</i>	-	17
19	Andaman Treepie	<i>Dendrocitta bayleyi</i>	NT	13

Following Endemics are added after they are split by Rasmussen and Anderton (2012): Andaman Cuckooshrike *Coracina dobsoni*, Andaman Bulbul *Microtarsus fuscoflavescens*, Andaman Shama *Copsychus albiventris*, Andaman Flowerpecker *Dicaeum virescens*.

*As per BirdLife: Nicobar Scrubfowl (*Megapodius nicobariensis*)

Endemic Bird Area 126: Nicobar Islands				
Sr	New Common Name	Scientific Name	IUCN Status	In Number of IBAs
1	Great (South) Nicobar Serpent-eagle	<i>Spilornis klossi (S. minimus)</i>	NT	3
2	Nicobar Sparrowhawk	<i>Accipiter butleri</i>	VU	3
3	Nicobar Megapode	<i>Megapodius nicobariensis</i>	VU	2
4	Nicobar Imperial-pigeon*	<i>Ducula nicobarica</i>	LC	-
5	Andaman Woodpigeon	<i>Columba palumboides</i>	NT	16
6	Andaman Cuckoo-dove	<i>Macropygia rufipennis</i>	NT	16
7	Nicobar Parakeet	<i>Psittacula caniceps</i>	NT	1
8	Andaman Nightjar	<i>Caprimulgus andamanicus</i>	LC	
9	Andaman Hawk-owl (Andaman Boobook)	<i>Ninox affinis</i>	NT	16
10	Nicobar Bulbul	<i>Ixos nicobariensis (Hypsipetes nicobariensis)</i>	NT	1
11	Nicobar Jungle-flycatcher	<i>Cyornis nicobaricus (Rhinomyias nicobaricus)</i>	-	-
12	Andaman White-headed Starling	<i>Sturnus erythropygia</i>	-	17

Following Endemics are added after they are split by Rasmussen and Anderton (2012): Nicobar Imperial-pigeon *Ducula nicobarica* and Andaman Nightjar *Caprimulgus andamanicus*.

Globally Threatened species found in the Coasts Biogeographic Zone

Sr.	Species Name	Scientific Nams	IUCN Status	No. of IBAs
1.	Masked Finfoot	<i>Heliopais personata</i>	VU	1
2.	Spotted Greenshank	<i>Tringa guttifer</i>	EN	2
3.	Spoon-billed Sandpiper	<i>Eurynorhynchus pygmeus</i>	CR	3

CR = Critically Endangered, EN = Endangered, VU = Vulnerable

11. COASTS

The coastline of India, excluding the Andaman & Nicobar Islands, is about 7,500 km. The coasts are perhaps the most neglected biogeographic zone of India, mainly because charismatic species are not found here. Nonetheless, the coasts do have fabulous bird concentrations, as seen in Chilika Lake and Bhitarkanika in Orissa, Point Calimere Wildlife Sanctuary in Tamil Nadu, Sunderbans in West Bengal, Sewri mudflats in Maharashtra, and Kori Creek in Gujarat.

The mangroves which are the best example of coastal vegetation, are present only in a small part of the Indian coast as they require special habitat requirement that are not found all along the coast. They grow best in tidal creeks, sheltered shores, backwaters and salt marshes. The Coastal Region is an interface between land and water, where the plant biodiversity provides a barrier against erosion by the sea. The major part of any coastline, and India is no exception, consists of mudflats, sandy beaches, rocky shores, lagoons, and sometimes just plain rocks (best seen in small conical islands that are the tops of submerged mountains). Even within these habitat types, there are many subtypes, each with its unique biodiversity.

Among the globally threatened species of the Indian coast, the rarest is Spoon-billed Sandpiper *Eurynorhynchus pygmeus* with few old records but no recent record (Rahmani 2012). Another globally threatened bird found in India is Spotted Greenshank *Tringa guttifer*, earlier known as Nordmann's Greenshank, listed as Endangered by BirdLife International and IUCN that stated "it has a very small population which is declining as a result of the development of coastal wetlands throughout its range, principally for industry, infrastructure projects and aquaculture." It is a rare winter visitor to India with confirmed records only from Point Calimere. Among the Vulnerable category of birds

in India, Great Knot *Calidris tenuirostris* is dependent on mudflats and coastal beaches. It is a rare winter visitor to the east coast, with regular sightings from Point Calimere, Pulicat lake, and Marine National Park in the Gulf of Mannar, Chilika lake, Bhitarkanika, and Sundarbans. Besides these globally threatened Indian species, there are up to 40 species of common birds that depend totally or partially on mudflats for foraging and resting. Inundated mudflats provide foraging sites for a few gull and tern species. The exposed areas of mudflats are roosting sites for thousands of terns, gulls, and ducks. Mudflats that are inundated twice a day by high tide are important feeding areas for flamingos, the classical example being the Sewri and Thane mudflats near Mumbai where thousands of Lesser Flamingos can be seen from November to June, along with a million small waders. Narara, Diu, and Gulf of Khambat in Gujarat are other important mudflats of India. The coasts of Tamil Nadu, Odisha, and West Bengal also have extensive mudflats, but all of them are under severe threat from development. Masked Finfoot *Heliopais personata* has not been confirmed from Indian Sundarbans but it is regularly seen in Bangladesh Sundarbans (Rahmani 2012).

Besides the sandy beaches and rocky outcrops which are important as foraging sites for many waders, the mangroves serve as breeding grounds for many species such as egrets, herons, storks, warblers, and raptors. A checklist of some birds associated with the mangroves of Ratnagiri was prepared by Samant (1985). Deshmukh (1990) identified 147 species of birds from the mangrove swamps of Vikhroli, near Mumbai.

According to Rodgers *et al.* (2000), the Coasts Biogeographic Zone covers about 83,000 sq. km, 2.52% of India's geographical area. There are five national parks covering an area of 1,731 sq. km, and 21 wildlife sanctuaries totalling about 3,888 sq. km. The total coastal area under legal protection of some kind is c. 5,600 sq. km.

REFERENCES

- Abdulali, H. (1945) Birds of the Vizagapatnam District. *JBNHS* 45(3): 333–347.
- Ahmed, F. (2003) A status and distribution update of Khasi Hills Swift. *Mistnet* 4(2): 6.
- Ali, S. (1933–34) The Hyderabad state Ornithological survey (5 parts) *JBNHS*. 36-37: 356–390; 707–725; 898–919; 124–142; 425–454.
- Ali, S. (1974). Breeding of Lesser Flamingo *Phoenicopterus minor* (Geoffroy) in Kutch. *JBNHS*. 71(1): 141-144.
- Ali, S. (1977) *Field guide to the birds of the Eastern Himalayas*. Third impression 1979 ed. Oxford University Press, New Delhi.
- Ali, S. and Ripley, S. D. (1971) *Handbook of the Birds of India and Pakistan*. Vol. 7. Oxford University Press, New Delhi., page 238.
- Ali, S. and Ripley, S. D. (1987) *Compact Edition of the Handbook of the Birds of India and Pakistan*. Oxford University Press, New Delhi.
- Allen, D. (1998) Report to the Indian Forestry Service concerning the Amarapur area of the Dibru-Saikhowa Biosphere Reserve. Unpublished.
- Baqri, Q. H. and Kankane, P. L. (2001). *Deserts: Thar* In: Ecosystems of India. ENVIS – Zool. Surv. India, Kolkata. Pp. 93–122.
- Bhushan, B. (1994) *Ornithology of Eastern Ghats*. Ph.D. Thesis, Bombay University, Bombay.
- BirdLife International (2001) *Threatened Birds of Asia: the BirdLife International Red Data Book*. BirdLife International Cambridge, U.K.
- BirdLife International (2015) IUCN Red List for birds. Downloaded from <http://www.birdlife.org>.
- BirdLife International (undated) Important Bird Areas (IBAs) in Asia: Project briefing book. BirdLife International, Cambridge, U.K., unpublished.
- Butchart, S. H. M., Collar, N. J., Crosby, M. J. and Tobias, J. A. (2005) “Lost” and poorly-known birds: tops targets for birders in Asia. *BirdingAsia* 3: 41-49.
- Chatterjee, A., Chandan, P., Gautam, P. and Droz, B. H. (2002) *High Altitude Wetlands of Ladakh: A Conservation Initiative*. World Wide Fund for Nature-India.
- Cherian, P. T. (2000) Deccan Peninsula. In.: Alfred, J. R. B., A. K. Das, and A. K. Sanyal (2002) Ecosystems of India, ENVIS – Zoological Survey of India, Kolkata: 1–410.
- Choundhury, A.U. (2006) *A Pocket Guide to the Birds of Arunachal Pradesh*. Gibbon Books and The Rhino Foundation for Nature in NE India. pp. 109.
- Choudhury, A.U. (2008) *Survey of mammals and birds in Dihang-Dibang Biosphere Reserve, Arunachal Pradesh*. Final Report to Ministry of Environment & Forests, Government of India. The Rhino Foundation for nature in NE India, Guwahati. 70 pp.
- Choudhury, A.U. (2009) Significant recent ornithological records from Manipur, north-east India with an annotated checklist. *Forktail* 25: 71–89.
- Daniel, J. C., Bhushan, B. and Sekar, A. G. (1986) Rediscovery of the golden gecko *Calodactylodes aureus* (Beddome) in the Eastern Ghats of Andhra Pradesh. *JBNHS*. 83: 15–16.
- Daniels, R. J. R (1991) Island biogeography of birds of the Lakshadweep archipelago, Indian Ocean. *JBNHS*. 88:320–328.
- Daniels, R. J. R. (1997) *A Field Guide to the Birds of the Southwestern India*. Oxford University Press, New Delhi.
- Daniels, R. J. R. (2000) Rarity of herpetofauna of the Southern Eastern Ghats. India. *The Eastern Ghats Eptir-Envis Newsletter* 5(2): 5–7.
- Das, A. K. (2002) Islands. In.: Alfred, J. R. B., A. K. Das, and A. K. Sanyal (2002) Ecosystems of India, ENVIS – Zool. Surv. India, Kolkata: 1–410.
- Deshmukh, S. V. (1990). Ecological Studies of mangroves in Bombay. Ph.D. pp 153. Bombay University, Mumbai.
- Gopi, G. V. and Pandav, B. (2007) Avifauna of Bhitarkanika mangroves, India. *Zoos’ Print Journal* 22: 2839–2847 (with web supplement).
- Grimmett, R. and Inskipp, C. and Inskipp, T. (1998) *Birds of the Indian subcontinent*. AandC. Black/Christopher Helm, London.
- Grimmett, R. and Inskipp, T. (2003) *Birds of Northern India*. Oxford University Press, New Delhi.
- Hargitt, E. (1890) *Catalogue of the birds in the collection of the British Museum*, 18-Picidae. British Museum, London.
- Howes, J. R. (1995) *Conservation and Sustainable Use of Floodplain Wetlands*. Asian Wetland Bureau, Kuala Lumpur, 123 pp. (Proceedings of the Workshop on the Conservation and Sustainable Use of Floodplain Wetlands, December 1993, Calcutta - AWB Publication No. 113.
- del Hoyo, Joseph del, Elliott, A. and Sargatal, J. (1994) *Handbook of the Birds of the World*. Vol. II, New World Vulture to Guineafowl, Lynx Edicion, Barcelona.
- del Hoyo, J. and Collar, N.J. (2014) *HBW and BirdLife International Illustrated Checklist of the Birds of the World*. Volume 1: Non-passerines. Lynx Edicions, Barcelona.
- Hussain, S. A. (1984) Some aspects of the Biology and Ecology of Narcondam Hornbill (*Rhyticeros narcondami*). *JBNHS* 81: 1–18.
- Jayakar, S.D. (1967) The Purple Wood Pigeon (*Columba punicea*, Blyth) and the Himalayan Tree Pie (*Dendrocitta formosae* Swinhoe) in Orissa. *JBNHS* 64: 109.
- Jeganathan, P. Green, R. E., Bowden, C. G. R., Norris, K., Pain, D. and Rahmani, A. (2002) Use of tracking strips and automatic cameras for detecting Critically Endangered Jerdon’s Courser *Rhinoptilus bitorquatus* in scrub jungle in Andhra Pradesh, India. *Oryx* 36(2): 182–188.
- Jeganathan, P. Green, R. E., Norris, K., Vogiatzakis, I. N., Bartsch, A., Wotton, S. R., Bowden, C. G. R., Griffiths, G. H., Pain, D. and Rahmani, A. R. (2004) Modelling habitat selection and distribution of the critically endangered Jerdon’s Courser *Rhinoptilus bitorquatus* in scrub jungle: an application of a new tracking method. *J. Applied Ecology* 41: 224–237.
- Jeganathan, P. and Wotton, S. R. (2004) The first recordings of calls of the Jerdon’s Courser *Rhinoptilus bitorquatus* (Blyth), Family Glareolidae. *JBNHS*. 101: 26–28.
- Javed, S. and Rahmani, A. R. (1998) Conservation of the avifauna of Dudwa National Park, India. *Forktail* 14: 55–64.
- Krishna Raju, K. S. R. (1985) Checklist of the Birds of Visakapatnam Region. Andhra Pradesh Natural History Society. Pp.1–25.
- Ludlow, F. and Kinnear, N.B. (1944) The birds of south-eastern Tibet. *Ibis* 86: 43–86, 176–208, 348–389.
- Mehta, H. S. and Julka, J. M. (2002) Mountains: North-west Himalaya. In: Alfred, J. R. B. (ed) *Fauna Diversity of India*. ENVIS Centre, Zoological Survey of India, Kolkatta.
- Mooney, H. F. (1934) Occurrence of the Purple Wood-Pigeon [*Alsocomus puniceus* (Tickell)] in Singbhum Dist., Bihar and

- Orissa. *JBNHS* 37: 735.
- Mundkur, T., Rishad, P., Khachar, S. and Naik, R.M. (1989) Hitherto unreported nest site of Lesser Flamingo *Phoenicopiterus minor* in the Little Rann of Kutch. *JBNHS*. 86(3): 281–285.
- Nandi, S. N., Pant, R. and Rao, K. S. (2000). *Indian Himalaya: a demographic database*. ENVIS Monograph 2, G.B. Pant Institute of Himalayan Environment and Development, Almora, India Pp 75.
- Pullaiah, T. (2002) Eastern Ghats. In.: Alfred, J. R. B., Das, A. K. and Sanyal, A. K. (2002) *Ecosystems of India*. ENVIS – Zool. Surv. India, Kolkata: 1–410.
- Rahmani, A. R. (1988) Grassland Birds of the Indian Subcontinent: A Review. In: *Ecology and Conservation of Grassland Birds* (ed. P. D. Goriup). Pp 187-204. ICBP Technical Publication No. 7. ICBP, Cambridge, U.K.
- Rahmani, A. R. (1996a). Changing avifauna of the Thar Desert. pp 305-324. In *Faunal Diversity in the Thar Desert: Gaps in Research* (eds. Ghosh, A. K., Baqri, Q. H. and Prakash, I.). Scientific Publishers, Jodhpur.
- Rahmani, A. R. (1996b) Management priorities for steppe birds in India. In: *Conservacion de las Aves Esteparias y su Habitat* (eds J. F. Gutierrez and J. Sanz-Zuasti). Pp 59-68. Junta de Castilla y Leon, Valladolid, Spain.
- Rahmani, A. R. (1997a). *Wildlife in the Thar*. pp 100. World Wide Fund for Nature: New Delhi.
- Rahmani, A. R. (1997b). The Effect of Indira Gandhi Nahar Project on the Avifauna of the Thar Desert. *JBNHS* 94: 233-266.
- Rahmani, A.R. (2012) *Threatened Birds of India: Their Conservation Requirements*. Indian Bird Conservation Network: Bombay Natural History Society, Royal Society for the Protection of Birds and BirdLife International. Oxford University Press. Pp xvi + 864.
- Rahmani, A. R. and Soni, R. G. (1997) Avifaunal changes in the Indian Thar Desert. *J. Arid Environment* 36: 687–703.
- Rahmani, A.R., Bhargava, R. and De, R. (2015a) Avifaunal Studies at Sohagi Barwa Wildlife Sanctuary: Final Report. Bombay Natural History Society, Mumbai. Pp.
- Rahmani, A.R., Bhargava, R. and De, R. (2015b) Avifaunal Studies at Suheldev Wildlife Sanctuary: Final Report. Bombay Natural History Society, Mumbai. Pp. 110.
- Rahmani, A.R. and Nair, M.V. (2015) *Threatened Birds of Odisha*. Indian Bird Conservation Network, Bombay Natural History Society, Royal Society for the Protection of Birds, and BirdLife International. Oxford University Press, New Delhi. Pp. 178.
- Rasmussen, P.C. and Anderton, J.C. (2005) *Birds of South Asia: the Ripley guide*. Vols 1 & 2. Smithsonian Institution and Lynx Edicions, Washington, D.C. and Barcelona.
- Rasmussen, P.C. and Anderton, J.C. (2012) *Birds of South Asia: The Ripley Guide*. Vols 1 & 2. 2nd edn. National Museum of Natural History, Smithsonian Institution, Michigan State University, & Lynx Edicions, Washington, D.C., Michigan & Barcelona.
- Ripley, S. D. (1982) *A synopsis of the birds of India and Pakistan, together with those of Nepal, Sikkim, Bhutan and Sri Lanka*. Bombay Natural History Society, Bombay.
- Ripley, S. D., Beehler, B. M., and Krishna Raju, K. S. R. (1987-88) Birds of Visakapatnam Ghats, Andhra Pradesh, (Parts 1and2) *JBNHS*. 84(3) and 85(1): 540–559; 90–107.
- Robin, V.V., Vishnudas, C.K. and Ramakrishnan, U. (2014). Reassessment of the distribution and threat status of the Western Ghats endemic bird, Nilgiri Pipit *Anthus nilghiriensis*. *Current Science* 107 (4): 622–630
- Rodgers, W. A. and Panwar, H. S. (1988) *Planning a Wildlife Protected Area Net-work in India*. 2 vols. Wildlife Institute of India, Dehra Dun.
- Rodgers, W. A., Panwar, H. S. and Mathur, V. B. (2000). *Wildlife Protected Area Network in India: A Review (Executive Summary)*. Wildlife Institute of India, Dehra Dun.
- Samant, J. (1985) Avifauna of the mangroves around Ratnagiri, Maharashtra. Pp 456-466 in L. J. Bhosale, (Edit). Proceedings of National Symposium on Biology, Utilization and Conservation of Mangroves, November 1985. Shivaji University Press, Kolhapur, India.
- Sankaran, R. (1995a) The distribution, status and conservation of the Nicobar Megapode *Megapodius nicobariensis*. *Biological Conservation*. 72: 17–26.
- Sankaran, R. (1995b) Impact assessment of nest collection on the Edible-nest Swiftlet in the Nicobar Islands. SACON Occasional Report 1. Coimbatore: Salim Ali Centre for Ornithology and Natural History.
- Sankaran, R. (1998) An annotated list of the endemic avifauna of the Nicobar Island. *Forktail* 13: 17–22.
- Sankaran, R. and Vijayan, L. (1993) The avifauna of the Andaman and Nicobar Islands: A review and the current scenario. Pp 255-271. In Verghese, A., Sridhar, S. And Chakravarthy, A. K. (eds.): Bird conservation strategies for the nineties and beyond. Ornithological Society of India, Bangalore.
- Sankaran, R. and Sivakumar, K. (1999) Preliminary results of ongoing study of the Nicobar Megapode *Megapodius nicobariensis* Blyth. *Zoologiszhe Verhandelingen, Leiden*. 327: 75–90.
- Sankaran, R., Rahmani, A.R. and Lachungpa, U. G. (1992) The Distribution and status of the Lesser Florican *Sypheotides indica* (J. F. Miller) in the Indian subcontinent. *JBNHS*. 89: 156–179.
- Shah N. and Qureshi, Q. (2015) Habitat Occupancy and Population distribution of Flamingos & Wintering Cranes in Gujarat. Final Technical Report submitted to WWF-India. Pp. 97.
- Sharma, B.K., Kulshreshtha, S. and Rahmani, A.R. (Eds) (2013) *Faunal Heritage of Rajasthan, India*. 2 volumes. (Eds. B.K. Sharma,). Springer, New York, USA.
- Sivakumar, K. (2000) A study on breeding behavior of the Nicobar Megapode *Megapodius nicobariensis*. PhD. Thesis. Bharathiar University, Coimbatore
- Sivakumar, K. (2007) Impact of tsunami on the Nicobar Megapode. Research Report No. RR 07/002. Wildlife Institute of India, Dehradun. 48 pp.
- Sivakumar, K. (2010) Impact of tsunami on the Nicobar megapode *Megapodius nicobariensis*. *Oryx* 44(1):71–78.
- Stattersfield, A. J., Crosby, M. J., Long, A. J. and Wege, D. C. (1998) *Endemic Bird Areas of the World: Priorities for Biodiversity Conservation*. BirdLife Conservation Series No. 7. BirdLife International, Cambridge, U.K.
- Subramanya, S. (2004) Does the Yellow-throated Bulbul *Pycnonotus xantholaemus* occur in Orissa? *Newsletter for Ornithologists* 1 (3): 39–40.
- Subramanya, S., Prasad, J. N. and Karthikeyan, S. (1995) In search of the Yellow-throated Bulbul. *Sanctuary-Asia* 15(5): 68–70.
- Subramanya, S., Prasad, J. N. and Karthikeyan, S. (1993) Status and habitat requirements of Yellow-throated Bulbul. Pp 111.

- In A. Verghese, S. Sridhar and A. K. Chakravathy (eds). Bird conservation strategies for the nineties and beyond. Bangalore: Ornithological Society of India.
- Trevor Price, D. (1978) Some observations on the Warbler population of the upland perennial wetlands in the Eastern Ghats. *JBNHS*. 75(2): 488–490.
- Trevor Price, D. (1979) The seasonality and occurrence of birds in the Eastern Ghats of Andhra Pradesh. *JBNHS*. 76(3): 379–422.
- Whistler, H. and Kinnear, N. B. (1930-37) The vernay scientific survey of the Eastern Ghats-Ornithological Section (16 parts). *JBNHS*. 34–39: 720–735; 505–524; 67–93; 96–105; 418–437.
- Wikramanayake, E., Dinerstein, E., Loucks, C. J., Olson, D. M., Morrison, J., Lamoreux, J., McKnight, M. and Hedao, P. (2002) *Terrestrial Ecoregions of the Indo-Pacific: A Conservation Assessment*. Island Press, Washington.
- Vijayan, L., Sankaran, R., Sivakumar, K. and Murugan, V. (2000) *A Study on the ecology, status and conservation perspectives of certain rare and endemic avifauna of the Andaman and Nicobar islands*. Pp. 184. Final Report of the Project. SACON, Coimbatore.
- Vivek R. and Vijayan V. S. (2003). Ecology and Conservation of the Narcondam Hornbill (*Aceros narcondami*) at Narcondam Island Sanctuary, India. SACON.
- Yahya. S. A. and Zarri, A. A. (2002). Status, Ecology and Behaviour of Narcondam Hornbill (*Aeceros narcondami*) in Narcondam Island, Andaman and Nicobar Islands, India. *JBNHS* 93: 434–445.
- Zarri, A. A., Rahmani, A.R., Singh, A. and Kushwaha, S.P.S. (2008) Habitat suitability assessment for the endangered Nilgiri Laughingthrush: A multiple logistic regression approach. *Current Science* 94 (11): 1487–1494.

OBJECTIVES AND METHODS OF THE INDIAN IBA PROGRAMME



People's involvement in conservation to the protection of species that are generally found outside protected areas

AIMS OF THE INVENTORY

The IBA Programme aims to identify, document, and advocate the protection and management of a network of sites that are important for the long-term viability of naturally occurring bird populations across the geographic range of those bird species for which a site-based approach is appropriate. The main aim of the Indian IBA Inventory is to document and protect a network of sites which covers all the habitats and species. Given that birds are good indicators of overall biological diversity, most IBAs will also be important for other animals and plants, particularly those which are under great threat. This Inventory is intended to provide comprehensive information on IBAs and species and to be used as an advocacy tool for site and species conservation, to enable informed decisions.

The following are the key areas where the IBA Inventory would be useful:

- Help identify high biodiversity areas
- To form a sound basis for the development of national conservation strategies, including protected areas programme
- Contribute to the development of national conservation strategies, highlight sites which are threatened or inadequately protected

- Help build regional and national networks of ornithologists and conservationists
- Help identify future priorities for birds and biodiversity conservation action
- Provide decision makers with high quality biodiversity information for sustainable land and resource use
- Assist governments in the implementation of international agreements such as the Convention on Biological Diversity
- Provide material for education and training
- Help build national and regional networks of ornithologists and conservationists through Indian Bird Conservation Network
- Influence regional migratory bird agreements
- Help to implement the National Biodiversity Strategy and Action Plan

Site-based approach

The IBA programme is a site-based approach, which identifies sites of international importance for the conservation of birds and other biodiversity, and collates and disseminates key information.

Birds are one of the best researched taxa in India and a fairly

reliable indicator of biodiversity loss. Given that birds are good indicators of overall biological diversity, most IBAs will also be important for other animals and plants. A significant proportion of birds (and other animal and plant species) can be effectively conserved by the protection of key sites, either as official protected areas (national parks, sanctuaries, conservation and community reserves) with necessary and appropriate management, and/or through the promotion of sustainable land-use practices.

Using birds to set conservation priorities

India is the seventh largest country in the world and comes within the top ten megabiodiversity centres. Although India has a good protected area system, the PAs are not distributed uniformly across the states or across the biogeographic zones of the country. Some zones are more well protected than others (Rodgers & Panwar 1988). Moreover, there are very few areas that are protected on the basis of birds conservation. Through the IBA programme, we have identified 554 sites using standardised, internationally agreed criteria. These sites are of international significance for the conservation of birds at the global, regional, and national levels. The IBA inventory process has considered including major existing protected areas, provided they qualify for IBA criteria. Many non-protected areas that are large enough to support viable population(s) of threatened bird species are also included.

Ninety two Indian bird species are globally threatened with extinction, of these 17 are listed as Critical, 19 species as Endangered, 54 are Vulnerable, 3 are Data Deficient. A further 81 are classified as Near Threatened (BirdLife International 2015). Many other supposedly common species are also rapidly declining and are in urgent need of conservation action.

The IBA approach is not the only answer to bird conservation but undoubtedly it is one of the important steps for long-term conservation of birds. For some bird species which are thinly and widely distributed, such as the Greater Spotted Eagle *Clanga clanga*, Lesser Florican *Sypheotides indicus*, Great Indian Bustard *Ardeotis nigriceps*, and Sarus Crane *Grus antigone*, the IBA approach may not be appropriate. The IBA approach is appropriate for those birds that are restricted to particular habitat(s) or found in large congregations (e.g., waterbirds). For example, different pheasants are restricted to different forest types and hence protecting those forest types would ensure the long-term survival of pheasants. Other examples are the harrier (*Circus* spp.) congregation at Velavadar National Park, Gujarat, or the seabirds of Pitti Island, or waterbird congregations at Chilika Lake and Keoladeo National Park.

The IBAs should form part of a wider, integrated approach to conservation that includes sites, species, and

habitat protection (Tucker & Heath 1994). IBAs are selected based upon certain global criteria which are common global conservation currency. In the IBA process, information on a site is generated through local organizations and ornithologists working in their respective areas. This process builds institutional capacity and sets an effective bird conservation agenda. This means the IBAs could be a practical and significant tool for bird conservation.

All natural areas are important for conservation, but some need more urgent attention than others. We have prioritised some of the sites on the basis of threatened species, i.e., Red Data Book (RDB) species, restricted range species (RRS), and bird congregations. We have also identified many sites on the basis of those RDB species that are widely distributed in the country, such as the Sarus Crane, Lesser Florican, Great Indian Bustard, and Spot-billed Pelican *Pelecanus philippensis*, knowing full well that we cannot protect all the agricultural fields or wetlands where these birds are found. Imaginative conservation strategies are required to protect these species with the cooperation of local communities.

The impact of people is seen on all the habitats of India, so much so that many habitats and bird species that depend on them are becoming severely threatened. Most of the bird species are facing severe threats such as loss or alteration of habitat, poaching, persecution including trapping and egg collection for food and for commercial purposes. Deforestation disturbs forest birds such as the Forest Owlet *Heteroglaux blewitti*, hornbills, laughingthrushes, babblers, parrotbills, warblers, flowerpeckers, woodpeckers, and barbets. Plantation or excessive grazing by livestock disturbs grassland species such as the White-browed Bushchat *Saxicola macrorhyncha*, the Great Indian Bustard, and the Lesser Florican.

Presently, 26 wetlands in India are listed under the Ramsar Convention, but through the IBA programme, we have identified 135 sites that qualify the Ramsar Congregation criteria (Islam and Rahmani 2008). These sites are also important for many threatened species such as the Spot-billed Pelican, Dalmatian Pelican *Pelecanus crispus*, Oriental Stork *Ciconia boyciana*, White-headed Duck *Oxyura leucocephala*, Marbled Teal *Marmaronetta angustirostris*, Baer's Pochard *Aythya baeri*, and Spoon-billed Sandpiper *Eurynorhynchus pygmeus* (= *Calidris pygmea*).

One of the main threats for some of the species is their national and international trade for commercial purposes as well as for livelihood (Ahmed 1997, 2002). According to the Convention on International Trade of Endangered Species of Wild Flora and Fauna (CITES), trade in some species, listed in the CITES appendices (Imperial Eagle *Aquila heliaca*, Green Avadavat *Amandava formosa*, and Yellow Weaver *Ploceus megarhynchus*), is banned or regulated depending on the level of threat. Species that are morphologically similar to certain threatened species, not threatened themselves but

likely to be confused with endangered ones, are also listed. We have identified IBA sites where these species could find protection from illegal trappers.

Many globally threatened and restricted range species are declining because of alien species introduced into their habitats. For example, domestic goats were introduced into Narcondam Island, where they have greatly impacted the regeneration of vegetation and thus the nesting sites of the Endangered Narcondam Hornbill *Aceros narcondami* (the goats are now removed). Another example is the Nicobar Bulbul *Hypsipetes nicobariensis* that is suffering from competition from the introduced Red-whiskered Bulbul *Pycnonotus jacosus whistleri* (R. Sankaran, *pers. comm.* 1998). Attempts were made to identify sites where Nicobar Bulbul would have long-term security without the danger of being wiped out by hybridisation.

Species

The IBA programme not only covers the 180 globally threatened birds in India (comprising Critically Endangered, Endangered, Vulnerable, Near Threatened, and Data Deficient species) but also covers species that are endemic or have restricted ranges, congregatory birds, and assemblages of species that are typical to a habitat or biome.

Habitats

As the IBA programme covers a wide array of bird species, it also ranges across various habitats such as wetlands, islands, coastal areas, deserts, forests, grasslands, and agricultural ecosystems.

Geographic range

Up till 2004, BNHS had organized 15 regional workshops to identify IBAs for every state and union territory of India. With the exception of Daman and Diu and Chandigarh, IBAs were identified for all the states and union territories of India. Subsequently, 10 regional workshops have been organized, and based upon new records and field data, 108 more areas have been identified as IBAs, bringing the total to 554.

Limitations of the IBA approach

- The IBA approach only works for those species for which a site-based approach is appropriate. Bird species with highly dispersed or nomadic distributions may not be protected through this approach. Some bird species are not well protected by the IBA approach (such as large raptors, cranes, and bustards, which are nomadic species dispersed at low densities across wide areas).
- For others, the IBAs might be appropriate only across parts of their range or for parts of their life cycle, (e.g., colonial nesting species that disperse extensively during the non-breeding season) (Barnes 1998).

The IBAs

- are places of international significance for the conservation of birds at the global, regional, or sub-regional level;
- are practical tools for conservation;
- are chosen using standardised, agreed criteria applied with common sense;
- must, wherever possible, be large enough to support self-sustaining populations of those species for which they are important;
- are places which can be defined and distinguished from surrounding areas, and which are feasible to conserve;
- where possible preferentially include, where appropriate, existing Protected Areas;
- are not appropriate for all bird species and, for some, are only appropriate in parts of their ranges;
- should form part of a wider, integrated approach to conservation that embraces sites, species, and habitat protection.

- Any strategy for the long-term protection of biotic diversity should encompass evolutionary and biogeographic considerations. The IBA programme attempts to take this into account by selecting a network of sites that were spread through most habitats and in different areas of the species distributions. However subspecific variation was not taken into account. Any future assessment should attempt to include sites where different morphs and subspecies (particularly endemic and restricted range subspecies) are located (Barnes 1998).
- The IBA programme is just one approach to bird conservation. It is not the whole or the only answer. IBA criteria are fairly stringent and many sites that are of undoubted local, provincial, and national importance fail to qualify as IBAs. This does not mean that they are not important for conservation; on the contrary these sites often fulfill vital conservation roles at local levels. It must be emphasized here that sites not designated as IBAs are not dispensable and their role in a wider land-use conservation strategy may be as vitally important as that of any IBA (Barnes 1998).

“To promote conservation of birds and their habitats through development of a national network of individuals, organizations, and the government.”

PROCESS OF IBA IDENTIFICATION AND SELECTION

Establishment of Indian Bird Conservation Network (IBCN)

To conserve bird species and their habitats, the Bombay Natural History Society (BNHS) initiated the Important Bird Areas Programme (IBA) in collaboration with BirdLife



ZAFAR-UL ISLAM

The IBCN has played a key role in capacity building of many Indian NGOs

International and the Royal Society for the Protection of Birds (RSPB). In India, numerous studies have been done on birds and their habitats, but there was no common platform from where the information could be disseminated and pooled. In 1998, the BNHS organized a Strategy Planning workshop in Mumbai and invited key ornithologists from across India to discuss the issue. It was decided to have a strong network of ornithologists and conservationists, and the Indian Bird Conservation Network (IBCN) came into existence with the following mission: “To promote conservation of birds and their habitats through development of a national network of individuals, organisations and the Government.”

The objectives of the IBCN are (a) research and monitoring, (b) conservation action, (c) network development, (d) awareness and education, (e) policy and advocacy, and (f) fund raising.

The IBCN is one of the leading membership networks of Indian organizations and individuals who collaborate to promote the conservation of birds in India and the conservation of biological diversity as a whole. At present, IBCN has more than 900 individual and 120 organizations as partners, supporting the bird conservation movement in India. Some of the partners are not ornithologists but are working on different aspects of environment conservation.

This network brings together diverse strengths and expertise focused on strategic conservation objectives.

It provides assistance in a way that encourages local communities to focus and combine efforts for greater impact. In this way, IBCN acts as a conductor, inspiring and directing a network of partners all helping to implement a larger strategy for concrete conservation outcomes in India.

The IBCN publishes a quarterly newsletter *MISTNET* that contains articles and information on bird species (threatened and common), IBAs along with their conservation issues, interventions and advocacy for the protection of biodiversity and habitats. The IBCN website: www.ibcn.in

SOURCES OF DATA

Literature Survey

The foundation of this project is the data on bird numbers and distribution generated through the numerous field surveys and research programmes carried out in India during the last few decades. Exhaustive literature surveys were undertaken and information was gathered from various sources including national and international environmental organizations, individuals, scientists, protected areas staff, natural history museums (including the Bombay Natural History Society, Tring Museum, and British Museum of Natural History), research institutions, universities, and publications. Unpublished material held by research and conservation organizations was also analysed during this

study. This list included records of vagrancy and historical occurrence of bird species, which had to be filtered out.

Red Data Book

The main source of information on threatened birds continues to be the Red Data Book account prepared for Asian threatened bird species (BirdLife International 2001 and BirdLife website).

Regional workshops and consultation

Researchers, ornithologists, local forest officials, bird enthusiasts, and other individuals were consulted through workshops, meetings, and correspondence to identify a list of IBAs throughout the country. Emphasis was given to the participation of governmental and non-governmental conservation bodies and academic institutions. Regional workshops were held in which contributions were made by a vast network of ornithologists, birdwatchers, forest department personnel, and conservation experts across India and the world. State coordinators of the Indian Bird Conservation Network have been involved in collating and assessing the data for each state in collaboration with BNHS. The participants reviewed the draft list and added and deleted sites based on current information and possibility of occurrence of species at sites.

Identification of gaps

There was lack of information from several areas in India and for certain species. Sites could not be identified for some species and several states and districts. This was mainly due to lack of adequate data from these areas.

Surveys for sites and species

Surveys were then commissioned and successfully executed for data deficient species and areas in several states like Meghalaya, Mizoram, Nagaland, Maharashtra, Kerala,

Orissa, Bihar, and Jharkhand.

Capacity building workshops

Some areas remained unexplored largely due to the lack of skilled manpower to execute the surveys. The Indian Bird Conservation Network conducted several training workshops in bird census techniques. A manual on bird census techniques (Javed & Kaul 2002) was developed and distributed.

Final prioritised IBAs

After detailed analyses and consultation with experts, 466 sites were identified as IBAs in 2004 (Islam & Rahmani 2004). In 2014, ten years after the Indian IBA inventory was published it was felt necessary to revise and update the inventory. BirdLife International has also renamed IBA as Important Bird and Biodiversity Area. Therefore, we worked for two years to revise and update the IBA inventory which now covers 554 sites.

The IBA sites are identified on the basis of bird numbers and species complements that they hold, and are selected in such a manner that taken together they form a network throughout the species' biogeographic distribution. This network may be considered as a minimum essential to ensure the survival of threatened species across their ranges, should there occur a net loss of remaining habitat elsewhere through human or other modification. Therefore, the consequences of the loss of any one of these sites may be disproportionately large. The continued ecological integrity of these sites will be decisive in maintaining and conserving birds for which a site based approach is appropriate. Legal protection, management, and monitoring of these crucial sites will be important targets for action, and many but not all bird species may be effectively conserved by these means. Patterns of bird distribution are such that, in most cases, it is possible to select sites that support many species (Heath & Evans 2000).

CATEGORIES AND CRITERIA TO IDENTIFY IMPORTANT BIRD AREAS

The following categories and criteria are the standard guidelines for the identification of IBAs. These guidelines were used with scientific backup and with common sense. A site must meet at least one of the criteria described below (BirdLife International, undated).

(A1) Globally Threatened species

The site regularly holds significant numbers of a globally threatened species, or other species of global conservation concern.

This category refers to species classified as globally threatened with extinction, Critically Endangered, Endangered, Vulnerable, Conservation Dependent or Data Deficient according to the IUCN criteria for threatened status. The site qualifies if it is known, estimated or thought to hold a population of a species as categorized to this IUCN criteria. Population-size thresholds for globally threatened species are set regionally, as appropriate, to help in site selection.

The word ‘regular’ and ‘significant’ in the criterion definition are intended to exclude instances of vagrancy, marginal occurrence, ancient historical records, etc. ‘Regularly’ includes seasonal presence (and at longer intervals, if suitable conditions themselves only occur at extended intervals, e.g., temporary wetlands such as Chhari Dhand in Kutch district of Gujarat). However, sites that have the potential to hold threatened species, following habitat restoration work or re-introductions, may also be considered, for instance, grasslands sites for the Lesser Florican and/ or the Great Indian Bustard. Near Threatened (NT) species can also be included in this category as defined and listed by BirdLife International (2001) and BirdLife website.

(A2) Restricted-Range Species

The site is known or thought to hold a significant component of the restricted-range species whose breeding distributions define an Endemic Bird Area (EBA) or Secondary Area (SA).

A Restricted-Range bird species is a landbird which has had, throughout historical times (i.e., post 1800 CE, in the period since ornithological recording began), a total global breeding range estimated at below 50,000 sq. km. Species with historical ranges estimated to be above this threshold, but which have been reduced to below 50,000 sq. km by habitat loss or other pressures, were not covered because the EBA project seeks to locate natural areas of endemism for birds, which are also likely to be important for other

unique animals and plants (although it is recognised that many species’ ranges may have been severely altered by human impact prior to 1800 CE). Restricted-range landbirds which have become extinct since 1800 CE were included in the analysis, because they have helped to identify areas which have concentrations of such taxa (Stattersfield *et al.* 1998).

Seabirds were excluded from the analysis because their distributions are determined by factors different to those which affect landbirds and other terrestrial taxa, and they are therefore considered to be best treated as a separate group for conservation purposes (Stattersfield *et al.* 1998).

Endemic Bird Area

An Endemic Bird Area (EBA) is defined as an area which encompasses the overlapping breeding ranges of restricted-range bird species, such that the complete range of two or more restricted-range species are entirely included within the boundary of the EBA. This does not necessarily mean that the complete ranges of all of an EBA’s restricted-range species are entirely included within the boundary of that single EBA, as some species may be shared between EBAs (Stattersfield *et al.* 1998).

Endemic Bird Areas relevant to India:

1. Western Ghats (EBA 123)
2. Andaman Islands (EBA 125)
3. Nicobar Islands (EBA 126)
4. Western Himalaya (EBA 128)
5. Eastern Himalaya (EBA 130)
6. Assam Plains (EBA 131)
7. Southern Tibet (EBA 133) (Though the area primarily lies in Tibet, portions of it also extend into India) (*For a list of EBAs see Appendix III*)

Secondary Area

A Secondary Area (SA) is an area which supports one or more restricted-range bird species, but does not qualify as an EBA because fewer than two species are entirely confined to it. Typically, Secondary Areas include single restricted-range species which do not overlap in distribution with any other such species, and places where there are widely disjunct records of one or more restricted-range species (Stattersfield *et al.* 1998). For example, Taloda IBA is considered as a Secondary Area as it has only one restricted-range species, the Forest Owllet.

Secondary Areas in India:

1. Eastern Andhra Pradesh (SA 071)
2. Southern Deccan plateau (SA 072)
3. Indus plains (SA 074)

4. Central Indian forests (SA 075)
5. North Myanmar lowlands (mainly in Myanmar, but also includes lowlands in India) (SA 079)

(For a list of SAs see Appendix III)

(A3) Biome-Restricted Assemblages

The site is known or thought to hold a significant component of the group of species whose distributions are largely or wholly confined to one biome.

A biome may be defined as a major regional ecological community characterised by distinctive life forms and principal plant species. No system of global biome classification has been found which can be adequately used as a basis for generating bird species lists. Therefore, it is necessary that we should have a regional approach, which may result in inter-regional differences but may be comparable at the overall scale at which biome divisions are recognised.

This category applies to groups of species with largely shared distributions of greater than 50,000 sq. km, which occur mostly or wholly within all or part of a particular biome and are, therefore, of global importance.

The major biomes in India as classified by BirdLife International

Biome 05 : Eurasian High Montane (Alpine and Tibetan)
 Biome 07 : Sino-Himalayan Temperate Forest
 Biome 08 : Sino-Himalayan Subtropical Forest
 Biome 09 : Indochinese Tropical Moist Forests
 Biome 10 : Indian Peninsula Tropical Moist Forest
 Biome 11 : Indo-Malayan Tropical Dry Zone
 Biome 12 : Indo-Gangetic Plains
 Biome 13 : Saharo-Sindian Desert

(For a list of biome-wise distribution of bird species that qualify for this criterion for each biome, please see Appendix IV)

(A4) Congregations

This category applies to species that congregate at sensitive sites when breeding or wintering, or while on passage. The term ‘waterbird’ is used here in the same sense as the Ramsar Convention uses ‘waterfowl’ and covers the list of families more precisely defined by Wetlands International (Rose & Scott 1994). Congregatory non-waterbird species (A4ii) include both terrestrial species and families of seabirds such as Procellariidae, Hydrobatidae, Pelecanidae, Phaethontidae, Sulidae, and Fregatidae.

The Congregatory category has four subdivisions:

(A4i) Site known or thought to hold, on a regular basis, $\geq 1\%$ of a biogeographic population of a congregatory waterbird species. For the thresholds of this criterion, relevant flyway populations are combined to produce biogeographic population estimates.

(A4ii) Site known or thought to hold, on a regular basis, $\geq 1\%$ of the global population of a congregatory seabird or terrestrial species. This category covers non-waterbirds or terrestrial birds or seabirds.

(A4iii) Site known or thought to hold, on a regular basis, $\geq 20,000$ waterbirds or $\geq 10,000$ pairs of seabirds of one or more species. Use of this criterion is discouraged where data quality permits A4i and A4ii to be used.

(A4iv) Site known or thought to be a ‘bottleneck site’ where at least 20,000 storks (Ciconiidae), raptors (Accipitriformes and Falconiformes), or cranes (Gruidae) pass regularly during spring or autumn migration.

Categories of criteria for site selection under the Ramsar Convention (adopted at the Conference of the Parties, May 7, 1999)

1. Representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.
2. Supports Vulnerable, Endangered, or Critically Endangered species or threatened ecological communities.
3. Supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.
4. Supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.
5. Regularly supports 20,000 or more waterbirds.
6. Regularly supports 1% of the individuals in a global population of one species or subspecies of waterbird.

IBA criteria A4i and A4iii identify wetlands of international importance (Ramsar Sites), being similar to Ramsar criteria 5 and 6 respectively (see Box).

Waterbird as seabird

The term ‘waterbird’ is used in the same sense as that used for ‘waterfowl’, seabird, and water-dependent birds under the Ramsar Convention.

Biogeographic population

‘Biogeographic’ is used in the sense of a zoogeographic realm, e.g., the Palaearctic, which are large geographical regions in which the organisms present tend to be different from those of other realms. Thus such regions are characterised largely through the shared distribution patterns of many species. All ‘populations’ of a given species that are resident in or migratory through this region are combined to form the ‘biogeographic population’. We do not have sufficient flyway population information at the moment, but through the IBA programme we may be able to get good information in future.

1% thresholds and applying the criteria

1% threshold figures have been defined for all congregatory waterbird species, including species for which no thresholds are currently recognised under the Ramsar Convention. Wetlands International has collaborated in generating numeric thresholds from range estimates and from unpublished population data.

Criteria A4iii and A4iv are applied at the site level only, not to individual species.

The A4iv criterion embraces sites over which flying migrants concentrate, e.g., at narrow sea-crossings, along mountain ranges or through mountain passes. Conservation of the land beneath may be necessary to protect the site and its birds from threats such as shooting and the construction of lethal obstacles such as power lines wind mill, and high radio masts. Also included under A4iv are migratory stop-over sites and nocturnal roosts which may not hold 20,000 or more storks, raptors, or cranes at any one time but which, nevertheless, do hold such numbers over a relatively short period due to the rapid turnover of birds on passage (e.g., roosting sites of Amur Falcon *Falco amurensis*).

How IBA criteria relate to the identification of Ramsar sites under the Ramsar Convention

The Ramsar (or Wetlands) Convention defines a wetland as “an area of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed 6m” (Article 1). Article 2.1 of the Convention also states that “the boundaries of each wetland may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than 6 m at low tide lying within the wetlands, especially where these have importance as waterfowl habitat”.

The criteria for identifying wetlands of international importance under the Ramsar Convention, as adopted at the Conference of the Parties on May 7, 1999, fall into eight categories. There is a strong relationship between the

Ramsar categories for waterbirds and the IBA criteria. IBA criteria A1, A4i, and A4iii which are equivalent to Ramsar criteria 2, 5, and 6 were used for identifying IBAs. They were used for both non-breeding populations of waterbirds and for breeding concentrations of some congregatory species.

Overall the IBA criteria comply with the Ramsar criteria for birds. However, there is one difference: IBA criteria A4i could be applied to congregations of waterbirds in grassland and marine habitats (not classifiable as wetland habitat under the Ramsar definition). Some of the congregatory sites, especially 1% threshold for some waterbirds, may be met in grassland areas (Ramsar Criterion 6). The Ramsar wetland definition excludes these sites from consideration under the Convention, therefore their eligibility for designation as Ramsar Sites has to be considered case-by-case.

GIS based mapping of the IBAs of India Background

For any work targeted to serve conservation needs, especially relating to field-based targets, it is crucial to have good quality maps, describing the location and its geographic ambience. The idea of preparing maps for the present work transcended beyond providing plain maps to actually producing accurate and meaningful graphic descriptions of the site locations in map form. The maps are intended to serve as an additional source of contextual information that normally gets subdued in write-ups, but is crucial for field workers, administrators, and site managers for orientation and better management.

Another important concern for mapping was to lay the foundation for a comprehensive GIS based digital database for all the IBA locations to serve current as well as future mapping and spatial analysis needs for individual sites or site clusters. In this age of information technology an extended target was to keep options open for future web-based applications for better information sharing and conservation planning. All of these goals and many others required the mapping to be conducted in a state of art GIS application. Hence, all the GIS based mapping was generated on Environmental Systems Research Institute’s ArcGIS software.

While creating the GIS generated database, preference was given to global free datasets from various sources. We have used freely available global datasets for national and international boundaries, place locations and names, digital elevation model and the landuse/landcover map with adequate modifications. The administrative boundaries with approximate accuracy were originally taken from the free data server (<http://www.cipotato.org/diva/data/DataServer.htm>) and were updated using the census 2001 snapshots (<http://www.undp.org.in/VRSE/>

Links/census.htm) to account for the 2001 redistribution of district boundaries and names. The place names and locations were taken from the free gazetteer (<http://www.cipotato.org/diva/data/DataServer.htm>) and were manually corrected for discrepancies. The high resolution Digital Elevation Model (DEM) data (<http://edcsgs9.cr.usgs.gov/pub/data/srtm/Eurasia/>) was interpolated for the missing values wherever possible. For larger gaps in the DEM data at higher resolution, where the interpolation resulted in unacceptable error, the coarser resolution DEM (<http://edcsgs9.cr.usgs.gov/pub/data/srtm/SRTM30/>) was used. The global landcover class names (<http://glcf.umiacs.umd.edu/data/landcover/index.shtml>) as described in the original dataset were quite different from what is in practice among Indian field workers. Therefore, the class names were renamed/merged for the convenience of Indian users.

DATA PRESENTATION

India has 28 States and six Union Territories. All the state accounts contain an overview of the status of the Important Bird and Biodiversity Areas (IBAs) and their conservation, followed by a series of site accounts describing the IBAs in that particular state.

STATE ACCOUNTS

State overview, Human population, IBAs, Threatened

bird species, Endemic Birds, Biomes, Threats and conservation issues and References.

SITE ACCOUNTS

Header

All the site accounts have been written in a standard format, with a box header which gives basic information on a particular site, such as site name, site code, administrative region (state) name, district name, coordinates, ownership, area in hectares, ownership, altitude in metres, rainfall in millimetres, temperature in centigrade, biogeographic zone (of Rodgers & Panwar 1988), and habitats. Below the header box, IBA Criteria and Protection Status (if protected, with date of establishment or not officially protected) are mentioned.

General description

This section gives information about the site, its location, topographical features, physical features, and overview of the main flora and fauna.

Avifauna

This section gives information about the key avifauna, and general information pertaining to the number of bird species recorded, if a checklist is available. This section also explains why the site has been selected an IBA and the criteria used.

Original value	Original class name	New value	New class
0	Water (and Goode's interrupted space)	0	Water
1	Evergreen Needleleaf Forest	1	Coniferous Forest
2	Evergreen Broadleaf Forest	2	Evergreen Forest
3	Deciduous Needleleaf Forest	NA	Not Available
4	Deciduous Broadleaf Forest	4	Semi-Evergreen Forest
5	Mixed Forest	5	Mixed Forest
6	Woodland	6	Deciduous Forest
7	Wooded Grassland	7	Open Scrub Forest
8	Closed Shrubland	8	Tropical Thorn Forest
9	Open Shrubland	9	Grassland
10	Grassland	9	Grassland
11	Cropland	10	Cropland
12	Bare Ground	11	Non Forest
13	Urban and Built-up	11	Non Forest

The table below summarises all the links for the free data sources used for preparation of the maps in the present work:

Sr.	Source	Data
1	http://www.undp.org.in/VRSE/Links/census.htm	District Boundaries, Names
2	http://www.cipotato.org/diva/data/DataServer.htm	Admin. Boundaries, Gazetteer
3	http://glcf.umiacs.umd.edu/data/landcover/index.shtml	Global Landcover
4	http://maps.jpl.nasa.gov/pix/ear0xuu2.tif	Global DEM
5	http://edcsgs9.cr.usgs.gov/pub/data/srtm/SRTM30/	Global DEM
5	http://edcsgs9.cr.usgs.gov/pub/data/srtm/Eurasia/	High Resolution DEM
6	http://www.maproom.psu.edu/cgi-bin/dcw/dcwarea.cgi?Asia	Rivers, Roads

The general description of avifauna is followed by a table presenting data on all the globally threatened species that occur in the site, with English and scientific names of the species. This table also provides information on the IUCN category for each threatened bird. Below the threatened and restricted range species table, a table of biome assemblages is given if the site is identified on the basis of biome criteria.

Other biodiversity

This section gives the list of the other fauna found in the site, which includes large and small mammals, and sometimes key species of herpetofauna are also mentioned.

Land use

This section describes the land use practices, e.g., forestry, tourism, and agriculture.

Threats and Conservation Issues

This section lists the key threats to the site and to the biodiversity, especially to birds. It also includes the research done on the site, regular monitoring, conservation and site management initiatives, awareness programmes aimed at biodiversity or on particular bird, and also the management plan, if any, of the site.

Key contributors

This section contains the name of the key persons who helped in collecting information on the sites or commented on the text, and/or in some cases wrote the site account.

Key references

A list of cited references is given.

References

- Ahmed, A. (1997) *Live Bird Trade in Northern India*. WWF/TRAFFIC-India, New Delhi, 104 pp.
- Ahmed, A. (2002) *Live bird trade in India*. Unpublished report. WWF/TRAFFIC-India. New Delhi.
- Barnes, K. N. (ed.) (1998) *The Important Bird Areas of Southern Africa*. BirdLife South Africa, Johannesburg.
- BirdLife International (2001) *Threatened Birds of Asia: The BirdLife Red Data Book*. BirdLife International, Cambridge, UK.
- Heath, M. F. and Evans, M. I. (eds.) (2000) *Important Bird Areas in Europe: Priority Sites for Conservation*. 2 Vols. BirdLife Conservation Series No. 8. BirdLife International, Cambridge, UK.
- Islam, Z.A. and Rahmani, A.R. (2004) *Important Bird Areas in India: Priority Sites for Conservation*. Indian Bird Conservation Network, Bombay Natural History Society and BirdLife International (UK). Pp xviii + 1133.
- Islam, Z.A. and Rahmani, A.R. (2008) *Potential and Existing Ramsar Sites in India*. Indian Bird Conservation Network, Bombay Natural History Society, BirdLife International and Royal Society for the Protection of Birds. Oxford University Press. Pp 592.
- Javed and Kaul (2002) *Field Methods for Bird Surveys*. Bombay Natural History Society, Bombay.
- Rodgers, W. A. and Panwar, H. S. (1988) *Planning a Wildlife Protected Area Network in India*. 2 vols. Wildlife Institute of India, Dehra Dun.
- Rose, P. M., and Scott, D. A. (1994). *Waterfowl Population Estimates*. International Waterfowl and Wetlands Research Bureau (IWRB Special Publication 29). Slimbridge, UK.
- Stattersfield, A. J., Crosby, M. J., Long, A. J. and Wege, D. C. (1998) *Endemic Bird Areas of the World: Priorities for Biodiversity Conservation*. BirdLife Conservation Series No. 7. BirdLife International, Cambridge, U.K. pp 846.
- Tucker, G. M. and Heath, M. F. (1994) *Birds in Europe: Their conservation status*. BirdLife Conservation Series 3. BirdLife International, Cambridge, U.K.

NATIONAL OVERVIEW



The Endangered Black-necked Cranes *Grus nigricollis* breeds only in Ladakh but a very small population found in north of West Bengal and part of Sikkim

ANALYSIS AND RESULTS

Status of IBAs

This IBA Inventory is the revised comprehensive study in which sites have been identified for bird conservation in India on the basis of globally accepted criteria. Five hundred and fifty-four sites have been identified throughout the country, covering almost all threatened and Near threatened species, restricted range species, biome-assemblages and congregatory species (mainly wetland birds) of India. This list, however, is dynamic and not a fixed list of sites, as it is revised after 12 years. The first edition of the IBA Inventory gave a baseline to improve knowledge on birds, especially threatened species. As new sites were identified, the database on the IBAs and on birds has improved.

Categories and criteria met by Indian IBAs

The analysis of these 554 IBAs shows that 506 sites have globally threatened species (A1), 240 sites hold restricted range species (A2), and 99 sites qualify biome-restricted assemblages (A3), and 136 sites fit the congregatory (A4) criteria. Many sites fit more than one criterion, and some sites such as Keoladeo National Park and Chilika Lake qualify all the four criteria. That is why the sum total is more than 554.

Around 90% of IBAs in India are important for one or more of the 92 globally threatened species in India and 47% for the 74 restricted range species found in India. Almost all IBAs fall under at least one biome and hold some of the 374 bird species that fall in the biome criterion. The IBAs are also important for species that congregate in large numbers, such as congregatory terrestrial birds, wintering and passage waterbirds and breeding seabirds. Almost 17% of the IBAs have been identified for these species.

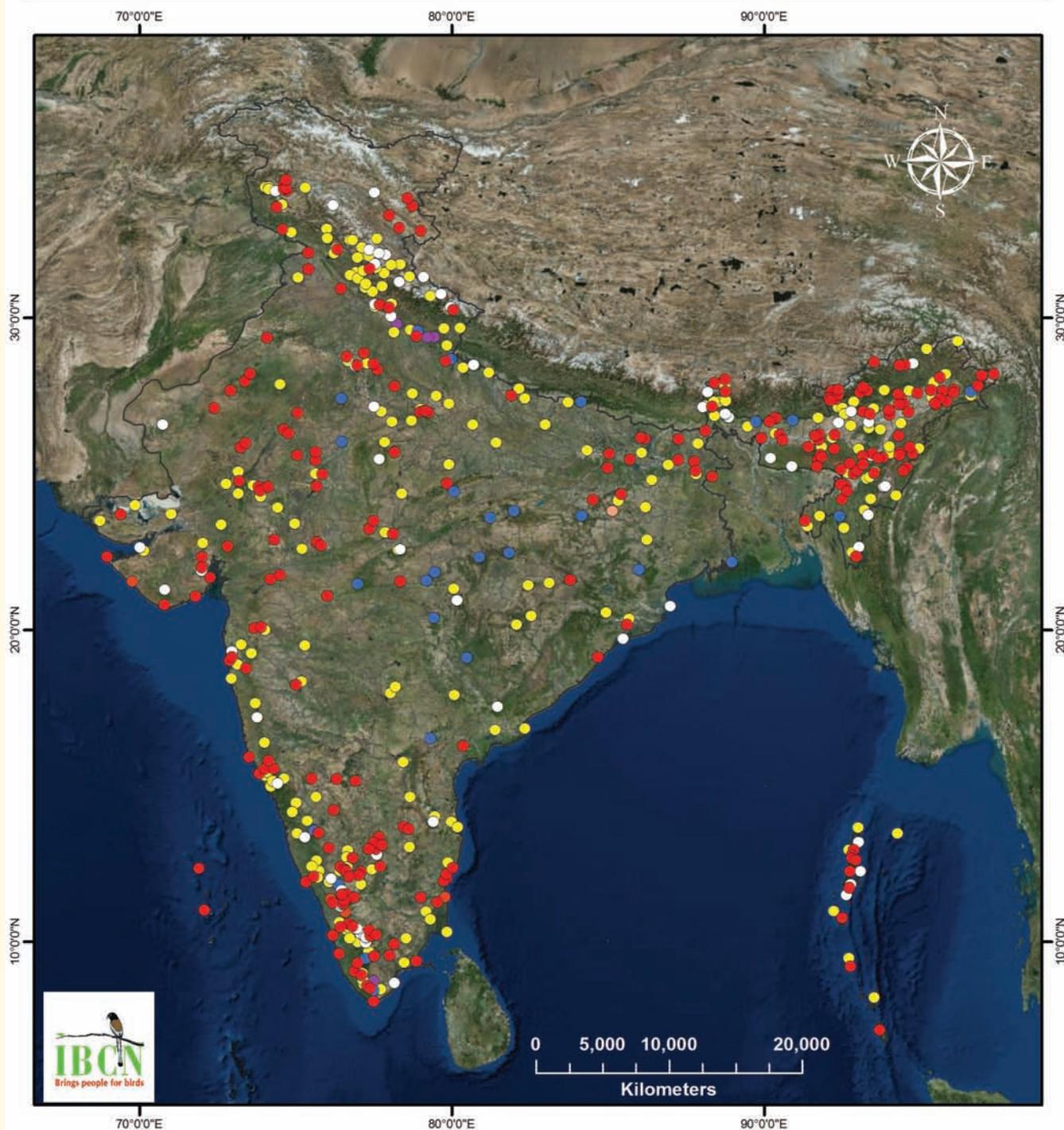
The following are the results of the analysis of the IBA sites on the basis of categories and criteria defined in the methodology.

(Many IBAs qualify more than one criterion so here the total is more than 554.)

A1: GLOBALLY THREATENED SPECIES

There are 92 globally threatened bird species in India (BirdLife International 2015). The key habitats for the threatened species are wetlands (29 species), forest birds (27 species), grassland (14) and scrubland (4). There are many bird species which uses many habitat types, for example, the Greater Adjutant *Leptoptilos dubius* uses forest, wetland and urban areas.

Protection Status of Important Bird Areas in India

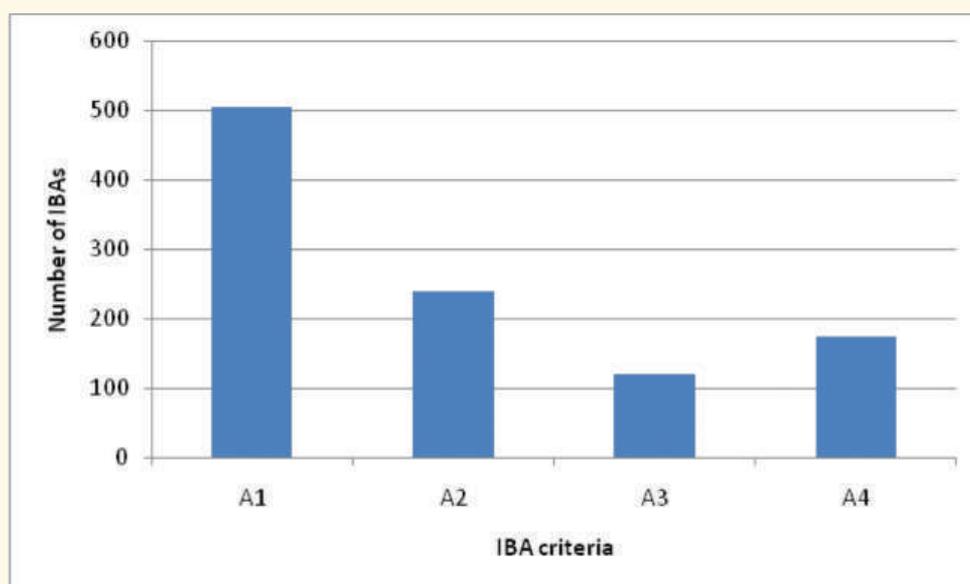


Legend

- Not Officially Protected
- National Park
- Tiger Reserve
- Wildlife Sanctuary
- Conservation Reserve
- Reserve Forest
- Protected Forest



The Indian IBAs and Criteria



A1- Red Data Book Species; A2- Restricted Range Species; A3- Biome Restricted Species; A4- Congregation

The IUCN categorizes birds in the Red Data List as:

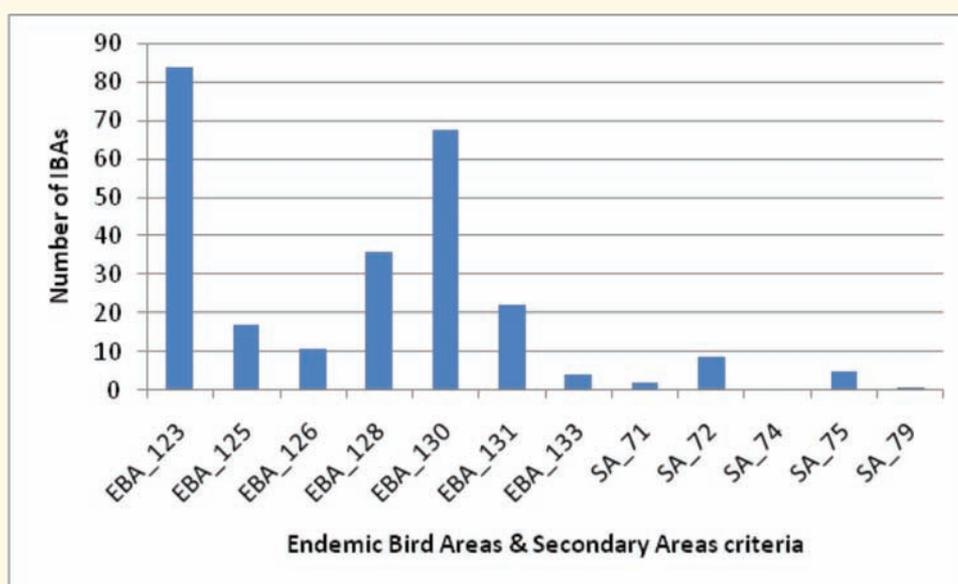
- (a) Critically Endangered, 17 species are found in India,
- (b) Endangered, 19 species in India,
- (c) Vulnerable, 56 species in India,
- (d) Data Deficient, three species: Large-billed Reed-warbler *Acrocephalus orinus*, Sillem’s Mountain-finch *Leucosticte sillemi* and Nicobar Scops-owl *Otus alius*,
- (e) Near Threatened, 85 species in India.

The following figures give details about the distributions of the globally threatened species in the IBAs. Vulnerable species are found in 84% of the IBAs, while Critically Endangered species are found in 48% of the IBAs, followed by Endangered and Data Deficient.

A2: COVERAGE OF RESTRICTED RANGE SPECIES

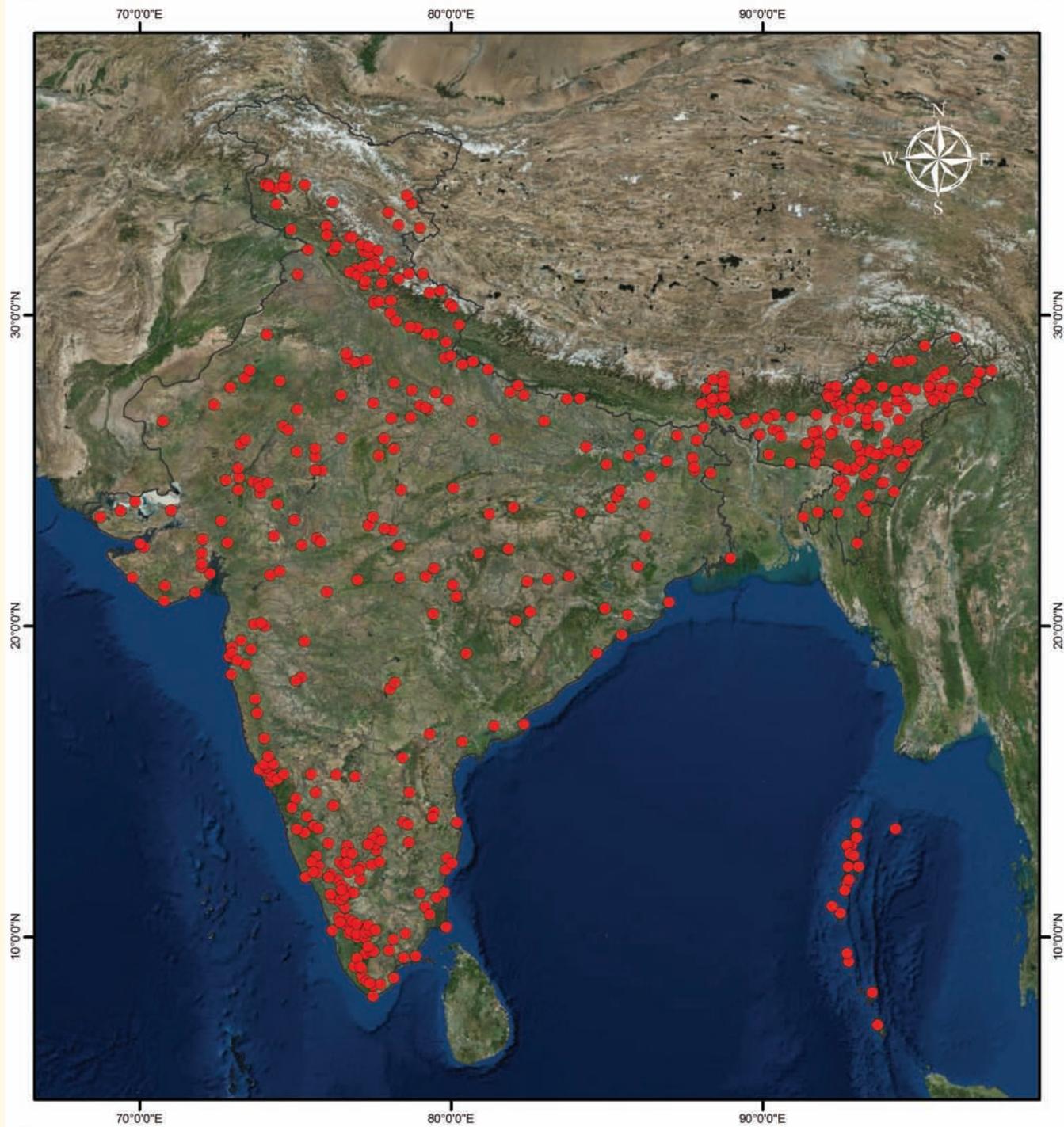
There are 74 Restricted Range bird species in India (Stattersfield *et al.* 1998), many of them are found in neighbouring countries also. Twenty-seven of them are globally threatened. Out of these 74 species, 38 are confined to India (not found in any other country), of which 10 are globally threatened. Of the remaining 36 species (found in neighboring countries also), 13 are globally threatened species. We also found that out of 74 species, 57 restricted range species are continental and 22 are island species (Stattersfield *et al.* 1998).

The BirdLife International (2001) has identified seven Endemic Bird Areas (EBAs), and five Secondary Areas (SAs) in India. The EBAs hold more than two restricted range



Distribution of IBAs in different Endemic Bird Areas and Secondary Areas

Globally Threatened Species in IBAs of India



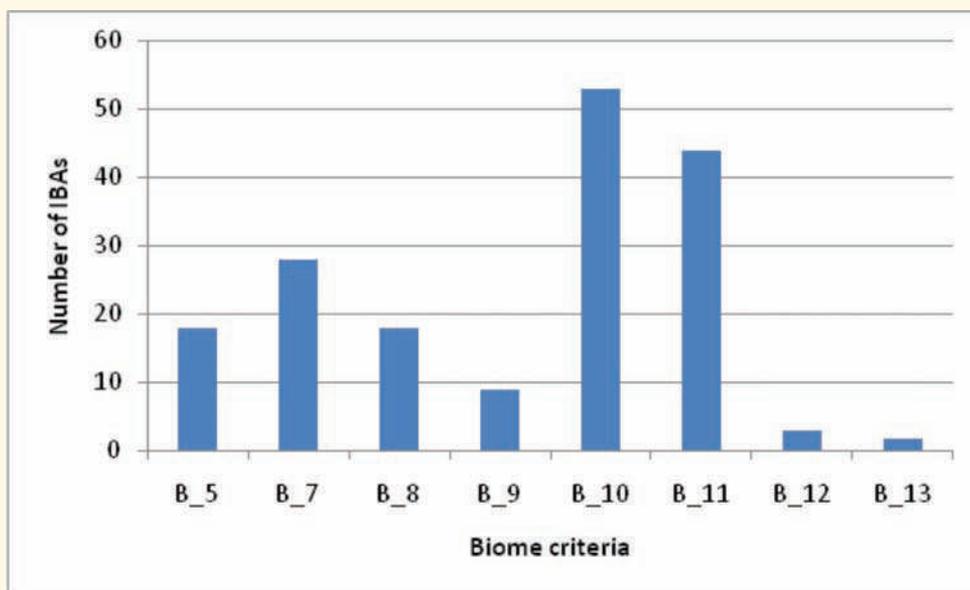
Legend

- IBAs Qualifying A1 Criterion

0 5,000 10,000 20,000
Kilometers

The legend block contains a red dot symbol next to the text 'IBAs Qualifying A1 Criterion'. Below this is a scale bar with markings at 0, 5,000, 10,000, and 20,000 kilometers. At the bottom of the legend are two logos: the IBCN logo with the tagline 'Brings people for birds' and the BNHS India logo with the tagline 'CONSERVING NATURE SINCE 1883'.





Distribution of IBAs in different Biomes in India

species, while SAs are those areas which have only one restricted range species. In the Western Ghats, 26 restricted range species are found, of which six are globally threatened. Sixty-six IBAs have been identified in the Western Ghats. In the Western Himalayas where 11 restricted range species are listed, four are globally threatened. Thirty-three IBAs have been identified in the Western Himalayas. The number of restricted range species, threatened species and EBAs/SAs are given below.

A3: BIOME RESTRICTED ASSEMBLAGE

This category applies to groups of species with largely shared distributions of greater than 50,000 sq. km, which

occur mostly or wholly within all or part of a particular biome and are, therefore, of global importance.

The site is known or thought to hold a significant component of the group of species whose distributions are largely or wholly confined to one biome.

Ninety-nine IBAs have been identified using this criterion. The range of each biome and maps were provided by the BirdLife International. The status of the IBAs in the Biome categories are given in the following table.

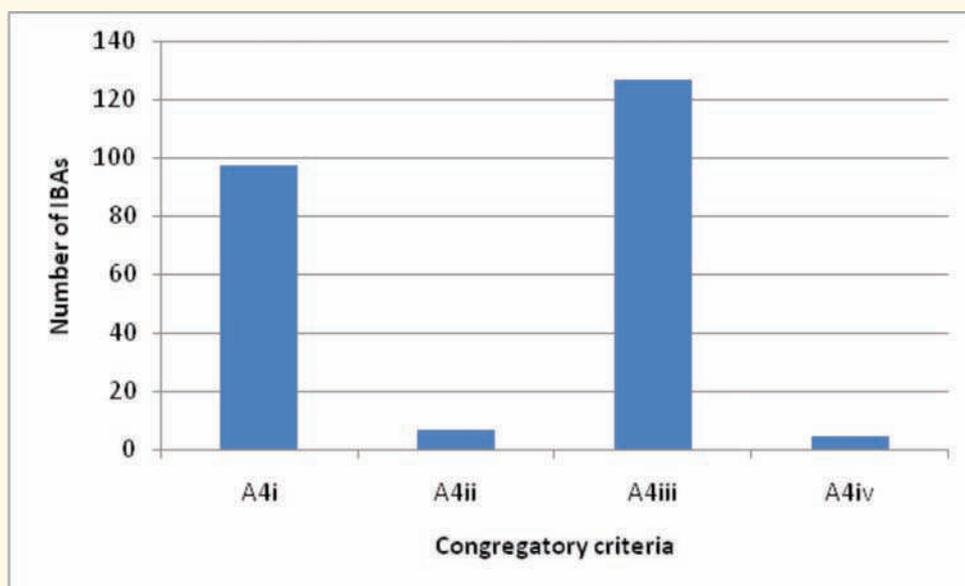
A4: CONGREGATORY SPECIES

Nearly 150 IBAs were identified using the congregatory criteria. The A4i criterion talks about the ≥ 1% of a



ASAD R. RAHMANI

The numbers of vultures of *Gyps* species in India has crashed by 98% in the last 20 years. This is chiefly due to the introduction of drug Diclofenac for veterinary use

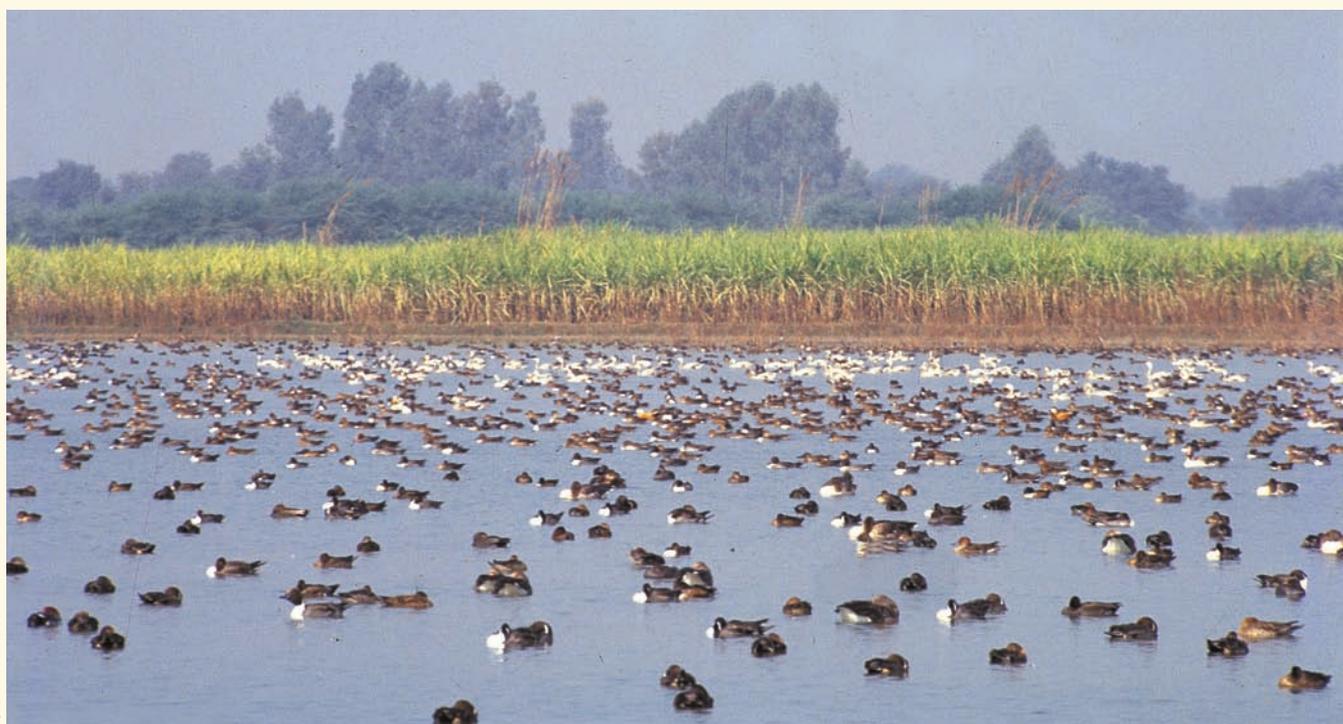


Number of IBAs qualifying different congregatory criteria A4

biogeographic population of a congregatory waterbird species. Eighty-eight IBAs have been identified using the updated threshold list published in 2002 by the Wetlands International (Wetlands International 2002). A4ii is about $\geq 1\%$ of the global population of a congregatory seabird or terrestrial species; five IBAs have been identified using this criteria, e.g. Habang in Assam and Velavadar in Gujarat. A4iii is about the presence of $\geq 20,000$ waterbirds; 105 sites qualify this criteria. The A4iv is about the site exceeding the thresholds set for migratory species at bottleneck sites. In India, only five IBAs were selected under this criteria.

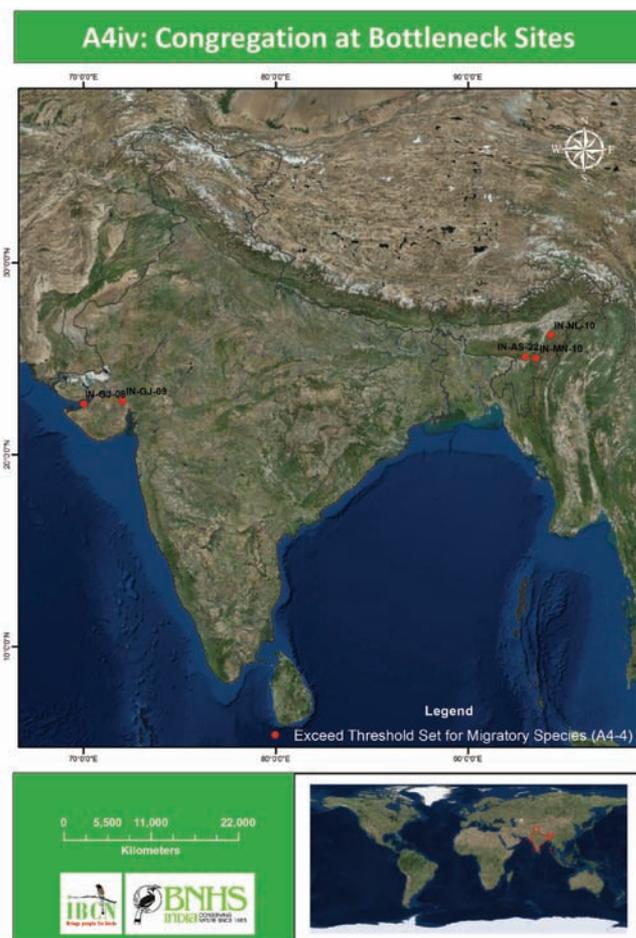
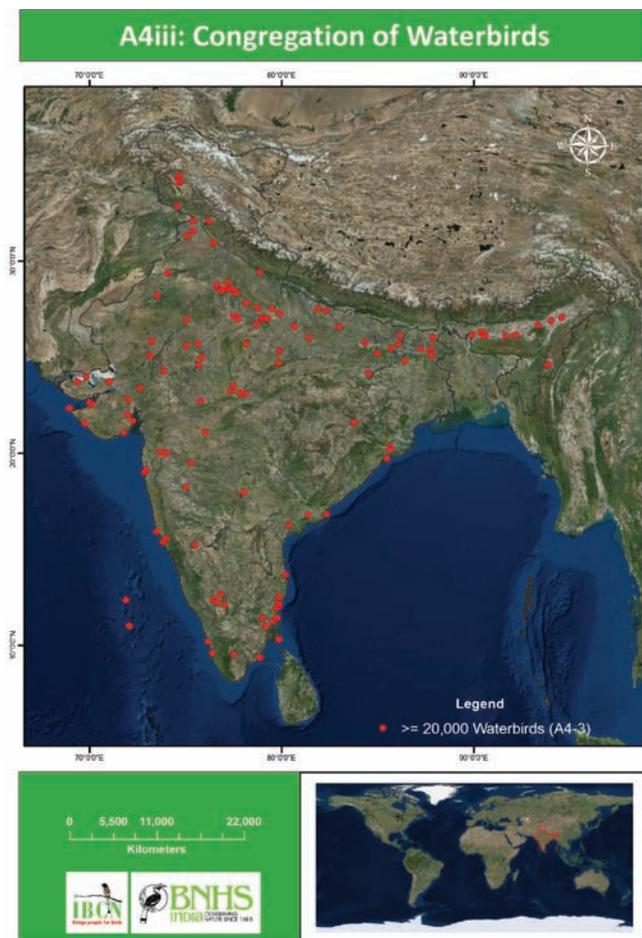
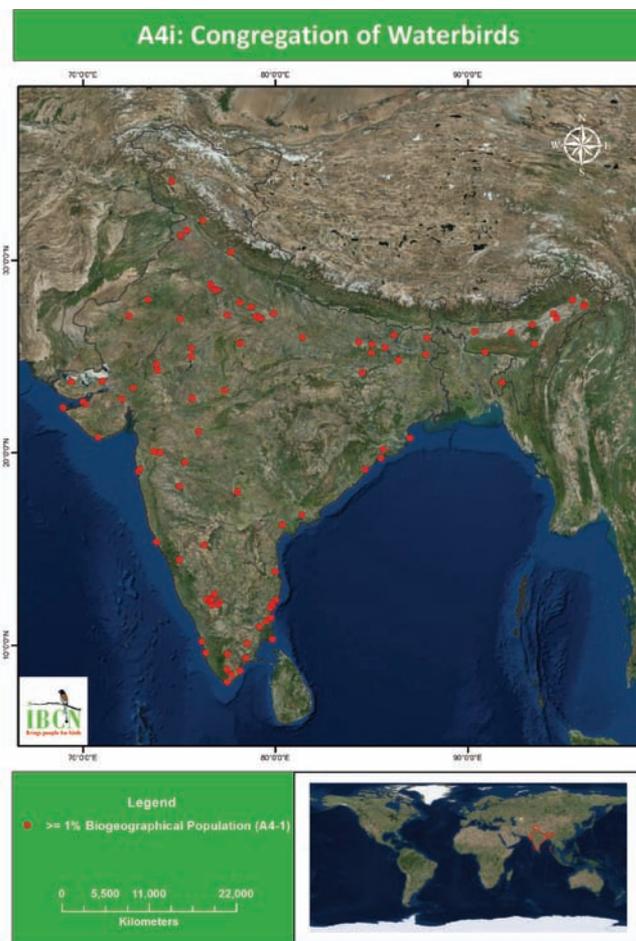
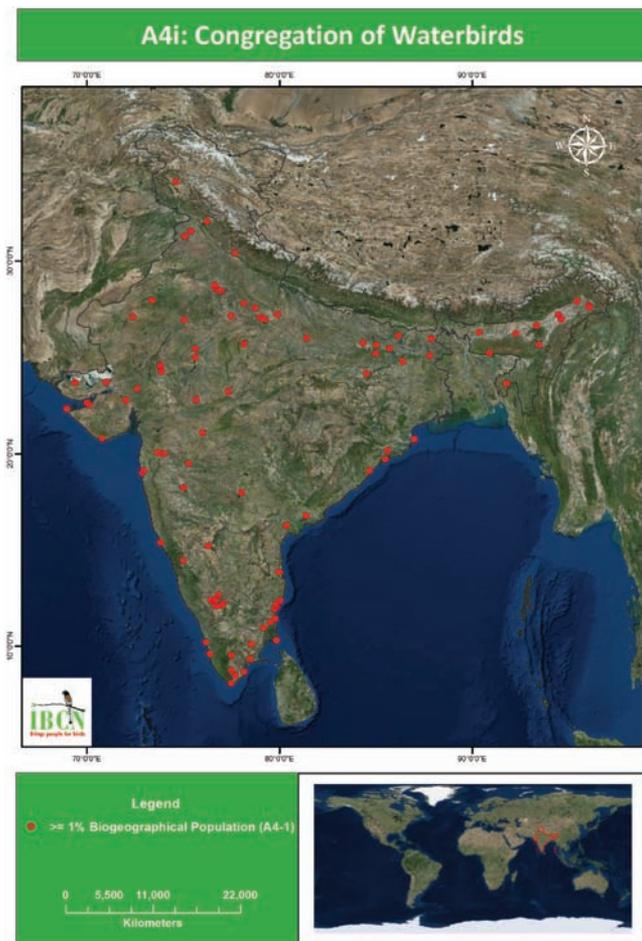
IBAs IN DIFFERENT HABITAT TYPES

Champion and Seth (1968) have classified India’s vegetation into seven major groups, 16 sub-groups and over 150 sub-types and seral stages. This classification, by far, takes physiognomy, floristics as well as local edaphic and biotic factors into classification hence widely used by foresters as well as ecologists. Description of wildlife habitats, including major biomes and Important Bird Areas (IBAs) can best be done using Champion and Seth’s categories. However, as this book deals with birds and Important Bird Areas, we have not gone into details of vegetation types

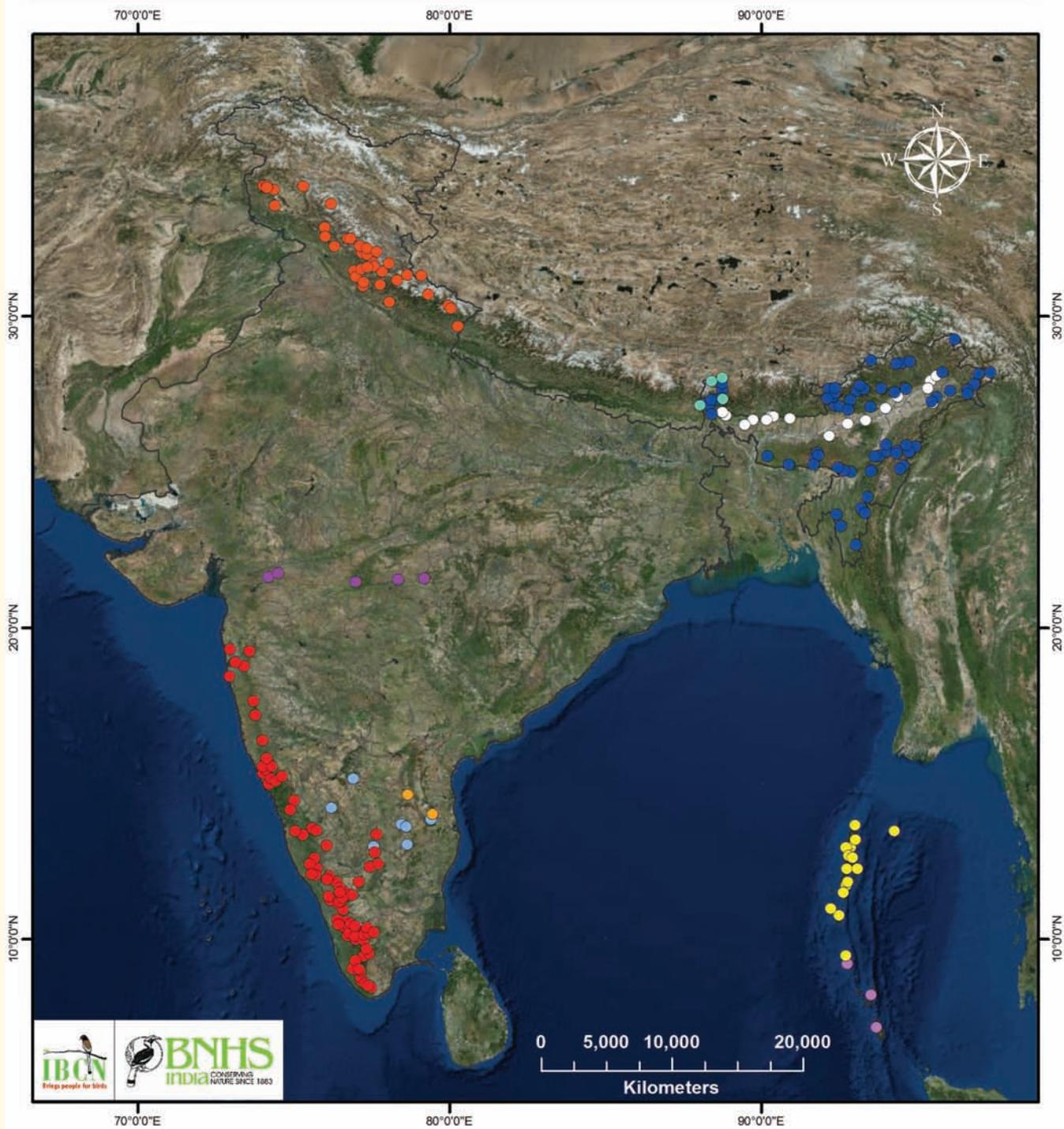


ASAD R. RAHMANI

Many wetlands in India, such as Sheikha Jheel in north India, are important wintering sites for congregatory species where more than 20,000 waterbirds congregate

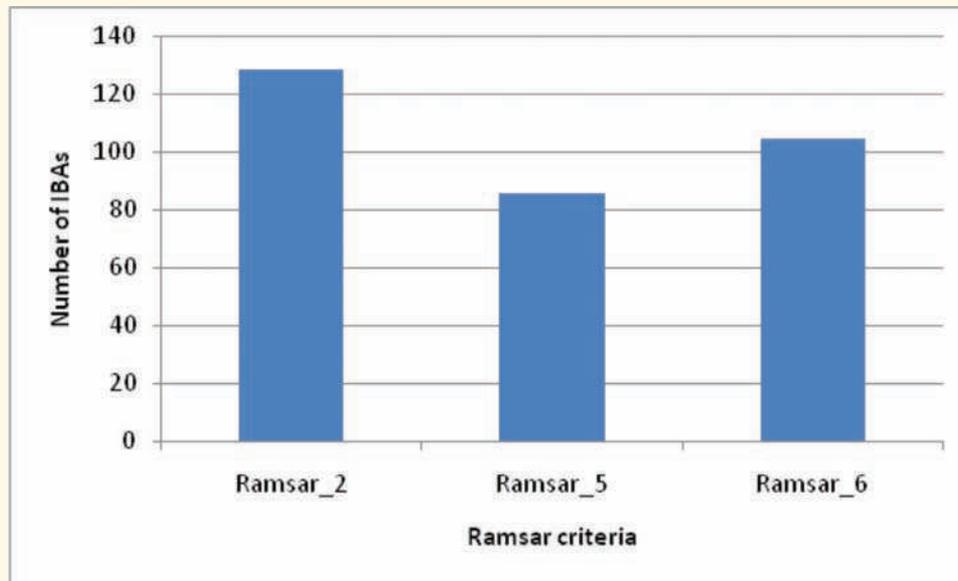


A2: Restricted Range Species in IBAs of India



Legend	
● EBA-123	● EBA-131
● EBA-125	● EBA-133
● EBA-126	● SA-71
● EBA-128	● SA-72
● EBA-130	● SA-75





Number of IBAs qualifying different Ramsar criteria

of India, and for our analysis, we have categorized India's vegetation into eight general broad habitat categories, which are (1) Alpine Forest; (2) Sub-Alpine Forest; (3) Temperate Forest; (4) Evergreen Forest; (5) Deciduous Forest; (6) Grassland; (7) Wetland and (8) Desert.

Forest is the foremost habitat for threatened and other categories of IBAs in India, grasslands are very important for some of the most endangered birds such as the Great Indian Bustard, Bengal Florican and the Lesser Florican, and wetlands are important for 29 globally threatened and many common waterbirds.

Out of the 554 IBAs in India, the foremost category where the IBAs are distributed is Wetland with 27% IBAs. This is followed by Evergreen Forest (23%), Deciduous Forests (21%), Temperate Forests (11%), Grasslands (10%), Desert (7%), Alpine Forests (4%) and Sub-Alpine Forests (3%).

IBAs and Biogeographic Zones

The Wildlife Institute of India (WII) had produced a document in 1988 by W. Alan Rodgers and H. S. Panwar which defined the biogeographic zones of India for planning a protected area network. This document was updated in 2000 (Rodgers *et al.* 2000). The WII classification uses four levels of planning unit which are as follows: (1) The Biogeographic Zone; (2) The Biotic Province; (3) The Land Region; and (4) The Biome.

We have used only the biogeographic zones which are large distinctive units of similar ecology, biome representation, community and species e.g., Himalayas, Western Ghats, Coasts etc. Rodger and Panwar (1988) had identified 10 biogeographic zones, divided into 26 provinces and many biomes. *The biome definition should not be confused with the BirdLife International's definition of biome.* As per Rodgers *et al.* (2000), a biome is an ecological unit, not a biogeographic

unit. A biome such as Littoral Forest, Tropical Swamp Forest, Dry Grasslands or Riverine Habitats could be found in several biogeographic zones or provinces. Biome can be equated to Champion and Seth's broad forest vegetation types, with the addition of non-forest categories such as grassland, wetland etc. (Rodgers *et al.* 2000).

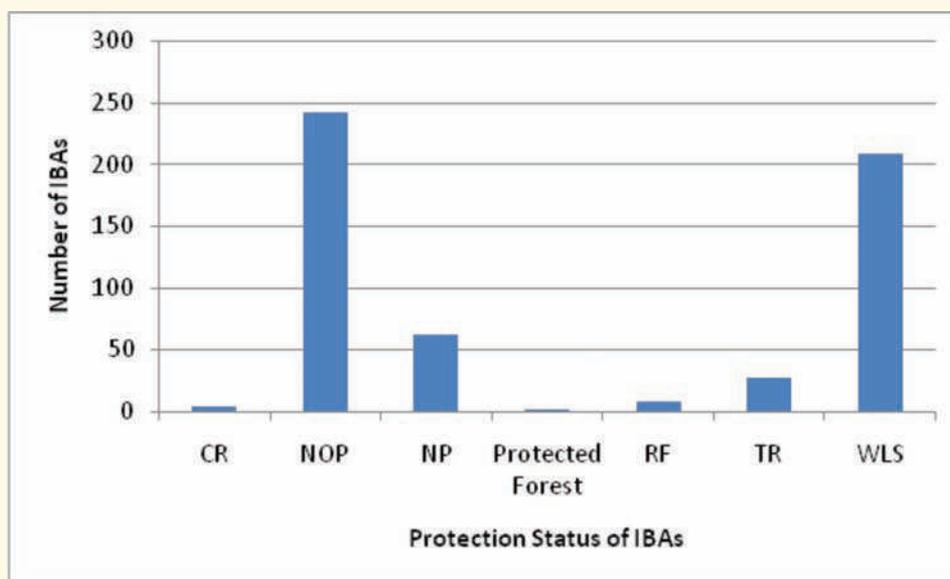
As per BirdLife International, biome is defined as "a major regional ecological community, characterised by distinctive life forms and principal plant species". No system of global biome classification has been found which can be adequately used as a basis for generating bird species lists. Therefore, it is necessary that we should have a regional approach, which may result in inter-regional differences but at the over all scale at which biome division are recognised may be comparable. The biome category applies to groups of species with largely shared distributions of greater than 50,000 sq. km, which occur mostly or wholly within all or part of a particular biome and are, therefore, of global importance.

The following figure gives the details of ten biogeographic zones of India defined by Rodgers *et al.* (2000) and the number of IBAs in each zone.

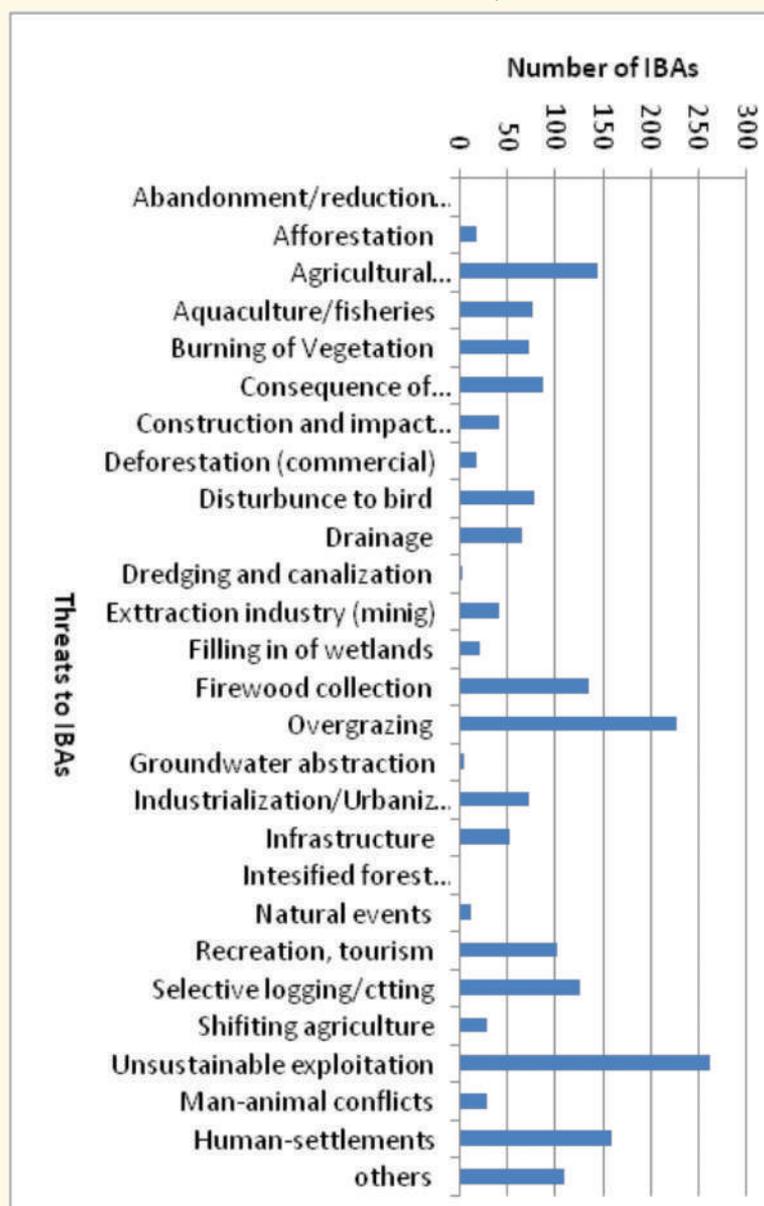
The maximum number of IBAs (81 sites) are distributed in the Deccan Peninsula while the Himalaya and the North East biogeographic zones have same number of IBAs, i.e., 80 sites each, followed by the Western Ghats, the Semi-Arid, the Gangetic Plains, the Coasts, the Islands, the Trans-Himalayas and the Indian Desert.

Protection Status of IBAs in different States in India

In India, 465 IBAs have been identified using international criteria. The maximum number of IBAs are in Assam i.e., 46 of which 28 are not officially protected, while Delhi and



Protection Status of IBAs in India
 CR: Conservation Reserve, NOP: Not officially protected, NP: National Park, RF: Reserve Forest, TR: Tiger Reserve, WLS: Wildlife Sanctuary



Key threats to the IBAs in India

List of IBAs in Danger

Sr.	State	IBA Name	IBA code	Main Threats
1	Andaman & Nicobar	Tillanchong WLS, Camorta, Katchal, Nancowry, Trinkat	IN-AN-19	Navy activities. Unsustainable hunting
2	Andhra Pradesh	Kolleru Lake WLS	IN-AP-04	Proposal to decrease the area
3	Andhra Pradesh	Rollapudu WLS	IN-AP-11	Trigger species extinct
4	Andhra Pradesh	Sri Lankamalleswara WLS	IN-AP-12	Trigger species extinct (?)
5	Arunachal Pradesh	Itanagar WLS	IN-AP-08	Proposal to decrease the area
6	Arunachal Pradesh	The Chaporis of Lohit River	IN-AP-25	Impact of large dams upstream
7	Assam	Bauwua Beel	IN-AS-04	Encroachment, excessive Fishing
8	Assam	Deobali Jalan	IN-AS-11	Encroachment, over-grazing
9	Assam	Jengdia Beel and Satgoan	IN-AS-23	Encroachment
10	Assam	Sivasagar Tanks	IN-AS-38	Increasing construction activities
11	Assam	Son Beel	IN-AS-39	Encroachment, excessive fishing
12	Assam	Urpod Beel	IN-AS-46	Encroachment, excessive fishing
13	Bihar	Goga Beel Pakshi Vihar, Baghar Beel, and Baldia Chaur	IN-BR-03	Encroachment, excessive fishing
14	Bihar	Kawar Lake Bird Sanctuary	IN-BR-04	Encroachment, excessive fishing
15	Bihar	Nagi Dam and Nagti Dam Bird Sanctuary	IN-BR-08	Encroachment, excessive fishing
16	Gujarat	Flamingo City	IN-GJ-04	Infrastructure development
17	Haryana	Basai wetland	IN-HR-01	Land development
18	Haryana	Wetlands of Yamuna River	IN-HR-05	Land development
19	Karnataka	Ranebennur Blackbuck Sanctuary	IN-KA-30	Trigger species extinct
20	Madhya Pradesh	Dihaila Jheel and Karera Wildlife Sanctuary	IN-MP-05	Encroachment. Trigger species extinct
21	Madhya Pradesh	Ghatigaon WLS	IN-MP-07	Trigger species extinct
22	Madhya Pradesh	Sailana Kharmor Sanctuary	IN-MP-15	Cattle grazing, agriculture
23	Madhya Pradesh	Sardarpur Florican Sanctuary	IN-MP-16	Cattle grazing, agriculture
24	Maharashtra	Nannaj and other Grasslands	IN-MH-06	Trigger species ecologically extinct
25	Maharashtra	Mahul-Sewree Mudflat	IN-MH-08	Infrastructure development
26	Maharashtra	Ozar, Wani and adjoining grasslands	IN-MH-13	Trigger species extinct
27	Rajasthan	Diyatra	IN-RJ-04	Trigger species ecologically extinct, hunting
28	Rajasthan	Sonkhaliaya	IN-RJ-21	One trigger species extinct
29	Uttar Pradesh	Bakhira WLS	IN-UP-01	Massive encroachment
30	Uttar Pradesh	Parvati-Aranga WLS	IN-UP-13	Encroachment, excessive fishing
31	Uttar Pradesh	Pyagpur and Sitadwar	IN-UP-15	Encroachment, excessive fishing
32	Uttar Pradesh	Surha Taal	IN-UP-25	Encroachment, excessive fishing

Lakshadweep have just one IBA each. For the protection point of view, IBAs have been categorized into four, viz., wildlife sanctuary, national park, tiger reserve and not officially protected. The 'not officially protected' category consists of forest reserves, community reserve forests, community protected areas and so on.

Out of 465 IBAs in India, 191 are wildlife sanctuaries, 52 are national parks, 23 are tiger reserves, while 199 are not officially protected.

THREATS TO IBAs

One bird in eight in the world could join the extinction list in the next century (BirdLife International 2000). The

main causes of extinction are habitat loss and habitat degradation. The foremost key threat to the Indian IBAs is the human-settlement and encroachment because with more than a billion people in the country, pressure on land is immense. Agricultural intensification is also a serious threat affecting the IBAs, especially in the north Indian states such as Punjab, Haryana, Uttar Pradesh or those states where the Green Revolution was started. Agricultural intensification results in excessive use of chemicals, changes in crop pattern, loss of habitat, effects of pest control on non-target species and so on. Deforestation has been the key issue in the Andaman Islands because of human population on some of the larger islands has grown rapidly due to the

settlement of people from mainland India. Remaining forest is consequently under severe pressure from agriculture and grazing, with habitat loss and degradation from logging being another major threat to wildlife (Whitaker 1985, Sinha 1992).

In the northeastern states of the Eastern Himalayas, the shifting cultivation (*jhum*) in the subtropical and temperate forests in the mountains can be sustainable if practiced on a small scale using clearing cycles of 15-20 years, but in many areas increased human population pressure has led to a rapid reduction in this cycle, for example in Meghalaya, where shifting cultivation resulted in the loss of large areas of forest and severe soil erosion (Stattersfield *et al.* 1998, Katti *et al.* 1992). As per our analysis, 321 IBAs are affected by agricultural intensification and expansion.

The Assam Plains have a huge and rapidly growing human population as a result of which very little natural habitat is left. This habitat is now much reduced in area and also severely fragmented (Rahmani 1988). Nonetheless, small relict patches of tall wet grasslands are left in Kaziranga, Orang, Pabitora, Dibru-Saikhowa and Laokhowa. Two of the three restricted range species of the Assam Plains are under severe threat, with one, Manipur Bush Quail *Perdica manipurensis*, has not been seen since 1932. The second threatened species is the Black-breasted Parrotbill *Paradoxornis flavirostris*. We have recent sight records of this species from some IBAs. The third species of the Assam Plains Endemic Bird Area is the Marsh Babbler *Pellorneum palustre*. It is perhaps doing slightly better as it is found in moderately disturbed grasslands also.

Many of the IBAs will be badly affected by the dams of hydroelectric projects planned or being executed presently in India, especially in the northeastern states (see *IBAs in Northeast India: Threats to habitats and opportunities for*

conservation). A large number of IBAs in the Northeast are impacted/likely to be impacted by large dams due to a range of issues: submergence, downstream impacts, pressures on forests due to labour involved in construction etc. A few examples are D'Ering Memorial Sanctuary, Talley Valley and Pakke sanctuaries in Arunachal Pradesh; Ripu Chirang, Subansiri, Chandubi *Beel* in Assam; Kailam Wildlife Sanctuary and Loktak Lake in Manipur; and Dzukou Valley in Nagaland.

In the Western Himalayas, habitat is being lost at important sites because of development projects such as roads and dams. Such projects adversely affects the habitats of some of the globally threatened species of this region such as the Western Tragopan *Tragopan melanocephalus*, Cheer Pheasant *Catreus wallichii*, Himalayan Quail *Ophrysia superciliosa*, and Kashmir Flycatcher *Ficedula subrubra*. The habitats of these birds are now much reduced and fragmented, and the Himalayan Quail may already be extinct. Overall 57 IBAs are directly affected by the dam projects in the country.

Overgrazing is another major problems all over the country, but especially in the grassland IBAs. Overgrazing causes adverse impacts on the habitats of grassland inhabiting birds such as the Lesser Florican *Sypheotides indica*, the Great Indian Bustard *Ardeotis nigriceps*, the Bengal Florican *Houbaropsis bengalensis*, larks, pipits and many others. The grazing policy in India is not very strong and even in many protected areas, illegal grazing is seen.

We have identified 26 major threats to IBAs and to threatened species. The major threats to 321 IBAs is agricultural intensification and expansion, which is the most serious threat affecting the IBAs in India. Excessive use of chemicals, changes in crop species or cultivation, loss of habitat, effects of pest control on non-target.