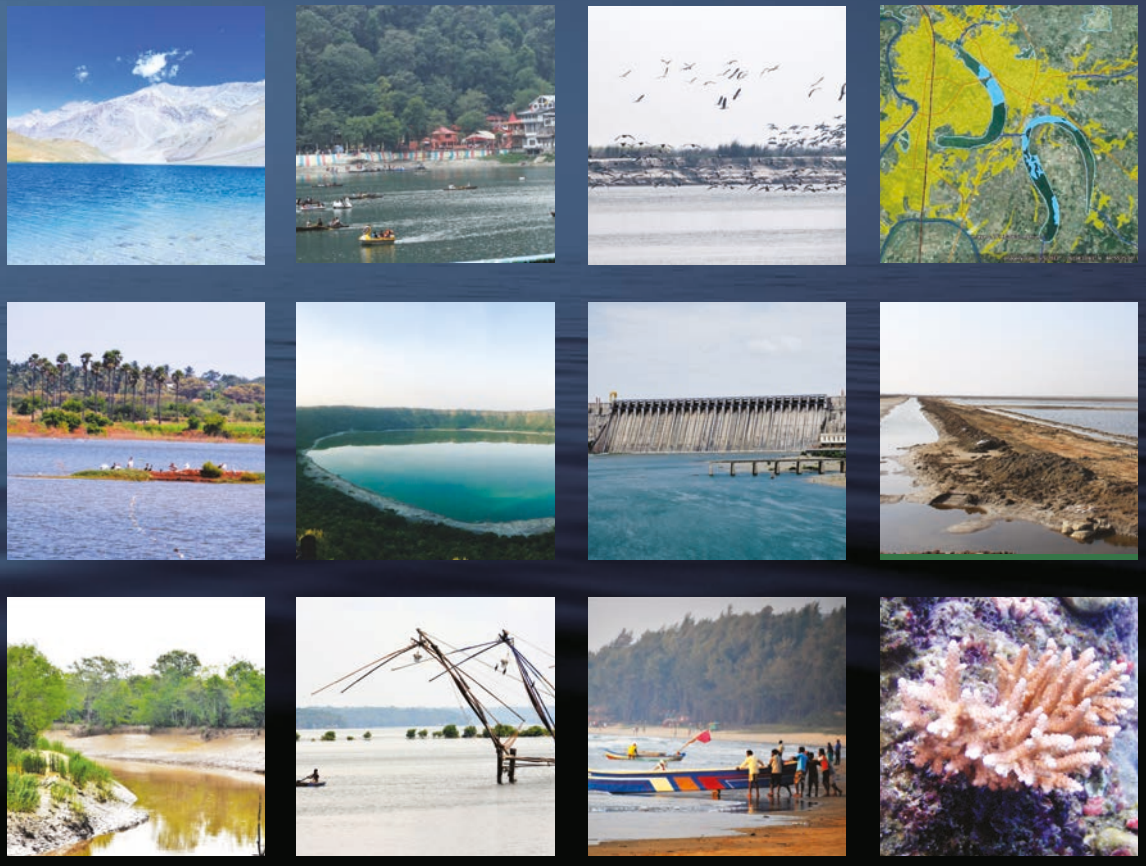
Wetland Conservation
Ethos



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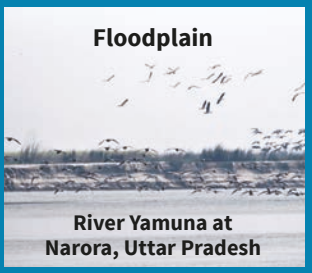
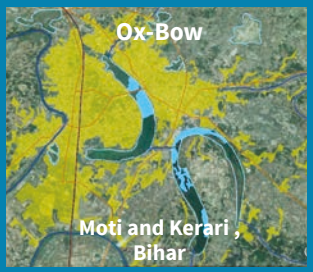
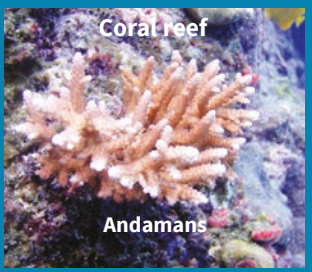




Wetland Conservation *Ethos*



Foreword

Dr Sidharth Kaul
President
Wetlands International South Asia

Wetlands are shallow waterbodies in which water keeps up for most part of the year and recedes below the surface level during the dry season. The biotic community undergoes time changes from aquatic/marshy to mesophytic types. They are among the most productive and most threatened ecosystems which help in society's ecological as well as economic security.

Water is life, and wetlands are the life support systems that ensure functioning of water cycle. As 'kidneys of landscape', wetlands receive flows of water and waste from upstream sources. They help stabilize water supplies, cleanse polluted waters, protect shorelines, and recharge groundwater aquifers. The extensive food chain and biological diversity in wetlands make them 'biological supermarkets'. Wetlands have special attributes as cultural heritage of humanity, and have deep connections with our beliefs and practices. Yet, these are one of the most rapidly degrading ecosystems due to conversion for agriculture, changes in water use and availability, increasing urbanisation and infrastructure development.

Wetlands if allowed to degrade due to intense human greed and developmental pressures will result in human catastrophe in terms of availability of fresh water all over the globe. Due to myopic sectoral vision, management of wetlands is not done in a systematic manner and they are being used under different names such as lakes, marshes, swamps, estuaries, tidal flats, river floodplains, mangroves, coral reefs and several others in diverse languages of India.

The book 'Wetland Conservation Ethos' has been written to remove this discrepancy in dealing with management issues of wetlands in a holistic manner. Wetlands should be the common nomenclature for all types of waterbodies to enable integrated and effective management of these fragile ecosystems. In its pages, the reader will get a glimpse of different wetland types and forms, their significance, threats, conservation measures taken so far, gaps therein, and ways of addressing these gaps.

It is expected that this publication will stimulate readers to take decisive and result oriented action for conservation and wise use of wetlands.

Contents

Introduction	7
Wetland Definitions and Forms	9
Distribution of Wetlands in India	15
Significance of Wetlands	19
Threats to Wetlands	25
International Convention on Wetlands	31
Present Status of Wetlands	37
Integrated Wetland Management	41
Conservation and Management Efforts	49
Gaps and Future Needs	57
Citizens and Wetlands Conservation	63
Abbreviation	65
Glossary	66

A large flock of Demoiselle Cranes in wetlands of Wadwana, Gujarat. These cranes undertake one of the toughest winter migrations over the Himalayas, from Black Sea region to the Indian sub-continent

Introduction

Wetlands are fragile aquatic ecosystems covered with water, either permanently or seasonally. They are a vital part of the hydrological cycle, highly productive and support rich biodiversity.

Wetlands provide a wide range of important resources and ecosystem services, such as food, water, fiber, groundwater recharge, water purification, flood moderation, erosion control and climate regulation.

Wetlands enhance the aesthetic value of the landscape and support a wide variety of recreational, social and cultural activities. Wetlands are and will remain vitally important for human wellbeing.

Wetlands are severely threatened due to anthropogenic activities like reclamation through drainage and landfill, discharge of domestic and industrial effluents and solid wastes, changes in water inflow and outflow patterns, excessive water withdrawal and over-exploitation of their natural resources.

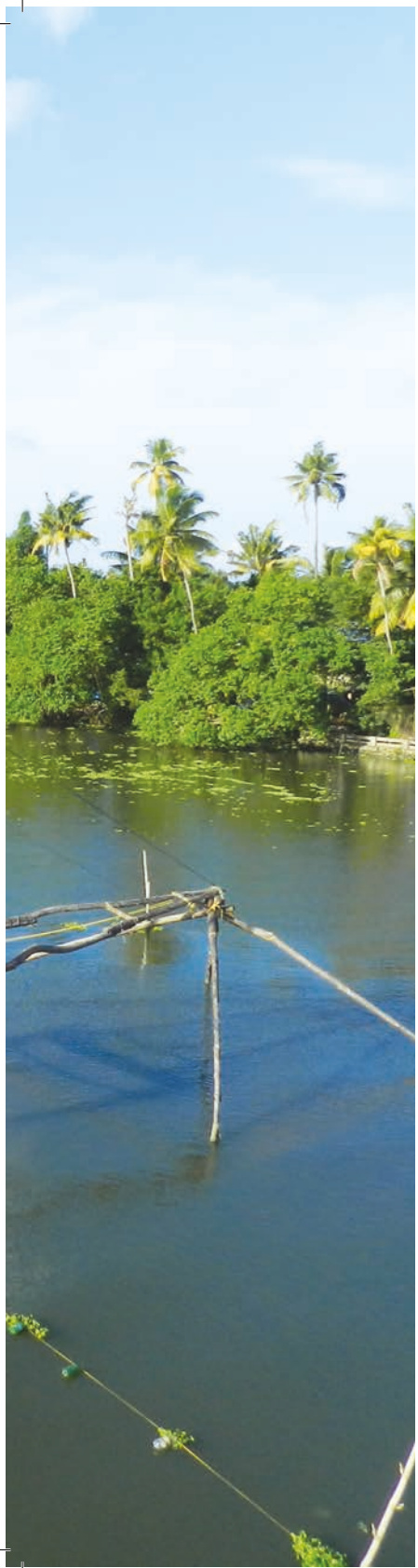
We must ensure that all wetlands are conserved and managed sustainably not only by concerned government agencies and NGOs but also by society at large.

This would enforce our commitment towards conservation and wise use of these fragile ecosystems.

Dip-net in Vembanad backwaters of Kerala

Wetland attributes

- **Inundation by water, either permanently or seasonally**
- **At least periodically supports hydrophytes**
- **Substrate of predominantly undrained hydric soils**



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Wetland Definition and Forms

Wetlands are transitional lands between terrestrial and aquatic ecosystems where the water table is usually at or near the surface, or the land is covered by shallow water permanently or seasonally. Wetland is a generic term used for waterbodies and hydrological entities such as lakes, rivers, floodplains, estuaries, marshes, swamps, fens, bogs, tidal flats, mangroves, corals and other related ecosystems.

The biotic community in wetlands changes over time from aquatic or marshy to mesophytic type. The abundance of water at least for a part of the year is the single dominant factor for defining wetlands.

Wetlands are complex hydrological and biogeochemical systems. They are a distinct class of ecosystems between the terrestrial and aquatic ones, known as ecotones.

In our sectoral pursuits, often aquatic ecosystems are referred as lakes, marshes, swamps, creeks, backwaters, mangroves, coral, peat, bogs, fens and by other different terminologies. Basically, all these are different wetlands types. In order to conserve and manage these aquatic ecosystems in an integrated and coordinated manner and prevent ad-hoc management, they need to be consistently addressed only as wetlands.

Wetlands as per Ramsar Convention

The Convention on Wetlands, an intergovernmental treaty adopted on 2 February 1971 in the Iranian city of Ramsar and since signed by 170 countries, defines wetlands as:

'Areas 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 tides does not exceed six meters'.

In addition, to protect coherent sites, Article 2.1 of the Convention provides that ***'wetlands may include riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six meters at low tide lying within the wetlands.'***

By origin, wetlands can be classified as follows:

Tso Moriri, Jammu and Kashmir

Glacial Wetlands

These include wetlands formed due to the action of glaciers, such as damming of rivers, scouring of valleys, the creation of pits and depressions and reworking of floodplains. These wetlands are exposed to high solar radiation during short summer duration. As these wetlands generally do not have drainage, they are highly saline and contain little vegetation. The water in these wetlands is very clear.

Tso Moriri in Jammu and Kashmir and Chandertal in Himachal Pradesh are examples of glacial wetlands.

Nainital, Uttarakhand

Tectonic Wetlands

These wetlands are formed due to tectonic movements of earth and loading of high amounts of organic materials received from inflowing catchments.

Nainital in Uttarakhand is a tectonic wetland.

Shailendra Kotian

Lonar, Maharashtra

Crater Wetlands

Collision of meteorites or other extra-terrestrial objects with earth's surface creates depressions in which crater wetlands are formed. Lonar in Buldhana, Maharashtra is believed to have developed in a crater created by meteor impact on Earth.

Wetland Types

Marine and coastal wetlands such as open coasts, coral reefs, estuaries, tidal flats, mangroves and coastal lagoons.

Inland wetlands such as permanent and seasonal rivers, inland deltas and floodplains, permanent and seasonal lakes and ponds, marshes, freshwater swamps and peatlands.

Human-made wetlands such as reservoirs, barrages and dams, aquaculture ponds, excavations and burrow pits, wastewater treatment ponds, irrigation canals, ditches, irrigation ponds and rice fields.

Often these wetland types are interlinked hydrologically and ecologically, merging into one another and the larger landscapes. Wetlands should, therefore, be considered as part of the river basin or coastal zone.

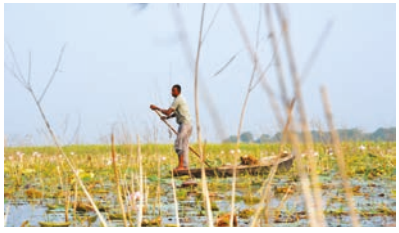
Pradosh Kumar Sahu

Ansupa, Odisha

Oxbows

Oxbows are formed when the meander of a river is cut off due to silt deposition, or river changing course, isolating a crescent-shaped waterbody.

The basins of Ganga and Brahmaputra rivers abound in oxbows. In Mahanadi Delta, Ansupa is an oxbow located at delta apex.



Kanwar, Bihar

Marshes

These are dominated by herbaceous plants and are sustained by water sources other than direct rainfall like surface runoff, groundwater or tidal flow.

Kanwar Jheel is a marsh located in floodplains of Burhi Gandak in Bihar.

David V Raju

Sundarbans, West Bengal

Swamps

Swamps are wetlands dominated by trees. These have poor drainage and sufficient water supply to keep the ground waterlogged, and level of minerals to stimulate decay of organisms and prevent accumulation of organic materials. Mangroves are coastal swamps bordering major deltas of the country.

Sunderbans, spread across India and Bangladesh is the world's largest single contiguous mangrove swamp.

River Yamuna Floodplains, Narora, Uttar Pradesh

Floodplains

These are lands adjacent to river or stream which is subject to periodic inundation by water over-topping the channel.

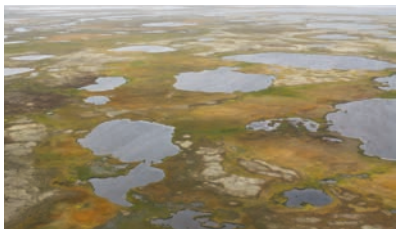
Yamuna floodplains are the primary source of water for Delhi.

Frank Hoffman

Drentsche Aa National Park, Balloerveld, The Netherlands

Fens

These are peat forming freshwater wetlands and, in general, are non-acidic receiving nutrients from ground water sources. They are not commonly found in India.



Pieter van Eijk

Peatlands on Tibetean Plateau, China

Bogs

A bog is a wetland that accumulates peat, a deposit of dead plant material. These wetlands are unusually acidic and low in nutrients. These have high water table maintained directly by rains and snow, which in turn maintains waterlogging and relative oxygen levels. They are not commonly found in India.

Chilika, Odisha

Estuaries

An estuary is a partially enclosed coastal body of brackish water with one or more rivers or streams flowing into it, and with a free connection to the open sea. Estuaries form a transition zone between river and maritime environments. A coastal lagoon is a bar-built estuary, formed when offshore barrier sand islands develop above sea-level and extend in a chain, broken by one or more inlets.

Chilika is a lagoon in Odisha separated from the Bay of Bengal by a long sand berm.

Vembanad, Kerala

Backwaters

Backwaters are coastal wetlands formed when the inflowing river flows are blocked by an opposing current or the flow of tides.

The Malabar Coast of Kerala has several backwater areas, significant as tourist destinations of the state.

Dr Raju Kasambe

Sewri Mudflats, Maharashtra

Mudflats

Mudflats, also known as tidal flats, are coastal wetlands that are formed by mud deposited by tides and rivers, and usually found in sheltered areas as bays and lagoons.

Sewri mudfalts in Mumbai is one of the important breeding areas of flamingoes.

Corals, Andamans

Coral Reefs

Coral reefs are coastal wetlands characterised by reef building corals. Reefs are formed of colonies of coral polyps held together by calcium carbonate.

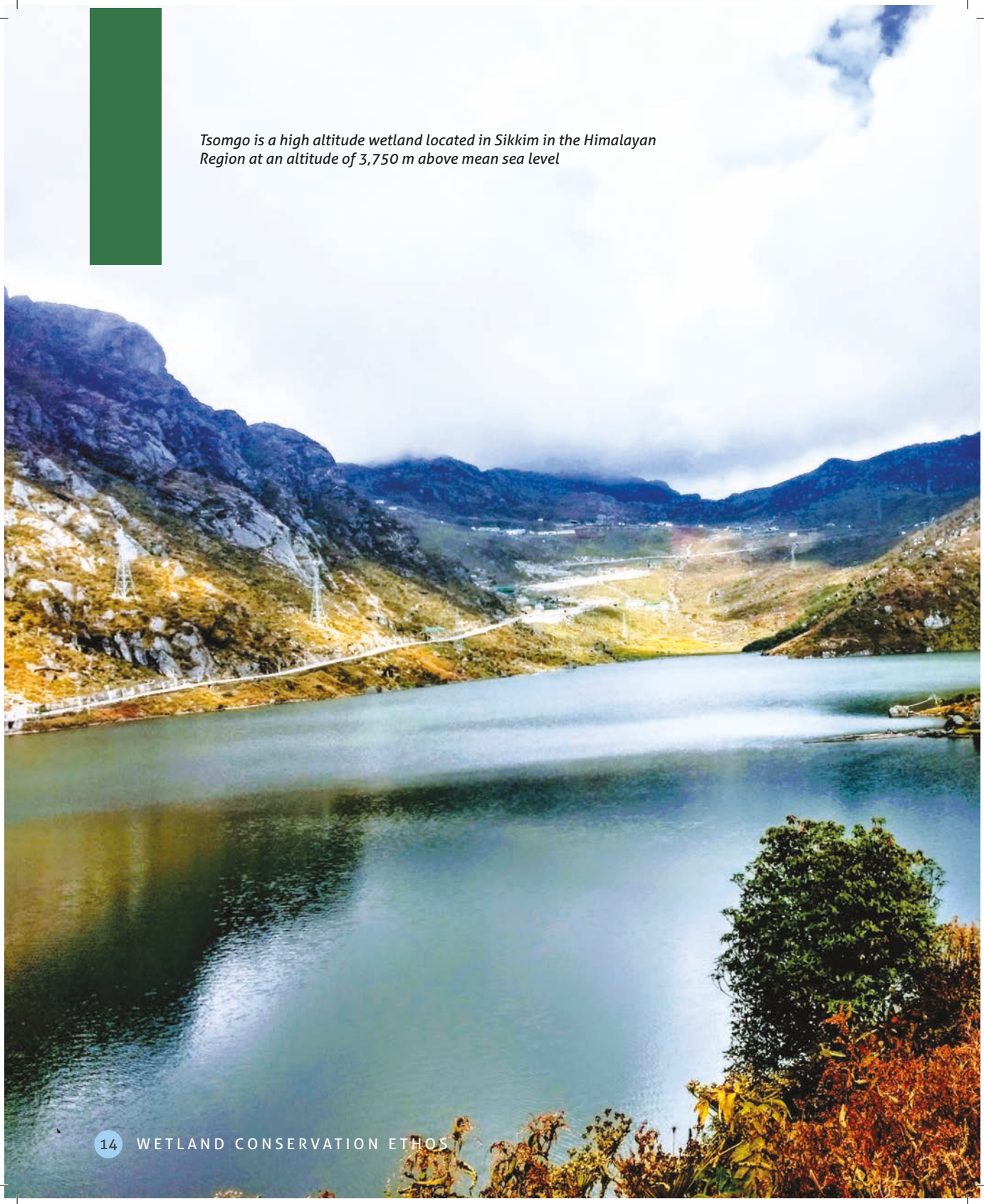
Gulf of Kachchh and Lakshwadeep in the Arabian Sea and Gulf of Mannar, Andaman and Nicobar Islands in the Bay of Bengal are the major reef areas of India.

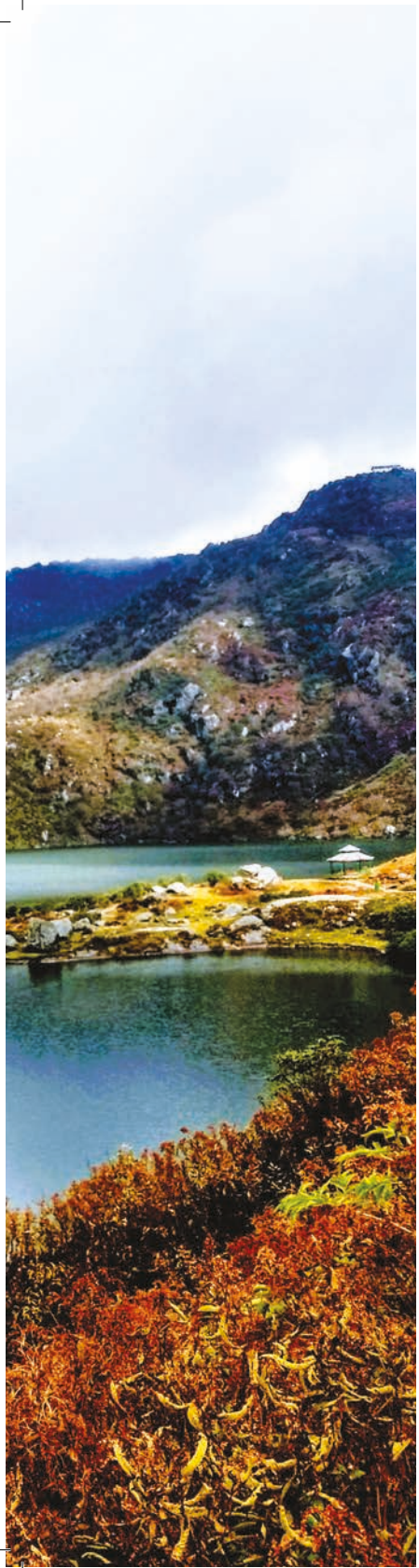
Hirakud, Odisha

Human-made Wetlands

These are wetlands built for a purpose, such as storing water for irrigation and drinking, or for producing fish or for recreation. Reservoirs, aquaculture ponds, salt pans, dams, barrages, and impoundments are some examples of human-made wetlands.

Tsomgo is a high altitude wetland located in Sikkim in the Himalayan Region at an altitude of 3,750 m above mean sea level





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Distribution of Wetlands in India

Wide variations in rainfall, physiography, geomorphology and climate create a rich diversity of wetlands in India. Their structure and functions vary as per genesis, hydrological regimes, substrate factors, trophic levels, turnover capacities, pollution levels and interaction of biotic and abiotic factors.

Wetlands range from high altitude lakes of Himalayas, floodplains and marshes of Ganga-Brahmaputra alluvial plains, saline flats of Great Indian Desert to extensive marshes and coral reefs bordering the country's coastline and islands.

Dibyendu Ash

Tsokar, a high altitude wetland in Ladakh, is a breeding site for the globally vulnerable Black-necked Cranes

Wetlands in the Himalayas

The Himalayas are dotted with glaciated lakes, swamps, and floodplain marshes spread across Leh-Ladakh, Kashmir valley, parts of Uttarakhand, Himachal Pradesh, Sikkim and Arunachal Pradesh. These wetlands support the flow of mighty rivers like Ganges, Brahmaputra and Indus and act as a buffer between glacial melt waters and outflow to smaller river and streams. Pasturelands fringing the wetlands are used for grazing livestock and are the home of several rare and endemic species of birds, medicinal plants and mammals.

The floodplain of Rapti River in Uttar Pradesh

Wetlands in the Gangetic Floodplains

The alluvial plains of River Ganges and the Brahmaputra have extensive riverine wetlands as floodplains and oxbow lakes. They are locally known as maun, beel, chaur, jheel or jhabar. These wetlands sustain highly productive agriculture and fisheries and act as flood buffers.

Flamingos in Sambhar, Rajasthan

Wetlands in the Desert and Semi-arid zone

The arid zone spanning Rajasthan and Gujarat has vast saline and monsoon fed freshwater lakes and reservoirs. The Rann of Kachchh (Gujarat) and salt lakes as Sambhar, Pachpadra, Deedwana and Lukransar (Rajasthan) are some of the characteristic wetlands of this part.

Periyar was formed due to construction of Mullaperiyar Dam on the Periyar River in Kerala, and is surrounded by the Periyar National Park

Wetlands of the Western Ghats

The Western Ghats, one of the biodiversity hotspots of India, is criss-crossed by numerous rivers and streams giving rise to swamps and marshes. The Myristica swamps found in the region are dominated by Myristica trees.

Upper and Lower Lakes (also known as Bhoj wetland) are human-made tanks in Bhopal City (Madhya Pradesh)

Wetlands in the Deccan Peninsula

The Deccan Peninsular region has few natural wetlands and is mostly studded with constructed tanks providing water for various human needs, besides serving as nesting, feeding, and breeding sites for a large number of birds.

Loktak is the lifeline of Manipur valley

Wetlands in the North-East

Located at the junction of Indian, Indo-Malayan and Indo-Chinese biogeographic regions, north-east zone is considered the gateway of Indian floristic and faunistic diversity. This region abounds with several rivers, streams, lakes, ponds, waterlogged areas and oxbows, especially in Assam.

Mangroves in Munroe Island, Ashtamudi, Kerala

Wetlands in the Coasts and Islands

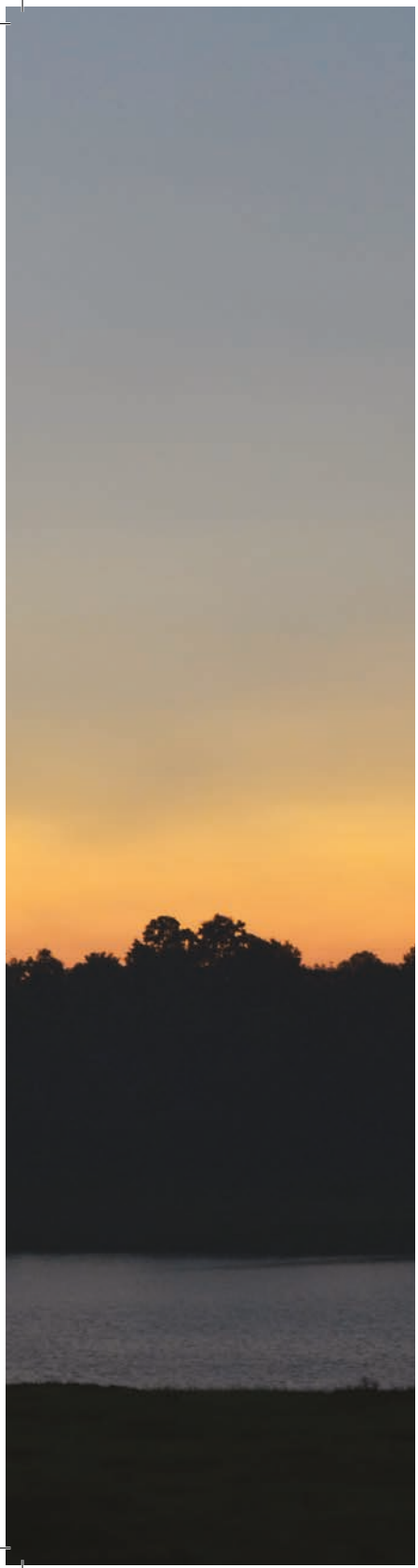
The narrow plains of the east and the west coast, and islands harbour a range of coastal wetlands as lagoons, salt marshes, mangroves and coral reefs. Chilika (Odisha), Pulicat (at the border of Andhra Pradesh and Tamil Nadu), Point Calimere (Tamil Nadu) and Asthamudi (Kerala) are major lagoons.

Mangroves are found along the coastlines of nine states and three union territories of India. Sunderbans (West Bengal), Bhitarkanika (Odisha) and Pichavaram (Tamil Nadu) and Andamans are major mangrove areas.

Gulf of Kachchh and Gulf of Mannar, and the islands of Lakshadweep, and Andaman and Nicobar have major reef areas in the country.

Coral reefs in Andamans

Sasthamkotta, a large freshwater wetland of Kerala, is the primary source of water for Kollam City



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Significance of Wetlands

Wetlands are one of the most important part of landscapes. Ever since civilizations began, wetlands have played an important role in development of human society. The benefits wetlands provide are called their 'ecosystem services'. These can be broadly categorised as provisioning, regulating, cultural and supporting services.

Harike (Punjab) provides water to Southern Punjab and Rajasthan

Wetlands as source of water

Our main supply of freshwater comes from an array of wetlands. Groundwater contained in aquifers accounts for over 95% of available freshwater and is the most critical source of drinking water and irrigation. Several wetlands help soak rainfall and recharge groundwater.

Floods in Guwahati City of Assam would be much worse if Deepor Beel and associated wetlands did not absorb large parts of monsoon flows of River Brahmaputra

Wetlands as flood and storm buffers

Wetlands buffer floods and reduce droughts. In the upper reaches of a basin, wetlands act as sponges absorbing rainfall and snowmelt and allowing water to percolate slowly into the soil. Floodplains of rivers serve as natural storage reservoirs enabling excess water to spread out over a wide area reducing its depth and speed.

Coastal wetlands like mangroves, coral reefs, mudflats and estuaries can limit damaging effects of storm surges and tidal waves by acting as physical barriers. Mangroves and coastal marshes help bind shoreline and reduce erosion. The super cyclone of Kalinga which hit Odisha in 1999 devastated the entire coastline. It was found that villages that had retained mangroves had lesser number of casualties as compared to those with little or no mangroves.

A fish catch in Loktak

Wetland products

Sustainably managed wetlands can provide a range of plants, animals and mineral products. Nearly two-thirds of fish, one of the primary sources of animal protein, is sourced from coastal wetlands. Over three-fourth of rice in Asia is produced in wetlands. Honey is collected from many mangrove swamps, including Sundarbans. Several wetland plants have medicinal properties. Wetlands also provide a source of livelihood to a large population especially those inhabiting their shorelines.

Kolkata city discharges nearly 600 million litres of wastewater daily into East Kolkata Wetlands located on its eastern periphery. This sewage is used to produce approximately 15,000 MT of fish and 30,000 MT of vegetables annually. The quality of water improves after passing through these wetlands

Wetlands as water purifiers

Wetlands help in purifying water by locking up pollutants in their sediments and vegetation. High level of nutrients as phosphorus and nitrogen, commonly associated with agricultural runoff, can be significantly reduced by wetlands. Many wetland plants can remove toxic substances that come from pesticides, industrial discharge and mining. Tissues of floating plants such as Water Hyacinth, Duck weed and Azolla can store iron and copper from wastewater. However, continuous waste discharge beyond carrying capacity of wetlands can lead to environmental disasters.

Vembanad in Kerela is visited by nearly one million tourists each year. Wetland tourism is a significant economic activity for the state

Wetlands for recreation and tourism

The natural beauty and diversity of plant and animal life in wetlands make them ideal destinations for recreation and tourism. However, irresponsible tourism can create pressures on wetlands.

Wetland Research and Training Centre of Chilika Development Authority, Odisha

Wetlands for education and research

Wetlands provide excellent opportunities for education and research on aquatic ecosystems.

The diversity of habitats, the complexity of ecosystem processes and broad social and cultural connections make them suited for multi-disciplinary studies on nature-society interactions.

Mangroves are known to store up to 50 times more carbon than the tropical forests

Wetlands and Climate change

Wetlands, as several other ecosystems, are vulnerable to climate change. These ecosystems, however, can help mitigate and adapt to a changing climate.

Some wetlands such as mangroves and salt marshes act as carbon stores, thereby preventing the release of dangerous greenhouse gases into the atmosphere.

As variability of water availability is likely to increase in future, the ability of wetlands to absorb and retain water and moderate floods and storms are essential functions that can help buffer impacts of climate change. Conserving wetlands is also essential for securing habitat of aquatic species threatened by changing climate.

Pong (Himachal Pradesh) supports large congregrations of Bar-headed Geese migrating from Tibet, Kazakhstan, Mongolia and Russia

Wetlands as habitats for migratory birds

Nearly two thousand bird species make regular seasonal movements, travelling thousands of miles between breeding and non-breeding areas to escape the harsh winters of the polar and temperate regions. Migrating birds use wetlands as stopover sites for feeding, resting and breeding. Indian wetlands connect the Central Asian and East Australasian Flyways.

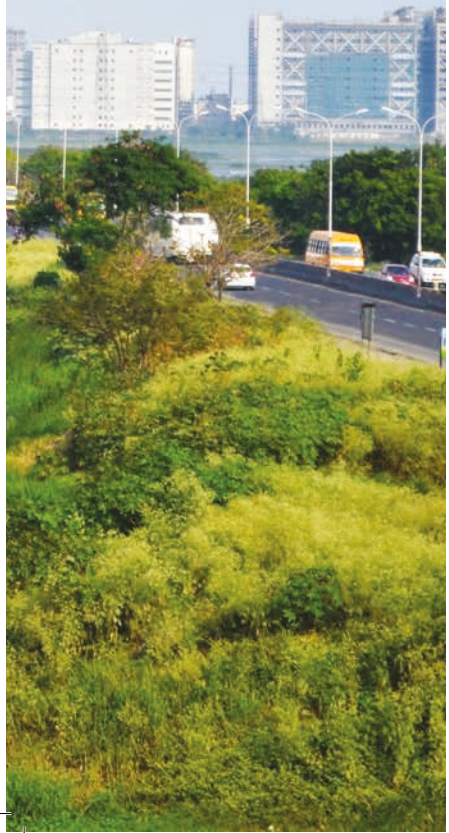
A Brow-antlered Deer in Keibul Lamjao National Park, Loktak, Manipur

Wetlands as Biodiversity Hotspots

Several wetlands are habitats of a number of endemic and highly threatened to near threatened species. Chilika maintains a healthy population of, and, is one of the only two lagoons in the world inhabited by endangered Irrawaddy Dolphin *(Orcaella brevirostris)*.

Keibul Lamjao, a floating national park on the south of Loktak is the only known natural habitat of globally endangered Brow-antlered Deer *(Rucervus eldii)*. The largest remaining populations of critically endangered Gharial *(Gavialis gangeticus)* are found around River Son, Girwa and Chambal of Central India. Over 70% of the global population of vulnerable Great Indian Rhinoceros *(Rhinoceros unicornis)* is largely confined within the grasslands and swamps of Kaziranga National Park in Assam.

Encroachment of Pallikarnai marsh has rendered Chennai City vulnerable to floods



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Threats to Wetlands

Despite being the source of a range of benefits, wetlands have been drained, filled and converted for alternate uses in almost all parts of the globe. Since 1900, the world has lost around 50% of its wetlands. In India, nearly one-third of the natural wetlands have been lost in the last three decades alone. As wetlands degrade, the benefits provided naturally by these ecosystems are lost, impacting survival of species as well as livelihoods of dependent communities.

Some of the major threats to wetlands are discussed in this section.

Ithai Barrage on Loktak, Manipur

Alteration of natural hydrological regimes

Water regimes govern biodiversity and ecosystem services of wetlands. Alteration of natural hydrological regimes often leads to reduced water availability, altered hydro-period, loss of connectivity with biodiversity habitats, impeded nutrient exchange and other processes which significantly enhance their degradation.

The water resources development projects have played a critical role in providing water for economic use such as hydropower and agriculture. In several instances, lack of consideration of the functioning of wetlands has created adverse impacts on the aquatic habitats. Diversion of water for hydropower generation through the construction of Ithai Barrage downstream of Loktak has converted a natural floodplain wetland into a reservoir, critically affecting the habitat of the Manipur Brow–antlered Deer and near complete obstruction of migratory pathways of fish from Chindwin–Irrawaddy system. In Kashmir valley, conversion of marshes associated with Wular for agriculture has reduced the capacity of the wetland for regulating flow regimes, leading to increased floods and droughts.

Stone mining in catchment of Wular (Jammu and Kashmir)

Catchment degradation

The water holding capacity of wetlands plays a crucial role in determining its ability to regulate flow regimes, cycle nutrients and support biodiversity. Being depositional in nature, wetlands act as sediment traps, which in the long run plays a key role in their succession. However, catchment degradation accelerates sedimentation rates, thereby, risking sustenance of ecosystem processes and services. Similarly, the runoff from cropped area of the catchment loads nutrient, resulting in eutrophication.

In Harike (Punjab), 86 percent of water holding capacity has been lost since 1954 due to excessive silt accumulation from Shivalik catchments. The resulting decline in inundation has reduced hydrological regime moderation capability of this wetland, and coupled with high levels of nutrient enrichment, promoted infestation of Eichhornia. Surajkund and Badhkal, tourist hotspots in the state of Haryana, frequently run dry on account of excessive mining in the catchments, which prevent the inflow of rainwater and recharge of groundwater critical to the maintenance of the hydrological regimes of these wetlands.

A waste dump on Deepor (Assam)

Pollution

Increasing urbanisation without the development of adequate waste management infrastructure has led wetlands located within urban and the peri–urban areas to become waste receptacles. Agricultural intensification and the increased use of chemical fertilisers have resulted in negative impacts on the water quality within rural wetlands. For instance, most of the Gangetic floodplain wetlands are in an advanced state of eutrophication due to the discharge of untreated sewage as well as runoff from agricultural fields.

Water hyacinth

Invasive species

Most of the inland wetlands of India have been invaded by exotic species, which have acquired nuisance proportions considerably influencing the native biota and habitat conditions. Water hyacinth, which was introduced in India about a century ago occurs almost throughout the country. The other dominant species that have gradually infested several wetlands are *Salvinia, Ipomoea* and *Alternanthera*. Adverse impacts of fish invasive on local biodiversity have been noted in case of Tilapia (*Oreochromis mossambicus*).

A fisher using fine-mesh net

Over-harvesting of resources

Owing to high livelihood dependence, wetlands are often subjected to over–harvesting of resources and modification for enhancing provisioning services such as wood, fish, water, etc. at the cost of regulating and cultural services. Uses of harmful fishing practices, such as small mesh size nets, are prevalent in a majority of inland wetlands. Often sustainable yield for a particular wetland is not known and at times ignored by stakeholders. Wetland biodiversity and wider food webs are also put under stress by loss through by catch. Varying inundation regimes are often modified to suit agriculture and

aquaculture uses. Livelihoods of over 15,000 fishers living around Kanwar Jheel in North Bihar have been disrupted as dynamic inundation patterns have been transformed for promoting permanent agriculture, which in turn, has been impacted by lowering of ground water levels and flooding attributed to shrinkage in wetland regimes

House boats in Dal (Jammu and Kashmir)

Unregulated tourism

Tourism is an important driver of economic growth. Wetlands, an essential part of tourism experiences, are likely to see an increase in touristic pressure in the times to come. For example, backwaters of Kerala are visited by over one million tourists annually. Accordingly, the tourism industry ensures the livelihoods of over 85,000 households. Often, the habitat characteristics or functioning of wetlands are not taken into account while developing tourism infrastructure and recreation facilities. Increase in houseboats in Dal (Jammu and Kashmir), and Vembanad-Kol backwaters (Kerala) have converted tourism from a livelihood option to threat for these fragile ecosystems.

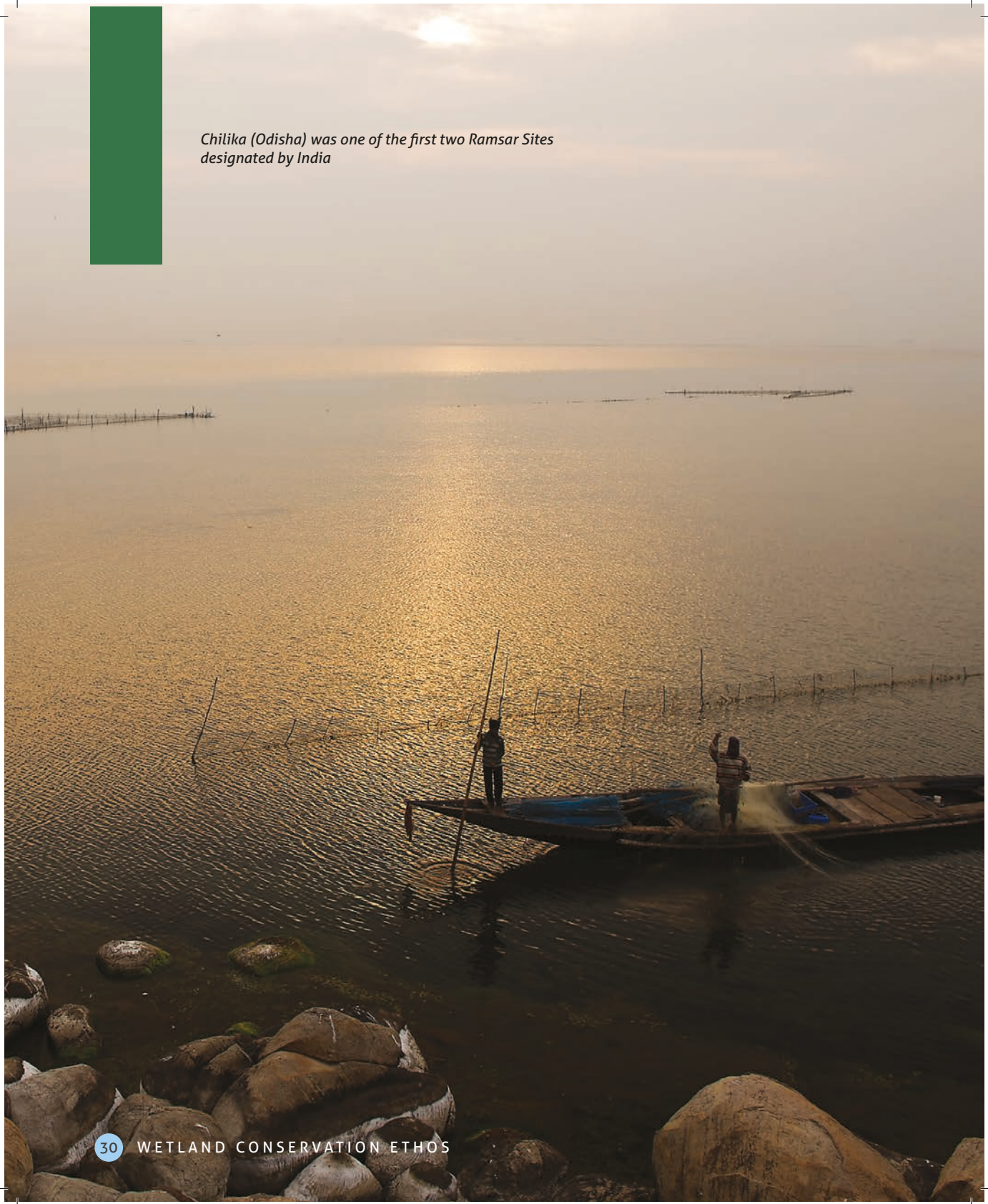
StoriesofKabeera

Gurudongmar (Sikkim)

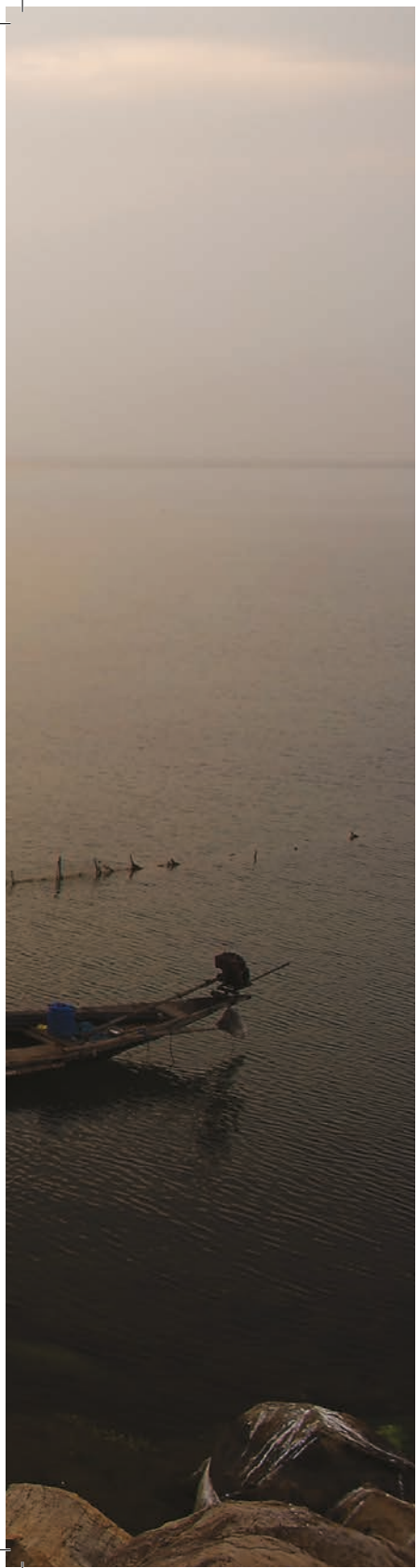
Climate change

Global climate change has emerged as an important driver of loss and degradation of wetlands especially high altitude and coastal wetlands. Climate change induced melting of glaciers has led to increased water levels of Tso Moriri (Jammu and Kashmir) submerging habitats utilised by migratory birds such as the Black–necked Crane and Bar–headed Goose. Modelling simulations indicate that about 84 percent of coastal wetlands in India are at risk due to a one meter sea level rise. Inland wetlands are at risk from alteration in hydrological regimes, eutrophication, and algal blooms that are likely to result from increasing temperatures.

The municipal corporation of Gurugram (Haryana) has chosen Basai as the site for a waste treatment plant



Chilika (Odisha) was one of the first two Ramsar Sites designated by India



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International Convention on Wetlands

Wetlands are the only ecosystem to have a dedicated multilateral environmental agreement of their own, known as the Ramsar Convention. The Convention was signed in 1971 at the Iranian city of Ramsar, located on the Caspian Sea shoreline. It is an intergovernmental treaty providing the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The Convention entered into force in December 1975.

The Convention has 12 articles on conservation and wise use of wetlands including their definition, criteria for designation of Ramsar sites, wise use, establishing nature reserves, research, monitoring, management of wetland biodiversity, international cooperation and transboundary wetland issues.

Under the "three pillars" of the Convention, the Contracting Parties commit to:

- work towards the wise use of all their wetlands;
- designate suitable wetlands for the list of Wetlands of International Importance (the "Ramsar List") and ensure their effective management;
- cooperate internationally on transboundary wetlands, shared wetland systems and shared species.

As on date, the 170 Contracting Parties have designated 2,337 wetlands with 252.05 million hectares as Wetlands of International Importance under this Convention.

International Organization Partners

The Convention works with six global non-governmental organisations. Four of them have been associated with the treaty since its beginnings and, in 1999, were conferred the formal status of International Organization Partners (IOPs).

Wetlands International (1999)

IUCN – International Union for Conservation of Nature (1999)

WWF International (1999)

BirdLife International (1999)

International Water Management Institute (2005)

The Wildfowl & Wetlands Trust (2015)

Constituents of Ramsar Convention

Implementation of Ramsar Convention is a partnership between Contracting Parties, the Standing Committee (SC) and the Ramsar Secretariat.

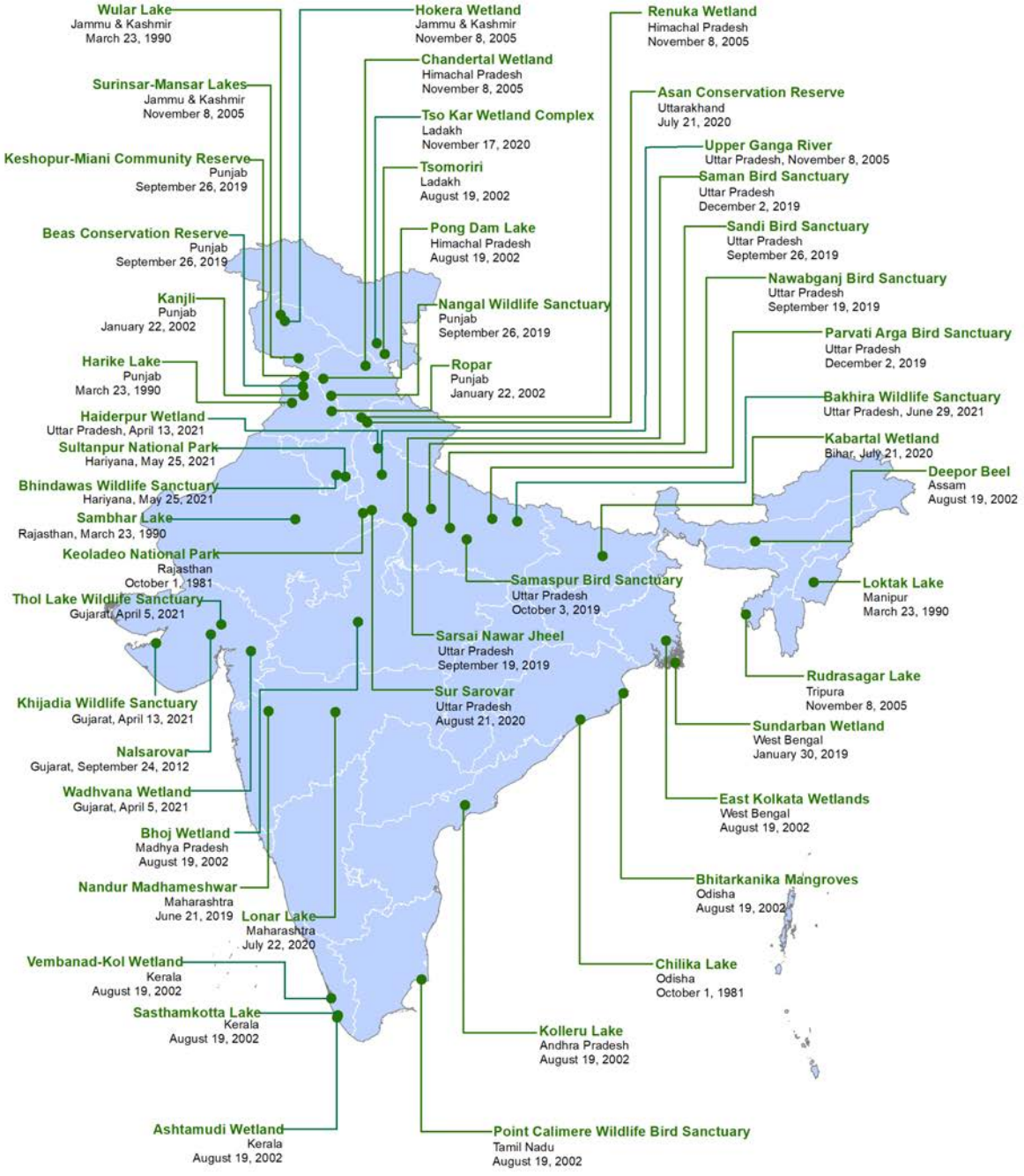
The Conference of Contracting Parties (CoP) is the policy making organ of the Convention. The conference enables the Contracting Parties to hold broad ranging discussions on the implementation of the Convention and to adopt decisions in the form of resolutions and recommendations. Government representatives from each of the Contracting Parties meet every three years to receive national reports on the preceding triennium, approve the work programme and budgetary arrangements for the next three years, and consider guidance for the Parties on a range of ongoing and emerging environmental issues.

The SC of the Ramsar Convention is the intersessional executive body which represents the CoP between its triennial meetings. The Contracting Parties that are members of the SC are elected by each meeting of the CoP to serve for three years.

The Ramsar Convention Secretariat carries out the day-to-day coordination of the Convention's activities. It is located in Gland, Switzerland.

The Scientific and Technical Review Panel of the Ramsar Convention was established in 1993 as a subsidiary body to provide scientific and technical guidance to the CoP, the SC, and the Secretariat.

Ramsar Sites in India



Keoladeo National Park (Rajasthan) was placed in the Montreux Record in 1990 due to water shortage and an unbalanced grazing regime. The invasive growth of grass Paspalum changed the ecological character of a large area, reducing its suitability for certain waterbird species, notably the Siberian Crane

Montreux Record

The Montreux Record is a register of wetland sites on the List of Wetlands of International Importance where changes in ecological character have occurred, are occurring, or are likely to occur as a result of technological developments, pollution or other human interference. It is maintained as part of the Ramsar List.

The inclusion of wetland within Montreux Record does not mean red listing or blacklisting a wetland site. It instead highlights priority action to be taken for management of these wetlands so that further deterioration is prevented, and the site restored to good ecological health.

India had three wetlands under this Record, namely Chilika in Odisha, Keoladeo National Park in Rajasthan and Loktak in Manipur.

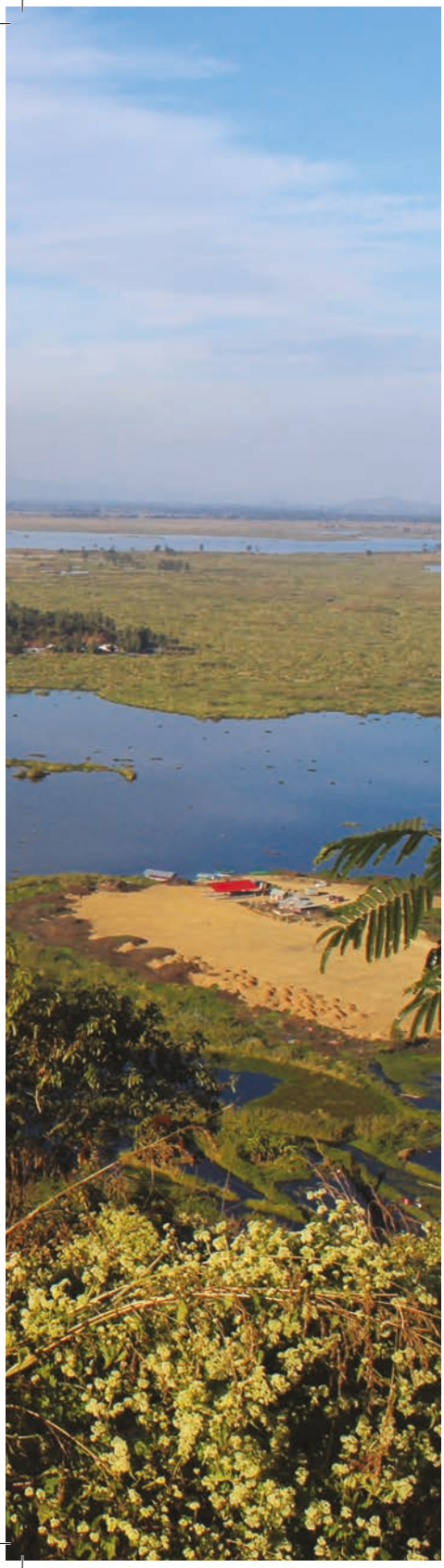
Chilika was taken out of the Record after a successful restoration and recommendation of the Ramsar Advisory Mission in 2002. To date, Chilika remains the only wetland in Asia to be delisted from Montreux Record.

In India the Ramsar Convention entered into force on February 1, 1982. India was a SC member from 1993-1996 and from 1999-2002. India has played a vital role in conservation and wise use of wetlands, and overall strengthening the Convention. Twenty-seven wetlands have been designated as Wetlands of International Importance. Restoration of Chilika was recognized by the Convention with a Ramsar Award in 2002.

Advantages of joining the Ramsar Convention

- Entails an endorsement of and commitment to the principles that the Convention represents, facilitating the development of national level policies and actions, including legislation, that help nations to make the best possible use of their wetland resources in their quest for sustainable development.
- Presents an opportunity for a country to make its voice heard in the principal intergovernmental forum on conservation and wise use of wetlands.
- Brings increased publicity and prestige for the wetlands designated to the List of Wetlands of International Importance, and hence expanded possibilities of support for conservation and wise use measures.
- Brings access to the latest information and advice on the adoption of the Convention's internationally accepted standards.
- Brings access to expert advice on national and site-related problems of wetland conservation and management.
- Encourages international cooperation on wetland issues and brings the possibility of support for wetland projects.

Phumdi, floating mats of vegetation, are the characteristic feature of Loktak (Manipur)



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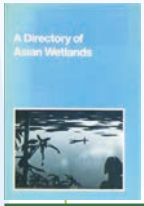
Present Status of Wetlands

Several wetland types exhibit large seasonal and inter-annual variations in inundation regimes and vegetation, rendering a comprehensive assessment of status and trends difficult. Nonetheless, efforts to create an inventory of wetlands and assess their extent in the country have been made since the nineteen-eighties, wherein an All India Wetland Survey was initiated by the Government of India. Measures taken to assess the extent of wetlands in the country are discussed in this section.

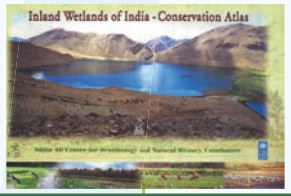


A Directory of Asian Wetlands published by IUCN and Wetlands International (then International Waterfowl Research Bureau) published in 1989 included a detailed description of 92 significant wetlands of India.

Based on a questionnaire survey, the Ministry of Environment, Forest and Climate Change (MoEF&CC then Ministry of Environment and Forest) published a Directory of Wetlands in 1990, listing 2,167 natural and 65,253 human-made wetlands (spanning 1.45 million and 2.59 million hectare area respectively).

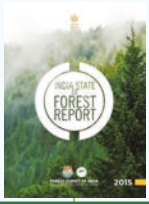
In 1993, WWF-India in collaboration with MoEF&CC published a wetland directory providing details of 140 wetlands.

Efforts to map wetlands at national scale using remote sensing techniques began in the nineties. The first remote sensing based national inventory of wetlands was published in 1998 by Space Application Center (SAC) using post and pre monsoon imageries of 1992-93 (IRS LISS I and II data). Subsequently, the national inventory was updated at a uniform scale (1:250,000) using 2004–05 Resourcesat AWiFS (8 m spatial data), as per which the national wetland extent was assessed to be 8.83 million hectare).

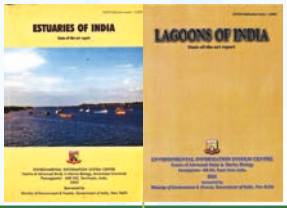


In 2004, the Salim Ali Center for Ornithology (SACON) under a UNDP sponsored project carried out a mapping of inland wetlands using 23.5 m resolution data of IRS LISS III mostly of 2001. The assessment also included data on select species groups for analyzing conservation significance.

The SACON inland wetlands assessment, based on analysis of change in wetlands areas from 71 districts concluded that 38% wetlands had been lost during 1992-2001.

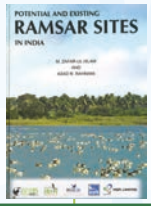


The first inventory of coastal habitats in India, with focus on coral reefs and mangroves, was carried out in 1989–1991 at 1:250,000 and 1:50,000 scales, with maps showing high tide line and low tide lines and wetland features such as mudflats, beach, mangroves, and coral reefs. Since then, several remote sensing assessments have been carried for the Indian coast, results published in the form of National Wetlands Atlas based on analysis of satellite images of 2006-07, shoreline change assessments reports, an atlas of mangroves and coral reefs and other products.

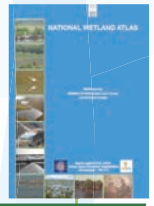


In 2001-02, the Center of Advanced Study in Marine Biology (CASMB) published state of art reports on 17 lagoons and 15 estuaries.

In 2006, the CASMB updated existing inventories to include information on 2,692 wetlands. Natural wetlands were estimated to span 3.58 million hectare, and human-made 3.33 million hectare.



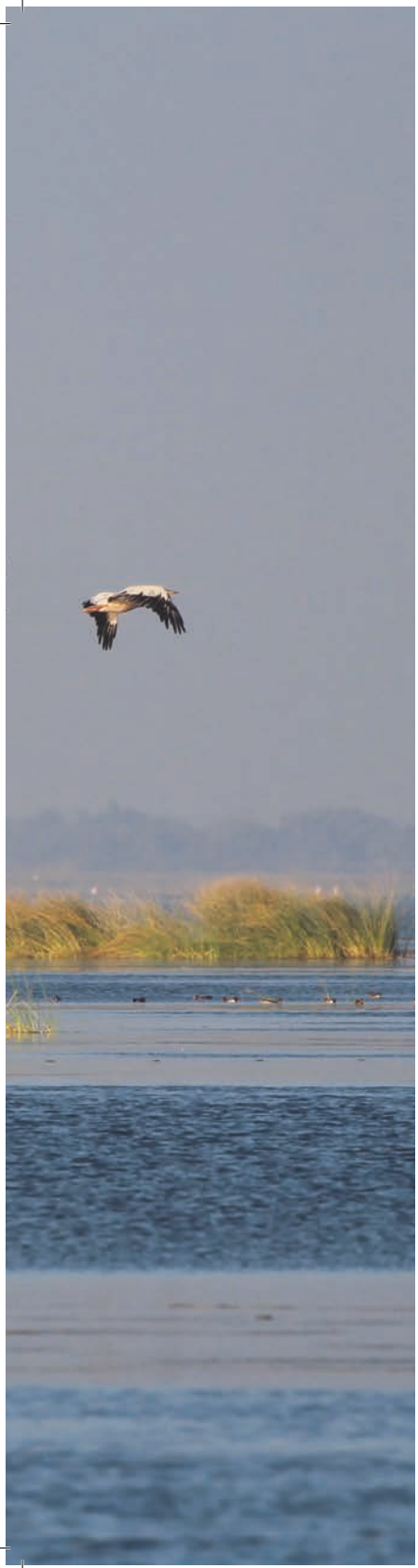
BNHS published an assessment of existing and potential Ramsar Sites of India in 2008. Nearly 140 wetlands were identified as potential Ramsar sites.



The MoEF&CC commissioned a nation–wide wetland mapping project entitled 'National Wetland Inventory and Assessment' to the Space Application Centre (SAC) in 2007. The project used a 19 wetland type classification (including natural as well as human–made), derived from analysis of RESOURCESAT I LISS III data of 2006–07 at 1:50,000 scale (with 23.5 m resolution) for pre–monsoon and post-monsoon periods. The atlas, for the first time, included a separate category of high altitude wetlands (wetlands located above 3,000 m amsl).

As per the atlas published in 2011, the national extent of wetlands was assessed to be 15.26 million hectare, equivalent to 4.63 percent of the country's geographical area. Inland wetlands (including wetlands below the minimum mapping unit of 2.25 hectare) constitute 69 percent (10.56 million hectare) of the total wetland area. High altitude wetlands have been assessed to extend 126,249 ha. The state of Gujarat has the maximum wetland area (3.47 million hectare).

Pelicans flying over Gosabara - Mokarsar (Gujarat)



7

Integrated Wetland Management

Wetlands need to be managed in a manner that their biodiversity is conserved, and the benefits humans derive from these ecosystems are maintained for long-term. The management needs to be holistic, multidisciplinary, and based on the scientific knowledge. Conservation measures should take into account wetland catchments and coastal zones, as well as integrate socioeconomic development of wetland-dependent communities. A range of activities is required for this purpose which is discussed in this section.

Integrated management planning

Wetlands need to be managed on the basis of an integrated plan resulting from systematic review of wetland features and governing factors. Diagnostic processes should be used to identify causative factors for wetland degradation. Management goals and objectives should be defined clearly, and suitable monitoring and evaluation systems put in place. Stakeholders should review the plans through consultative processes. All forms of information – scientific and traditional need to be factored in while preparing these plans.

Capacity development

Wetland management requires specialised skills. Building the capacity of managers through training and related activities can strengthen integrated management. Capacity development efforts should cut across all sections of society. Need-based training programs can be organised at national, regional or district levels. Training on dominant themes of wetland conservation like catchment area treatment, water management, pollution abatement, livelihood options, restoration techniques, biodiversity conservation, sustainable resource development, managing invasive species, environmental education and awareness, impact assessment of developmental activities surrounding wetlands can be of great help in implementing activities of management plans.

Institutional mechanisms

Conserving and managing wetlands requires collaborative efforts between various sectors and agencies. It is therefore essential to create institutional mechanisms for intersectoral collaboration, through a nodal agency. State governments have been advised to constitute Wetlands Authorities so that expertise is available in all desired departments for execution of management plans in a scientific and cohesive manner.

Wetlands inventory

Wetlands inventory is crucial for setting policy priorities and targeting conservation efforts. The MoEF&CC has commissioned several wetlands inventories to improve the overall knowledgebase on wetland status and extent. The Wetlands (Conservation and Management) Rules, 2017 require that states prepare inventories of wetlands within their jurisdiction, and prioritise them for regulation and management. Preparation of brief documents for notification requires geographic delineation of the wetland, its zone of influence, and an account of preexisting rights and privileges, consistent or not consistent with the ecological health of wetlands. Survey, mapping and inventorisation need to take into consideration impact of developmental activities on wetland and its catchment. It is vital to confirm remote sensing data with adequate ground

truthing. Inventorisation is an ongoing activity and can be of great help once higher resolution imageries are available so that even smaller wetlands of less than 2 hectare are mapped.

Valuing wetlands

As public goods, a broad category of wetland ecosystem services and biodiversity values are not factored in decision-making, thereby resulting in wetlands being converted for alternate uses. The resultant loss has direct economic consequences, which are underestimated.

Making the value of wetlands visible to society creates an evidence base for more targeted and cost–effective solutions. In the recent times, several methods for valuing wetlands in economic, ecological, and social terms have been developed. These can be used by wetland managers to express the contribution of wetlands to developmental decisions, and quantify impacts of wetland loss.

Community participation

Wetlands affect lives and livelihoods of a range of stakeholders. It is important to seek their engagement in all stages of management.

This can be achieved through consultations, involvement in design and implementation of management plans and monitoring. An enabling role can be played by policy planners, managers, research organizations, NGOs and CSOs towards creation of a common platform wherein community concerns for wetlands are discussed and appropriately factored in management.

Participatory Rural Appraisals and community consultation can be used to leverage traditional knowledge into design of interventions. Issues of gender sensitization and involvement of women in decision making processes need prioritization. Engagement is also aimed at enhancing the awareness of communities and stakeholders on values of wetlands and the need for their integrated management.

Monitoring and review

Wetlands need to be continually monitored to assess their health and functioning. This should not be limited to monitoring status of plant and animal life alone. Exchange of water, sediment and nutrients; the status of catchments, as well as sustainability of wetland resources need to be monitored. Monitoring of climatic and geophysical parameters is required to identify long-term changes.

A three-tier system at national, state and district level may need to be created for assessing the effectiveness of management plans. At the national level, advice on appropriate policy, research and capacity development aspects may be made. Management plans recommended by the state governments can be examined at this level from a feasibility perspective.

An advisory body consisting national experts in specialized fields can guide managers in executing all activities in a desired manner. Within states, monitoring is the responsibility of the State Wetlands Authorities. At District levels, monitoring may be entrusted to a team of experts, capable of assessing conservation and livelihood outcomes of management plans.

Synergies within international conventions and multi-lateral agreements

Apart from the Ramsar Convention, there are several international conventions, and multi-lateral environmental agreements wherein the Contracting Parties have made commitments related to wetlands conservation. Notable amongst these are Convention on Biological Diversity, Convention on Migratory Species, United Nations Convention to Combat Desertification, World Heritage Convention, UNESCO Man and Biosphere programme, United Nations Sustainable Development Goals, United Nations Framework Convention on Climate Change and the Sendai Framework for Disaster Risk Reduction.

There is a need to coordinate national implementation of these Conventions and agreements for achieving synergistic outcomes. Coordination efforts should also be made at state levels, wherein much of direct action is implemented.

Blackbucks in Point Calimere Wildlife Sanctuary (Tamil Nadu)

Wetlands and the Sustainable Development Goals

NO POVERTY

More than a billion people depend on wetlands for a living.

ZERO HUNGER

Rice, grown in wetland paddies, is the staple diet of 3.5 billion people.

GOOD HEALTH & WELL BEING

Half of international tourists seek relaxation in wetland areas, especially coastal zones.

QUALITY EDUCATION

Safe water access enhances educational opportunities, especially for girls.

GENDER EQUALITY

Women play a central role in the provision, management and safeguarding of water.

CLEAN WATER & SANITATION

Almost all of the world's consumption of freshwater is drawn either directly or indirectly from wetland.

AFFORDABLE & CLEAN ENERGY

Sustainable upstream water management can provide affordable and clean energy.

DECENT WORK & ECONOMIC GROWTH

Wetlands sustain 266 million jobs in wetland tourism and travel. How Wetlands Support Achievement of the SDGs.

INDUSTRY, INNOVATION & INFRASTRUCTURE

Healthy wetlands form a natural buffer against the increasing number of natural disasters.

REDUCED INEQUALITY

Healthy wetlands mitigate the risk to an estimated 5 billion people living with poor access to water by 2050.

SUSTAINABLE CITIES & COMMUNITIES

Urban wetlands play a vital role in making cities safe, resilient and sustainable.

RESPONSIBLE CONSUMPTION & PRODUCTION

Wetland areas properly managed can sustainably support increased demands for water in all sectors.

CLIMATE ACTION

Peatlands cover only 3% of global land but store twice as much carbon as the entire world's forest biomass.

LIFE BELOW WATER

Healthy and productive oceans rely on well functioning coastal and marine wetlands.

LIFE ON LAND

40% of all the world's species live and breed in wetlands.

PEACE, JUSTICE & STRONG INSTITUTIONS

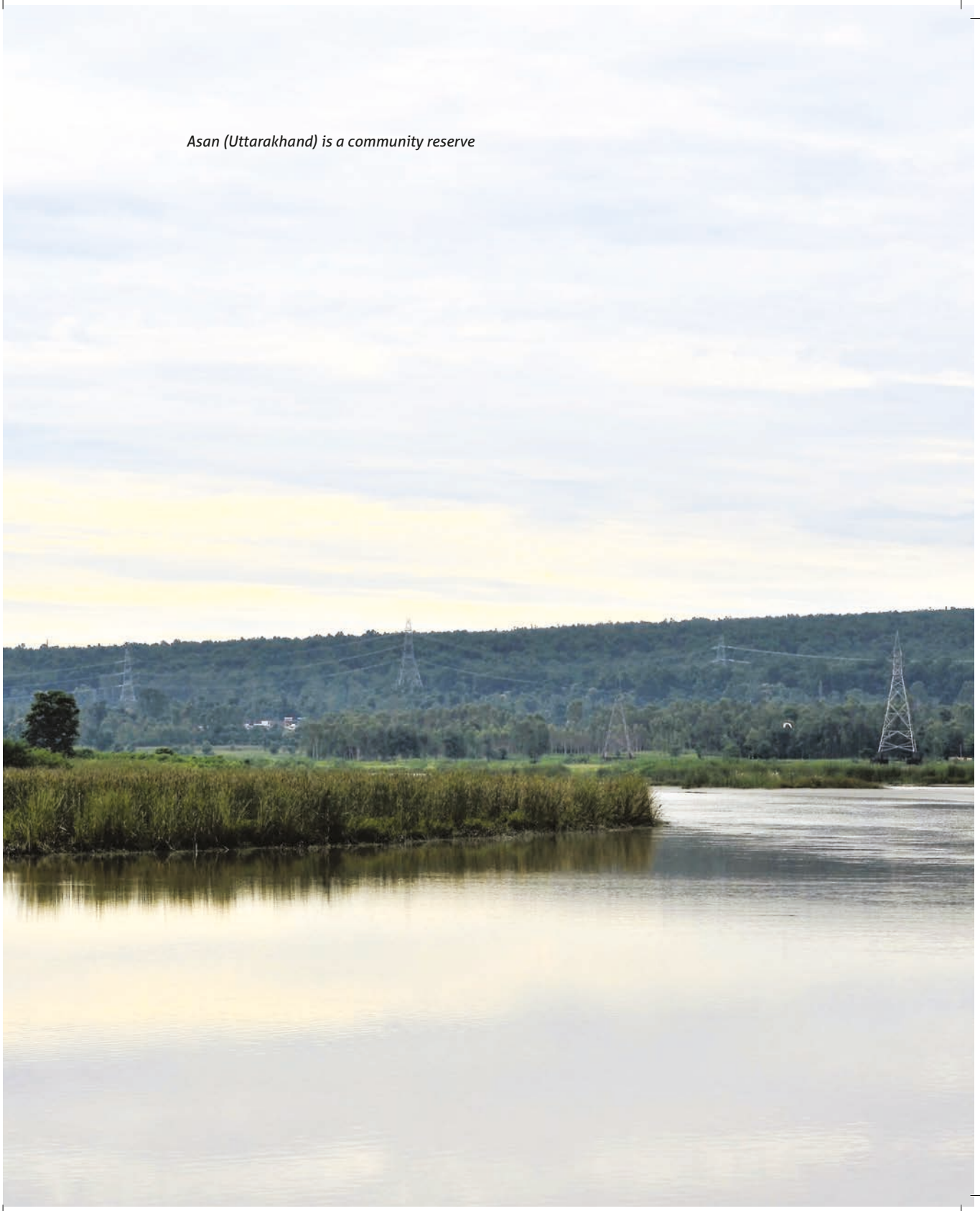
Effective management of transboundary wetlands contributes to peace and security.

PARTNERSHIPS FOR THE GOALS

Ramsar Convention works in partnership with other MEAs to support governments in achieving the SDGs.

Source: Ramsar Convention

Asan (Uttarakhand) is a community reserve



Tso Moriri, a high altitude wetland in Changthang Plateau is a Ramsar site

8

Conservation and Management Efforts

Wetland conservation draws strength from India's rich legacy of environmental conservation enshrined in various policies, legislations and regulatory regimes. The Indian Constitution encapsulates this spirit, notably in its Article 51–A (g) stating that "it shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures."

Efforts by national and state governments

Wetland conservation and sustainable management are placed within the mandate of MoEF&CC. Several broad ranging policies, strategies and action plans have been formulated by the Government which directly or indirectly supports wetland conservation.

Wetlands were initially conserved primarily for their biodiversity values, and several landscapes such as Keoladeo, Harike, Kaziranga and Manas were notified as protected areas.

With India becoming a signatory to the Ramsar Convention in 1982, and MoEF&CC (the then MoEF) being established in 1985, a national programing framework for wetlands was institutionalised. MoEF&CC established the National Wetland Conservation Plan (NWCP) in 1986 to provide overarching policy framework and financial assistance to the state governments for implementation of site management plans. Mangroves and coral reefs were initially covered under NWCP but were later bifurcated as a separate programme. In 2001, the National Lake Conservation Programme (NLCP) was carved out of NWCP to address pollution issues in urban and semi–urban waterbodies through interception, diversion and treatment of pollution load. In 2013, and the two schemes were merged into the National Plan for Conservation of Aquatic Ecosystems (NPCA) to enable adoption of integrated approaches. Wetlands located within Protected Areas are covered under the Ministry's scheme Integrated Development of Wildlife Habitats. As of December 2017, the network of sites of national and international significance includes 250 wetlands.

The regulatory framework for wetlands is defined within the broader national environment policy. The National Conservation Strategy and Policy Statement on Environment and Development (1992) identified pollution and over–exploitation of wetlands as an area of concern. Conservation of wetlands was emphasized as a strategy for sustainable use of land and water resources as well as biodiversity conservation. Subsequently, the National Environment Policy (2006) laid down specific policy elements for wetlands. Wetlands have been identified as components of 'freshwater resources', and the recommended policy actions include integration in developmental planning, management based on prudent use strategies, promotion of ecotourism, and implementation of a regulatory framework. Integration of wetlands in river basin management has been identified as a strategy for the management of river systems.

In 2010, a regulatory framework for wetlands was introduced by MoEF&CC in the form of Wetland (Conservation and Management) Rules, 2010 under the provisions of the Environment (Protection) Act, 1986. The rules have been further revised and notified as Wetlands (Conservation and Management) Rules, 2017. Key features include constitution of State Wetlands Authorities and National Wetlands Committee at the national level, and wise use as a framework for regulating wetlands.

The diverse wetlands of Mahanadi Delta, Odisha

Provisions of the Indian Forest Act, 1927 and the Indian Wildlife (Protection) Act, 1972 define the regulatory framework for wetlands located within forests and designated protected areas. Similarly, coastal wetlands are protected under the Coastal Regulation Zone (CRZ) Notification (2011 recently modified in 2018) and the Island Protection Zone (IPZ) Notification 2011. The Indian Fisheries Act, 1897, The Water (Prevention and Control of Pollution) Act, 1974, The Environment (Protection) Act, 1986 and The Biological Diversity Act, 2002 provide substantive legal and regulatory conditions for conservation of Indian wetlands. The Coastal Aquaculture Authority Act, 2005 prohibits the conversion of natural coastal wetlands such as mangroves, salt pans, estuaries and lagoons for aquaculture.

In line with the CBD Strategic Plan 2011–2020, India has formulated 12 National Biodiversity Targets. Wetlands find direct reference under Target 3 (Strategies for reducing rate of degradation, fragmentation and loss of natural habitats are finalized and actions put in place by 2020), Target 6 (ecologically representative areas on land and in inland waters, as well as coastal and marine zones, especially those of particular importance for species, biodiversity and ecosystem services, are conserved effectively and equitably), and Target 8 (by 2020, ecosystem services, especially those related to water, human health and livelihoods and well–being are enumerated and measures to safeguard them are identified).

Wetlands also find a place in sectoral policies for water and climate change. The National Water Policy

(2012) provides an important policy framework for linking wetlands to water resources management. The policy recommends adoption of a basin approach for water resources management, and identifies conservation of river corridors, waterbodies and associated ecosystems as important action areas. Ministry of Water Resources, River Development and Ganga Rejuvenation (MoWRRD) has several programmes that contribute to wetland conservation. The MoWRRD also coordinates implementation of "National Project for Repair, Renovation & Restoration (RRR) of Waterbodies directly linked to Agriculture" since January 2005. The programme supports restoration and augmentation of storage capacities of waterbodies, including recovery and extension of their lost irrigation potential. In 2013, the Ministry of Housing and Urban Affairs has issued an advisory on conservation and restoration of waterbodies in urban areas.

The National Action Plan for Climate Change has identified eight missions which form the core intervention strategy for climate change mitigation and adaptation. Wetland conservation and sustainable management is included in the National Water Mission and Green India Mission.

Several state governments (notably West Bengal, Odisha, Kerala, Manipur and Assam) have also enacted their legislation on wetlands. The Government of Manipur notified the Manipur Loktak Lake (Protection) Act, 2006 and Manipur Loktak Lake (Protection) Rules, 2008, which define a core zone and buffer zone, and stipulate specific activities that can be permitted within these designated areas. Similarly, the East Kolkata Wetlands (Conservation and Management) Act, 2006 curtails landuse changes within the Ramsar Site. In Kerala, the Conservation of Paddy Land and Wetland Act, 2008, bans conversion of wetlands. In 2015, the state governments of Karnataka and Rajasthan have enacted legislations for conservation of wetlands.

In collaboration with national and international organisations, the Ministry has published several documents on various aspects of wetlands (for example, monographs on wetlands published with WWF-India). Guidelines for application oriented research and development have been published and assistance is given to select research organisations to provide, in time series, a robust research database on wetlands.

Wetland Interpretation Center at Chilika (Odisha)

Highlights of wetlands conservation efforts

- An effective network of protected areas consisting National Parks, Sanctuaries and Biosphere reserves has been setup in the country. Many wetlands are included in the protected area network.

- A list of priority wetlands for integrated management has been drawn up by the MoEF&CC in consultation with state governments. Financial assistance is provided to the state governments, on cost sharing basis, for implementation of management plans. On the basis of area, financial support is also provided for drafting Management Action Plans. These plans are examined by an expert group before finalization. Key elements of management plans include:
    - Restoration of catchment health to address soil erosion
    - Management of invasive species through biophysical methods and economic utilization
    - Maintaining water inflow and outflow patterns
    - Controlling pollution
    - Conservation of habitat of endangered species
    - Providing additional livelihoods for wetlands dependent communities
    - Communication and outreach on diverse values of wetlands

- Integrated water resource management principle has been followed for holistic management of wetlands. Basin level approach has been taken up for some of the wetlands like Wular in Kashmir, Loktak in Manipur, and Chilika in Odisha. The environmental flows for Chilika have been assessed and enforced.

- Keeping in view problems confronting wetlands in India and the research studies carried out so far, following priority areas have been identified:
    - Survey and mapping of wetland resoruces in the country using remote sensing technology
    - Application of Geographical Information System (GIS) and mathematical modelling in some selected wetlands
    - Evolving wetland evaluation techniques to have a quick appraisal of health of specific wetland ecosystem and also environmental impacts of development projects and other human activities on the ecosystems
    - Management and control of prolific growth of some exotic species
    - Siltation control
    - Fisheries development

- Inventory of wetlands using remote sensing techniques has been completed and National Wetlands Atlas published in 2011.

- Regulatory framework for wetlands have been notified in the form of Wetlands (Conservation and Management) Rules, 2017 under Environment Protection Act, 1986.

- The synergy between CBD and Ramsar convention in our country has helped to integrate various departmental sectors into the planning process at river basin level for management of wetlands. The models developed in this direction for Loktak and Chilika have been extensively used at the regional level to demonstrate successful interventions for conserving wetlands.

- Economic valuation of some of the wetlands has been undertaken to assess the applicability of economic tools to know the contribution of biodiversity and other functions of wetlands. Under the TEEB (The Economics of Ecosystems and Biodiversity) initiative pilot studies have been carried out in 12 sites to demonstrate economic consequences of wetland loss.

- Interpretation centres have been established in several wetlands for communication and outreach on wetland values and functions

- Under the Environmental Information System programme of MoEF&CC, wetland related information is collated and disseminated through SACON, Wildlife Institute of India and Bombay Natural History Society (BNHS).

- The National Ganga River Basin Mission of the Ministry of Water Resources, River Development and Ganga Rejuvenation has initiated development of a framework for integration of wetlands restoration in select stretches of Ganga River.

Efforts by NGOs and civil society

NGOs and civil society have played an instrumental role in the conservation of wetlands by complementing efforts made by the government. Some of the key NGOs and their contributions are:

Wetlands International South Asia has led the formulation of integrated management plans for several wetlands, particularly Ramsar Sites. The organisation has also implemented programmes on wetlands inventory, assessment of ecosystem services values, and capacity development of wetlands managers.

WWF-India has published monographs on Indian Ramsar Sites. The organization has supported conservation of high-altitude wetlands through its Secure Himalayas Initiative. It also supports wetlands communication and outreach through interpretation centers at Harike and Keoladeo National Park.

Bombay Natural History Society has been a front runner in bird migration studies on wetlands. The organisation maintains active bird monitoring stations at several wetlands, of which Point Calimere and Chilika are prominent.

Salim Ali Center for Ornithology maintains the MoEF&CC's ENVIS center on wetlands. It also works with south and central Indian states on wetlands assessment and prioritisation, besides carrying research on wetlands.

Care Earth has been actively supporting Government of Tamil Nadu's initiative for conservation of Pallikarnai marsh.

NGOs have also been instrumental in seeking judicial intervention on wetlands by acting as societal watchdogs and petitioning courts on wetlands related issues.

However, with an increase in the coverage and scope of the national programme on conservation of wetlands, there is an increasing need for trained wetland managers to effectively implement management plans.

Review of the management action plans submitted by various state governments indicates that the requisite integration and professionalism is yet to be achieved. The main reason for this is the lack of capacity within the agencies involved with wetland management to design and develop multi-sectoral programmers for conservation and wise use of wetlands. This not only weakens efforts made by the government but poses serious limitations to address wetland conservation in the face of increasing anthropogenic and non-anthropogenic pressures such as climate change. In this context, the MoEF&CC proposes to establish a national level wetland manager's capacity building programme aimed at developing trained personnel within the country for wetlands.

The full range of ecosystem services and biological diversity values of wetlands are rarely integrated in sectoral developmental plans. This impedes the ecological and hydrological functioning of these ecosystems and leads to stakeholder conflicts. In several instances, interventions for increasing food production and water supply (e.g. through the construction of hydraulic structures and expansion of irrigated area) have led to the reduced ability of wetlands to recharge groundwater, and buffer floods.

In most states, wetlands are often clubbed within 'wastelands' meant to be used for alternate developmental purposes and not recognised as land use category. Within sectoral policies, there is the considerable scope of enhancing recognition of various wetland ecosystem services.

The National Water Policy (2012), while recommending allocation of water for maintaining ecosystems, does not refer to wetlands as a solution in achieving water management objectives such as flood control, groundwater recharge and increasing overall freshwater availability.

The National Action Plan for Climate Change needs to acknowledge the contribution of wetlands towards climate change adaptation, and also address the risks imposed on these ecosystems due to mal–adaptation. Wetlands also need to be included within National Agriculture Policy and National Marine Fisheries Policy, as lack of consideration of wetland functioning within prevailing agro–practices and food production programmes continue to be significant drivers of wetland degradation.

Mangroves such as these in Muthupet (Tamil Nadu) are important for climate change mitigation and adaptation

9

Gaps and Future Needs

Historically, wetlands have been used extensively as a source of drinking water, irrigation, fisheries and supporting livelihoods in diverse ways. Wetlands have acquired critical importance given their role in providing water security. Despite their immense value, wetlands are under tremendous anthropogenic and non-anthropogenic pressures resulting in their shrinkage, drainage, reclamation, pollution and habitat destruction. A well-thought, holistic and knowledge-based approach is long overdue for securing the full range of biodiversity and ecosystem service values of these ecosystems. This section discusses gaps that need urgent attention.

- Developmental activities and land use change within wetland catchments having adverse impacts such as enhanced siltation or pollution need to be regulated. Land use change within wetland catchments need to be systematically monitored.

- Wetlands need to be recognised as a distinct land use category. This would deter conversion of wetlands into non-wetland usages. The land records need to be updated based on a comprehensive inventory of wetlands.

- Use of wetlands for tourism, fisheries, agriculture and other livelihood activities should be within the carrying capacity of the ecosystem. Only sustainable use, appropriately incorporating traditional wisdom with technological knowhow, should be permitted within wetlands.

- Environmental appraisal committees of the MoEF&CC entrusted with assessing environmental impacts of developmental projects should include wetlands experts. Similarly, experts nominated to State Wetlands Authorities should bring on board adequate experience to guide decision-making on wetlands.

- Plantation of trees inside the wetlands needs to be restricted. Trees should only be planted within wetland catchments, wherein they regulate moisture regimes and silt loading. Experiences from Wular, a Ramsar Site of India may be referred to. Plantation of willows inside Wular for fuel-wood and sports material ultimately led to rapid shrinkage in wetland's water holding capacity and area.

Varthur (Bangalore) is highly polluted and choked with water hyacinth

Willow plantations inside Wular (Jammu and Kashmir) reduced capacity of the wetland to buffer floods

- The inflow of sewage into wetlands must be prevented. Constructed wetlands technology may be used for the treatment of domestic and municipal wastewater and industrial effluents.

- Management interventions should include livelihood options of wetland dependent communities. Such interventions may be planned through stakeholder consultations and public hearing, wherein communities needs and aspirations are understood, and appropriately integrated in management plans. NGOs and CSOs can play a proactive role in linking community concerns with wetlands management.

- The proliferation of aquatic invasives needs to be controlled to desirable limits . Harvested biomass should be safely disposed away from the wetlands to minimise the risk of nutrient enrichment in the wetland waters. Economic use of harvested biomass may be promoted in the form of value added products which may offer livelihood opportunities to the communities. An example is of Kuttanad Integrated Development Society, an NGO based in Kerala which has refined technologies for the use of water hyacinth for making bags, spice boxes and other value added products.

- Capacity development of wetlands managers be accorded high priority to ensure that a well-trained team of personnel is available to design and implement wetland management plans. Capacity can be built through regular training workshops, exposure visits, handholding and guidance and networking.

- List of wetlands brought into integrated management by state governments need to be enhanced, with due consideration to conservation as well as development goals. Geographic delineation of wetlands and their zone of influence, and account of pre-existing rights and privileges consistent with the ecological health of wetland may be prepared so that wetlands are covered into schemes of national and state governments and accorded protection with the provisions of Wetlands (Conservation and Management) Rules, 2017.

- Wetlands need an appropriate amount of water for their functioning and ecological integrity. Water regime requirements of wetlands, therefore, need to be assessed and factored in within water allocation planning and decision making. Any construction of hydraulic structures which adversely impacts the water and sediment flow pattern within the wetland should be prevented. Wetlands should be made a part of the river basin and coastal zone planning so that their ecosystem services and biodiversity values are integrated within the planning and decision making processes.

- Regular monitoring of water quality and biodiversity should be a part of the management plan to keep a tab on the health of the wetland ecosystem.

- Scientific baselines on status and trends in wetlands need to be developed to assess the impacts of conservation and management efforts. Time series data on various ecological and socioeconomic parameters can guide adaptive management of wetlands.

- Proper linkages and networking is key to successful management intervention. Such arrangements need to be made by nodal agencies and linkages developed with all national and international agencies including all environment related conventions to get exposure on latest techniques and best practices.

- The Central Government may consider integrating all programmes dealing with water under a single institution, so as to enable taking up a holistic approach in management. This shall also enable integration of wetlands in water resources planning and management processes.

Nangal (Punjab) on the foothills of Shivalik is formed due to construction of Nangal Dam

Local community participation plays a significant role in wetland management

10

Citizens and Wetlands Conservation

Wetlands conservation dwells on conservation and management actions from stakeholders from diverse strata of the society.

The ways in which citizens can participate in wetland management is discussed in this section.

- Be aware of wetlands in your neighborhood and motivate people to care about these ecosystems.
- Reduce excessive water consumption and runoff by reporting it to concerned authorities.
- Organise community wetland clean-ups.
- Generate awareness among people about the functions, services and values of wetlands. Launch various environmental awareness campaigns through workshops, folk dance, street theatre, brochures, padyatras, hoardings etc.
- Document traditional wetland management practices and support their integration in management planning.
- Do not litter in wetlands, dump sewage and solid waste into wetlands. Prevent others from doing so.
- Do not encroach on wetlands. Concretising natural shorelines in the name of beautification can disrupt critical habitats within these ecosystems.
- Do not disrupt natural water inflow and outflow of wetlands.
- Participate in waterbird census. Also, engage in citizen science initiative, related to wetlands.
- Participate in wetland management planning processes.
- Engage with local authorities responsible for wetlands on management and monitoring aspects. Participate in discussions to retain and restore wetlands.
- If you are a researcher, conduct research on various aspects of wetlands and their benefits to society.

Abbreviations

BNHS	-	Bombay Natural History Society
CASMB	-	Center for Advanced Sciences in Marine Biology
COP	-	Conference of Contracting Parties
CRZ	-	Coastal Regulation Zone
CSOs	-	Civil Society Organizations
IOPs	-	International Organisation Partners
IPZ	-	Island Protection Zone
IUCN	-	International Union for Conservation of Nature
IWMI	-	International Water Management Institute
MoEF&CC	-	Ministry of Environment, Forest and Climate Change
MoWRRD	-	Ministry of Water Resources, River Development and Ganga Rejuvenation
MEAs	-	Multilateral Environmental Agreements
NGOs	-	Non-governmental organizations
NLCP	-	National Lake Conservation Plan
NWCP	-	National Wetlands Conservation Programme
NPCA	-	National Programme on Conservation of Aquatic Ecosystems
RRR	-	Repair, Renovation & Restoration
SACON	-	Salim Ali Centre for Ornithology and Natural History
SAC	-	Space Applications Centre
SC	-	Standing Committee
SDGs	-	Sustainable Development Goals
UNESCO	-	United Nations Educational, Scientific and Cultural Organization
UNFCCC	-	United Nations Framework Convention on Climate Change
WISA	-	Wetlands International South Asia
WWF	-	World Wide Fund for Nature

Glossary

Aquifer: Geologic formation that contains sufficient saturated permeable material to yield significant quantities of water to springs and wells.

Basin: A bowl-shaped depression or dip in the Earth's surface with sides higher than the bottom.

Basin approach: Process of coordinating conservation, management and development of water, land and related resources across sectors within a given river basin, in order to maximise the economic and social benefits derived from water resources in an equitable manner while preserving and, where necessary, restoring freshwater ecosystems.

Biodiversity: The degree of variation of life forms with in a given ecosystem, biome, or an intire planet.

Biodiversity hotspot: A biogeographic region characterized both by exceptional levels of endemism and by serious levels of habitat loss.

Biogeographic zone: A large distinctive unit of similar ecology, biome representation, community and species.

Breeding sites: A place or an environment suitable for the growth and development.

Carbon stores: Area or ecosystem that absorbs and stores greenhouse gases, thereby preventing their release into the atmosphere.

Climate change adaptation: Anticipating the adverse effects of climate change and taking appropriate action to prevent or minimise the damage they can cause, or taking advantage of opportunities that may arise.

Ecosystem: Community of organisms interacting with each other and with their environment such that energy is exchanged and system-level processes, such as the cycling of elements, emerge.

Ecosystem services: The direct and indirect benefits that humans derive from ecosystem processes such as pollination, biodiversity and nutrient cycling that are not captured in traditional economic accounting, but that are vital to social, economic and spiritual wellbeing.

Ecotone: A zone wherein exists active interaction between two or more ecosystems (or patches of ecosystems), which result in the region having properties that do not exist in either of the adjacent ecosystems.

Emergent: Rooted plants often along the shoreline that stand above the surface of the water.

Endemic: Endemic plants and animals are those that are unique to a specific geographic region. Because they are only found in certain locations, they may require special conservation efforts due to threats as habitat destruction

Food chain: Group of organisms linked in order of the food they eat, from producers to consumers, and from prey, predators, scavengers and decomposers.

Free Floating: Plants floating in the water column, on the surface of the water or laying at the bottom.

Freshwater: Water with less than 0.5 parts per thousand of dissolved salts (or water that is not salty).

Genetic material: The material that determines the inherited characteristics of a functional organism.

Geomorphology: The physical features of the earth's surface and their relation to its geological structures.

Greenhouse gases: Gases in the atmosphere (such as carbon dioxide, methane, water vapour, and ozone) that absorbs solar heat reflected by the surface of the Earth, warming the atmosphere.

Habitat: Geographical unit that effectively supports the survival and reproduction of a given species or of individuals of a given species.

Herbaceous: Having little or no woody tissue and persisting usually for a single growing season.

Hydric soils: Soils formed under the conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in its upper part.

Hydrological regimes: Long-term spatial variation in the water depths and period of inundation within a wetland system.

Hydrophytes: Plants that grow partly or wholly in water whether rooted in the mud or floating without anchorage.

Integrated management: The method of encompassing the effective direction of every aspect of an organization so that the needs and expectations of all stakeholders are equitably satisfied by the best use of all resources.

Inundation: Presence of water over land

Macrophytes: The conspicuous plants that dominate wetlands, shallow lakes and streams. Macrophytes can be emergent, submerged or floating.

Mesophyte: Terrestrial plants which are neither adapated to particularly dry nor particularly wet environments and thus, are capable of growing in environments with moderate supply of water.

Migratory Flyway: Routes comprising the entire range of a migratory bird species through which it moves on an annual basis from the breeding grounds to non-breeding areas, including intermediate resting and feeding places as well as the area within which the birds migrate.

Organic material: Matter derived from living or dead organisms

Pastureland: A large area of land where animals feed on the grass.

Physiography: Study of features and attributes of earth's land surface

Primary Production: The synthesis of organic compounds from atmospheric or aqueous carbon dioxide.

Remote sensing: Technique of acquiring information about the Earth's surface by sensing and recording reflected or emitted energy.

Riparian: Ecosystems located along the banks of rivers, streams, creeks or any other water networks. Usually riparian zones are narrow strips of land that line the borders of a water source.

Stakeholder: Person or organization that has an interest or investment in a place or situation.

Submerged: Rooted plants with most of their vegetative mass below the water surface.

Trophic level: The position an organism occupies in a food chain.

Water table: Upper limit of sub-surface saturated zone. Water table rises after recharge and declines as ground water discharges

Wetlands International South Asia

Wetlands International South Asia (WISA) is a non-government organization with mission to sustain and restore wetlands, their resources and biodiversity. WISA's office at New Delhi, India was established in 1996 as a part of global network of offices of Wetlands International (WI) with a mandate to promote wetland conservation and wise use in South Asia region. WI is a global non-profit organization which works on wetland conservation and restoration through 19 regional offices in over 100 countries supported by a headquarters based in the Netherlands. WI is also one of the five International Organization Partners of the Convention on Wetlands (Ramsar Convention). In 2005, WISA was registered as a legal entity under the Societies Registration Act of Government of India. The strategic direction and policies of WISA are set by a General Body which comprises eminent experts and conservation planners.

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