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World Wetlands Day 2020

Special Issue | Wetlands and Biodiversity

CONTENTS

Wetlands International South Asia

Wetlands International South Asia Society (Regd.) (WISA) is a non-government organisation with a mission to sustain and restore wetlands, their resources and biodiversity. WISA's office at New Delhi, India was established in 1996 as part of the global network of Wetlands International (WI) with a mandate to promote wetland conservation and wise use in South Asia region. WI is a global non-profit organisation which works on wetland conservation and restoration through 18 regional offices in over 100 countries supported by a Global Office in the Netherlands. WI is also one of the 5 International Organisation Partners of the Ramsar Convention on Wetlands. In 2005, WISA was registered as a legal entity under the Society Registration Act of Government of India. The strategic direction and policies of WISA are set by a General Body which comprises eminent experts in various fields.

The Editorial Panel welcomes contributions of articles and information. These may be sent to: editor@wi-sa.org

Cover Photograph: Chital, Keoladeo National Park, Bharatpur
☎ Harsh Ganapathi

Inside Cover Photograph: Oriental darter, Keoladeo National Park, Bharatpur
☎ Harsh Ganapathi

Back Cover Photograph: Dragonfly, Chilika, Odisha
☎ Harsh Ganapathi

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Message from the President

It gives me immense pleasure to place the Sixth Volume of our Newsletter Sarovar in your hands.

As you will note, this issue has been brought on the World Wetlands Day theme – Wetlands and Biodiversity. The theme highlights the important role healthy wetlands play in supporting life on earth. Biodiversity encompasses the variety of all life on earth. It forms the web of life of which we are an integral part and upon which we depend. We derive our supply of food, medicines energy and many industrial products from biological resources. Biodiversity also maintains ecological balance and continues evolutionary processes. For India, conservation of its biodiversity is crucial not only because it provides several goods and services necessary for human survival, but also because it is directly linked with providing livelihood to millions of our local people, thereby contributing to sustainable development. As per estimates, over 40% of life forms that we know of live or breed in wetlands. The diversity of life enables these ecosystems to support human well-being by providing freshwater, regulating water availability and thus buffering floods and drought, recharging groundwater, providing food in the form of rice, fish and a range of plants, and being an avenue of culture and recreation. Wetlands, such as peatlands and mangroves soak harmful greenhouse gases (about 30% of land-based carbon) and thus help in climate change mitigation.

Unfortunately, the diverse values of wetlands are seldom recognized, and they are being lost at rates three times higher than the known rates of loss of forests. Wetland species, particularly those dependent on freshwater are declining faster than most of the species.

The year 2020 will be important for setting the international framework for biodiversity conservation. This is the year when post-2020 biodiversity targets shall be set, which will also set a stage for implementation of SDGs in the 2020-2030 decade. The zero-draft circulated by the Convention on Biological Diversity calls for working towards a 'goal of living in harmony in nature' which could be achieved through transformation of economic, social and financial development models which have created the current biodiversity crisis. Goals related to integrity of ecosystems have been proposed, which can trigger a shift from species to habitats and landscapes. The draft will be intensively negotiated at the CBD CoP; however, it would be crucial to align our National Biodiversity Action Plan to ensure that we contribute to the global cause of biodiversity conservation.

India has moved proposals for designating 10 additional Ramsar Sites, making us the country with the highest number of Wetlands of International Importance in South Asia, and next only to Japan and China in Asia. As these numbers shore up, it will be critical to ensure that the sites are also well-managed, so that the biodiversity and ecosystem service are sustained.

It is also heartening to see the increasing attention being paid by to the issue of water security in India. A new water policy is also being shaped up. Wetlands are fundamental to country's water and ecological security. As India grapples with declining water availability and increasing frequency of floods and droughts, it is important that wetland conservation is rapidly upscaled across all parts of the country. The Government of India's mission of Jal Shakti can be realized only if wetlands are in a healthy state.

I hope you will like this issue of Sarovar. We will like to receive your feedback and comments, and also your valuable contributions for the next issue.

Happy Reading!

Dr Sidharth Kaul
President

From the Director's Desk

'Transformation' rightly is the new buzzword in conservation circles. The global assessment report on biodiversity and ecosystem services of the IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) released in May 2019 concluded that goals for conserving nature and achieving sustainability can only be achieved through 'transformative changes' across economic, social, political and technological factors. The zero draft of the post-2020 Global Biodiversity Framework carries the message further by calling for 'transformative actions' for putting in place tools and solutions for mainstreaming biodiversity; reducing the threats; and, ensuring that biodiversity is used sustainably to meet people's needs. Closer home, the Government of India shortlisted 167 big-bang 'transformative ideas' in the first 100 days towards a new development trajectory for the country.

Transformation runs counter towards our inertia for business as usual – and I find this adage highly relevant for wetlands conservation in our country. It has been over three and a half decades since India ratified the Convention on Wetlands and put in place a national programme on wetlands. While our capability to assess the status and trends on wetlands has increased significantly, and the numbers and statistics on wetlands are becoming more refined, our track record on achieving positive change in the health of wetlands and well-being of people has been dismal. The reach of the national programme may not have been in excess of 1-2% of the total wetlands in the country. Clearly, there is a case to move beyond a site-centred and management plan intensive mode of delivery of wetlands conservation programmes followed so far.

So, what do the contours of a transformed nation-wide initiative on wetlands look like? Wetlands loss, in today's time, needs to be seen not just as a biodiversity crisis, but as a developmental crisis – manifesting into increased water, food and climate insecurity for the society. A transformed response to addressing rapid wetlands degradation and loss would be to pursue the integration of wetlands, and their wide-ranging values, within developmental programming at various levels.

As per the National Wetlands Atlas, India has over 0.77 million wetlands, a majority of which (over 80%) are under 5 ha in area, and mostly human-made tanks and ponds. Management needs of such wetlands are different, and can mostly be addressed within the local gram panchayat and municipality level development programmes. Of the rest, the natural wetlands constitute 45% of the area. Not all of these need very sophisticated and data-intensive management planning interventions. In fact, the complexity of management must be related to the level of threat and ecosystem health.

Much of wetlands conservation efforts have been placed on those located within forests or protected area network. The State of Forest Report of 2019, for the first time gives an assessment of number of wetlands located within forests: 62,466 wetlands covering 3.8% of the recorded forest area. It is wetlands outside such networks that are at a higher threat, and therefore demand priority within programming.

How we communicate wetlands also matters a lot. We are often used to conveying wetlands in myriad terms. For development integration, it is also important to understand how wetlands function, and the ways in which these ecosystems help in meeting development needs. A behaviour change strategy for wetlands, which can motivate positive action by leveraging positive emotions, harnessing cognitive biases and designing behaviourally informed-incentives can do the trick.

A venture of such gigantic proportions will also need new models of governance. There are limited means by which accountability for wetlands loss can be fixed, especially at levels of district and below. This gap needs to be filled by bringing in Panchayats and Urban Local Bodies within the wetland governance frame. Recognizing wetlands as a distinct land use category and recording them as such in land-use records would be the first step towards this direction.

We hope that the 2020 decade will bring out positive stories of wetlands rejuvenation. We have been, and will increasingly emphasize on demystifying and downscaling wetlands conservation in order to bring more stakeholders on board. We need more hands on the deck – so goes the saying!

Dr Ritesh Kumar
Director

The Ramsar Site Network and Biodiversity Conservation

Biodiversity has globally come under increasing pressure from a range of factors such as habitat fragmentation, development imperatives and global warming. Populations of several wetland-dependent species are declining. The Ramsar Convention on Wetlands introduced the Ramsar List as a mechanism for creating an international network of wetlands, which when sustainably managed, lead to the conservation of global biodiversity and support human well-being.
As India prepares to add more wetlands to the Ramsar List, **Dr Ritesh Kumar** (Director, Wetlands International South Asia) and **Dr Sidharth Kaul** (President, Wetlands International South Asia) look into the various aspects of designating and conserving Ramsar Sites in the country towards the overall efforts for conserving national, regional and global biodiversity.

THE LIST OF WETLANDS OF INTERNATIONAL IMPORTANCE AS A NETWORK OF SIGNIFICANT BIODIVERSITY AREAS. The Ramsar Convention is the only multilateral environment agreement focused on wetlands. The Convention provides a framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. Entered into force in 1975, the Convention predates the three Rio Conventions - the Convention on Biological Diversity, the United Nations Framework Convention on Climate Change and the United Nations Convention to Combat Desertification, and thus is amongst the oldest multilateral environmental agreement.

Ramsar List is one of the three Convention pillars. The vision for creating this List is to 'develop and maintain an international network of wetlands which are important for the conservation of global biological diversity and for sustaining human life through the maintenance of their ecosystem components, processes and benefits/services'. The Secretariat works with Contracting Parties, International Organization Partners (IOPs) and other stakeholders towards establishing a national network of Ramsar Sites which represent the diversity of wetlands and their key hydrological and ecological functions, and contribute to maintaining global biological diversity through the designation and management of appropriate wetland sites.

Wetlands can be designated to the Ramsar List under any (one or more) of the nine criteria. The List presently includes over 2,370 wetlands covering 253 million hectare and is touted as the world's largest protected area network for meeting biological diversity conservation outcomes.

Group A of the criteria is based on representativeness, rarity or uniqueness of the site. Group B comprises eight criteria based on species and ecological communities (site supports vulnerable, endangered, or critically endangered species or threatened ecological communities; supports plants or animal species important for maintaining the biological diversity of a particular region, or supports plants and animal species in a critical phase in their life cycle), waterbirds (regularly supports >20,000 waterbirds, or atleast 1% of individuals of know population of single species or subspecies), fish (presence of significant indigenous fish species, or providing habitat condition for maintenance of fish species populations) and other taxa (1% population of wetland-dependent non-avian taxa).

Dr S A Hejmadi signing the Ramsar Convention agreement on behalf of Government of India at Ramsar in 1971 (Photo courtesy: Ramsar Convention Secretariat)

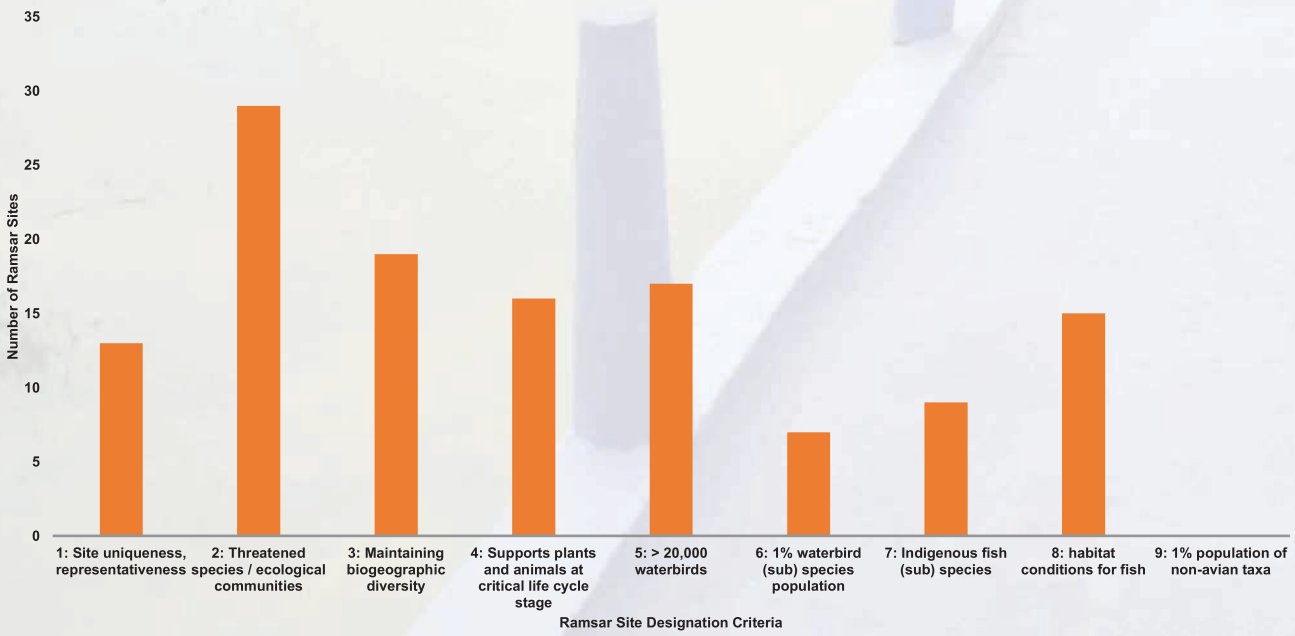
THE INDIAN NETWORK OF RAMSAR SITES AND THEIR BIODIVERSITY VALUES. India has so far designated 27 wetlands to the Ramsar List, ranging from Himalayan high altitude wetlands (Tso-moriri and Chandertal), lakes and marshes (Wular, Renuka, Keoladeo, Loktak, Deepor, Rudrasagar, Nalsarovar and Sasthamkotta), river stretches (Upper Ganga River stretch and Kanjili), salinas (Sambhar), mangrove swamps (Sunderbans, Bhitarkanika and Point Calimere) and lagoons and estuaries (Chilika, Ashtamudi and Vembanad-Kol). Water storage areas (Pong, Bhoj Wetlands and Surinsar-Mansar) and assemblages of sewage fed fish farms (East Calcutta Wetlands) have also been designated to the List by the Government of India.

A majority of the sites (19 of 27) are designated under criteria 2 (presence of threatened species and ecological communities). This is followed by designations under criteria 1 (uniqueness or representativeness of the site) and criteria 8 (wetlands providing suitable habitat conditions for fish). Incidentally, the waterbird number related criteria 5 has been used only for eight sites. There has been no designation fulfilling criteria 9, which pertains to non-avian wetland-dependent taxa, although sites such as Loktak fulfil this criterion.

The Ramsar sites also form an integral part of the national protected area network. Thirteen of the Ramsar Sites have been designated as protected areas or are located within reserved forests. Another five Ramsar Sites have their parts designated as protected areas.

Each of the Ramsar Site is a habitat of species of high conservation interest. Chilika maintains a healthy population and, is one of the only two lagoons in the world inhabited by Irrawaddy Dolphin, *Orcaella brevirostris.* Keibul Lamjao, a floating national park on the south of Loktak is the only known natural habitat of globally endangered swamp deer, *Rucervus eldii.* The globally vulnerable Black-necked Crane *Grus nigrocollis* breeds in the region around Tso-moriri. Kolleru was famed for large herenories of Asian Openbill Stork *Anastomus oscitans*. The Sunderbans are famed as the world's largest single chunk of contiguous mangroves, and an abode of globally endangered Bengal Tiger *Panthera tigris*. Two globally threatened mangrove species: *Sonneratia griffithii* and *Heritiera* are also found in Sunderbans. With over 35 true mangrove and 70 associate species, Bhitarkanika stands out as a hotspot of mangrove species diversity in the world, and one of the world's largest rookeries of vulnerable turtle Olive Ridley *Lepidochelys olivacea.* Spectacular flocks of flamingos can be seen at Sambhar and Point Calimere, whereas Pong is regularly visited by flocks of Bar-Headed Goose *Anser indicus*. The diversity of waterbirds visiting Keoladeo and Harike during the migration season often crosses in excess of 100 species.

A systematic inventory of the biota of Indian Ramsar Sites is yet to be carried out. Unpublished records of faunal diversity of Ramsar Sites collated by Zoological Survey of India for 27 Ramsar Sites indicate the presence of over 5,000 species from protozoans to mammals, with insects being the most predominant group.



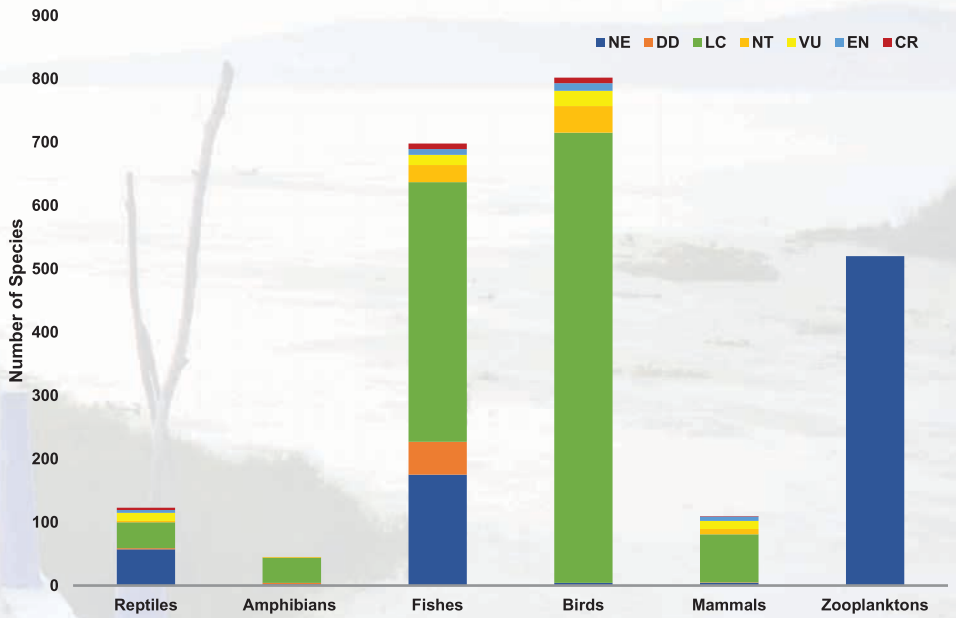
Ramsar sites designation by India under the nine Convention criteria (for 37 sites)

THE SPECIES RICHNESS OF INDIAN RAMSAR SITES

Dhruv Verma and Dr Asghar Nawab

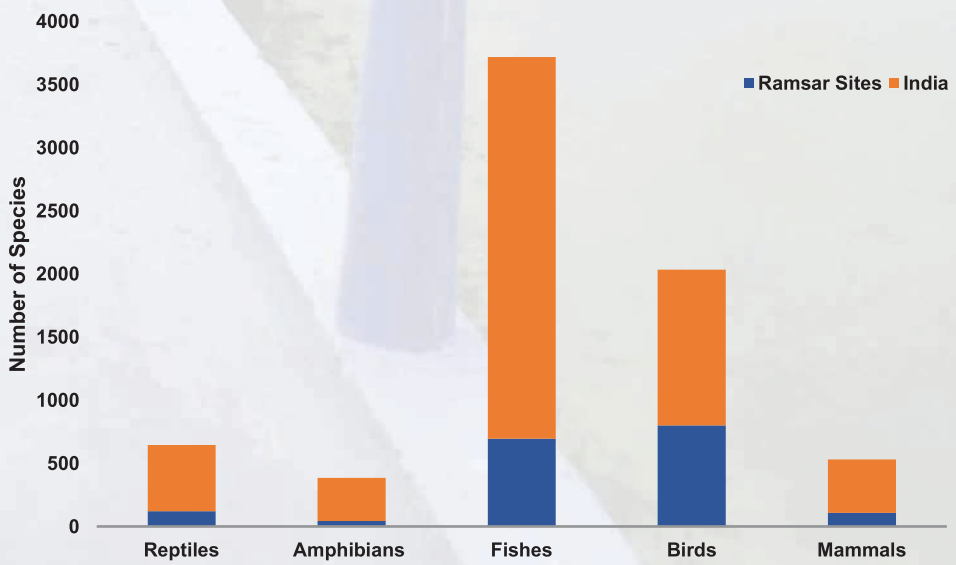
Wetlands International South Asia collated an inventory of species for select groups (mammals, birds, reptiles, amphibians, fishes and zooplankton) for which published and peer-reviewed work was available for the Indian Ramsar Sites. The List includes over 2,300 species from 27 Ramsar Sites.

Twenty-two of these species are classed as Critically Endangered, 32 as endangered and 66 as vulnerable in the IUCN Red List. Critically endangered species in Indian Ramsar sites include one mammal (*Manis pentadactyla*), four reptile (*Eretmochelys imbricate, Batagur kachuga, Batagur baska, Rhina ancylostoma*), ten fish (*Glaucostegus typus, Pristis pristis, Rhynchobatus laevis, Pristis pectinate, Glyphis gangeticus, Carcharhinus hemiodon, Sphyrna lewini, Glyptothorax kashmirensis, Sarcogyps calvus*) and eight bird species (*Gyps tenuirostris, Gyps indicus, Gyps bengalensis, Grus leucogeranus, Eurynorhynchus pygmeus, Calidris pygmaea, Aythya baeri, and Artisornis moreaui*)



Global conservation status of species found in 27 Indian Ramsar Sites (as per IUCN Red List)

The species richness at the Ramsar sites represents atleast 23% of reptile, 13% of amphibian, 23% of fish, 65% of birds, and 26% of mammal species known to occur in India. We believe that this share is a gross underestimate, and can be validated by a more comprehensive and systematic analysis.



Species richness for select groups found in 27 Indian Ramsar Sites as compared with national records.

At the time of writing this article, proposals for inclusion of 10 additional wetlands to the List had been sent by the Ministry of Environment, Forest and Climate Change to the Ramsar Secretariat (6 from Uttar Pradesh, three from Punjab, and one from Maharashtra). These sites will increase the representativeness of the biodiversity of the northern plains and the Deccan region. With 37 designated wetlands, India will have the highest number of Ramsar sites in the South Asia and next only to Japan and China in Asia.

Yet, the current List is not representative of the diversity of wetlands in the country as is the objective of establishing the Ramsar List. Western Ghats and Islands are not represented and so are the coral reefs. Two of the three Central Asian Flyway bottleneck sites, Marine National Park (Gujarat) and Doyang (Nagaland) are still not part of the Ramsar network. The BNHS has identified over 200 wetlands that fulfilled waterbird related criteria of the Ramsar Convention. The List provides an excellent basis for further expansion of the Ramsar Site network.

MANAGING RAMSAR SITES – BALANCING THE GOALS OF BIODIVERSITY CONSERVATION WITH DEVELOPMENT. Article 3.1 commits the Contracting Parties to put in place management arrangements to ensure wise use of all wetlands within their jurisdiction. The goals of creating a List of internationally important sites for conservation of biological diversity and wise use are mutually reinforcing. The act of designating a wetland as internationally important under the Convention is considered as an appropriate first step along a conservation and sustainable use pathway, the endpoint of which is achieving the long-term wise (sustainable) use of the site.

The text of Ramsar Convention defines wise use as “the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development”. This recognizes the human interdependency with wetland functioning and accommodates sustainable utilization of ecosystems for the benefit of humankind in a way compatible with the maintenance of natural properties of the ecosystem. Emerging from an era of predominantly ‘protection’ and ‘wilderness preservation’ approaches to nature conservation, and much before the famed 1992 Rio Conference on Environment and Development wherein the term ‘sustainable development’ was coined, Ramsar’s wise use concept was indeed visionary in recognizing and articulating societal interdependencies in the quest for conserving nature.

The term wise use is often interpreted to indicate that human use of all wetlands is promoted by the Ramsar Convention; however, this needs very careful consideration. The most recent updation of the wise use definition was in 2005, wherein along with the definition cited in the previous paragraph, two footnotes were also placed. The first clarifies that ‘ecosystem approaches’ include the elements elaborated by the Convention on Biological Diversity – integrated management, stakeholders’ participation in decision-making, transparency about tradeoffs, and equitability of the outcomes. Mechanisms such as integrated river basin management, integrated coastal zone management respond to this aspect.

The second footnote expands the phrase ‘in the context of sustainable development’ to recognize that development, though inevitable in most cases, is not an objective for every wetland. Wherever development is to take place, it has to be facilitated in sustainable ways by approaches elaborated in the Convention. Thus, when the concept of wise use is examined from the lens of sustainability, the elements of wetlands ‘conservation’ and ‘use’ are reconciled to ensure that the ecosystem retains capability for use now and in the future, rather than ‘using’ or developing the wetlands at present. The onus of elaborating a pathway for achieving wise use outcome is on the management planning process.

Management of wetlands in India in general, including those designated to the Ramsar List, broadly falls within two clusters. Wetlands designated as protected areas, or located within the protected area network, is guided by the wildlife management planning framework. The framework in vogue is based on the 2004 Sawarkar guidelines for ‘planning wildlife management in protected areas and managed landscapes. The plans are structured in two sections, the first being an analysis of the existing situation in terms of ecological settings, history of management and present practices, and the situation in the zone of influence. Part two of the plan describes the proposed management in terms of vision, objectives and problems, management strategies, and interventions for monitoring, conservation education and ecotourism, ecodevelopment in peripheral areas and administration

of regulation. While the guidelines call for specific attention to wetland characteristics when being applied to wetlands, in reality, the management plans rarely refer to hydrological regimes and catchment influences. The institutional arrangements are primarily driven by wildlife management concerns, with the forest and wildlife department in the central role.

For various reasons, Keoladeo has become a role model for the management of most wetland protected areas. Creating stagnant pools of water, earthen mounds to enable birds to perch, plantation, installing bird watching facilities (such as bird hides, watchtowers, nature trails and walkways) are almost standard interventions in wetland protected areas across the country. Such management interventions may not always yield the desired results. An example can be seen in Nawabganj (near Lucknow, Uttar Pradesh, which is in the process of being designated as Ramsar Site), wherein alteration of the landscape by creating mounds and tree plantation led to a decline in the number of waterbird sightings.

Elsewhere, lack of consideration of hydrological regime interactions has proven to be counterproductive. In Keibul Lamjao National Park (Loktak, Manipur), while the numbers of brow-antlered deer have gone up due to the control of poaching, the habitat has considerably shrunk on account of the regulation of fluctuating water regimes for hydropower production.

The second category of management plans are those formulated as per guidelines of national wetland programme (NPCA or the National Plan for Conservation of Aquatic Ecosystems) of the MoEFCC. The programme encourages site management to be based on integrated plans, developed based on the diagnostic evaluation of wetlands features and threats, and covering interventions within the entire river basin or coastal zone. Such management plans have been prepared for Loktak, Chilika, Ashtamudi, Sasthamkotta, Harike, Wular and some other wetlands. Implementation of these plans entail interventions across multiple sectors and leveraging funds from ongoing schemes of the central and state governments. While the initial design was to fund an annual action plan linked with the long term plan, in reality, this coordination has seldom been achieved. Monitoring is mostly limited to activities, and the impact of management interventions on wetland condition is seldom known or assessed.

A management effectiveness evaluation of seven Ramsar Sites conducted by Wetlands International South Asia sheds light on this issue. Most of the site management scored low on management inputs (in terms of allocating human and financial resources) and processes (workplan development, inter-sectoral coordination, communication), resulting in limited outputs (completion of specific activities) and very limited outcomes (realizing actual positive change in wetlands condition or reduction in adverse threat or wetlands).

Presently, several important Ramsar Sites, such as Sambhar, Kolleru, East Ctalcutta and Deepor do not have an approved management plan. Revision of management plans is in progress for Point Calimere, Bhitarkanika, Upper Ganga and the Sunderbans. The multiplicity of guidelines for management planning also complicates matters for wetlands managers. There is an urgent need to harmonize guidelines (particularly the PA framework and the NPCA framework) and use a single point of reference for management of all wetlands.

Consistent financing of management actions remains an area of concern. While most of the approved protected area management plan receive funding support under the MoEFCC's Integrated Development of Wildlife Habitat scheme, funding for other wetlands has been erratic. In several cases, the activities for which funding is provided does not address the root cause of wetland degradation and thus produces no or very limited positive improvement in wetland condition.

For effectively conserving biodiversity, site-based planning may not be enough. For long distant migrants, conservation approaches may need to operate at a larger scale, such as migratory flyways (for waterbirds migrating along a migratory route) or even swimways (for fish) and corridors for range migrant mammals.

Most of the Ramsar sites face intense development pressures. These range from solid waste dumping (Deepor and East Calcutta Wetlands), flow regime alteration (Ashtamudi, Sasthakotta, Vembanad, Nalsarovar, Sambhar, Bhitarkanika, Point Calimere), aquaculture (Kolleru, Loktak), pollution (Harike, Kanjli, Renuka), land-use change (Rudrasagar, Loktak), unsustainable tourism (Chilika) and spread of invasives (Harike, Kanjli).

Replication of Bharatpur's habitat has not always led to increased waterbird numbers. This has been the case for Nawabganj, Uttar Pradesh

East Calcatta Wetlands were recognized as a wise use case even before its designation as a Ramsar Site

Wetlands International South Asia is working with several state governments on formulating integrated management plans. Yet, it is the systematic implementation of plans which needs urgent attention.

MONTREUX RECORD. Several Ramsar Sites are undergoing or have already undergone an adverse change in their ecological character. To bring priority attention to such sites, the Ramsar Convention maintains a list, in the form of Montreux Record (MR). Ramsar Sites are added to the MR at the request of the Contracting Parties, and the Secretariat may support the Contracting Party in addressing the threat by organizing a Ramsar Advisory Mission. The Mission, comprising wetlands experts, renders formal advice to the Contracting Parties on specific interventions required to rehabilitate wetlands.

India has thus far placed three wetlands on the Record, namely Keoladeo National Park (in 1990), and Chilika and Loktak in 1993. Two Ramsar Advisory Missions have been held for these sites (for Keoladeo in 1990; and Chilika in 2001).

Chilika was removed from MR in 2001 after the Advisory Mission recommended so, having taken into cognizance the efforts made by Chilika Development Authority in addressing wetlands degradation by reconnecting the lagoon to the sea, and putting in place a basin-wide integrated management and monitoring programme. Keoladeo and Loktak have continued to persist on the List for over three decades now. In the case of Keoladeo, the threat of invasion by Prosopis has been handled well through a comprehensive eradication programme taken up during 2000-2005. Issues related to the management of the grazing regime have also been handled reasonably. In 2017, the Park Authority organized a consultation meeting to revise the management plan for the Ramsar Site, and the issue of initiating a process for removal of Ramsar Site from Montreux Record. Wetlands International South Asia is working with the Forest Department to prepare the necessary documentation. However, no such process or discussion is underway for Loktak.

The core idea behind the creation of MR was to trigger priority action (in the form of management intervention) for addressing the degradation of a Ramsar Site. In reality, the use of MR as a mechanism has been on a decline. At the time of writing this article, 49 wetlands were listed by Contracting Parties on the Record, from a total of 82 wetlands included since the mechanism was introduced in 1990. The number of additions seems to have peaked during the 1990-1995 period. Of the 65 wetlands added then, 34 still continue to be on the MR at present. Since 1995, only 11 wetlands have been added to the Record, and since 2010, only one addition has taken place and two deletions. Asia and Oceania region, where many wetlands are in decline, have placed fewer wetlands on the Record.

In general, it appears that MR may have been interpreted as a 'naming and shaming' mechanism, rather than once incentivizing proactive action for addressing wetlands degradation. The case of Chilika stands out in this context, as the then Government of Odisha, used the MR listing as a rallying point for taking up wetland restoration measures. The value of MR as a governance tool needs reinvigoration and realignment with amore targeted implementation of the Convention.

MONITORING WETLANDS BIODIVERSITY AND ECOSYSTEM HEALTH. An important commitment linked with the designation of Ramsar Sites is to keep a tab on their ecological character by updating Ramsar Information sheet once every six years. This has been a challenge globally. Fortunately, the long-pending task of updating Ramsar Information Sheet for 25 of the 27 Ramsar Sites has been taken up by the Ministry in the last three years.

Monitoring systems for assessing wetlands biodiversity and ecosystem health remain the Achilles Heel of the national wetland programme. In fact, monitoring of wetlands, barring a couple of sites as Chilika and Bharatpur, is mostly done on an ad-hoc basis. Wherever biodiversity monitoring is done, it is largely confined to reporting presence or absence of taxa in the form of checklists. In several coastal Ramsar Sites wherein Wetlands International South Asia has worked in the last two decades, there has been a considerable reduction in recording of freshwater species as the ecosystem is progressing towards high salinity conditions. In the absence of a well-defined monitoring system, such changes go unnoticed for a long time.

Chilika has been a forerunner in introducing new management tools in the country, including bringing on board an ecosystem health report card system. Using a set of ecological and hydrological indicators, the CDA biennially conducts ecosystem health assessment in simple categories ranging from A+ (very good health) to F (very poor health). The tool is increasingly being improvised. The ecosystem health report card for Bhitarkanika, for example, also considers socioeconomic and governance variables. The MoEFCC recently piloted a light version of ecosystem health card in 130 wetlands and was able to zero down on sites requiring urgent management intervention by mapping ecosystem health scores with threat scores. Four Ramsar Sites (Sambhar, Harike, Kolleru and Rudrasagar) have ended up being on the list of wetlands needing urgent attention.

What is also needed is to make the current information on wetlands taxa more systematic and updated. The Zoological Survey of India and the Botanical Survey of India are a repository of information on plant and animal species, which needs to be compiled and made available in an easily accessible manner to researchers and managers. Citizen Science Initiatives such as Asian Waterbird Census Programme (now running for 30 years) have been recording January waterbird counts for various wetlands and has been an important tool not only for monitoring counts but also for promoting awareness on wetlands values. More recently, platforms like e-Bird have emerged as tools for converting count data into species distribution models and beyond. Such citizen science programmes can add much value to the site monitoring programmes.

WISA Photo Library

Chilika was delisted from Montreux Record after successful hydrological and ecological restoration

In the recent times, much emphasis has been laid on using Essential Biodiversity Variables (EBVs) as a putative set of parameters intended to be the minimum set of broadly agreed upon necessary and sufficient biodiversity variables for monitoring, researching and forecasting biodiversity. Alongside structural elements, these variables also capture species traits, community composition, ecosystem structure and function. Policy and decision making for wetlands biodiversity may be enriched by developing a monitoring framework along the lines of EBVs for Ramsar Sites.

The Government of India has just sanctioned a high-level national mission on biodiversity. This mission will involve a comprehensive documentation of India's biodiversity with the potential for cataloguing and mapping all life forms in India including associated cultural and traditional practices; assessment of the distribution and conservation status of India's biodiversity; development of a cadre of professionals adept at handling large sets of environmental data for management and monitoring of biodiversity; and expansion of knowledge in ecosystem functioning that will inform restoration efforts. The mission can be an important opportunity to systematize information on wetlands biodiversity, including that of Ramsar Sites.

POLICY FRAMEWORKS FOR CONSERVING WETLANDS AND THEIR BIODIVERSITY. India's ratification of Ramsar Convention in 1982, and the establishment of MoEF&CC (the then MoEF) in 1985 formed the backdrop of institutionalization of a national programming framework for wetlands, as well as the articulation of key policy elements within the national environment policy.

It is but natural that wetlands conservation policy and programming as we see today in India drew its roots from the recognition of their roles as waterbird habitats, drawing in parts from waterbird centric-wetlands conservation movements in Europe and North America. A national wetlands programme to support state governments in implementing integrated management plans was established in 1986, the programme currently known as NPCA.

The National Environment Policy of 2006 identifies wetlands as components of 'freshwater resources', and the recommended policy actions for wetlands conservation include integration in developmental planning, management based on prudent use strategies, promotion of ecotourism, and implementation of a regulatory framework.The National Biodiversity Action Plan (2014 Addendum to 2008 Plan) recommends the integration of wetlands in river basin management within 'in-situ' biodiversity conservation strategies. The policy also envisages the development of a regulatory regime. This articulation is similar to the emphasis on regulatory regimes for wetlands placed in National Environment Policy (2006). India's third wildlife action plan for 2017-2031 encourages landscape approach for wildlife conservation. It includes a specific chapter on 'conservation of inland aquatic ecosystems'. Key actions include 'identification of ecologically significant biodiversity safe zones and strengthening inland wetlands protected area network' and 'establishing a national wetlands mission'. Development of a national wetland biodiversity register is also envisaged. Similarly, the conservation of coastal and marine ecosystems includes actions for the conservation of mangroves, salt marsh and coral reef habitats.

India is located at the heart of Central Asian Flyway. Nearly 71% of the migratory waterbirds of the CAF use India as a stopover site. Sustaining the health of Indian wetlands is thus crucial for maintaining the waterbird populations within the Flyway. In 2018, the MoEFCC adopted a National Action Plan for Conservation of Migratory Waterbirds and their Habitats along the Central Asian Flyway. Its long-term goal is to arrest population decline and secure habitats of migratory bird species. In the short-term, the action plan seeks to halt the downward trends in declining meta-populations and maintain stable or increasing trends for healthy populations by 2027.

While the environment sector policies envisage integration of wetlands conservation in river basin management as well as developmental planning, the articulation in sectoral policies is not that strong. The National Water Policy (2012) recommends adoption of a basin approach for water resources management and identifies conservation of river corridors, water bodies and associated ecosystems as an essential action area. However, the value of wetlands as an important source of water, and as a sink for sediments and nutrients is very understated. The rampant loss of wetlands that the country has witnessed in the last four decades is seldom seen as a water security threat. The National Agriculture Policy does not make a reference to wetlands at all.

Wetlands receive protection from several rules. Wetlands (Conservation and Management) Rules, 2017 was notified under Environment (Protection) Act as the national regulatory framework for wetlands. As per the provisions of these Rules, State Wetlands Authorities have been constituted as the primary policy and regulatory bodies within the Rule. All Ramsar Sites need to be notified following a due process which includes placing a map in public domain, and enlisting prohibited, regulated and permitted activities. Till date, no wetland has been notified under the Rules.

One of the major regulatory gaps that is often exploited for degrading and encroaching upon wetlands is the lack of recognition of wetlands as a distinct land use category. Wetlands are mostly clubbed within the wasteland category, thus opening avenues for their conversion. The state of Uttar Pradesh has made a novel attempt of identifying over 0.1 million wetlands and recording them within the land-use records. There is an urgent need to emulate this example, as several

wetlands located outside the protected area network have private rights. In Loktak Lake, for example, much of the shoreline area is under private rights, and thus conversion of natural marshes into fish farms is rampant.

Lately, it is the judiciary that has been calling for increased accountability of the governments towards ensuring conserving wetlands, including wetlands designated as Ramsar Sites. The Supreme Court has on several occasions expressed displeasure on the limited progress made in notifying wetlands, and has requested State High Courts to monitor progress made in conserving Ramsar Sites.

IN CONCLUSION. For India, conservation of its biodiversity is crucial not only because it provides several goods and services necessary for human survival but also because it is directly linked with sustainable development. The crisis of biodiversity loss has been reiterated by several recent assessments, with dependent wetland species being at most risk. Concerted global action is required to halt and reverse the loss of global biodiversity. The Ramsar List makes an important contribution towards this cause. By designating wetlands to the international List, India is making her valuable contribution as a megadiverse country to this global goal. Sustaining and expanding this List is a virtuous goal and needs a strong policy and programming support. Future expansion of the List may consider the representativeness of wetlands types, as well as biogeographic balance. Consideration may also be given to life-cycle needs of species. A new site added to the List should also be viable, both in terms of ecological condition (by meeting Ramsar criteria on a continuous basis) and management arrangements.

It is also true that the designation to the Ramsar List is only a stepping stone, and to realize actual change, the Ramsar Sites need to be managed to achieve their wise use, encapsulating the objectives of preservation, protection, conservation and sustainable use. One would expect the management of Ramsar sites to be role model for other wetlands. Sadly, this is not the case. The quality and effectiveness of management is far from desired. There is limited evidence of good governance arrangements being put in place for these wetlands, and financing remains a cause of concern. The fact that it has taken, recently, the outbreak of avian botulism and deaths of a massive number of waterbirds at Sambhar, to highlight the rapidly worsening situation of the Ramsar Site is a telling tale on the state of affairs. The case of Sambhar is definitely not an isolated one.

Wetlands such as Khijadiya (Gujarat) fulfil several criteria of Ramsar Site designation

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Sarus Crane: Hard Life in the Complex and Changing World

Sarus Crane, a splendid example of mutual tolerance, faces many challenges in rapidly changing environs of developing India threatening its lasting survival. **Dr Asad Rahmani** (Member, Governing Body of Wetlands International South Asia) enumerates ever-growing challenges faced by Sarus Crane within central Uttar Pradesh and calls for proactive wetlands management and timely policy intervention to ensure availability of suitable habitats for this iconic wetland bird.

Human societies are complex, dynamic, and continuously changing. Human being is perhaps the only species that modifies its environment to suit its materialistic, economic, and emotional needs. Most wild species are happy to live away from human beings and human-modified world, but a few have learnt to live with human beings despite various challenges of concrete urbanised habitats. Some species are tolerated by human societies due to their aesthetic, religious, cultural and emotional believes. To the credit of the wild species, they also tolerate human presence – it is mutual tolerance. The Indian Sarus Crane *Grus antigone* is perhaps the finest example of this mutual tolerance. It is a large conspicuous bird of almost 2 metre, with specific habitat and food requirements. Sarus is considered as a sacred bird so not hunted in most of its distribution range in India (except in some tribal areas in central India).

As much is written on Sarus crane and a lot of literature/information is available on the internet, so I will not go into well-known facts. I will briefly describe the challenges that Sarus faces in the changing environment of developing India, based on my limited experience in central Uttar Pradesh. My study was conducted from 2017 to 2019 in seven districts of Uttar Pradesh (Sitapur, Lakhimpur-Kheri, Pilibhit, Shahjehanpur, Bahraich, Bariely, and Hardoi).

Sarus needs small shallow *jheel*, basically flood-plain wetlands formed during monsoon in natural depressions. This is the perfectly suitable habitat for drainage and cultivation, and this is what we see all around in the densely-populated Uttar Pradesh. Wetlands and *jheel*, called *jhabhar* in the local language, are under tremendous human pressure. According to the wetland data of the Space Application Centre, Ahmedabad, there are more than 27,000 wetlands in Uttar Pradesh. More than half (18,542) are less than 10 ha. These are the wetlands perfectly suitable for the Sarus Crane to breed, forage and rest. These are the wetlands that are in the process of drainage, cultivation and pollution.

Another problem that Sarus faces daily is the dense network of powerline. Like other large birds such as storks, bustards, eagles, cranes also have the problem of frontal visionary block due to their large head, placement of eyes on the

Bridesh Kumar

Dr Asad Rahmani

sides and a large beak. They can see sidewise but not in the immediate front, resulting in frequent collision with powerlines. In our two-year study, we found three cases of Sarus death after hitting the high-tension powerlines, and know another eight cases of Sarus death due to the same reason. In long-living, slow breeding species, any death of adult individuals due to unnatural causes - even if it is less than 5% per annum - results in the decline of the population.

Death by powerlines and wind mills is a new major threat to many birds and bats. In a remarkable study by Mohibuddin of Wildlife Institute of India, it was shown that nearly 18,700 birds die per month due to powerlines in Jaisalmer district alone. Gopi Sundar and B.C. Choudhury were the first to highlight the mortality of Sarus due to powerlines in Mainpuri and Etawah district. They found that about 1% of Sarus die every year after hitting the wires. We need more studies on Sarus Crane in the Sarus landscape to know the real impact of wire network on the survival of Sarus.

Another major threat is the menace of free-ranging stray dogs. Not only Sarus, but nearly 80 Indian species are directly impacted by dog menace. A dog is not a problem for an adult Sarus but eggs and chicks are in danger. In small, shallow, and disturbed wetlands, Sarus chicks are a constant threat to a pack of dogs. An insidious threat of dog menace is abandonment of an area where dogs are regularly seen. It has been shown by many scientific studies that regular presence of dogs, even if they are leashed, reduces bird diversity and abundance. We have millions of free ranging dogs killing and injuring wildlife in India.

Conservation problems do not come alone. Many have multiplier impact when two or three problems work together in tandem. As the cliché goes, the total could be much more than the sum. For example, after harassment by dogs, a Sarus is forced to fly away, and during flight it hits high tension wire and dies or gets injured. The Sarus may not have been killed by the dog directly, but it may get electrocuted by powerlines as it escapes the ground predator. As dog numbers increases and powerline network spreads, there will be more and more chances of electrocution of Sarus. We have to control this dog menace by the total elimination of stray dogs before they eliminate the State Bird of Uttar Pradesh.

Change in cropping pattern is another issue that will impact, or may be impacting even now, Sarus populations. Our studies show that Sarus can live in paddy and wheat growing areas but avoid sugarcane fields. As the crop pattern changes and more and more small wetlands are taken over by urbanization and cultivation, Sarus may have a huge problem in the future in finding a suitable habitat for nesting and foraging.

Earlier studies by Gopi Sundar and B.C. Choudhury, and my two-year study shows that the breeding success of Sarus is highly dependent on the normal rainfall pattern. Sarus pair needs three to four years of normal rainfall to nest, incubate and raise chicks. It is not only the quantum of rainfall that is important but the pattern of rainfall, falling regularly throughout the monsoon season. Sudden deluge disrupts the breeding, so does the long dry spells. The former creates flooding while the later results in water reduction in the jheel, thus exposing the nest/chicks to ground predators. It is likely that the vagaries of monsoon/drought resulting from climate change will bring more trouble for the Sarus Crane.

Human population increase, conversion of small wetlands, menace of dogs, spread of powerlines, pollution, and climate vagaries are not going to make life easy for our iconic wetland bird. We need policy and administrative interventions on the issue of wetland conservation, control of stray dogs, powerline placement, and control of water pollution before it is too late.

*Sarus crane **Grus Antigone** in a natural marsh habitat*

Dr Asad Rahmani

Lessons Learnt from the Loss of Small Wetlands in South Korea: Adaptive Strategies for India

Traditional knowledge and cultural heritage play a crucial role in conserving wetlands. This philosophy is shared by **Prof. Gea-Jae Joo** (Pusan National University, Busan, Korea), **Hogyeum Joo** (Columbia University, New York, USA), **Dr Yuno Do** (Kongju National University, Gongju, South Korea) and **Dr Ji Yoon Kim** (National Institute of Environment Studies, Tsukuba, Japan) while proposing adaptive strategies for their management in India taking inspiration from the lessons learnt during Korean urbanization era in the 70s and 80s.

Prof. Gea-Jae Joo

Despite the unclear definition of the concept 'small wetlands', the Resolution on 'Conservation and Management of Small Wetlands' was first adopted during the Ramsar COP 13 in 2018 in Dubai. The Resolution reflects on the need for understanding the current status of small wetlands, and urges for appropriate actions that can tackle this issue as urbanization accelerates. The small wetlands around the world are facing an imminent threat, especially in underdeveloped communities, from development pressures such as land-redevelopment, expansion of agricultural fields, and urbanization.

My research group at Pusan National University traced the changes in historical distribution of wetlands in lower Nakdong River (South Korea) between 1918 and 2011, and found that 90% of the small wetlands in the floodplain were lost due to anthropogenic influences that are related to development and urbanization (Im et al., 2017). During the 1960s and 1970s, wetlands were directly lost by reclamation and development of agricultural land, mainly rice paddies. In the floodplain, levees were first constructed on wetlands to protect crop fields from the flood. The roads that were constructed as supporting-infrastructure for the farms and crop fields fragmented the wetlands into smaller parts.

Since the 1990s, factories were built on wetlands and rice paddies. Due to the rapid industrialization and express road construction, individual factories and industrial complexes were built on peri-urban area. These are clear reflections of the change of the nation's priority from agriculture to heavy industry. During the last 30 years, the concentration of human population in the urban areas has been giving further pressure to relocate the factories and industrial complex to peri-urban zone, which are richer in the numbers of small wetlands.

During our first visit to India in 2005, which was made to attend the Asian Wetland Symposium in Bhubaneswar, Odisha, numerous small waterbodies near each village in Chilika Lagoon fascinated us. We were very intrigued, and decided to conduct a research project to identify the current status of the ponds – wetlands, or 'village ponds' in Chilika Lagoon Basin. With the support of Chilika Development Authority, we conducted the survey. First, we made a geographical analysis of the physical dimensions (distribution, size, elevation, etc) of the wetlands using Geographic Information System software. Secondly, in order to investigate the current status and usage of the ponds, we visited nearly 100 villages and conducted interviews with the local villagers. A ground-truthing process to increase the accuracy of geographic analysis was also done during the interview process

A total of 6,077 ponds (total area of ponds: 19.6km^2, catchment area: 6,200 km^2, population: approx. 690,000) were identified from the Chilika basin and it was about 3.7% of the total catchment. Distribution density was 11.5/km^2 with an average size of 3211±8834 m^2. We were amazed to identify such high numbers from such a small catchment in India. Furthermore, we categorized the ponds into four types based on their primary purposes – residential, irrigation, aquaculture, and religious ponds.

According the survey, we found that the village ponds serve as a source of ecosystem services to the communities, such as drinking water source, bathing place, irrigation, pisciculture, cultivation of leafy vegetables, breeding of native fishes and habitat for migratory birds. We conducted several studies on village ponds in other parts of India with different rainfall regimes Even though their size and density were slightly different, no significant differences in distribution patterns were identified.

A temple tank in Bhubaneswar, Odisha

Our concerns and recommended actions for this unique and interesting landscape take inspiration from the lessons the Koreans learned during the urbanization era in the 70s and 80s. Majority of the underdeveloped country sides of Korea were designated as a target for the government-lead modernization project titled New Village Movement (*'Saemaul Undong'* in Korean). The New Village Movement primarily aimed to be a community development movement that can improve villagers' quality of life with diligence, self-help and cooperation between communities as a foundational idea. The New Village Movement greatly improved the perceptions of the villagers in many ways – sanitation, education, economy and others. Furthermore, the Movement also included the improvement of physical environments – expansion of roads, construction of laundry facilities, changes to modern building materials from old and organic building materials. This has drastically changed the cultural landscape of Korea.

Traditional houses and infrastructures were all replaced with machines and modern materials. Traditional knowledge and cultural heritage that formed the cultural landscape of the non-urban areas were often discarded or replaced for efficiency, not giving importance to its traditional values – use of natural resources, village landscape layout and the philosophy behind locating village infrastructures. We hope that the Government of India recognizes the values such as history, traditional knowledge, and the cooperative community-spirit behind the village ponds when it comes to modernization and development of the not-yet-urbanized areas.

By 2030, more than 60% of the global population is expected to live in urban areas. India is also experiencing a similar urbanization pattern. During the last decade, Indian Government has launched several national campaigns such as "Clean India Movement" and "Smart Village". These national level movements will certainly alongwith economic pursuance and environmental welfare will uplift the quality of life in rural landscape.

We highlight suggestions to the Government of India to adopt the essence of traditional knowledge in conserving and managing small wetlands as cultural heritage. In order to do so, firstly, an interdisciplinary approach to appreciate the role of the wetlands is recommended. Understanding the current status of the wetlands and their services to society will help in providing a whole new vision towards this philosophy. Future village development plans should recognize the values of 'small wetlands' towards biodiversity and local communities, which will promote inclusive development culture in India.

Management Planning for Wetlands within Protected Area Landscapes

Harmonisation of wetlands management with wildlife management planning processes is crucial for the conservation of wetlands located within and around the Protected Areas network.

Dr Ajit Pattnaik,
(Vice-President, Wetlands International South Asia) and Former Principal Chief Conservator of Forests, Government of Odisha highlights the co-benefits of synergistic planning.

Protected areas (PAs) are the cornerstones for in-situ conservation of biological diversity. Their importance ranging from conservation of biological diversity, storehouses of genetic material, provision of essential ecosystems services for human welfare, and contribution to sustainable development, have been recognised at multiple levels.

Dr Ajit Pattnaik

Wetlands form a part of the Protected Area landform mosaic. As per rapid assessments done by Wetlands International South Asia, the 870 protected areas have over 8,400 wetlands of area >2.5 ha within their boundaries, spanning an area of 3.2 million ha.

Wetlands conservation in India draws its roots from protected areas management. Decades of work on Indian birds and passion of conservationists such as Salim Ali have laid the foundation of a network of wetland protected areas supporting large congregation of waterbirds. Vedanthangal, Keoladeo, Khijadiya and Rangathituu were designated as protected areas under the colonial laws and regulation.

Settings up of PAs at times have been marked with conflicts with local communities living inside and fringe areas of the forest for generations. The 2002 amendment of the Wildlife Protection Act introduced provisions for conservation reserves and community reserves, which integrate local communities and even private organisations in protected area management. Since then, several wetlands have been designated into the category, key being Charidhandh (Gujarat), Gharana, Hokera, Hygam, Mirgund and Tsomoriri (Jammu and Kashmir), Kokkare Bellur, Aghnashini and Puttenhalli (Karnataka), Kadalundi (Kerala), Ropar and Keshopur Chhamb (Punjab), and Asan and Jhilmil (Uttarakhand).

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Protected areas such as Nalsarovar, Gujarat face immense pressure from hydrological regime change

It has been debated widely nationwide on the governance of PA area management, particularly the role of protected area managers and the community. Institutional linkages between protected areas (protected landscapes) and the production landscape are essential. Most

protected area agencies have little or no mandate for the economic development of the production landscape, which are invariably beyond the PA boundaries. Protected area authorities can increase their influence in the production landscape by developing good working relationships with the stakeholders, including local communities with the authority, expertise, and budget to support economic activities in the buffer-zone areas.

Several wildlife areas in India are interspersed with human habitations, and various infrastructures and a variety of human activities. The PA is central to the conservation of wild biological diversity within such landscapes, generally acting as a source areas to counterbalance the negativity of sink areas, including managed forest outside. Given that PAs and even production landscapes are embedded in a complex mosaic of land use that is often human-dominated, the participation and cooperation of people is imperative for landscape-scale conservation to succeed.

The impact of protected areas on local community and economy could be positive or negative. The positive impacts of the local community can include direct revenue from environmental protection and the ecosystem services. The negative impacts can range from the displacement of local communities to crop damage by wildlife, and sometimes include restricted access to resources and changes in land tenure. Management of protected area and the level of community involvement vary significantly between individual protected areas, organisations and countries, and concerning their management paradigms and form of governance. The landscape approach entails managing multiple land uses in an integrated manner, taking into consideration both environmental conditions and the human needs that depend on the protected area ecosystems.

It is increasingly recognised that wildlife conservation in PAs has to go beyond the species conservation to the ecosystem-based management at the landscape scale. The National Wildlife Action Plan (2017-2031) adopts a landscape-scale level approach in the management of protected areas, and it acknowledges the importance of conservation of inland aquatic ecosystem within the protected areas. It recognises that multiple governance framework and structures administer wetlands in India.

Overlapping jurisdictions, divergent mandates and limited coordination hinders various agencies from working effectively in managing the wetlands. For example, the Wildlife Management Plans are formulated under Wild-life (Protection) Act, based on the guidelines of the National Wildlife Action Plan (NWAP). Though there is specific mention about including the wetlands in the wildlife management plan but in reality, it is treated nothing more than a water hole. In spite of several important Ramsar sites (such as Pong, Keoladeo, Point Calimere, Bhitarkanika, Renuka, Harike to name a few) are within the protected area, management of these important wetlands with an ecosystem approach is never embedded in the wildlife management plan.

Management planning for wetlands requires explicit consideration of functioning within landscapes, particularly hydrological and hydrodynamic processes which determine the habitat conditions and ecosystem service values of specific sites. Given the uniqueness of each wetland, a diagnostic approach which is based on careful evaluation of wetland features and their governing factors is required. The Ministry of Environment, Forest and Climate Change has recently notified guidelines for integrated wetlands management planning, which enlist a step-wise approach to formulate such a plan.

It is imperative to develop synergies between the Wildlife Management Plan and the Integrated Wetland Management Planning processes. One option could be to include the Integrated Wetland Management Plan in the section “Conservation of inland aquatic ecosystem” of the Wildlife Management Plan. This would meet the objectives of the National Wildlife Action Plan (2017-2031) that adopts a land-scape scale level approach for management of PAs with an ecosystem approach.

*Saltwater crocodile **Crocodylus porosus** in mangroves of Bhitarkanika Wildlife Sanctuary*

Dhruv Verma

Essential Biodiversity Variables for Monitoring Wetlands Ecosystem Structure

Long-term biodiversity monitoring within wetlands has always been challenging due to its resource intensive nature. With the advancements in Space Science and Technology there exists an opportunity which can enable and facilitate this complicated task. **Prof. J.K. Garg** (Honorary Treasurer, Wetlands International South Asia) and **Dr Ridhi Saluja** (Technical Officer - Wetlands Ecology, Wetlands International South Asia) endorse and promote the concept of satellite-derived Essential Biodiversity Variables (EBVs) by demonstrating their application for understanding structural changes within Bhindawas wetland, a refuge for migratory birds in the state of Haryana.

Prof. J.K. Garg

Aichi Targets adopted for 2020 under the Convention of Biodiversity (CBD) stresses for protection of biodiversity by safeguarding ecosystems, species and genetic diversity. Various global assessments indicate that despite continued conservation efforts biodiversity has declined due to an increase in anthropogenic pressures. In order to achieve Aichi Targets in an effective manner, availability of supporting information on regional and global patterns of biodiversity change, drivers of change and effectiveness of conservation policies/actions is crucial. Being resource intensive, long-term biodiversity monitoring programs are difficult to sustain. Henceforth, the concept of Essential Biodiversity Variables (EBVs) was developed by the Group on Earth Observations Biodiversity Observation Network (GEO BON) taking inspiration from Essential Climate Variables. This concept is efficient and supports coordinated monitoring programmes across the world.

EBVs are defined as the derived measurements required to study, report, and manage biodiversity change, focusing on status and trend in elements of biodiversity (GEO BON). Indicator variables have been grouped into six classes for identification of a minimum set of EBVs: genetic composition, species populations, species traits, community composition, ecosystem structure and ecosystem function. The current form of reporting does not include all classes of EBVs largely due to unavailability of monitoring data. Cost efficient remote sensing based Essential Biodiversity Variables (EBVs) are increasingly being used as a tool to assess and monitor biodiversity in conjunction with in situ measurements using ecosystem structure as an indicator.

Wetlands form refuge to several endangered, endemic and migratory species which makes them critical for biodiversity conservation action. Changes in wetland biodiversity depends on land cover/dynamics in the catchment, nonetheless, wetland structural components (within wetland features) per se reflect changes in biodiversity. These changes can be monitored with satellite remote sensing data of high spatial and temporal resolution.

Thus, to identify and highlight the impact of changes in wetland structure on wetlands biodiversity, a study was carried out on Bhindawas wetland, the largest wetland in the state of Haryana (28º37' N, 76º40'E; 70 km from Delhi). Remote sensing-based EBVs as indicators of wetland structure were derived using

Dr Ridhi Saluja

Indian Remote Sensing (IRS) Resourcesat-2 LISS IV data for summer and winter season of the years 2014 and 2015 (Figure 1). Seven different habitat types were identified within the wetland which support different floral and faunal species ranging from phytoplanktons to floating and emergent macrophytes, fishes, birds, reptiles and mammals.

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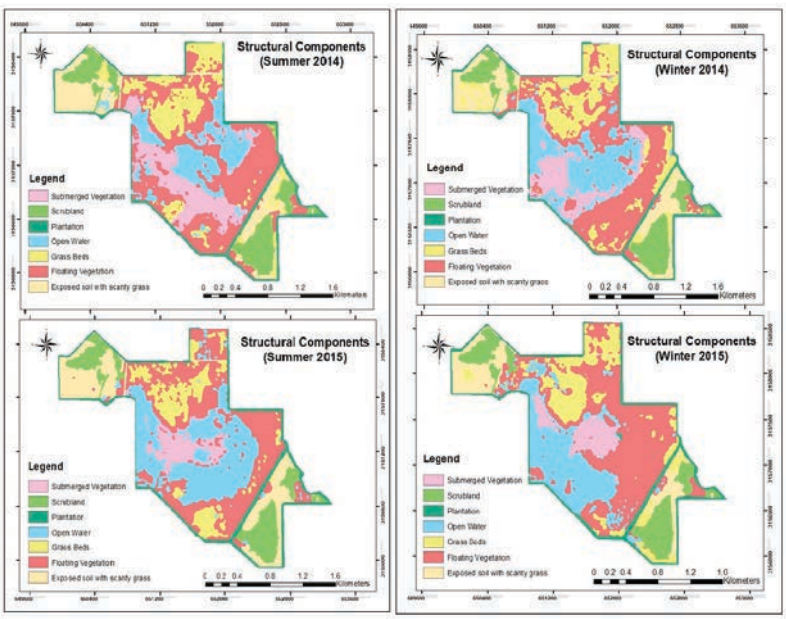
High seasonal and temporal variability as represented by patch density points towards a non-consistent trajectory of wetlands structural components highlighting its susceptibility to hydrological alterations. Fragmentation of wetland components adversely impacts the species migration within the patches. Increasing dominance of a habitat type such as floating vegetation which is largely represented by invasive species such as *Eichhornia species*. threatens the loss of faunal species which prefer other wetland macrophytes as their feeding and breeding grounds and is also supported by the wetland evenness index. An incessant decrease in diversity index of the wetland components accentuates the loss of habitat types available for different wetland species dependent on the wetland at certain stages of their lifecycle.

Essential Biodiversity Variables (EBVs) as indicators of structural changes for Bhindawas wetland

EBVs for Wetlands structure	Summer 2014	Winter 2014	Summer 2015	Winter 2015
Patch density	73.03	74.47	53.91	53.65
Edge density	210.65	221.81	189.34	173.48
Diversity index	0.937	0.943	0.923	0.908
Evenness index	1.82	1.83	1.8	1.76

EBVs thus allow mapping and understanding of changing wetland ecosystem structure in an easy and readily manner at high spatial and temporal resolution. The concept of EBVs can be propagated across other wetland ecosystems of the country to develop a baseline and evaluate structural changes occurring in these ecosystems. EBVs will further facilitate assessments and management applications to sustain supporting ecosystem services of the wetlands.



Wetland Structural Components of Bhindawas in 2014 and 2015 based on Resourcesat 2 LISS IV data.

Dr Ridhi Saluja

Protected Areas like Bhindawas wetland, Haryana are prominant habitat for migratory birds

Building a Common Future: Wetlands, Biodiversity and People

Pragmatic outlook towards conservation management helped to secure diverse habitats supporting rich biodiversity in Sri Lanka. The capital city Colombo has been accredited as a RAMSAR Wetland site during the 13th Conference of the Parties to the Ramsar Convention on Wetlands (COP13) in Dubai 2018. **Dr Priyanie Amerasinghe** (Senior Researcher, International Water Management Institute) presents Sri Lanka as a success model case showcasing ways in which natural infrastructure and urban development can go hand in hand

Dr Priyanie Amerasinghe

Sri Lanka became a signatory to the Convention on Biological Diversity (CBD) in 1994. Its vision for 2050 includes a clear message 'living in harmony with nature' – which calls for a closer look at the contribution natural infrastructure makes in providing the basic resources for human wellbeing. This is particularly important as ecological landscapes are changing rapidly as a consequence of human interventions. Wetlands are a good example of resource filled natural ecosystems that can convey the vision of the CBD, providing a clear example of the constituent components and life, interactions among the living and non-living systems and the overall ecological functions, and how these serve societies.

If we are to build a common future, humans have to visualise their environment as a shared space with shared resources for a myriad of interacting plants and animal species. Complex species interactions are responsible not only for increasing ecological productivity, but also for enhancing the 'ecosystem services' that people depend on for their livelihoods and wellbeing. Deciphering the intricate interactions that maintain the balance of ecological functions is somewhat complicated. A finely balanced, healthy system which contributes to a healthy sustainable planet is what we need. Therefore, the CBD's call to action should be taken very seriously as we plan in the next decades to achieve both the UN's sustainable development goals (SDGs) and the Aichi targets.

The tropical island nation of Sri Lanka, situated in the Indian Ocean encompasses a land area of 65,610 km^2. It comprises 103 major rivers and associated flood plains and marshes, and over 12,000 irrigation tanks (natural and man-made) harbouring wetland species that are unique to Sri Lanka. Due to ancient hydraulic system-based irrigation practices, Sri Lanka has a rich agro-biodiverse landscape that has flourished for many centuries and has created ecological habitats that are unique.

In Sri Lanka, wetland ecological diversity covers an array of ecological habitats, covering marine and coastal habitats, sea grass beds, coral reefs, sea coast saltwater lagoons and mangroves, inland freshwater ecosystems, marshes, rivers and streams, rock pools and man-made reservoirs. In each of these wetland systems faunal and floral species interactions enrich the ecosystems and contribute to Sri Lankan wetlands being listed as biological 'hotspots' in the national and IUCN red lists of important species. Hotspots are the earth's most biologically rich—yet threatened - ecosystems, and need thoughtful development of conservation plans if they are to survive.

*Sri Lanka blue magpie **Urocissa ornate** found exclusively in Sri Lanka is listed as endangered.*

*Asian elephant **Elephas maximus** in Wilpattu National Park, Sri Lanka.*

Overall, the ecosystems record 336 ferns and their relatives, 3,154 flowering plants, 1,492 invertebrates (including 253 land snail species and 245 butterflies), 748 vertebrates (including 240 birds, 211 reptiles). Apart from this, species unique to the island nation are also high. For instance, presently, a quarter of the 3,000 vascular plants occurring in the country are unique to Sri Lanka. The highest rates of species unique to Sri Lanka are recorded for amphibians, freshwater fishes and reptiles among the indigenous vertebrates (43%) (excluding marine forms). With a 1,620 km of coastline, rich marine and coastal biodiversity report 208 species of hard coral and 756 species of marine molluscs. In addition, more than 1,300 species of marine fish are to be found in the coral reefs, mangroves, sea grass beds, salt marsh vegetation.

Why is wetland biodiversity important? Biodiversity supports healthy ecosystems that increase productivity and provide much needed economic support to people (if managed sustainably). It is said that 40% of the world's economy and 80% of the needs of the poor are derived from natural resources, but in addition, they are also a part of culture, religion and identity (reports state that 231 species are formally used as national symbols in 142 countries). Some of the wetland species of plants help stabilize coastlines and reduce the impacts of sea waves and climate change.

The strategic direction of the vision of the CBD needs a better understanding of how people and societies value biodiversity. Wetland and biodiversity losses can be influenced by many drivers. For instance, according to the latest report by The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), the major drivers impacting biodiversity loss are, changes in land and sea use; the direct exploitation of organisms; climate change; pollution; and invasive species. It is also clear that the general lack of awareness, the tendency to require quick economic gains and the pressure to achieve developmental targets have resulted in massive wetland ecosystem losses in many countries including Sri Lanka.

In Sri Lanka, the preservation of wetlands has a high priority, incentivized by the Ramsar accreditation of the city of Colombo and the moratorium on reclamation of wetlands in Colombo. The Country is also a signatory to the Ramsar Convention on the conservation and wise use of wetlands, which gives a prominent place to biodiversity. The new investors in development are also looking at wetlands as part of a green investment portfolio, which appears to match with the global outlook for sustainable businesses. According to The Economics of Ecosystems and Biodiversity (TEEB) initiative, the global sustainable business opportunities of investing in natural resources could be worth US$ 2 to 6 trillion by 2050. Sri Lanka should also strive to invest in natural infrastructure, to preserve its biodiversity taking into consideration the number of legislative instruments and the policies and strategic action plans the country has developed over the past decades. The country should bring together the different sectors for better synergistic effects as the world visions on Wetlands and Biodiversity celebrating the Wetlands Day 2020.

Conservation Perspectives of Coastal Wetlands of India

COASTAL WETLANDS EXTENT AND DISTRIBUTION. Coastal wetland constitutes about 27 % of the country's total wetland area covering 4.1 million hectares. These wetlands stretch across the Indian coastline of 7516 km extending from Gujarat to Kerala on the western coast and from West Bengal to Tamil Nadu on the eastern coast and also the islands of Lakshadweep and Andaman & Nicobar. The dissimilarities between the west and east coasts of India are remarkable. The west coast is generally exposed, with heavy surf and rocky shores and headlands, whereas the east coast is generally shelving, with beaches, lagoons, deltas and marshes. Climatic variability along the coasts results in marked hydrographic differences affecting overall productivity and qualitative composition of fisheries along these coasts. Lakshadweep islands are characterised by oceanic atolls whereas Andaman & Nicobar are largely continental in nature. While Rocky outcrops, mudflats, lateritic shorelines, narrow funnel-shaped estuaries and backwater areas dominate the western coasts, delta-forming estuaries, sand dunes and wide beaches depict the eastern coast. India harbors 30% of the world's coral reefs and 10% of its mangroves. Intertidal mudflats with 15.82% of coastal wetlands area constitute the largest proportion followed by mangroves (3.09%), lagoons (1.61%), creeks (1.35%), salt marshes (1.05%), coral reefs (0.93%), and sand/beach (0.41%).

COASTAL WETLANDS AS MIGRATORY BIRD HABITAT. Many birds which inhabit the coastal wetlands of India are migrants and travel annually along the Central Asian Flyway (CAF). Minimum 223 species of birds were recorded from the coastal wetlands of India, which belong to 30 families of which 91 species were residents, 80 were trans-continental migrants, 37 resident migrants, four species of vagrant and one species of strangler. Nearly 75 species are seabirds found in marine environments. Of these, 56 species regularly nest along Indian coasts due to which 61 wetland sites have identified as Ecologically Sensitive Areas (ESAs) by Salim Ali

Dr K Sivakumar

Coastal wetlands have been identified as ecologically sensitive areas. They are important habitats for migratory birds.
Dr K Sivakumar (Senior Faculty at the Wildlife Institute of India, Dehradun) highlights that in spite of several conservation efforts and strategies in place, coastal wetlands remain vulnerable to high risks of adverse change resulting from developmental activities and anthropogenic stressors. Since millions of people are dependent for their livelihood on these wetlands their conservation and sustainable use should be one of the key issues seeking proactive participation from concerned stakeholders.

Dr K Sivakumar

Sundarbans Tiger Reserve is home to several marine fauna and flora

Intertidal flats with seagrasses

Centre for Ornithology (SACON). Intertidal mudflats from various states dominate these ESAs. Intertidal mudflats spanning 24,000 km^2 while acting as fish spawning areas and feeding grounds support large populations of ducks, shorebirds, gulls, terns, and flamingos during their annual cycle for breeding, nesting or shelter.

THREATS AND CHANGES.

Coastal wetlands are faced with numerous direct and indirect pressures and are lost at a much faster rate in comparison with terrestrial ecosystem. Primarily, the wetland loss is attributed to the reduction in wetland area or reduction in wetland functions due to five major reasons: wetland conversion, changes to water regime, decreased water quality, overexploitation of wetland resources and introduction of exotic invasive species. Climate change along with increased incidence of extreme events and sea level further intensity these impacts on coastal wetlands. For example, along the Godavari estuary, about 42 sp.km areas of mangroves were initially converted into mudflats between 1977 and 1988 and then to aquaculture ponds from 1988 to 2016. Similar scenario has been observed at the Gulf of Khambhat where 28.66 sq km area of high tidal mudflats has been eroded within a span of just three and a half years - from 2014 to 2017 at the annual erosion rate of 3.5 to 4 km per year. Other coastal wetlands, such as mangroves are also experiencing a coastal squeeze and are increasingly being restricted to a narrow patch. Loss of these impacts is directly related to the drastic decline in numbers of waders worldwide varying from 60-80% during the last three decades.

CONSERVATION OF COASTAL WETLANDS.

Protected Areas network largely serves as a tool to manage and conserve coastal wetlands in India. 25 coastal and marine protected areas have been recognized along with Indian coastline, the notable ones being Gulf of Mannar Marine National Park, Sundarbans National Park, Gulf of Kuchchh National Park, Bhitarkanika National Park, Coringa Wildlife Sanctuary, Chilika Wildlife Sanctuary. 106 marine protected areas have been identified in the islands of India. Designation of Important Coastal and Marine Areas (ICMBA) and Communities Reserves further strengthens the conservation of several biodiversity species. In addition, initiatives such as Mangrove for the Future serve as a platform for promoting interagency and inter-sectoral collaboration among various countries addressing issues related to coastal wetlands conservation and livelihood issues. In spite of, several conservation efforts and strategies in place coastal wetlands still face high risks of adverse change resulting from several anthropogenic pressures ranging from developmental activities, pollution to unsustainable resource use, Since millions of people are dependent for their livelihood on these wetlands their conservation and sustainable use should be one of the central issues seeking proactive participation from concerned stakeholders.

Wetland Flora of the Indo-Gangetic Basin

A valuable contribution to systematic botany, Christopher D. K. Cook wrote the *Aquatic and wetland plants of India* in 1996. The book describes in detail the vascular aquatic angiosperms, serving its purpose as a relevant field guide even in the present scenario. The Gangetic ecosystem forms a unique environment for hydrophytic, semi-hydrophytic and submerged floral association occurring in various habitat types.

Dr Bhupendra Singh Adhikari

During a recent field trip along the Indo-Gangetic Basin, we recorded a total of 289 plant species including herbs, shrubs and trees, representing 88 families and 219 genera. Of these, 77 plant species were wetland plants; identified on their characteristic habitat preferences like aquatic, riparian and terrestrial. The diversity of wetland plants was recorded low in upper and middle stretches of the river. This may be due to the topography and high-water velocity. While in the lower stretch of the river the diversity of wetland plants recorded was high with several unique species.

FREE FLOATING plants remain in contact with water and air only. They are generally found in stagnant water logged conditions or in areas where water flow is low. Examples include: Water Hyacinth *Eichhornia crassipes,* Four Leaf Clover *Marsilia quadrifolia,* Duck Weed *Spirodela polyrhiza,* Water Lettuce *Pistia* stratiotes and Water Chestnut *Trapa natans.*

SUBMERGED plants are rootless and remain in contact with water completely. They often inhibit the natural growth of other aquatic plants and also block the gradual water flow in the ecosystem. Examples include: Horn Wort *Ceratophyllum demersum*, Water Thyme *Hyrdilla verticillate*, Eel Grass *Vallisneria natans*, Crested Floating Heart *Nymphoides cristata*, Curled Pond Weed *Potamogeton crispus*, Long Leaf Pond Weed *Potamogeton nodosus*, Needle Leaf *Potamogeton* octandrus and Ribbon Weed *Stuckenia pectinata*.

Gangetic ecosystem supports a wide array of wetland plants which are unique and threatened. **Dipti Dey** and **Megha Shruti** (Project Fellows) and **Dr Bhupendra Singh Adhikari** (Senior Faculty at the Wildlife Institute of India, Dehradun) documented the floral diversity of wetlands in the Indo-Gangetic Basin under National Mission on Clean Ganga project, highlighting the threats and the need for conservation.

Dipti Dey

Megha Shruti

Semi-submerged: Water Hyacinth
Eichhornia crassipes.

Submerged: Curled Pond Weed
Potamogeton

Moisture loving: Water Primrose
Ludwigia adscendens

SEMI-SUBMERGED WITH FLOATING LEAVES are plants that remain in contact with soil, water and air. They grow in marshy habitats. Occasionally the whole plant body may remain submerged into the water and only the flower and leaves grow on the water surface. Examples include: Lotus *Nelumbo nucifera*, Blue Water Lily *Nymphaea nouchali*, White Water Lily *Nymphaea pubescens*, Red Water Lily *Nymphaea rubra* and Arrow Head *Sagittaria sagittifolia*. Distinguishing features like leaf variations (dissected or entire) in plant species such as Cursed Buttercup *Ranunculus sceleratus* and Water Speedwell *Veronica anagallis-aquatica* serve for adaptation in aquatic and marshy habitats.

MOISTURE LOVING plants are rooted in the soil, usually saturated with water, at least in the early growth stages and generally grow along the edges of wetlands. Examples include: Alligator Weed *Alternanthera philoxeroides*, Sessile Joy Weed *Alternanthera sessilis*, *Indian* Pennywort *Bacopa monnieri*, Indian Coinwort *Centella asiatica*, Job's Tears *Coix lacryma-jobi*, Fart Weed *Lindernia antipoda*, Bearded Knot Weed *Polygonum barbatum*, Water Pepper *Polygonum hydropiper*, Pale Knot Weed *Polygonum lapathifolia* and Small Knot Weed *Polygonum plebeium*.

Wetland vegetation aids in natural purification, provides food to humans, and used as medicine for different ailments. Riparian agriculture in the floodplains of the Ganga is quite common. Cultivation of economically important plants like Lotus and, Water Chestnut are frequent in adjacent wetlands. The less important weed flora like Water Hyacinth *Eichhornia crassipes* and Horn Wort *Ceratophyllum demarsum* is used as an indigenous source of chief fertilizer and compost manure. At times, the rapid growth of such weeds may lead to the choking of the wetland, which may reduce the productivity and free movement of aquatic organisms.

Unrealistic regulatory actions and anthropogenic disturbances bring about adverse changes to the fragile wetland's ecosystems directly impacting the floral composition and diversity. The densely populated Indo-Gangetic Basin faces various kinds of anthropogenic disturbances resulting in the continued habitat loss of several wetland floral elements. Plant assemblages act as an indicator of a healthy ecosystem, hence their conservation is vital to obtain optimum benefits (ecosystem goods and services) from wetlands. And thus, this may require a major shift in policies related to land and water resources.

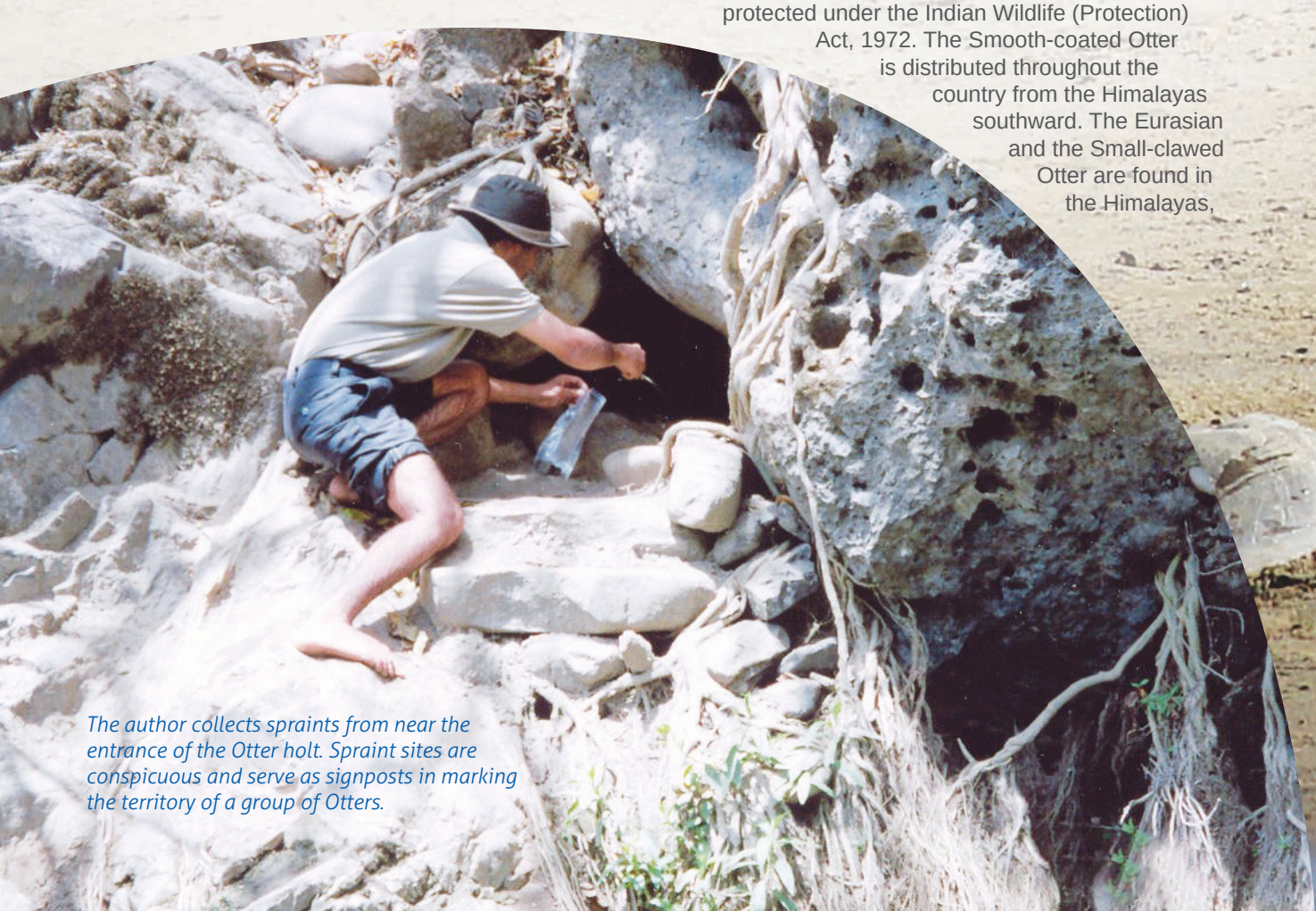
Free Floating: Duck Weed
Spirodela polyrhiza

Wetland Corridors: Keystone Habitats for Otter Conservation

Often considered as an indicator species of the riparian ecosystem, Otter populations over much of their distribution range are fragmented and threatened. **Dr Asghar Nawab** (Programme Head-Aquatic Ecology, Wetlands International South Asia) discusses the pitfalls in protecting only isolated oases of suitable habitat for Otters. An alternate strategy is to protect and restore wetlands as 'habitat networks' or 'connective corridors' particularly in non-protected stretches to improve habitat quality and support species viability.

The first time I saw Otters in the wild was in Corbett National Park along the River Ramganga. It was in the year 2000, late November; the Wildlife Institute of India had initiated a long-term study on Otter conservation ecology in the Corbett National Park. As a researcher in the project, I was thrilled to set up a field base camp in the Sarapduli Range of the National Park. During field sampling I relied on collecting data based on indirect evidences; following Otter track-sets, recording grooming signs, mapping spraint sites and locating den sites. Otters were difficult to sight. Moreover, being in an elephant and tiger country the task was daunting and the tough terrain added to the challenge. Winters had set in and usually the evenings were early. One day, after completing the rigorous field sampling exercise the team decided to retreat the jungles, a little early before the sun set. We had walked a few meters further in the direction of the field base camp when I heard some strange 'squeaky' sound and small barks coming from the river shore. Curious I quickly went back. To my surprise, it was a pair of Otters engaged in playful bouts, rolling on the sand bank. Soon they went back into the water and joined their 'raft' which was fishing. They were noisy, diving into the water and surfaced soon with a fish in their mouth to bite into while floating on the water. I was mesmerised. Anyone, who has seen an Otter will agree that there is something charming and, engaging about this species.

Otters are small, semi-aquatic carnivores and members of the large mammalian family called Mustelidae.Of the thirteen species found worldwide, three species viz; Eurasian Otter *Lutra lutra,* Smooth-coated Otter *Lutrogale perspicillata* and the Small-clawed Otter *Aonyx cinereus* are found in India. They are legally protected under the Indian Wildlife (Protection) Act, 1972. The Smooth-coated Otter is distributed throughout the country from the Himalayas southward. The Eurasian and the Small-clawed Otter are found in the Himalayas,



The author collects spraints from near the entrance of the Otter holt. Spraint sites are conspicuous and serve as signposts in marking the territory of a group of Otters.

to the north of the Ganges and in southern India. Occurrence of all three species has been reported from north-east India and the Western Ghats. While some measure of research has been established, Otter conservation efforts in India are inadequate such that our management decisions are often uncertain towards its benefits, or no decisions at all for want of empirical data. Occurrence of Otters is associated with clean water and undisturbed habitat with prey availability. They occur along extremely variable habitat, ranging from large rivers and wetlands to peat swamp forests, mangrove forests and coast and estuaries. Their amphibious nature allows them to disperse over wide areas of riparian landscape and as a consequence influence the ecological processes of the floodplain in a direct and expansive manner. They are threatened in many areas; owning to increasing dependency on aquatic resources and changing land use practices, riparian habitats have become fragmented leading to poor species dispersal isolating the populations. Outside Protected Areas, Otters are often in direct conflict with fishermen who view them as vermin or competitors for fish and kill them. While there is general awareness of the trade in wildlife and its derivatives in India, there is little information on the extent and prevalence of illegal trade in Otter skins, and consequently the threats to the species.

Being social, Otters live in large family groups often claiming kilometres of riverine stretch or hundreds of hectares of wetland as a territory. In 1995 a radio-telemetry study conducted by Dr S.A Hussain in Chambal River recorded that an adult male can traverse approximately 17km of riparian stretch in a single night. Thus, it is essential to recognize that individual reserves or protected areas will seldom be large enough to support self-sustaining Otter populations. Wetlands can serve as keystone habitats for Otters in degraded landscapes. This is possible through creation of corridors of suitable riparian habitat linking wetlands allowing for free movement, and re-colonization. Recent such conservation efforts have seen Otters returning to their natural habitat; such as, in the mangrove zone of the Ashtamudi wetland in Kerala state and Mhadei, Mahavir, Mollem and, Netravali protected areas of Goa state. It is thus essential to develop species conservation management strategies at the landscape level integrating wetlands as stepping stones for reinforcing locally low populations. This will give imperiled species a chance to come back from the brink of extinction.

Dr Harendra Singh Bargali

Otters are shy and elusive species often difficult to sight in the wild

Hydrogeomorphic Approach as a Tool for Analyzing Wetlands Functional Capacity

Due to their hydrological and ecological functional capacity, wetland ecosystem forms a crucial component for managing river basins. Different wetland types based on their location within the river basin perform different functions with varied capacity. **Dr Ridhi Saluja** (Technical Officer-Wetlands Ecology, Wetlands International South Asia) and **Dr Santosh Palmate** (Technical Officer-Water Management, Wetlands International South Asia) bring forth the Hydrogeomorphic (HGM) approach as a tool which can be adopted by the water and wetland managers to understand wetlands functioning, identifying priority restoration areas and facilitating their integration within river basin management plans.

WHY TO ASSESS WETLANDS FUNCTIONS?


Dr Santosh Palmate

Wetlands being an important landscape element, perform a host of ecological functions and provide innumerable 'ecosystem services. Despite their diverse values, wetlands are suffering due to lack of consideration within resource development plans. Apart from enduring wetland degradation and loss, our ability to conserve, manage and restore wetland ecosystems falls short, largely attributable to lack of tools for rapid and plausible assessment of their values. The capacity to apply such tools is also limited within a small pool of wetland experts. Wetlands, important in a geographic region, are not necessarily recognized for their functions due to lack of rapid field quantification techniques, conservation and restoration efforts are seldom successful majorly owing to impractical goals for wetlands functioning in a region.

OVERVIEW OF AVAILABLE METHODS. To address these issues, simple, rapid and verifiable approaches have been developed for assessing wetlands functions with an intention of large-scale replication, spatially and temporally, supporting wetlands management and strengthening wetlands science. Development and proliferation of these approaches has found motivation from wetland regulatory programs of different continents including Americas, Europe and Australia. Approaches developed can be classified into three categories: multi-objective multi-ecosystem landscape level assessment, rapid wetlands assessment methods and wetland site-specific tools. Methods developed for wetlands assessment, for instance Wetland Evaluation Technique (WET), Wetland Rapid Assessment Procedure (WRAP), Hydrogeomorphic (HGM) method, Habitat Evaluation Procedure (HEP) and Freshwater Mitigation Quality Assessment Procedure (WMQA), rely on professional judgement and experience ensuring efficient and rapid assessment.

Wetlands functional assessment using HGM approach

1. Classifying wetlands using HGM approach

- Establishment of wetlands classes /subclasses for the region

2. Developing functional assessment models

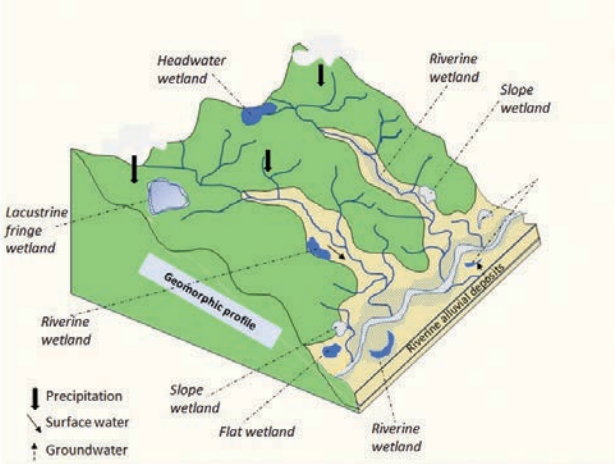
- Identify wetland functions
- Identify variables to denote each wetland function
- Establishing relationship between variables
- Field test the model and develop protocol
- Representative Reference wetlands as functional benchmarks

3. Implementation of assessment protocols

- Characterize project area
- Define assessment area
- Field Data collection
- Functional capacity of wetlands

HYDROGEOMORPHIC METHOD (HGM) FOR FUNCTIONAL ASSESSMENT. HGM is a widely accepted method for wetlands functional assessment around the world. Initially developed by Brinson and later modified by Smith, Hydrogeomorphic (HGM) assessment approach necessitates hydrologic and geomorphic wetlands classification within a narrowly defined regional subclass along with application of information derived from other wetlands of the HGM subclass to develop and calibrate assessment standards. HGM evaluates ecosystem functions of a wetland regional subclass prior to project impact or restoration and to estimate the degree of change post alteration. HGM approach to functional assessment of wetlands, as shown in the Figure 1, is characterized by three interrelated components: wetlands classification by HGM approach; articulation of wetland functions within assessment model and implementation of assessment protocols on site.

HGM classification, in contrast with other classification schemes, allows to focus on smaller subset of wetlands sharing similar structure and functions segregating natural variability within a region. It emphasises geomorphic and hydrologic attributes (water source and hydrodynamics) which fundamentally influence how wetlands function recognizing seven distinct wetland classes: Riverine, Depressional, Slope, Lacustrine, Mineral Soil Flats and Organic Soil Flats. These broad wetland classes can be further subdivided into regional subclasses in order to reduce variability and increase sensitivity for assessment of functional capacity with a specified region.



Wetlands classification using HGM approach within a landscape

ADAPTING HGM APPROACH FOR RIVER GANGA BASIN. Wetlands International South Asia is collaborating with Uttar Pradesh State Wetlands Authority to assess the functional capacity of wetlands within 27 River Ganga districts of Uttar Pradesh. The HGM approach, introduced in this article, will form the basis of formulating management plans and integration in water resourse managment plans.

Landscape of Upper Ganga River wetland at Mubarakpur, Uttar Pradesh

Dr Ridhi Saluja

Impacts of Hydrological Fragmentation on Aquatic Biodiversity along Farakka, Lower Ganga

Although the surge for development has evolved civilizations across major riparian stretches in India it has brought its peril on the aquatic ecosystem. The construction of Farakka barrage forms a classic example. **Kalpana Ambastha** (Research Associate, Wetlands International South Asia) and **Harsh Ganapathi** (Technical Officer – Water Management, Wetlands International South Asia) present the deleterious impacts on the floral and faunal composition along Farakka in Lower Ganga.

Harsh Ganapathi

The Farakka Barrage was built in India in 1975. The purpose was to improve the hydrological regime and navigability of the Bhagirathi-Hoogly river system. This was achieved by diverting adequate quantity of Ganga waters through a 40 km long feeder canal. The headwaters of the barrage discharges around 40,000 cusecs. This increased water supply reduces salinity and ensures fresh water supply to Kolkata and surrounding areas. The Ganges water sharing treaty, signed by India and Bangladesh in 1996 intends to last for 30 years, specifically addressing water flow during the dry season (January-May), stipulating that Bangladesh will receive at least a minimum water flow or at least 50% of the water flow. Given its geographical position, India holds a strategic advantage over Bangladesh which receives ninety four percent of its waters from bordering nations.

River systems are dynamic and obstruction of water flows is likely to alter how sediments get distributed in a natural system. This came in limelight recently with the severe floods in the Indian states of Uttar Pradesh and Bihar. The sediment build-up upstream of the Farakka barrage has raised the riverbed forming two islands in the upstream, which is said to have worsened the flood situation in the two states.


Kalpana Ambastha

From the perspective of natural science, floods are integral components of the eco-hydrological cycle. They cause damage, but as the floodwater recedes, it leaves behind rich silt and sediments, which have made the Gangetic plains the “rice bowl of South Asia”. Floods have been a regular phenomenon in Uttar Pradesh and Bihar.

However, the real problems emerge when the floods become severe, or

when they start depositing sand instead of silt. High sedimentation in Hooghly can be traced back to 17th Century but is known to increase after the building of Damodar Dams in post-independent India. Sedimentation loads in Rivers are often known to exceed the estimated limits as in the case of Hirakud (Odisha) in which the accumulated silt has almost filled up the dead storage capacity of the dam.

Despite establishing a direct road and rail commute link to the North-Eastern region with rest of the country, the barrage's construction has often been blamed for reducing water flow, causing salinity ingress and drying up of the Sundarbans delta in Bangladesh. While the barrage has created a hyposaline environment in the western Indian Sundarbans, it is said to be a major contributing factor in making the central sector hypersaline. This has led to reduced freshwater in the central zone of Indian Sundarbans resulting in the decline of freshwater-tolerant mangrove species *Heritiera fomes* locally called Sundari, an endangered species after which Sundarbans has been named. Altered water regimes have caused habitat fragmentation.

Before commissioning Farakka barrage in 1975, there are records of the *Tenualosa lisha* or Hilsa and India's national aquatic animal, the Gangetic River Dolphin *Platanista gangetica* migrating from Bay of Bengal right up to the Yamuna in New Delhi. In Buxar in Bihar, which is situated about 650 kilometres upstream the Hilsa fish was abundant. Post Farakka barrage there has been nearly 100% decline of Hilsa above the barrage. The freshwater zone now extends much downstream till Diamond Harbour. 172 fish species are reported from the Hooghly-Matlan estuarine complex, 73 occupy the freshwater zone and 99 occupy saline gradient zone.

Much of the catch is from the high salinity zone wherein Hilsa comprises 51% of the catch. The Gangetic River Dolphin is disappearing and rarely seen in the waterways of the Indian Sundarbans due to rise in salinity in the water, sedimentation and reduced freshwater flow. A National Mission for Clean Ganga (NMCG) report says, the Dolphin population which was once more than 10000 in 19th Century have been reduced to a mere 3526 in 2014. However, as reported the impact on biodiversity, fisheries and fisher livelihoods in Bangladesh is not a very positive story. The Gangetic River Dolphin, Pabda fish *Ompok pabda* and Hilsa fish have become rare in the River Padma.

The unilateral diversion of the Ganges water at Farakka barrage has caused a series of adverse environmental and ecological problems both upstream and downstream of the barrage. Not only does it affect the aquatic ecosystem and hydrological regime but also agriculture and livelihood on a large scale. The persistent ill effects of the barrage will only ameliorate the seriousness of major environmental problems such as drought, flood, saline intrusion, dry disease of mangrove forest and scarcity of freshwater.

The National Mission for Clean Ganga aims to oversee and protect the biodiversity of the Ganga River. The proximate goal is to achieve Ganga River conservation by restoring the ecological character of the river so that viable populations of all endemic and endangered aquatic species occupy their historical range and fulfil their role in maintaining the integrity of the Ganga River ecosystem.

Mangroves in Sundarbans are dependent on freshwater flows from the Ganga River

NEWS

INTECOL 2020

New Zealand will host the 11th INTECOL International Wetlands Conference in Christchurch during 18-23 October, 2020. With traditional knowledge and innovative science in wetland research and management as its theme, the conference will facilitate knowledge exchange around wetlands traditional knowledge and uses.

World Lake Conference 2020

International Lake Environment Committee Foundation (ILEC) will host the World Lake Conference (WLC) 2020 in Guanajuato, Mexico during 9-14 November, 2020. Since its inception in 1984, World Lake Conference is known to offer a platform for participants from different sectors to facilitate exchange of ideas and experiences on the sustainable management of lakes and their basins.

World Water Week 2020

Stockholm International Water Institute (SIWI) is organizing World Water Week 2020 in the city of Stockholm, Sweden during 23-28 August, 2020. The theme for 2020 is 'Water and Climate Change- Accelerating Action' with a specific focus on innovation, science and actions needed to face the challenges posed by climate change.

Adaptation Futures 2020

India will co-host the Adaptation Futures 2020 in Delhi during 27-30 April, 2020. Adaptation Futures is the flagship event of the World Adaptation Science Program, which is one of the four components of World Climate Programme. As a premier event in the global adaptation spectrum, Adaptation Futures 2020 presents an ideal opportunity to give visibility to the adaptation requirements of generating significant dialogues around actionable solutions.

Namami Gange program supports wetlands conservation in Uttar Pradesh

The National Mission on Clean Ganga (NMCG), Jal Shakti Mantralya of Government of India has provided support to Uttar Pradesh State Wetlands Authority for implementing a project on 'Conserving and Sustainably Managing Gangetic Floodplain Wetlands of Uttar Pradesh'. In this yearlong project, Wetlands International South Asia will provide technical support and hand-holding in project implementation for wetlands inventory and assessment, management planning, wetlands monitoring and, capacity development and outreach.

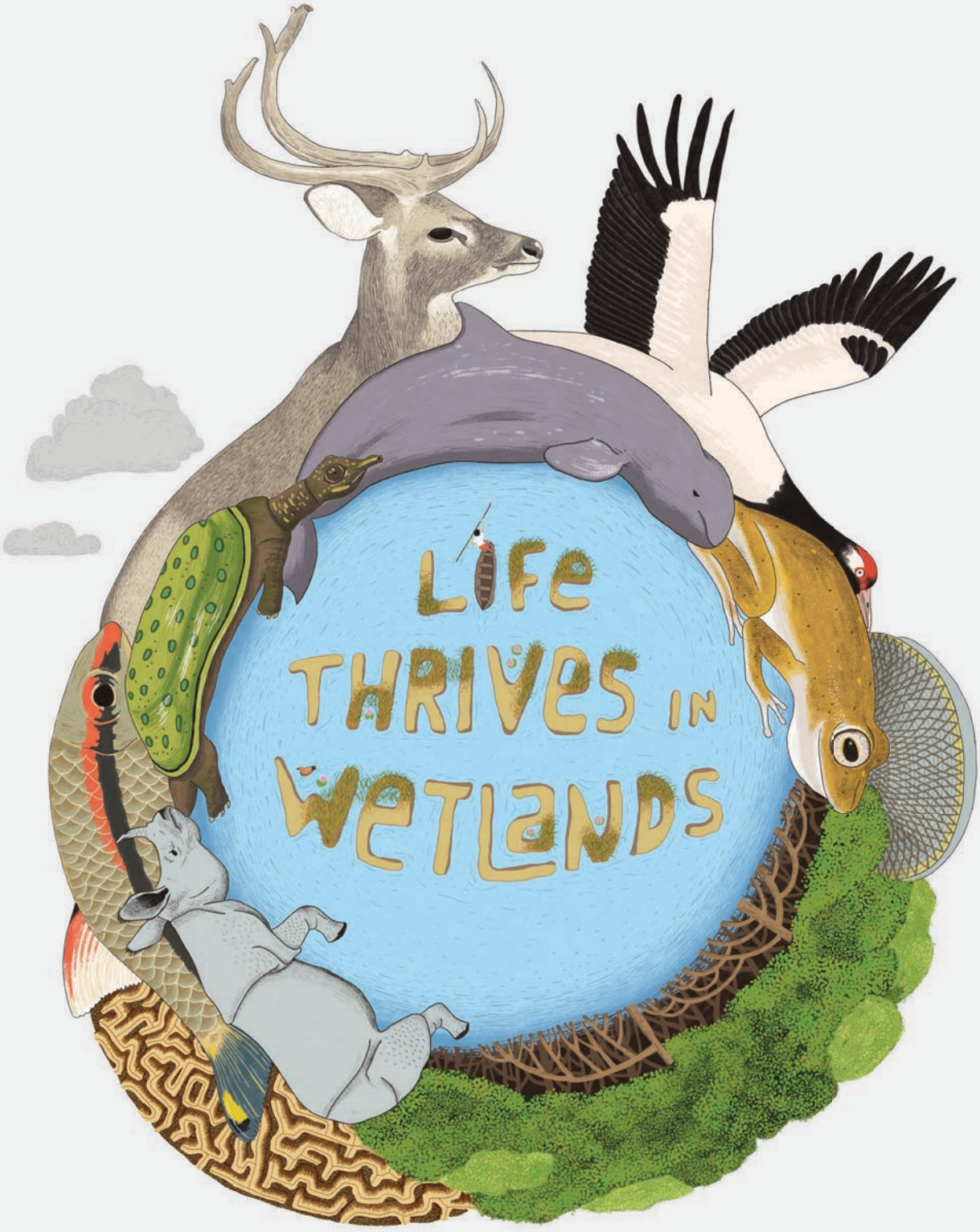
Wetlands included within India's State of Forest Report 2019

The India State of Forests Report 2019 was released by the Environment Minister, Shri Prakash Javadekar on 30 December, 2019. The report provides an assessment of wetlands within recorded forest area. 62,466 wetlands covering 3.83% of Recorded Forest Area have been enlisted.

Wetlands
INTERNATIONAL

World Wetlands Day

2 February



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