सत्यमेव जयते

INDIA'S



UPDATED NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN

In alignment with

Kunming-Montreal GLOBAL BIODIVERSITY FRAMEWORK

A ROAD MAP FOR CONSERVATION OF INDIA'S BIODIVERSITY

2024-2030

Government of India

Ministry of Environment, Forest and Climate Change

National Biodiversity Authority

सत्यमेव जयते

INDIA'S



UPDATED **NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN**

In alignment with

Kunming-Montreal GLOBAL BIODIVERSITY FRAMEWORK

A ROAD MAP FOR CONSERVATION OF INDIA'S BIODIVERSITY

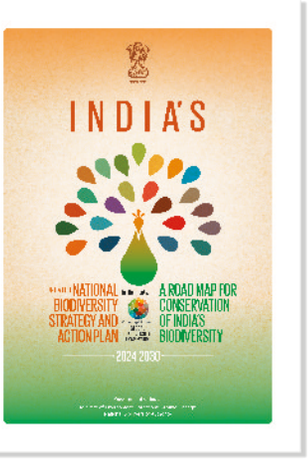
2024-2030

Ministry of Environment, Forest and Climate Change

Government of India

Ministry of Environment, Forest and Climate Change

National Biodiversity Authority



Cover

The updated India's NBSAP is in alignment with KM-GBF. The CBD Secretariat has developed and adopted a logo for KM-GBF, and issued guidelines to Parties and other users for using this logo through a branding toolkit. This logo shows 23 distinct elements, representing 23 Global Biodiversity Targets (GBTs), forming a unified whole that reflects the interconnectedness, illustrating the need for global action. Cover also reflects a picture of the National Bird of India i.e, Peacock (*Pavo cristatus*) incorporating 23 National Biodiversity Targets (NBTs) in coloured feathers. The detailed description of each NBT provided in Chapter 2 appropriately depicts colours of 23 elements adopted by the logo of KM-GBF.

© copyright MoEFCC 2024

Published by
MoEFCC, India

Supervisory Team
Shri Tanmay Kumar, IAS, MoEFCC
Shri C. Achalender Reddy, IFS (Retd.), NBA
Shri Raghu Kumar Kodali, MoEFCC
Dr. B. Balaji, IFS, NBA
Dr. Achuta Nand Shukla, MoEFCC
Dr. Ruchi Pant, UNDP

Drafting Committee
Dr. P. K. Mathur, UNDP
Dr. J. Soundrapandi, UNDP
Dr. Gayathri Shanbhag, NBA

IT Support
Shri N. Singaram, NBA

Disclaimer
The contents of this document may be freely used for academic citation purposes with due acknowledgment. However, no part of the publication may be reproduced, stored in a retrieval system, or transmitted in any form, or by any means, electronic, mechanical, photocopy, otherwise, without the permission of the copyright owner.

Design & Print
Xpressions Print & Graphics Pvt Ltd
#9219552563
Doc- XPS1010242402

Note
Any error that might have crept in unintentionally, if noticed may please be brought to the notice of National Biodiversity Authority to the email id: secretary@nba.nic.in

---

Citation
MoEFCC, 2024. India's updated National Biodiversity Strategy and Action Plan [2024-2030]- In alignment with Kunming - Montreal Global Biodiversity Framework, A Road Map for Conservation of India's Biodiversity, Government of India, Ministry of Environment, Forest and Climate Change, New Delhi. Pp. 204

मंत्री
पर्यावरण, वन एवं जलवायु परिवर्तन
भारत सरकार

Minister
Environment, Forest and Climate Change
Government of India

भूपेन्द्र यादव
BHUPENDER YADAV

foreword



India's vast expanse has been blessed with an enormous bounty of nature, fascinating natural ecosystems, magnificent wild flora, and spectacular wild fauna. India's rich culture, traditions, folklore, and ethos have immensely helped in the maintenance of the country's biodiversity. India ranks eighth amongst seventeen megadiverse countries, despite being the most populous and one of the fastest growing economies of the world. The country is home to four global biodiversity hotspots and we are taking all necessary measures to protect, conserve and promote sustainable use of our rich biodiversity and also share the benefit derived from the use of biological resources by putting in place the necessary administrative and legal framework.

A number of pathbreaking initiatives have been undertaken under the leadership of Hon'ble Prime Minister for protection and sustainable use of biodiversity through the launch of Mission LiFE - Lifestyle for Environment - a global mass movement aimed at bringing about behavioural changes linked to environment friendly lifestyle, launch of International Big Cat Alliance (IBCA), MISHTI (Mangrove Initiative for Shoreline Habitat and Tangible Incomes), to name a few. Besides, India has most recently undertaken new campaign of planting trees through Plant4Mother (Ek Ped Maa ke Naam) campaign launched by Hon'ble Prime Minister on the occasion of World Environment Day on 5th June. The target of planting 80 crore (800 million) trees by September, 2024 has already been achieved and it is proposed to plant 140 crore saplings (1400 million) by March, 2025.

India has been at the forefront of protection and conservation of our rich biodiversity and I am delighted to present India's third -generation 'National Biodiversity Strategy and Action Plan (NBSAP)' which is fully aligned with the Kunming-Montreal Global Biodiversity Framework (KM-GBF). The plan has been updated through a wider consultative process conducted across the country involving 23 Central Ministries, several National and State-level organizations, communities, and other stakeholders following a "Whole-of Government" and a "Whole of society" approach. The NBSAP aptly summarizes the country's efforts towards conservation of biodiversity, highlighting achievements, identifying gaps and threats, and describes strategies and result-oriented action points to achieve the 23 National targets set up and adopted in accordance with the Global Biodiversity Targets. The NBSAP includes a monitoring framework based on a wide array of biodiversity indicators. The plan emphasis the adoption of a transformative approach and focuses on ecosystem-based management approach, a bottom-up approach for planning, implementation, mainstreaming biodiversity, sectoral integration, and inter-agency cooperation. The plan also provides an insight into the current status of biodiversity across the country and trends therein, existing policy and institutional framework, biodiversity expenditure, and potentially possible biodiversity finance solutions. I am sure the proposed strategies, action points, and specific interventions included in the NBSAP would contribute meaningfully towards the realization of conservation goals and achieving National Biodiversity Targets.

I would like to place on record my deepest appreciation of the earnest efforts made by the senior officials of the Ministry of Environment, Forest and Climate Change (MoEFCC) and National Biodiversity Authority (NBA) in steering the whole process related to the updating of NBSAP. I also compliment the professional teams of the MoEFCC, NBA and United Nations Development Programme-India for their valuable contributions in planning the implementation of various phases involved in the updating of NBSAP, assisting in stakeholder consultations and such other activities. This challenging task would not have been possible without guidance, resource inputs, and data sharing by the concerned Ministries, Departments and Organizations, and the Working Group of NBSAP. I am thankful to all Agencies as well as individuals for their untiring contributions. I am sure that the concerned Central Ministries and State Governments would not only mobilize the desired finances but would also extend required support for timely implementation of the planned interventions as envisaged by the NBSAP. I wish all success for the ownership and implementation of the updated NBSAP by all the stakeholders which is so very crucial for the protection, growth and conservation of our rich biodiversity.

30-09-2024

(Bhupender Yadav)

कीर्तवर्धन सिंह
KIRTI VARDHAN SINGH

राज्य मंत्री
पर्यावरण, वन एवं जलवायु परिवर्तन
विदेश मंत्रालय
MINISTER OF STATE
ENVIRONMENT, FOREST AND CLIMATE CHANGE
EXTERNAL AFFAIRS
GOVERNMENT OF INDIA

message



Humanity, today, is facing the challenges of environmental crisis *viz.*, change, pollution and biodiversity loss. These human-induced crises have put all life forms at enormous risk and threatened their lives. Biological diversity, an essential ingredient for the healthy planet, human well-being, food security, climate change mitigation and adaptation, and sustainable development, is diminishing at an unprecedented rate. India, being a signatory to several international Conventions and other multilateral environmental agreements, is conscious about its global obligations, national aspirations, and local commitments and is adopting a holistic approach in meeting these challenges. In the process, India has created desired policy, legal and institutional frameworks, mobilized communities, adopted innovative approaches incorporating modern technologies, and developed the enabling environment. However, these efforts need strengthening.

I am pleased to note that the Ministry of Environment, Forest and Climate Change (MoEFCC) and the National Biodiversity Authority (NBA) have collectively updated India's National Biodiversity Strategy and Action Plan (NBSAP) aligned with the Kunming-Montreal Global Biodiversity Framework (KM-GBF). The updated NBSAP includes 23 National Targets which are to be achieved by 2030. The NBSAP envisages taking urgent actions to halt and reverse biodiversity loss, so that nature can be put on a path of recovery for the benefit of people and planet by conserving and sustainably using biodiversity and by ensuring the fair and equitable sharing of benefits from the use of genetic resources.

I compliment the efforts made by the officials of the MoEFCC, NBA and other concerned Ministries/Departments, including the Working Group of experts who have contributed towards the updating of NBSAP. I would also like to appreciate the efforts of policymakers, decision makers, professionals and communities that were involved in updating the NBSAP for their valuable contributions. I am confident that all the stakeholders would join hands together for the timely and effective implementation of the NBSAP in the overall interest of our environment and rich biodiversity.

(Kirti Vardhan Singh)

Ministry of Environment, Forest and Climate Change

सत्यमेव जयते

LiFE Lifestyle for Environment

लीना नन्दन, आई.ए.एस
Leena Nandan, IAS

सचिव
भारत सरकार
पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय

Secretary
Government of India
Ministry of Environment, Forest and Climate Change

message



Biological Diversity is the natural heritage of humankind and essential for ensuring overall sustainable development. India has a rich tradition of conserving biodiversity. Local communities have coexisted peacefully with Nature for centuries through a mutually beneficial relationship. However, increased biotic pressure, overburdened natural ecosystems and climate change have adversely impacted both natural and man-made ecosystems, leading to a decline in biodiversity and, a reduction in ecosystem services.

The UN Convention on Biological Diversity (UNCBD) adopted the 'Kunming-Montreal Global Biodiversity Framework (KMGBF)' in December, 2022 with a Mission 2030 and Vision 2050. The Framework envisages that Parties would fix their own national targets that are aligned with global biodiversity targets; update their existing National Biodiversity Strategy and Action Plan (NBSAP); and adopt a transformative approach so as to effectively contribute towards the global biodiversity agenda.

I am pleased to inform that India is one of the few countries that has successfully updated the NBSAP. The plan specifically elaborates on the priority needs relevant to community engagement, strengthening of Biodiversity Management Committees at the field level, communication, public awareness, capacity development, technology incorporation and resource mobilization.

The team comprising officials from the Ministry of Environment, Forest and Climate Change and the National Biodiversity Authority has done commendable work in updating the NBSAP. I would also like to compliment the members of the Working Group, subject matter specialists, and professionals from different Ministries and Agencies who have made significant contributions through extensive consultations, collation and analysis of information and consensus building.

I am confident that all the stakeholders would collectively ensure the timely and effective implementation of the National Biodiversity Strategy and Action Plan in India.

New Delhi
September 30, 2024

(Leena Nandan)

तन्मय कुमार, आई.ए.एस
विशेष सचिव

Tanmay Kumar, IAS
Special Secretary

भारत सरकार
पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय

Government of India
Ministry of Environment, Forest and Climate Change

message



The conservation and sustainable use of biological resources is essential not only for our own well-being but also for combating climate change which is a universal challenge and has to be faced both locally and globally. Through the forum of United Nations Convention on Biological Diversity (UNCBD) international agencies, national and sub-national governments, NGOs, and communities have been making collective efforts to protect, restore, and conserve ecosystems, species, land races, wild crop relatives and animal breeds for the benefit of the present and future generations. Recent global assessments have amply revealed declining trends in biodiversity. This is a worrisome situation and calls for an urgent action to halt and reverse the process of weakening of natural fabric vital for life on Planet Earth.

We have collectively worked to prepare the third-generation National Biodiversity Strategy and Action Plan keeping in view the emerging requirements at the global, national, state, and local levels. The updated NBSAP envisages a paradigm shift from a top-down approach to a bottoms-up approach and a 'degrade-abandon-migrate' practice to a ' restore-sustain-protect' model in natural resource management. The NBSAP ensuring effective stakeholder participation inclusive of women, youth, marginalized, and vulnerable sections of the Society, decentralized responsibilities, devolved power and authority, and intergenerational equity in planning and implementation. The NBSAP has a comprehensive biodiversity monitoring framework developed through an extensive consultative process. Several ministries, departments, organizations, and agencies will be involved in its execution as the lead or supporting agencies.

I compliment the entire team from the MoEFCC, NBA, UNDP, and all the experts and stakeholders who have dedicatedly and meticulously contributed towards updating the NBSAP in alignment with Kunming-Montreal Global Biodiversity Framework (KMGBF). National Biodiversity Targets, which are part of NBSAP have been prepared in accordance with national circumstances, priorities and capabilities.

I look forward to the mainstreaming of the NBSAP in the programmes and policies of all the stakeholders and its implementation following the "Whole of Government" and "Whole of Society " approach as it is only then that we can collectively work towards implementing the NBSAP at the field level and achieve its targets meaningfully by providing a biodiversity rich ecosystem to the present and future generations.

(Tanmay Kumar)

सी. अचलेन्दर रेड्डी, भा.व.से. (सेवानिवृत्त)
अध्यक्ष

C. Achalender Reddy, IFS (Retd.)
Chairperson

राष्ट्रीय जैव विविधता प्राधिकरण
भारत सरकार

National Biodiversity Authority
Government of India

message



The biological diversity, or biodiversity, comprising diverse natural and manmade ecosystems and associated innumerable enthralling plants, animals, and microorganisms seen around humanity originated some 3.5 billion years ago through varied processes such as evolution, speciation, migration, and extinction, and now they are all under enormous influence of human activities. Humanity has lately realized the importance of biodiversity for its own existence and the intricate relationships humankind has maintained with the natural environment.

Despite an increase in policies and actions to support biodiversity, science-based evidence shows that the drivers of biodiversity loss have increased and biodiversity has declined between 2011 and 2020. The degradation of ecosystems and the decline of biodiversity exacerbate climate change and threaten the natural processes that protect human health and provide clean air, water, and food.

In December 2022, Parties to the UN Convention on Biological Diversity adopted an ambitious global biodiversity framework seeking all nations to halt and reverse biodiversity loss to achieve a nature-positive world by 2030, attain the UN Sustainable Development Goals, and realize the vision of living in harmony with nature by 2050. In India, the National Biodiversity Authority (NBA), responsible for the implementation of the Biological Diversity Act, 2002, and various programmes, protocols, and other directives of the CBD, was entrusted with the task of updating the National Biodiversity Strategy and Action Plan aligned with the framework.

As envisioned by the Convention, the NBA, under the guidance of the Working Group-NBSAP and senior officials of the MoEFCC, and in collaboration with the UNDP and BCIL, has successfully prepared the third generation NBSAP aligned with GBF through the engagement of stakeholders, including concerned sectors, central ministries, specialized organizations, state departments, implementing and regulatory agencies, professionals, NGO, and CBOs. It gives me great satisfaction. I visualize a prominent role for the NBA as a facilitator of mainstreaming biodiversity concerns across sectors, aiming at convergence while making State Biodiversity Boards, UT Biodiversity Councils, and the Biodiversity Management Committees (BMCs) effective in their expected functions as some of the new priority areas proposed in the plan period.

I sincerely commend the efforts of all those who have contributed to the updating of the plan especially Dr. J.Soundrapandi, Project Officer, UNDP for his untiring efforts in completion of this task. I look forward to resolute support from all concerned for the timely and effective implementation of result-oriented priority actions proposed for conservation.

Chennai, Dated: October 4, 2024

(C.Achalender Reddy)

ACKNOWLEDGEMENT

The updating of NBSAP in the context of a vast and megadiverse country like India, that too as the third-generation plan aligned with the Global Biodiversity Framework, specifically seeking a holistic and consultative approach involving more than two dozen central ministries and departments, specialized organizations, state agencies, professionals, non-governmental organizations, and communities in a short period of just eight months, was a daunting task. A large number of organizations, agencies, professionals, and other individuals collaborated, participated in the consultative process. Obviously, providing here a complete list of all names is difficult. We would like to thank everyone who was involved and contributed at different stages of plan updating. Certainly, the following people need special mention for their important roles and significant contributions, including stewardship, advice, guidance, valuable contributions, information sharing, and assistance ultimately helping in updating the plan.

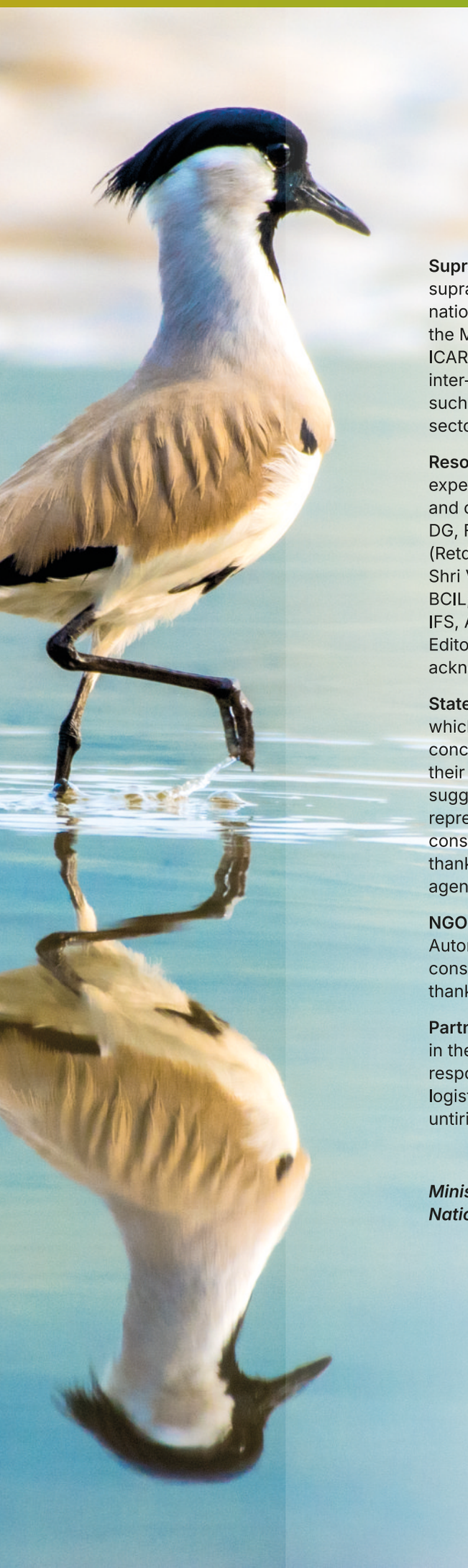
MoEFCC: Shri Bhupender Yadav, Hon'ble Union Minister; Shri Kirti Vardhan Singh, Hon'ble State Minister; Mrs. Leena Nandan, IAS., Secretary; Shri Tanmay Kumar, IAS., Special Secretary; and Shri Raghu Kumar Kodali, Advisor (Biodiversity). We are grateful to all of them for inspiration, encouragement, and much-desired direction at all stages.

NBA: Special gratitude to Shri C. Achalender Reddy, IFS (Retd.), Chairman, NBA for piloting the intricate process of planning required for updating NBSAP and country-wide consultations, providing encouragement and guidance, and sharing his wisdom and experience from the global biodiversity arena in his capacity as Chair of the Subsidiary Body on Implementation (SBI) of CBD.

Working Group-NBSAP: Special thanks to Dr. V. Rajagopalan, IAS (Retd.) Chairman and Former Secretary, MoEFCC; Dr. Mohit Gera, IFS (Retd.), PCCF and HoFF, Vice Chair; Dr. R. Shobha, IFS (Retd.), PCCF and HoFF; Smt. Vani Prasad, IAS, Principal Secretary, Telangana; Dr. Dhananjay Mohan, IFS, PCCF and HoFF; Shri Vinod Yadav, IFS (Retd.), PCCF; Shri. I.Anwardeen, IFS, APCCF, Chief Mission Director, Green Tamil Nadu Mission; Dr. Ruchi Pant, Head, NRM and Biodiversity, UNDP; Dr. C.R. Babu, Emeritus Professor, CEMDE, DU; Dr. Alka Rao, Advisor, FSSAI; Dr. Neelima Jerath, DG, Pushpa Gujral Science City; Ms. Vishaish Uppal, Director, WWF; Dr. Ravindra Singh, Director, Indo-German Biodiversity Programme (IGBP), GIZ;. and Dr P Krishnan, Director, Bay of Bengal Programme-Inter-Governmental Organisation, for steering the whole process, valuable guidance, and advice at all stages. We are equally grateful to all other members of the Working Group for their active participation in the consultation process, valuable inputs, and guidance from time to time.

Biodiversity-Related Central Ministries and Departments: Twenty-one ministries and two departments were involved. Special gratitude to the Hon'ble Union Minister, Hon'ble State Minister, and Secretary of all those concerned ministries for their whole-hearted support, designating focal points and nodal officers, and sharing information. Special thanks to all focal points and nodal officers for their active participation and resource inputs all through the inter-ministerial consultations.

UNDP-India: The UNDP-India immensely helped the entire process through the Global Biodiversity Framework - Early Action Support (GBF-EAS) Project. We thank Ms. Isabelle Tschan, Deputy Resident Representative, UNDP-India and Dr. Ruchi Pant, Head, NRM and Biodiversity, UNDP for the financial support, technical inputs and their active participation in the national and regional consultations.



Supra-national and national/state-level organizations: A large number of supra-national organizations such as GIZ, IUCN, UNDP and WWF, specialized national organizations dealing with the wider subject of biodiversity, particularly the MoEFCC, MoAFW, MoFAHD, MoS, MoJS, MoRD, MoST, MoHA, MoHUA, ICAR, DST, CSIR, DBT, etc., were represented during the national, regional, and inter- and intra-ministerial consultations, and officials and professionals from such organizations provided valuable insight and information relevant to their sector or subject. We thank all of them for their valuable contributions.

Resource Persons, Professionals, and Experts: Several resource persons, experts and other professionals were involved at different stages of planning and consultations. Prominent among them are Dr. Devendra Pandey, IFS (Retd.), DG, FSI; Shri Hem Pande, IAS (Retd.) Ex. Secretary, GoI; Shri A.K. Goyal, IFS (Retd.), Ex. Special Secretary Panchayati Raj; Dr. KSRVS Challam, IES (Retd.); Shri Vinod Kumar Yadav, PCCF IFS (Retd.); Dr. Vibha Ahuja, Chief Manager, BCIL; Dr. Yashveer Bhatnagar, Country Director, IUCN-India, Dr. Justin Mohan, IFS, APCCF; and Ms. Sana Shaikh, UNDP. They made significant contributions. Editorial comments provided by Prof. S.K. Barik and Dr. Neelima Jeerath are acknowledged.

State Governments, Departments, and SBBs: State departments and agencies which are 'Life Owning' and 'Life Supporting', and other organizations concerning biodiversity were well represented in all regional consultations, and their representatives made state- and region-specific recommendations and suggestions for the NBSAP and provided valuable information. All representatives of SBBs and UTBCs also attended national and regional consultations, and indeed, they facilitated region-specific consultations. Special thanks to all the officials and professionals from these departments and agencies who attended consultations and otherwise contributed.

NGOs, CBOs and BMCs: Representatives of several NGOs, CBOs, District Autonomous Councils, BMCs, Organic Farmers attended national/ regional consultations and made notable contributions. We acknowledge their inputs and thank all of them.

Partner Organizations: MoEFCC, NBA, UNDP and BCIL were prominent partners in the GBF-EAS Project. The Core teams based at these organizations responsible for planning, organization of consultations, drafting of NBSAP, and logistics made notable contributions. We are thankful to all of them for their untiring help at all stages.

Ministry of Environment, Forest and Climate Change, GoI
National Biodiversity Authority.

Harsh Rawat



EXECUTIVE SUMMARY

Biodiversity and Humanity

Biological diversity or Biodiversity comprising ecosystems, species, genes, and the ecological complexes of which they are part, are myriad creations of nature. The diversity of the ecosystem provides a life support system, an essential foundation for the maintenance of the environment, and varied ecosystem services vital for human wellbeing and a healthy planet. Diversity of species as precious nature's bounty denotes 'building blocks', crucial for the smooth functioning of an ecosystem. Genetic diversity ensures the evolutionary and adaptive potential of a species. Biodiversity includes diversity within species, between species, and in ecosystems and has been perceived as a vehicle for sustainable development. Biodiversity, is the natural heritage for humankind which is crucial for addressing emerging global challenges like food insecurity, water crisis, climate change, livelihoods, disasters, and sustainable development.



Anupam Joshi

Interconnected Global Emergencies

Despite concerted efforts made by all nations for the conservation of biodiversity, this crucial 'living fabric' is weakening and is on decline worldwide at rates unparalleled in human history. All available evidence is explicit that the living planet is being pushed to its boundaries and confronted with three interconnected emergencies, *viz.*, biodiversity loss, climate change, pollution and public health, all emanating from a common root cause, i.e., the widespread destruction of nature. Available evidence also suggests a broken relationship between humans and nature. Five major threats to biodiversity identified include: (i) land and sea change; (ii) pollution; (iii) species overexploitation; (iv) climate change; and (v) invasive species and diseases. There is an urgency to treat these interconnected emergencies. More so, all of humanity has a role to play in building a nature-positive society that safeguard the planet for the good health of everyone.

Kunming-Montreal Global Biodiversity Framework

Alarmed by astounding revelations made about global biodiversity, the UN Convention on Biological Diversity (UNCBD) adopted the Kunming-Montreal Global Biodiversity Framework during the COP 15 held in December 2022. The Framework is built around a 'Theory of Change' that recognizes an urgent policy action globally, regionally, and nationally to achieve sustainable development so that the drivers of undesirable change that have exacerbated biodiversity loss will be reduced and/or reversed so as to allow recovery of all ecosystems and to achieve the Convention's Vision of 'Living in Harmony with Nature' by 2050. The KM-GBF aims to catalyze, enable, and galvanize urgent and transformative action by governments and subnational and local authorities, with the involvement of all of society, to halt and reverse biodiversity loss, achieve the outcomes it sets out in its vision, mission, goals, and targets, and thereby contribute to the three objectives of the CBD and to those of its protocols. The Framework is action- and result-oriented and aims to guide and promote the revision, updating, development, and implementation of policies, goals, targets, and national and state biodiversity strategies and action plans by national and sub-national governments, as well as facilitate the monitoring and review of progress at all levels in a transparent and responsible manner. The Framework promotes coherence, complementarity, and cooperation between the CBD and its Protocols, other biodiversity-related conventions, multilateral agreements, and international institutions, respecting their mandates, and creates opportunities for cooperation and partnerships among diverse actors to enhance implementation of the Framework. The COP Decision (15/6) considered that the National Biodiversity Strategy and Action Plan (NBSAP) is the main instrument for implementing the Convention at the national level and seen as an umbrella process for achieving all goals and action-oriented targets, while periodic National Reports (NRs) are the main instruments for monitoring and reviewing the progress of implementation. The NBSAP needs to be revised or updated to align with the KM-GBF and its goals and targets as the main vehicle for implementation of the Framework, including National Biodiversity Targets communicated in a standardized format by the COP at its sixteenth meeting.

Progress of India's NBSAP

Conservation of biodiversity in the context of India is not new. Much before the global recognition of biodiversity and CBD came into force, India's cultural ethos, nature-loving communities, and national and subnational governments have immensely helped in the protection and conservation of nature's treasure. India framed the first NBSAP as the National Policy and Macro-Level Strategy on Biodiversity in 1999. India implemented the Global Environment Facility (GEF) Project during 2000–2003, and it helped in the preparation of the NBSAP through a wider consultative process besides state, region, and theme-specific plans. This was followed by the preparation of the National Biodiversity Action Plan (NBAP) in 2008. In 2010, the world's countries adopted the Strategic Plan for Biological Diversity (2011–2020): 'Living in Harmony with Nature', whereby member countries reaffirmed their commitment to undertake urgent measures for the conservation of biodiversity and enhanced benefits to people. This necessitated India adopting 12 National Biodiversity Targets (NBTs) aligned with 20 Aichi Global Biodiversity Targets and thus preparing an Addendum 2014 to the NBAP 2008. Biodiversity indicators were identified and are being used for monitoring. India published an illustrative NR5, while NR6 was submitted to the CBD online. In 2019, the country prepared 'An Overview: Implementation of India's National Biodiversity Action Plan'. All these sequential documents offer valuable insight on the country's biodiversity, particularly its status, trends, policy and legal framework, governance mechanism, threats, strategies, conservation initiatives, accomplishments, gaps, etc.

Implementation of NBSAP

The Ministry of Environment, Forest and Climate Change (MoEFCC), being the central nodal ministry at the national level, provides desired support and coordinates with national, state, and international agencies besides financial resources for conservation of biodiversity and dealing with interconnected matters related to the environment, natural resource management, climate change, and sustainable development. Over the years, several national-level organizations (scientific, research, education, and training institutes, statutory authorities, and regulatory bodies) under the control of MoEFCC have come into existence, and they support the Ministry in the implementation of various conventions, policies, laws, programmes, and schemes relevant to forest, wildlife, environment, and biodiversity.

In 2002, the Biological Diversity Act (BD Act) was enacted, recognizing India's richness and uniqueness in biological diversity and traditional and contemporary knowledge systems. The BD Act acknowledges the country's commitment to implement the CBD's three main objectives pertaining to: (i) conservation of biological diversity; (ii) sustainable use of its components; and (iii) fair and equitable sharing of the benefits arising out of the use of biological resources. In order to achieve these three objectives, the Act has provisioned a hierarchical three-tier system of implementation and governance at the national, state,

and local levels through the establishment of the National Biodiversity Authority (NBA), State Biodiversity Boards (SBBs)/ Union Territory Biodiversity Councils (UTBCs), and Biodiversity Management Committees (BMCs), respectively. Presently, the NBA, 28 SBBs, 8 UTBCs, and 2,77,688 BMCs are in existence in the country, and they all are helping in implementing the BD Act. The State Forest Department(s) (SFDs), being the custodians of public forest lands in States and UTs, are responsible for managing forests, wildlife, protected areas, other natural ecosystems, and the environment at large through a hierarchical, competent cadre of professionals and field-level formations. Local communities, especially forest dwellers living inside or in forest fringe areas traditionally dependent upon forest resources for subsistence and livelihoods, have been helping SFDs in different aspects of management of forests and other ecosystems, including protection of forests, PAs, control of poaching, intelligence gathering, conservation of wild species, habitat improvement works, control of forest fires, etc. Further, the community's or autonomous tribal council's owned forests, especially in the north-eastern region, are being managed by the communities themselves. In addition to SFDs, state departments of agriculture, horticulture, livestock production, animal husbandry, and dairying help in the conservation and development of domestic biodiversity (land races, crop varieties and animal breeds). The State Department of Fisheries takes care of managing wild fish diversity in inland waters and marine ecosystems and promotes the development of aquaculture.

Besides the MoEFCC, the central government ensures that all relevant protocols of CBD (e.g., the Nagoya Protocol on Access and Benefit-sharing and the Cartagena Protocol on Biosafety) are effectively implemented through various central ministries and state departments. Twenty-one central ministries and two departments are directly and indirectly contributing towards the conservation of biodiversity. 'Life Owning', Life Supporting', and other central ministries either regulating or using biodiversity have been mapped. Further, UN agencies, International organizations, NGOs, business houses, entrepreneurs, and individuals, either directly or indirectly, also supplement conservation efforts effectively.

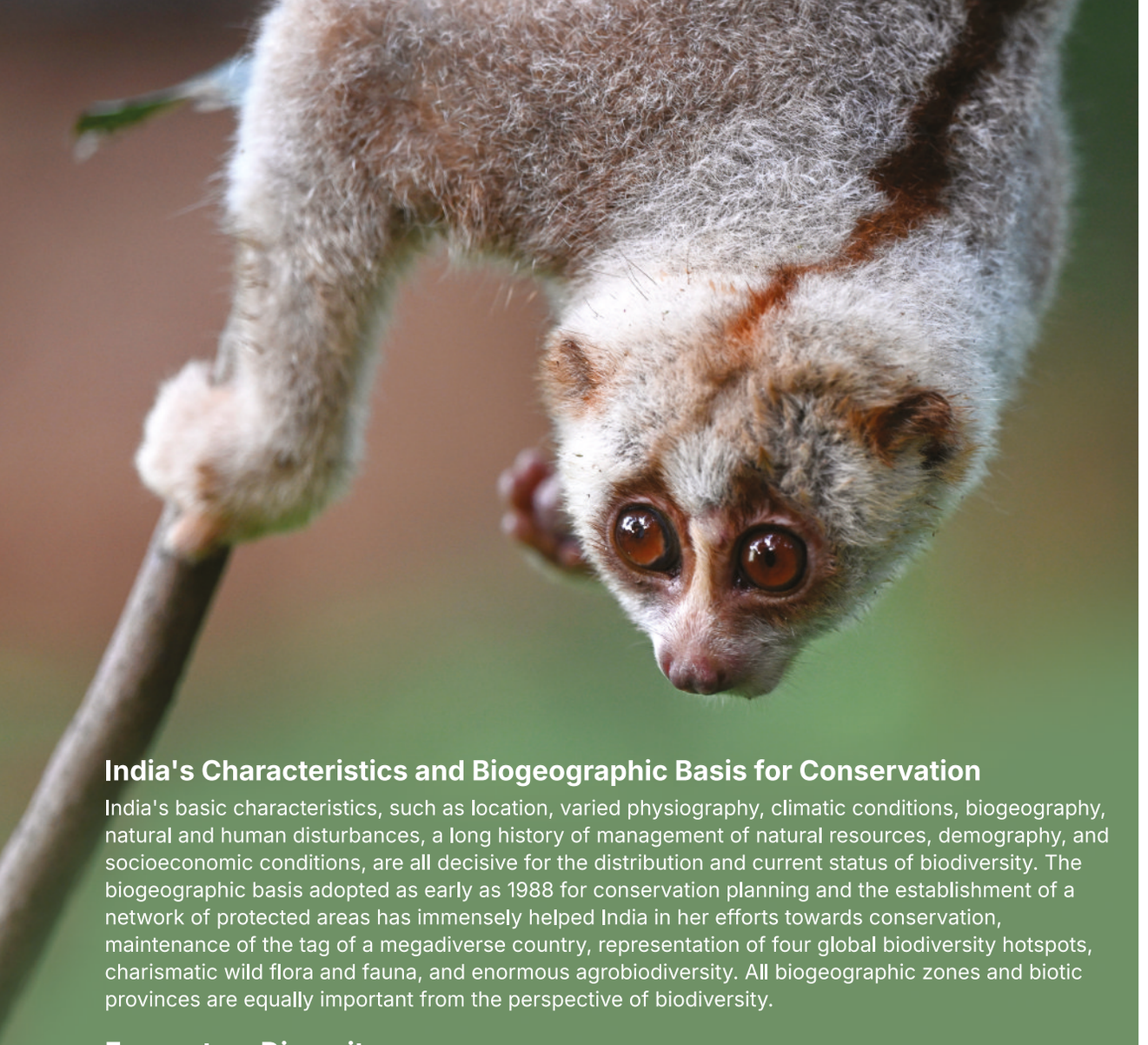
Updating India' s NBSAP

As envisioned by the CBD, particularly COP decision (15/6), the first priority for the Government of India was to update NBSAP aligned with KM-GBF. This specifically required setting up of the National Biodiversity Targets, formulate biodiversity strategy and result oriented actions, identify indicators, establish biodiversity monitoring system, adopt 'a whole-of-government and whole-of-society approach' for implementation of NBSAP, and prepare a strategy for communication, capacity buidling and development, and resource mobilization. All this was achieved through interministerial coordination, engagement of stakeholders, and wider consultative process.

The MoEFCC had entrusted the task on updating NBSAP of national importance to NBA. The senior officials, policy and decision makers, and professionals of the Ministry provided stewardship, guidance, direction, and support from time to time. The NBA has constituted a 21-member high-level Working Group (WG) for providing advice, technical inputs in preparation, and reviewing draft NBSAP. The Chairman, NBA steered the entire exercise. The team of the NBA and UNDP closely worked under the guidance of the MoEFCC towards updating NBSAP. The process of updating NBSAP involved: (i) rapid stocktaking and review of existing NBSAP and contextual analysis; (ii) stakeholder analysis and consultative process – national, interministerial, and regional/ state levels consultations; (iii) situation and problem analysis; (iv) collection of primary information from central ministries on ongoing schemes, biodiversity expenditure, financial needs, and subsidy, and secondary information on efforts made towards conservation and new initiatives; (v) setting National Biodiversity Targets, objective analysis, formulation of strategies and result-oriented action plan, development of biodiversity monitoring framework, (vi) preparation of draft NBSAP including policy alignment and coherence, adopting a whole of society approach, sectoral integration, mainstreaming, implementation architecture, coordination, schedule, monitoring, CHM, reporting, and sub-plans on capacity development, technology incorporation, communication and awareness, biodiversity finance plan and resource mobilization; (vii) review of draft NBSAP, and incorporation of feedback; and (viii) finalization and adoption of the NBSAP.

Structure of the NBSAP

The updated NBSAP has a total of 7 organized chapters. The first 3 chapters are organized to provide background and contextual analysis, situation analysis narrating the current status of India's biodiversity, conservation practices, policy and institutional framework, and problem analysis. The last four chapters deal with national biodiversity targets, and action points, capacity building and development, biodiversity finance and resource mobilization and biodiversity monitoring framework.



© Sanjay Shukla

India's Characteristics and Biogeographic Basis for Conservation

India's basic characteristics, such as location, varied physiography, climatic conditions, biogeography, natural and human disturbances, a long history of management of natural resources, demography, and socioeconomic conditions, are all decisive for the distribution and current status of biodiversity. The biogeographic basis adopted as early as 1988 for conservation planning and the establishment of a network of protected areas has immensely helped India in her efforts towards conservation, maintenance of the tag of a megadiverse country, representation of four global biodiversity hotspots, charismatic wild flora and fauna, and enormous agrobiodiversity. All biogeographic zones and biotic provinces are equally important from the perspective of biodiversity.

Ecosystem Diversity

India's enormous diversity of terrestrial and aquatic ecosystems, including inland waters and coastal and marine ecosystems, has been elaborated in Chapter 3. It provides a valuable insight into diversity, distribution, status, and trends in these ecosystems. These ecosystems offer a wide range of ecosystem services vital for subsistence and livelihoods, besides the maintenance of India's environment, economy, and prosperity.

Species Diversity

The intricate web of life on the living planet is comprised of innumerable interdependent species (plants, animals, and microorganisms), each playing a unique and irreplaceable role in the functioning of ecosystems. India, being a megadiverse country represented by four global biodiversity hotspots harbors nearly 8% of the world's known plant and animal species. The Botanical Survey of India and Zoological Survey of India, mainly responsible for systematic studies on flora and fauna are contributing the authentic insight on plant and animal diversity in the country, respectively have been undertaking plant/ animal explorations and field surveys. India harbours 9.24% plant species of globally known plant species. The latest estimate of plant diversity in India stands at 55,387 taxa, including 22,108 angiosperms, 83 gymnosperms, 1,319 pteridophytes, 2,819 bryophytes, 3,044 lichens and Lichenicolous fungi, 15,701 fungi, 9,035 algae, and 1,278 microbes, viruses, and bacteria. Angiosperms represents nearly 40% of the overall species of plants, fungi, and protists described from India while pteridophytes and bryophytes contribute 2.38% and 5.09% of the country's overall plant species, respectively. Fungi represented 28.35% of India's plant diversity.

Owing to diverse natural and manmade ecosystems across the country, India harbours a spectacular diversity in terrestrial and aquatic ecosystems. Altogether, 6,502 vertebrate species representing 8.67% of the globally known vertebrate species have been described from the country so far. Among vertebrates, India harbours 3,532 species of fish, 450 amphibian species, 738 species of reptiles, 1,346 bird species, and 436 species of mammals, representing the world's fish, amphibian, reptilian, bird, and mammalian species diversity to the extent of 9.71%, 5.17%, 6.12%, 12.02%, and 6.58%, respectively. Nearly 97,000 species of invertebrates and protozoans represent 93.84% of the India's faunal diversity, while vertebrates account for only 6.24% of the faunal diversity.

Area Based Conservation

The CBD has recognized protected areas (PAs) as the cornerstone of conservation of biodiversity as they help to maintain diverse ecosystems, key habitats, provide refugia, facilitate species migration and movement, and allow evolutionary and ecological processes across the landscape besides offer a wide range of ecosystem services. Traditionally, India has practiced five biodiversity governance models as a continuum across a landscape. Two state-driven models, including PAs and managed forests (MFs), have been highly effective in achieving conservation goals despite PAs and MFs located in a human dominated landscapes face enormous challenges. Remaining three community-driven biodiversity models, including autonomous community efforts, co-management, and decentralized governance institutions, supplement conservation efforts to a great extent, especially in terms of proposed 'Other Effective Area Based Conservation Measures (OECMs). In view of the global biodiversity target 3, communities need to be mobilized, encouraged, and supported so that they can identity and expand the extent of OECMs and strengthen them.

Agrobiodiversity

Agrobiodiversity, as a sub-set of biodiversity, is vital for food and food security. India is one of Vavilov's centers of origin for crop plants and domestications. Besides 15 agroclimatic zones identified across the country, the Protection of Plant Varieties and Farmers' Rights Authority (PPVFRA) has identified 22 agrobiodiversity hotspots in India based on the number of species, crop varieties, wild relatives of cultivated crop species, social relevance, ancientness of agriculture, number of species domesticated and the uniqueness of the agroecosystem. About 168 species of crops including 25 major and minor crops have been domesticated and developed significant unique diversity in the country. The National Bureau of Plant Genetic Research (NBPGR) has prioritized and shortlisted crop wild relatives of 171 native crops belonging to 769 species, which include cereals, millets, pseudocereals, grain legumes, oilseeds, fibers, forages, fruits and nuts, vegetables, spices and condiments, ornamental plants, medicinal and aromatic, plantation crops, etc. The ICAR-NBPGR make country-wide comprehensive effort and explorations across to collect accessions comprising various agri-horticultural crops, wild relatives of crops, and other economically important species. As of December, 2022, NBPGR had altogether 4,63,130 accessions. ICAR has characterized the livestock population of India in their natural home tracts and so far, registered and gazette notified altogether 205 animal breeds including 180 breeds of livestock (cattle 50, buffalo 19, goat 34, sheep 44, pig 10, horses/ ponies 7, donkey 3, camel 9, yak 1, dog 3, poultry 22). For *ex situ* conservation, semen doses and somatic cells are being cryo preserved at the National Gene Bank.

The country has made concerted efforts towards conservation of the country's rich agrobiodiversity. However, landraces, crop wild relatives, and indigenous animal breeds are threatened owing to cross breeding, policies favoring female progeny, and inadequate incentives to farmers and herders. Conservation of agrobiodiversity and agricultural development in the country have been supported by a well-established network of 'National Agriculture Research and Education System' backed up by a large number of reputed specialized national level institutions under the umbrella of ICAR, agriculture universities, Krishi Vigyan Kendra's, and extension activities. Presently, ICAR has 113 research institutes, 74 agricultural universities, 4 deemed-to-be-universities, 3 central universities and 731 Krishi Vigyan Kendras (KVKs) spread across the country. These organizations have notable contributions to conserve agrobiodiversity, and overall development in the agriculture sector. The MoAFW and MoFAHD are two prominent central ministries taking care of agriculture, animal husbandry, dairying, and fishery sectors. On the lines of NBPGR, bureaus of genetic resources conserving germplasm of domestic animals, fishes, and agriculturally important insects and microorganisms also operate.

Conservation Approaches

Over past several decades, India has adopted various approaches for conservation. Definitely, *in situ* conservation or area-based conservation besides landscape/ riverscape approach to conservation have been effective in achieving various conservation goals. India has made a notable progress in the fields of *ex situ* conservation, wildlife health, wildlife forensics, and ecotourism. However, conservation of wetlands, coastal and marine ecosystems, genetic diversity and biosafety, participatory approaches, ecodevelopment, communication, and public awareness are some of the priority conservation areas that require urgent attention, augmenting, and strengthening.

Goals, National Biodiversity Targets and Strategies

As envisioned by the KM-GBF, setting up National Biodiversity Targets aligned with 23 global biodiversity targets was an important and priority task. This was achieved through a country-wide consultative process. India decided to frame 23 National Biodiversity Targets corresponding to each of the global

targets so as to contribute towards the four goals of the KM-GBF. Twenty-three National Biodiversity Targets aim to address three broad themes adopted by the KM-GBF. These themes pertain to: (i) reducing threats to biodiversity, including eight targets; (ii) meeting people's needs through sustainable use and benefit-sharing, with five targets; and (iii) tools and solutions for implementation and mainstreaming, with ten targets. Details on each of the National Biodiversity Targets were worked out in the prescribed format for submission to the CBD. Chapter 4 elaborates on each of the National Biodiversity Targets, identifies important domains relevant to conservation, and formulates appropriate strategies. Six broad conservation domains were identified in view of the emerging needs and various considerations of the KM-GBF. These include: (i) Area-based conservation; (ii) Building ecosystem resilience; (iii) Recovery, rehabilitation, and conservation of threatened species; (iv) Conservation of agrobiodiversity; (v) Sustainable management and use of biodiversity; and (vi) Enabling conditions, tools, and solutions for implementation.

Implementation Architecture

India has successfully updated the NBSAP as envisioned by KM-GBF. However, the multifaceted NBSAP requires an appropriate implementation architecture keeping in view the requirements of the multiscale, multidiscipline, multisector and multistakeholder approaches. The chapter 4 elaborates on the vertical and horizontal integrated architecture, and highlights the need for adopting a hierarchical governance mechanism promoting a paradigm shift towards the bottom-up approach. Vital enabling conditions, tools and solutions for conservation such as biodiversity research, monitoring, capacity development, CEPA, ABS, resource mobilization, etc. have been elaborated. In past, India has made notable progress towards various enabling conditions, tools and solutions. However, current efforts by concerned ministries and their specialized scientific organizations need to be strengthened in view of the transformative changes envisioned.

Communication, Education and Public Awareness

The updated NBSAP highlights that effective communication with people is crucial for conservation of biodiversity as they are using or influencing biodiversity and responsible for its current state, and unabated decline. In past, India has made considerable efforts towards communication, education and public awareness (CEPA). However, in view of the newer challenges and emerging needs, a revamped communication strategy is required. The thrust of updated NBSAP is on a whole-of-government and whole-of-society approach involving government and non-government agencies, communities, and professionals. The Chapter 5 identifies various target groups for CEPA, their specific needs, and the priority themes to be addressed. It also identifies a wide range of communication tools and approaches.

Capacity-building and development

In past five decades, various sectors involved in conservation of biodiversity have made huge investments towards capacity building of individuals and professionals. In the process, these sectors have created a number of reputed training institutions, developed infrastructure, and designed course curricula catering to the diverse needs of various target groups. Over the years, a variety of tools and training delivery modes have been used. In view of the emerging needs and newer stakeholders, chapter 5 highlights that capacity development cannot be just addressed at the level of 'individuals', instead it concurrently needs to be addressed at two other levels *viz.*, 'organizational development' and 'enabling environment'. Moreover, several new dimensions have been added. In addition, several neglected areas and priority conservation areas have been identified. Further, several new stakeholders like SBBs, BMCs, and other CBOs have been identified. Obviously, existing training institutes and other organizations involved in capacity development would consider these aspects to revise/ update curricula accordingly.

Biodiversity Expenditure Review and Resource Mobilization

The Chapter 6 deals with two important key steps of Biodiversity Finance Initiative (BIOFIN) including Biodiversity Expenditure Review (BER) (actual and projected attributable expenditures), and Biodiversity Finance Solutions. Study on BER included review of ongoing programmes and schemes of 21 central ministries and two departments. The average annual attributable biodiversity expenditure for the FY 2017-2018 to 2021-2022 was estimated to the tune of INR 32,207.13 Crore (322,071.30 million) at the Central Government level. This expenditure data provided the basis for projection of biodiversity attributable expenditure for the FY 2024-2025 to FY 2029-2030 (six years) using forecast method. Implementation of updated NBSAP up to FY 2029-2030 would require the estimated annual average financial requirement of INR 81,664.88 Crore (816,648.80 million) at the Central Government level. This amply reflects that every year a substantial enhanced budget would be required over and above the current fund allocations. The Chapter suggests a broad menu of new and innovative finance solutions for resource mobilization. Since, most ministries/ departments primarily use public funds, urgent efforts at

© Harsh Rawat

all level would be required to create a mechanism for channelizing and accepting finances from varied sources.

Biodiversity Monitoring Framework:

The Global Biodiversity Framework lays a special emphasis on monitoring of biodiversity and seeks that Parties would design and develop a comprehensive biodiversity monitoring framework to ascertain the progress on each of the national biodiversity targets. CBD provided an insight on 'global', 'headline' and 'component' indicators besides expected that Parties will develop 'national' indicators in view of their specific conditions and requirements. CBD also seeks biennially National Reports through Clearing House Mechanism (CHM) based on monitoring activities, outputs, and trends. Various central ministries concerning conservation of biodiversity have been implementing different programmes on monitoring. Generally, biodiversity monitoring is complex, cumbersome, expensive, and time consuming and involves large manpower and a wide range of tools and techniques. The country wide consultative process immensely helped in identification and selection of monitoring indicators, and ultimately development of a monitoring framework. The monitoring framework presented in the chapter 7 not only identifies potential indicators against each NBTs but also identifies 'Lead' and 'Supporting' agencies responsible for implementation and fixes periodicity of monitoring.



LIST OF ABBREVIATIONS

ABI	Agro Biodiversity Index
ABS	Access and Benefit Sharing
ABTs	Aichi Biodiversity Targets
AER	Agro-ecological Regions
AHTEG	Ad Hoc Technical Expert Group
AITE	All India Tiger Estimation
ARS	Agricultural Research Service
ATREE	Ashoka Trust for Research in Ecology and the Environment
AYUSH	Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homeopathy
BAIF	Bharatiya Agro Industries Foundation
BCIL	Biotech Consortium India limited
BD	Biological Diversity
BGCI	Botanical Gardens Conservation International
BHS	Biodiversity Heritage Site
BMC	Biodiversity Management Committee
BNHS	Bombay Natural History Society
BRSR	Business Responsibility and Sustainability Reporting
BSI	Botanical Survey of India
CA	Conservation Areas
CASFOS	Central Academy for State Forest Service
CAZRI	Central Arid Zone Research Institute
CBD	Convention on Biological Diversity
CBOs	Community Based Organisations
CCA	Community Conserved Area
CEBPOL	Centre for Biodiversity Policy Law
CEE	Centre for Environment Education
CEPA	Communication, Education and Public Awareness
CHM	Clearing-House Mechanism
CI	Conservational International
CII	Confederation of Indian Industry
CITES	Convention on International Trade in Endangered Species
CMFRI	Central Marine Fisheries Research Institute
CMLRE	Centre For Marine Living Resources & Ecology
CMS	Centre for Media Studies
COP	Conference of Parties
CPCB	Central Pollution Control Board
CPREEC	C.P.R. Environmental Education Centre
CR	Critically Endangered
CRZ	Coastal Regulation Zone
CSOs	Civil Society Organisations
CSR	Corporate Social Responsibility
CSIR	Council for Scientific and Industrial Research
CSS-PT	Central Sector Scheme – Project Tiger
CWR	Crop Wild Relative
CZA	Central Zoo Authority
DAC&FW	Department of Agriculture & Farmers Welfare
DAE	Department of Atomic Energy
DBT	Department of Biotechnology

DD	Data Deficient
DFE	Directorate of Forest Education
DIN	Dissolved Inorganic Nitrogen
DNA	Deoxyribonucleic Acid
DoS	Department of Space
DSI	Digital Sequence Information
DST	Department of Science and Technology
EDCs	Eco Development Committees
EEZ	Exclusive Economic Zone
EF&CC	Environment, Forest and Climate Change
EIA	Environment Impact Assessment
EIACP	Environment Information, Awareness, Capacity Building and Livelihood Programme
EN	Endangered
ENM	Ecological Niche Modelling
ENVIS	Environmental Information System
EPA	Environmental (Protection) Act
ER	Elephant Reserve
ESCAP	Economic and Social Commission for Asia and the Pacific
ESZ	Eco-sensitive Zone
EW	Extinct in the wild
EX	Extinct
FAO	Food and Agriculture Organization
FC	Forest Cover
FD	Forest Division
FES	Foundation for Ecological Security
FRA	Forest Right Act
FRCs	Forest Right Committees
FRI	Forest Research Institute
FSI	Fishery Survey of India
FSI	Forest Survey of India
GA	Geographical Area
GBF	Global Biodiversity Framework
GBF-EAS	Global Biodiversity Framework Early Action Support
GBO	Global Biodiversity Outlook
GCRMN	Global Coral Reef Monitoring Network
GDP	Gross Domestic Product
GEER	Gujarat Ecological Education and Research
GEF	Global Environment Facility
GIM	Green India Mission
GIS	Geographic Information System
GMA	Global Mangrove Alliance
GoI	Government of India
GRK	Great Rann of Kutch
GSPC	Global Strategy for Plant Protection
GTI	Global Taxonomy Initiative
GVA	Gross value Added
ha	Hectare
IAS	Invasive Alien Species



IBA	Important Bird Areas
IBBI	India Business & Biodiversity Initiative
IBEF	India Brand Equity Foundation
ICAR	Indian Council of Agriculture Research
ICFRE	Indian Council of Forest Research and Education
ICMBA	Important Coastal and Marine Biodiversity Areas
IGNFA	Indira Gandhi National Forest Academy
ICRI	International Coral Reef Initiative
ICZMP	Integrated Coastal Zone Management Plan
IEG	Institute for Economic Growth
IFA	Indian Forest Act
IFAD	International Fund for Agricultural Development
IFFCO	Indian Farmers Fertilizer Cooperative Limited
IGIDR	Indira Gandhi Institute for Development Research
IHR	Indian Himalayan Region
IIFM	Indian Institute of Forest Management
IIRS	Indian Institute of Remote Sensing
IISC	Indian Institute of Science
INR	Indian Rupee
IPBES	Intergovernmental Platform for Biodiversity and Ecosystem Services
IRMA	Institute of Rural Management Anand
IRS	Indian Remote Sensing
ISFR	Indian State of Forest Report
ISRO	Indian Space Research Organization
IUCN	International Union for Conservation of Nature
JFM	Joint Forest Management
JFMCs	Joint Forest Management Committees
KBAs	Key Biodiversity Areas
Km	Kilometer
KM-GBF	Kunming Montreal Global Biodiversity Framework
LC	Least Concern
LGP	Length Of Growing Period
LiFE	Lifestyle for Environment
LISS	Linear Imaging and Self Scanning Sensor
LMO	Living Modified Organism
LRK	Little Rann of Kutch
LBSAP	Local Biodiversity Strategy and Action Plan
MAB	Man and the Biosphere Programme
MAPs	Medicinal and Aromatic Plants
mBRCs	Microbial Bioresource Centres
MDF	Moderately Dense Forest
MDGs	Millennium Development Goals
MEE	Management Effectiveness Evaluation
MEITY	Ministry of Electronics and Information Technology
MF	Managed Forest
Mha	Mega hectare
MIKE	Monitoring of Illegal Killing of Elephants
MLA	Member of Legislative Assembly
MoA	Ministry of Agriculture
MoAFW	Ministry of Agriculture and Farmers Welfare
MoC	Ministry of Culture
MoCF	Ministry of Chemical and Fertilizers

MoCI	Ministry of Commerce and Industry
MoCIT	Ministry of Communications and Information Technology
MoDNER	Ministry of Development of North Eastern Region
MoDWS	Ministry of Drinking Water and Sanitation
MoEF	Ministry of Environment and Forests
MoEFCC	Ministry of Environment, Forest and Climate Change
MoES	Ministry of Earth Science
MoFAHD	Ministry of Fisheries, Animal Husbandry and Dairying
MoHA	Ministry of Home Affairs
MoHFW	Ministry of Health and Family Welfare
MoHRD	Ministry of Human Resources Department
MoHUA	Ministry of Housing and Urban Affairs
MoJS	Ministry of Jal Shakti
MoNRE	Ministry of New and Renewable Energy
MoP	Ministry of Power
MoPNG	Ministry of Petroleum and Natural Gas
MoPR	Ministry of Panchayati Raj
MoRD	Ministry of Rural Development
MoS	Ministry of Shipping
MoSJE	Ministry of Social Justice and Empowerment
MoSPI	Ministry of Statistics and Programme Implementation
MoST	Ministry of Science and Technology
MoT	Ministry of Tourism
MoTA	Ministry of Tribal Affairs
MoU	Memorandum of Understanding
MoYAS	Ministry of Youth Affairs and Sports
MoWCD	Ministry of Women and Child Development
MPA	Marine Protected Area
Mps	Members of Parliament
MTAs	Material Transfer Agreements
NABARD	National Bank for Agriculture and Rural Development
NABII	National Bureau of Agriculturally Important Insects
NAIMCC	National Agriculturally Important Microbial Culture Collection
NARES	National Agricultural Research and Education System
NBA	National Biodiversity Authority
NBAGR	National Bureau of Animal Genetic Resources
NBAII	National Bureau of Agriculturally Important Insects
NBAIM	National Bureau of Agriculturally Important Microorganisms
NBAIR	National Bureau of Agricultural Insect Resources
NBAP	National Biodiversity Action Plan
NBFGR	National Bureau of Fish Genetic Resources
NBPGR	National Bureau of Plant Genetic Resources
NBSAP	National Biodiversity Strategic and Action Plan
NBSSLUP	National Bureau of Soil Survey and Land Use Planning
NBTs	National Biodiversity Targets
NCBS	National Centre for Biological Sciences
NCCR	National Centre for Coastal Research
NCF	National Curriculum Framework
NCSM	National Council of Science Museums
NCSCM	National Centre for Sustainable Coastal Management
NDDB	National Dairy Development Board
NEP	National Environment Policy

NERIST	North Eastern Regional Institute of Science and Technology
NFDB	National Forest Development Board
NFP	National Forest Policy
NGO	Non-Government Organization
NIDM	National Institute of Disaster Management
NIO	National Institute of Oceanography
NITI Aayog	National Institution for Transforming India
NIUA	National Institute of Urban Affairs
NISCAIR	National Institute of Science Communication and Information Resources
NMPB	National Medicinal Plant Board
NP	National Park
NPMF	National Policy on Marine Fisheries
NRAA	National Rainfed Area Authority
NRSC	National Remote Sensing Centre
NR5	National Report Fifth
NT	Near Threatened
NTAP	National Agricultural Technology Project
NTCA	National Tiger Conservation Authority
NTFP	Non-Timber Forest Produce
NTs	National Targets
NWAP	National Wildlife Action Plan
ODA	Official Development Assistance
OECD - DAC	Organization for Economic Cooperation and Development - Development Assistance Committee
OECM	Other Effective Area-Based Conservation Measures
OF	Open Forest
PA	Protected Area
PAGE	Pilot Analysis of Global Ecosystems
PBR	People's Biodiversity Register
PE	Project Elephant
PFs	Protected Forests
PGR	Plant Genetic Resources
POC	Particulate Organic Carbon
PoWPA	Programme of Work on Protected Areas
PPVFRA	Protection of Plant Varieties and Farmers' Rights Authority
PRI	Panchayati Raj Institutions
R&D	Research and Development
RET	Rare, Endangered and Threatened
RFA	Recorded Forests Area
RFD	Result Framework Document
RFs	Reserve Forests
RLB	Rural Local Bodies
SAARC	South Asian Association for Regional Cooperation
SAC	Space Applications Centre
SACON	Salim Ali Centre for Ornithology and Natural History
SBBs	State Biodiversity Boards
SBSAP	State Biodiversity Action Plan
SDG	Sustainable Development Goal
SFDs	State Forest Departments
SMART	Specific, Measurable, Achievable, Relevant, Time-bound
SP	Strategic Plan for Biodiversity

SPCB	State Pollution Control Boards
TCF	Tiger Conservation Foundation
TCL	Tiger Conservation Landscape
TERI	The Energy and Resources Institute
TK	Traditional Knowledge
TKDL	Traditional Knowledge Digital Library
TLB	Traditional Local Bodies
TNC	The Nature Conservancy
TOFs	Tree Outside Forests
TR	Tiger Reserve
TRAFFIC	Trade Records Analysis of Flora and Fauna in Commerce
TRS	Tiger Range States
UDFs	Un-demarcated Forests
UFs	Unclassed Forests
ULB	Urban Local Bodies
UN	United Nations
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNDG	United Nations Development Group
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCC	United Nations Framework on Climate Change
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USD	United States Dollar
UT	Union Territory
UTBC	Union Territory Biodiversity Council
VDCs	Village Development Committees
VDF	Very Dense Forest
VP	Van Panchayat
VU	Vulnerable
WCCB	Wildlife Crime Control Bureau
WCS	Wildlife Conservation Society
WG	Working Group
WHC	World Heritage Convention
WI	Wetlands International
WII	Wildlife Institute of India
WLS	Wildlife Sanctuary
WPA	Wildlife Protection Act
WRCP	Wild Resources Conservation Programme
WTI	Wildlife Trust of India
WWF	World- Wide Fund for Nature
ZSI	Zoological Survey of India

LIST OF TABLES

Table 1.1.	Linkages between Goals and Targets of KM-GBF	**36**
Table 2.1.	Mapping of India's NBTs with KM-GBF Targets	**41**
Table 2.2.	Twenty-three National Biodiversity Targets of "updated NBSAP"	**43**
Table 3.1.	Biogeographic Zones and Biotic Provinces of India	**49**
Table 3.2.	Extent of Forest types in India	**52**
Table 3.3.	Number of plant species in India vis-a-vis global	**59**
Table 3.4.	Faunal Diversity in the World and in India	**61**
Table 3.5.	Trends in Forest Cover in India during 2001-2021	**68**
Table 3.6.	Range of Area Based Conservation Measures under Different Legal Instruments, International Conventions/ Agreements, etc	**70**
Table 3.7.	Crop wild relatives of India	**83**
Table 3.8.	Accession of Plant Genetic Resources Conserved	**84**
Table 3.9.	Conservation of Biodiversity - SWOT Analysis	**88**
Table 3.10.	Achievements, Gaps, Key Issues and Future Requirements of Conservation of Biodiversity in the context of India	**89**
Table 3.11.	Conventions and Multilateral Environmental Agreements	**90**
Table 3.12.	National Policies/ Guidelines/ Rules/ Action Plan	**92**
Table 3.13.	Prominent National Level Legislations pertaining to Biodiversity Conservation	**96**
Table 3.14.	Conservation Authorities and Regulatory Bodies	**98**
Table 3.15.	New Initiatives and Ongoing Schemes	**100**
Table 5.1.	Indicative List of Organizations Involved in Capacity Development Relevant to Wild Biodiversity and Agrobiodiversity	**132**
Table 5.2.	Identified Thrust Areas Relevant to Three Levels of Capacity Development in the Context of Updated NBSAP	**136**
Table 6.1..	Modified RIO-markers attribution adapted to Indian context	**143**
Table 6.2.	Ministries/Departments having Schemes and Programmes relevant for Biodiversity in the Country	**144**
Table 6.3.	Ministry-wise Total and Attributable Expenditure for Biodiversity Conservation for Five Year Period from 2017-18 to 2021-22	**146**
Table 6.4.	Ministry/ Department-wise Projected Expenditure till FY 2029-30	**148**
Table 6.5.	Ministry/ Department-wise contribution to biodiversity expenditure for the FY 2017-18 to FY 2021-22	**150**
Table 7.1.	National biodiversity targets and biodiversity monitoring framework	**156**

LIST OF FIGURES

Fig 1.1.	Progress of NBSAPs in India	34
Fig 1.2.	The Goals of KM-GBF	36
Fig 1.3.	Important Considerations for the Implementation of KM-GBF	37
Fig 2.1.	Process of updation NBSAP and adoption of NBTs	39
Fig 3.1.	Biogeographic Classification of India	48
Fig 3.2.	Distribution of Forest Types and TOF/ Plantation in India	51
Fig 3.3.	Changes in Forest Cover (2001-2021)	52
Fig 3.4.	Extent of Different Grassland Types	53
Fig 3.5.	Wetland type-wise area distribution in percentage w.r.t total area of wetlands [2017-2018]	54
Fig 3.6.	Wetland map of India	55
Fig 3.7.	Coral Cover in Different States/UTs in 2017-2018	56
Fig 3.8.	Mangrove Cover in India	57
Fig 3.9.	Number of plant species discovered and described in India (2013-2023)	60
Fig 3.10.	Number of faunal species discovered and described in India (2013-2023)	62
Fig 3.11.	Annual increment in Microbial holdings	64
Fig 3.12.	State Driven and Community Driven Biodiversity Governance Models	65
Fig 3.13.	Growth in Extent of Protected Areas during 1970 - July, 2023	66
Fig 3.14.	Network of 55 Tiger Reserves in India	72
Fig 3.15.	Elephant Reserves of India	73
Fig 3.16.	State-wise Extent of Elephant Reserves	74
Fig 3.17.	Progress in Area of Eco Sensitive Zones in India	76
Fig 3.18.	Three-Level Classification of Wetlands Adopted for the Preparation of National Atlas of Wetlands	77
Fig 3.19.	Integral Parts of Agrobiodiversity	80
Fig 3.20.	Agro Biodiversity Hotspots in India	82
Fig 3.21.	New varieties (Farmers and Breeders) Registered under the PPVFRA	86
Fig 3.22.	Policy, Laws, Guidelines, Rules and Action Plans relevant to Forest, Wildlife, Biodiversity and Environment	95
Fig 3.23.	Organizations Involved in Conservation of Biodiversity at Different Levels	97
Fig 4.1.	Hierarchical Governance Mechanism Promoting Bottom-Up Approach for Implementation of Updated NBSAP	126
Fig 4.2.	Vertical and Horizontal Integrated Architecture for Implementation of NBSAP	128
Fig 5.1.	Steps involved in organizing need-based Capacity Development programme for biodiversity conservation	132
Fig 5.2.	The updated process of capacity development for implementation of NBSAP	133
Fig 5.3.	Objectives of Capacity Development	135
Fig 6.1	Five Key Steps of BIOFIN	142
Fig 6.2.	Total and attributable Biodiversity expenditures (INR Crore)	151

CONTENT

032

Chapter 1

Introduction

1.1. Background
1.2. The Kunming-Montreal Global Biodiversity Framework
1.3. Rationale for updating NBSAP and relevance of KM-GBF Goals to India

038

Chapter 2

Process of updating NBSAP

2.1. Introduction
2.2. Highly participatory process
2.3. Adopting the National Biodiversity Targets in alignment with the KM-GBF targets
2.4. Development of action points for updated NBSAP

046

Chapter 3

India's Biodiversity- Achievements, Threats and Challenges

3.1. Introduction
3.2. Biogeographic regions
3.3. Ecosystem diversity
3.4. Species diversity
3.4.1. Floral diversity
3.4.2. Faunal diversity
3.4.3. Microbial diversity
3.4.4. Genetic diversity
3.5. Ecosystem - specific species diversity
3.6 Area based conservation
3.5. Protected areas
3.6. Community driven conservation
3.7. Tiger conservation area
3.8. Elephant Conservation Area
3.9. Eco-Sensitive Zones (ESZs)
3.10. Ecologically Sensitive Areas (ESAs)
3.11. Sustainable use of biodiversity
3.12. Assessment of extinction risk and conservation of threatened species
3.13. Challenges in taxonomic research and digitalized databases
3.14. Agro-biodiversity
3.15. Conservation challenges and threats
3.16. Policies, legislations and institutional framework
3.17. Lifestyle for Environment (LiFE)



102

Chapter 4

National Biodiversity Strategy and Action Plan-NBSAP

4.1. Introduction
4.2. KM-GBF themes and national biodiversity targets
4.3. India's national biodiversity targets and action points
4.4. Implementation approach
4.5. Implementation framework

130

Chapter 5

Capacity Building and Development

5.1. Introduction
5.2. Existing capacity building programmes in India
5.3. Relevant thrust areas
5.4. Capacity development response – 'Assessment to Action'

140

Chapter 6

Biodiversity Finance and Resource Mobilization

6.1. The Biodiversity Finance Initiative (BIOFIN)
6.2. BIOFIN India- Assesment
6.3. Ministry wise total and attributable expenditure of available funding
6.4. Biodiversity Expenditure Review (BER) for India
6.5. Ministry-wise total and attributable expenditure of available funding

154

Chapter 7

National Biodiversity Targets and Monitoring Framework

7.1. National monitoring framework

E N T S



1

INTRODUCTION

1.1.

Background

National Biodiversity Strategies and Action Plan (NBSAP) serve as crucial framework for countries to integrate biodiversity conservation into their development agendas. By aligning with the Convention on Biological Diversity (CBD), these plans enable nations to focus on the sustainable use of biological resources and ensure the fair and equitable sharing of benefits derived from them.

Every four years, countries are required to report their progress through National Reports (NRs), which detail advancements based on specific targets and indicators tailored to their unique contexts and priorities. This process not only tracks progress but also promotes accountability and fosters collaboration among stakeholders at various levels, enhancing the effectiveness of biodiversity initiatives. Through NBSAPs, countries can better align their environmental, economic, and social goals, ultimately contributing to global biodiversity conservation efforts.

India, recognized as one of the 17 megadiverse countries, harbors 7-8% of the world's recorded species within just 2.4% of the global land area. The country became a party to CBD in 1994, showcasing its commitment to biodiversity conservation. Following this, India developed "India's National Policy and Macro-level Strategy on Biodiversity" in 1999, which laid the groundwork for more comprehensive biodiversity governance.

The enactment of the Biological Diversity Act in 2002 and the accompanying Biological Diversity Rules in 2004 further demonstrate India's dedication to preserving its rich biological heritage. These initiatives, established within a decade of ratifying the CBD, reflect a proactive approach to integrating biodiversity considerations into national policy, ensuring sustainable use and equitable sharing of biological resources. Through these measures, India aims to balance ecological integrity with socio-economic development, fostering a sustainable future for its diverse ecosystems.

In alignment with the Convention on Biological Diversity (CBD) mandate, India formulated its National Biodiversity Action Plan (NBAP), which was approved in 2008 following a comprehensive inter-ministerial process. This updated plan builds upon the 1999 document from the Ministry of Environment and Forests (MoEF) and incorporates insights from a participatory project report developed with various stakeholders, ensuring broad-based support and relevance.

In 2014, an addendum to the NBAP was introduced, establishing 12 National Biodiversity Targets (NBTs) through extensive consultations. These targets align with the Global Strategic Plan for Biodiversity (2011-2020) and the 20 Aichi Biodiversity Targets agreed upon at the CBD's 10th Conference of the Parties (CoP 10).

India has consistently submitted its National Reports since 1998, detailing progress in biodiversity conservation efforts. Notably, in December 2018, India became the first country to digitally upload its Sixth National Report, showcasing its commitment to transparency and modernizing reporting practices. This proactive approach highlights India's dedication to biodiversity conservation and its integration into national policies and frameworks.The progress of NBSAPs in India is depicted in Fig 1.1.

Fig 1.1
IProgress of NBSAPs in India

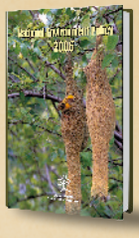
1992

Adoption of UNCBD, UNFCCC,and UNCCD



First NBSAP (National Policy and Macro Level Strategy on Biodiversity)

1999



2006

National Environmental Policy



National Biodiversity Action Plan

2008



2010

Strategic Plan for Biodiversity 2011-2020



Addendum to NBAP 2008

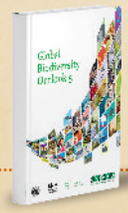
2014



2019

An Overview: Implementation Plan for National Biodiversity Action Plan

IPBES Report on Global Assessment of Biodiversity and Ecosystem Services



Global Biodiversity Outlook 5

2020

2022

Adoption of Kunming- Montreal Global Biodiversity Framework



Initiation of Consultative Process on Updating NBSAP aligned with KM-GBF

2023

2024

Updated NBSAP aligned with Global Biodiversity Framework



INDIA'S UPDATED NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN 2024-2030

In alignment with **Kunming - Montreal Global Biodiversity Framework**

A ROAD MAP FOR CONSERVATION OF INDIA'S BIODIVERSITY



1.2.

The Kunming-Montreal Global Biodiversity Framework

Alarmed by astounding revelations made about the assessment of biodiversity in the Global Biodiversity Outlook (GBO), the UN Convention on Biological Diversity (UNCBD) adopted the Kunming-Montreal Global Biodiversity Framework during the COP 15 held in December, 2022. The Framework is built around a 'Theory of Change' that recognizes urgent policy action is required globally, regionally, and nationally to achieve sustainable development so that the drivers of undesirable change that have exacerbated biodiversity loss will be reduced and/or reversed so as to allow recovery of all ecosystems and to achieve the Convention's Vision of 'Living in Harmony with Nature' by 2050.

The KM-GBF aims to catalyze, enable, and galvanize urgent and transformative action by governments and subnational and local authorities, with the involvement of all of society, to halt and reverse biodiversity loss, achieve the outcomes it sets out in its vision, mission, goals, and targets, and thereby contribute to the three objectives of the CBD and to those of its protocols. The Framework is action- and result-oriented and aims to guide and promote the revision, updating, development, and implementation of policies, goals, targets, and national and state biodiversity strategies and action plans by national and sub-national governments, as well as facilitate the monitoring and review of progress at all levels in a more transparent and responsible manner.

The Framework promotes coherence, complementarity, and cooperation between the CBD and its Protocols, other biodiversity-related conventions, multilateral agreements, and international institutions, respecting their mandates, and creates opportunities for cooperation and partnerships among diverse actors to enhance implementation of the Framework. The CBD also took several important decisions for effective implementation of the Framework. The COP Decision (15/6) considered that the National Biodiversity Strategy and Action Plan (NBSAP) is the main instrument for implementing the Convention at the national level and seen as an umbrella process for achieving all goals and action-oriented targets, while periodic National Reports (NRs) are the main instrument for monitoring and reviewing the progress of implementation.

The Framework is based on the Convention's previous Strategic Plans and supports to achieve the Sustainable Development Goals. The vision and mission of the framework are

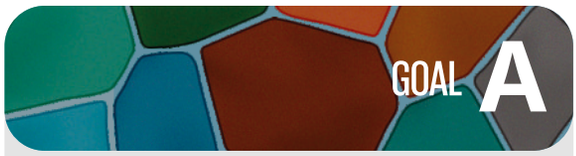
Vision - 2050

A world of living in harmony with nature where "by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people."

Mission – 2030

To take urgent action to halt and reverse biodiversity loss to put nature on a path to recovery for the benefit of people and planet by conserving and sustainably using biodiversity and by ensuring the fair and equitable sharing of benefits from the use of genetic resources, while providing the necessary means of implementation.

This new framework, specifies 4 global goals for 2050 (Fig 1.2) to be achieved through 23 Global Biodiversity Targets to be achieved by 2030 (Table 1.1). It sets out an ambitious plan to implement broad-based actions, in line with the 2030 Agenda for Sustainable Development, to ensure that, by 2050, the shared vision of living in harmony with nature is fulfilled.

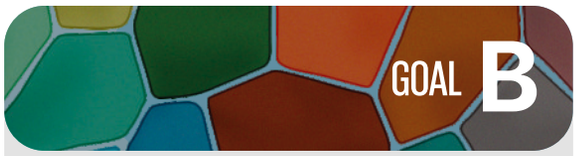


Ecosystems Are Conserved, Human Included Extinctions Are Halted And Genetic Diversity Is Maintained

The integrity, connectivity and resilience of all ecosystems are maintained, enhanced, or restored, substantially increasing the area of natural ecosystems by 2050;

Human induced extinction of known threatened species is halted, and, by 2050, the extinction rate and risk of all species are reduced tenfold and the abundance of native wild species is increased to healthy and resilient levels;

The genetic diversity within populations of wild and domesticated species, is maintained, safeguarding their adaptive potential.



Biodiversity Is Sustainbly Used And Its Contibutions To People Are Maintained, Enhanced And Restored

Biodiversity is sustainably used and managed and nature's contributions to people, including ecosystem functions and services, are valued, maintained and enhanced, with those currently in decline being restored, supporting the achievement of sustainable development for the benefit of present and future generations by 2050.

Fig 1.2. The Goals of KM-GBF



Benefits from the use of gentic resource are shared and substantially increased

The monetary and non-monetary benefits from the utilization of genetic resources and digital sequence information on genetic resources, and of traditional knowledge associated with genetic resources, as applicable, are shared fairly and equitably, including, as appropriate with indigenous peoples and local communities, and substantially increased by 2050, while ensuring traditional knowledge associated with genetic resources is appropriately protected, thereby contributing to the conservation and sustainable use of biodiversity, in accordance with internationally agreed access and benefit-sharing instruments.



Biodiversity finance gap is closed ensuring adequate enhanced means of implementation (funds, capacity technical and scientific cooperation) are available

Adequate means of implementation, including financial resources, capacity-building, technical and scientific cooperation, and access to and transfer of technology to fully implement the Kunming-Montreal Global Biodiversity Framework are secured and equitably accessible to all Parties, especially developing country Parties, in particular the least developed countries and small island developing States, as well as countries with economies in transition, progressively closing the biodiversity finance gap of $700 billion per year, and aligning financial flows with the Kunming-Montreal Global Biodiversity Framework and the 2050 Vision for biodiversity.

Table 1.1. Linkages between Goals and Targets of KM-GBF

Goals	Global Biodiversity Targets																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
A	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
B	■	■			■			■	■	■	■	■		■	■	■	■	■	■	■	■	■	■
C									■	■			■	■	■		■		■	■	■	■	
D						■	■	■		■				■	■		■	■	■	■	■	■	

Source : CBD

1.2.

Rationale for updating NBSAP and relevance of KM-GBF Goals to India

The urgent need to address issues and challenges relating to biodiversity conservation and its sustainable use is well recognized both at global and national levels. In response to the need to accelerate action in India to conserve, protect and enhance global biological resources, maintain integrity, resilience, and connectivity of ecosystems, and halt/reduce anthropogenic impact on species, the NBSAP needs to be revisited. In addition, as a party to the CBD, India's NBSAP needs to be revised or updated to align it with the KM-GBF goals and targets. Since KM-GBF has been adopted as the main vehicle for implementation of the Biodiversity Framework, the National Biodiversity Targets along with the global targets need to be communicated in a standardized format, which will be presented during the COP at its sixteenth meeting.

Accelerating action for realization of the 4 Goals and 23 Targets under KM-GBF is required to address the key drivers of biodiversity loss, promote the conservation agenda, and achieve global targets and SDGs by 2030, to safeguard and sustainably use the country's rich biodiversity. Building on existing policies, legal framework and previous Strategic Plans, the Framework provides opportunities to include citizen led initiatives, adopt a landscape approach to restore ecosystems, halt/reduce human induced species loss, promote sustainable use of biodiversity and equitable sharing of its benefits, and address biodiversity finance gap by identifying sources for resource mobilization. The Framework also provides an opportunity to identify country relevant indicators and their effective monitoring and evaluation.

The framework promotes coherence, complementarity and cooperation between the CBD and other biodiversity related conventions, multilateral agreements and international institutions. The framework also acknowledges the need for recognizing gender equality, women's empowerment, gender-responsive approaches and engagement of youth while ensuring the full and effective participation of local communities in the implementation of this framework.

Goal A: places greater emphasis on ecosystems and genetic diversity as compared to previous Aichi Targets by covering all three elements of biodiversity (ecosystem, species, and genetic diversity), with focus on: (i) connectivity, integrity, and resilience of all ecosystems; (ii) substantially increasing the area of natural ecosystems; (iii) reducing human-induced extinction of species; (iv) ecosystem restoration; and (v) maintaining genetic diversity not just to serve human needs, but for enhanced reproduction and survival rates of all species and their reduced vulnerability to climate change. A Mission Mode approach would be required to restore degraded ecosystems, enhance their resilience, and reduce the risk of extinction of species.

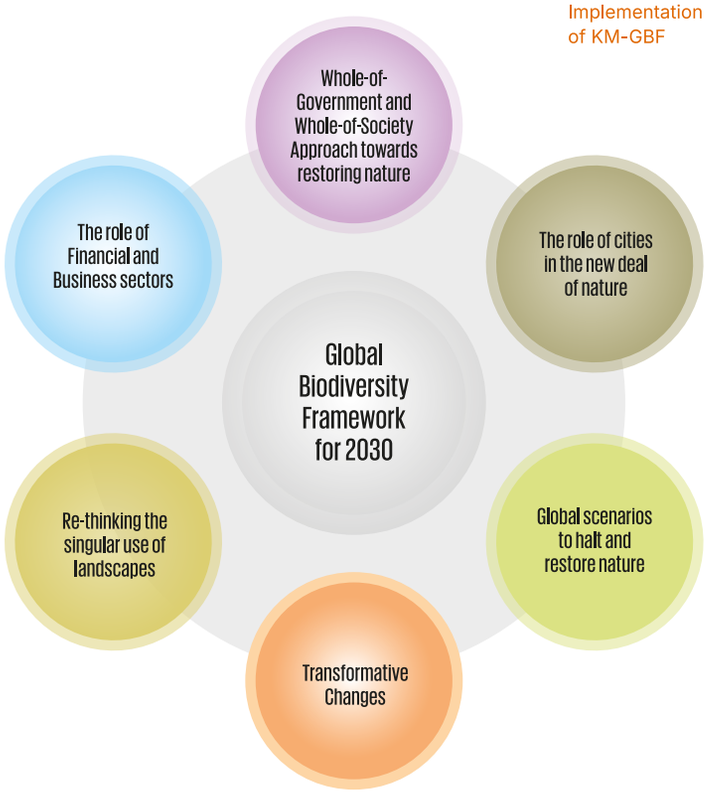
Goal B: warrants an urgency to promote sustainable use of biodiversity and management of ecosystems to achieve SDGs.

Goal C: lays emphasis on the monetary and non-monetary benefits from the utilization of genetic resources, digital sequence information and associated traditional knowledge and strengthening of the ABS system by building capacities of SBBs, BMCs and all stake holders.

Goal D: acknowledges the importance of capacity development, technical and scientific cooperation, access to and transfer of technology, and bridging the finance gap to implement the NBSAP.

The important considerations for translating the provisions of the KM-GBF in the field are summarised in Fig 1.3.

Fig 1.3 Important Considerations for the Implementation of KM-GBF





2

PROCESS OF UPDATING NBSAP

2.1.

Introduction

To update its NBSAP, India followed 'a whole of government and whole of society approach' conforming to Article 6 of the Convention on Biological Diversity, and aligned the National Biodiversity Targets with KM-GBF global targets for submission to the 16th meeting of COP in October 2024. The process adopted is depicited in Fig 2.1.

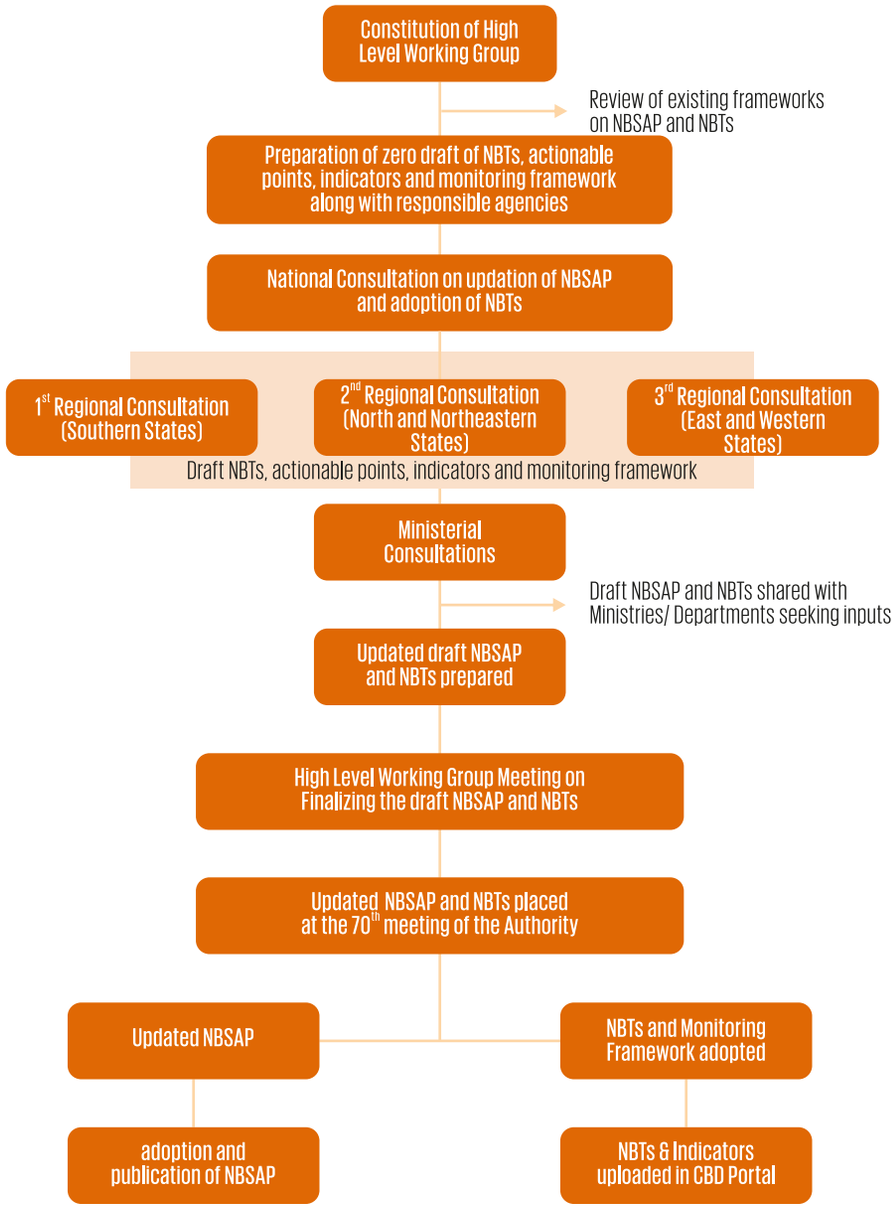


Fig 2.1
Process of updating NBSAP and adoption of NBTs

© A N Shukla

2.2.

Highly Participatory Process

To prepare an "Updated NBSAP", the National Biodiversity Authority (NBA), under the aegis of the Ministry of Environment, Forest and Climate Change, had set up a High-Level Working Group (WG) comprising independent experts and representatives from various Ministries, State Biodiversity Boards and public institutions. A series of National, Regional, Inter and Intra - Ministerial Consultations were held with technical and financial support from the United Nations Development Programme and the Global Environment Facility. Suggestions on SMART indicators and the Action Points were obtained during these consultations. Representatives from 24 Central Ministries and their associated institutions, 15 Institutions under the Ministry of Environment, Forest and Climate Change, International Conservation Organizations, subject matter specialists, Corporates, Industry, State



governments, local level Institutions, NGOs, Youth and women groups and civil society members from all the 28 States and 8 Union Territories of India participated.

The National Biodiversity Targets, indicators, monitoring framework and data sources were consolidated by the Working Group ensuring that majority of indicators are quantifiable. Finally, the MoEFCC along with a small team of experts from NBA and UNDP, streamlined the indicators, prioritized actions and finalized the NBSAP considering the national circumstances and priorities. In addition, the expert group also incorporated the inputs/suggestions received from various line Ministries/Departments as a response to the draft version of the "Updated NBSAP".





2.3.

Adopting the National Biodiversity Targets in alignment with the KM-GBF Targets

A conscious and concerted decision was taken to align the National Biodiversity Targets to the 23 Kunming- Montreal Global Biodiversity Targets (Table 2.1).

Table 2.1 Mapping of India's NBTs with KM-GBF Targets

Kunming-Montreal Global Biodiversity Framework Targets

NBT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	■	■	■		■					■		■											
2		■	■					■			■	■											
3			■	■					■		■												
4	■	■	■	■	■	■	■	■															
5				■	■	■			■		■												
6		■	■	■		■				■	■												
7				■			■			■													
8		■	■	■				■		■	■	■											
9				■	■				■		■												
10		■	■	■		■	■	■	■	■	■					■							
11		■	■		■	■	■	■	■	■	■	■											
12		■	■	■				■			■	■											
13				■					■				■		■				■				
14														■	■	■		■					
15				■	■	■	■		■	■			■	■	■	■							
16				■	■	■	■	■	■	■	■	■	■	■		■							
17				■		■	■	■		■							■						
18					■		■		■	■						■		■	■				
19														■	■			■	■				
20	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
21	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
22	■		■		■				■					■							■	■	■
23										■	■	■	■										■

INDIA'S UPDATED NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN 2024-2030

In alignment with Kunming - Montreal Global Biodiversity Framework

A ROAD MAP FOR CONSERVATION OF INDIA'S BIODIVERSITY

2.4.

Development of Action Points for Updated NBSAP

India in response to the country's National Environment Policy, 2006 had prepared the National Biodiversity Action Plan (NBAP) through a comprehensive inter-ministerial consultative process. The Government of India approved the NBAP in November, 2008 that included 11 objectives and 175 action points. Although, the NBAP 2008 was prepared prior to the adoption of the CBD's Strategic Plan for Biodiversity (SP) 2011-2020 and its 20 Aichi Biodiversity Targets (ABTs), the NBAP 2008 was broadly aligned with the 5 Strategic Goals and the 20 ABTs of SP.

The CBD urged Parties to develop National Biodiversity Targets, using SP and its targets as a flexible framework, in accordance with national priorities and capacities. Parties are also required to review, and as appropriate update and revise their NBSAPs or equivalent instruments with the SP, by integrating the National Biodiversity Targets (NBTs) into the NBSAPs, and report to COP 12. Though, India had prepared its second generation of NBAP in 2008, it was decided that the NBAP need not be completely overhauled or revised, but an exercise be undertaken of updating the NBAP by developing NBTs keeping in view the ABTs as a framework.

Accordingly, in pursuance to the decision of CBD, India had developed and adopted 12 NBTs using the SP as the broad framework, aligned 175 action points to these 12 NBTs, and continued to pursue them till date. Although, these action points were framed and adopted more than 15 years ago, most of them are still relevant. In view of this, an effort was made to assort these existing 175 action points to newly drafted 23 NBTs aligned with KM-GBF. However, at least four NBTs (11, 12, 18 and 23) remained unrepresented by even a single existing action point. Also, several NBTs had inadequate action points in view of the wider scope of NBTs aligned with KM-GBF, their multiple components, elements, and themes.

Thus, an attempt was made by the expert team of NBA and UNDP to list some potential supplemental action points against each NBT. Target-wise existing and proposed supplemental action points were shared with varied stakeholders during the national, regional, and inter/ intra- ministerial consultative process to seek their feedback and valuable resource inputs so that the action points for each 23 NBTs can be finalized in due course.

The wider consultative process at different levels provided valuable inputs and comments on the existing and proposed action points. Based on the feedback, action points relevant to 23 NBTs were firmed up in consultation and as per advice of the working group and presented in Table 2.2. The third generation NBSAP aligned with KM-GBF includes a total of 193 action points against 23 NBTs. These result-oriented action points firmed up through the extensive consultative process are now a part of broader biodiversity monitoring framework indicating each of the 23 NBTs, corresponding indicators, and responsible Lead/ Supporting Agencies for execution of monitoring framework. Firmed up action points will be implemented by relevant sectors across national and sub-national governments, local bodies, and other stakeholders / agencies by 2030. This collective effort aims to operationalize transformative approaches necessary to achieve the ambitious targets set forth.



Table 2.2 Twenty-three National Biodiversity Targets of "Updated NBSAP"

Number	National Biodiversity Targets
NBT 1	**Biodiversity inclusive integrated land / sea use planning:** Ensure that all areas are under participatory integrated biodiversity- inclusive spatial planning and effective management processes addressing land and sea use change, to bring the loss of areas of high biodiversity importance, including ecosystems of high ecological integrity, close to zero by 2030, while respecting the rights of Local Communities (LCs).
NBT 2	**Ecosystems restoration:** Ensure that by 2030, at least the prioritized 30 per cent areas of degraded terrestrial, inland water, and marine and coastal ecosystems are under effective restoration, in order to enhance biodiversity and ecosystem functions and services, ecological integrity and connectivity.
NBT 3	**Conserve biodiversity in land, water and sea:** Ensure and enable that by 2030, at least 30 per cent of terrestrial, inland waters, and coastal and marine areas, especially areas of importance of biodiversity, ecosystem functions and services, are effectively conserved through ecologically representative, well-connected protected areas and Other Effective Area-based Conservation Measures (OECMs). Also, integrate tribal areas wherever applicable into wider landscapes/ seascapes and ensure that sustainable use is legal and consistent with conservation outcomes while respecting the rights of Local Communities (LCs), including their traditional territories.
NBT 4	**Manage species and genetic diversity:** Ensure urgent management actions to halt human-induced extinction of known threatened species, as well as recovery and conservation. Also, maintain and restore the genetic diversity within and between populations of native wild and domesticated species to maintain their adaptive potential through *in situ* and *ex situ* conservation and sustainable management practices and effectively manage human-wildlife interactions.
NBT 5	**Sustainable harvest, trade, and use of wild species:** Ensure that the use, harvesting, and trade of wild species are sustainable, safe, and legal, preventing overexploitation, minimizing impact on non-target species and ecosystems, and reducing the risk of pathogen spillover. Apply the ecosystem approach while respecting and protecting customary sustainable use by Local Communities (LCs).
NBT 6	**Manage Invasive alien species:** Eliminate, minimize, reduce and or mitigate the impact of prioritized invasive alien species on biodiversity and ecosystem services by identifying and managing pathways for the introduction of alien species and eradicating or controlling invasive alien species, especially in priority sites, such as islands.
NBT 7	**Reduce pollution risks and negative impact:** Reduce pollution risks and the negative impact of pollution from all sources by 2030 to levels that are not harmful to biodiversity and ecosystem functions and services, considering cumulative effects by (a) reducing excess nutrients lost to the environment including through more efficient nutrient cycling and use; (b) reducing the overall risk from pesticides and highly hazardous chemicals by at least half, including through integrated pest management, based on science, taking into account food security and livelihoods; and (c) preventing, reducing, and working towards eliminating plastic pollution.
NBT 8	**Minimize the impact of climate change:** Minimize the impact of climate change and ocean acidification on biodiversity and increase its resilience through mitigation, adaptation, and disaster risk reduction actions through nature-based solutions and/ or ecosystem-based approaches. Minimize negative impacts and foster positive impacts of climate action on biodiversity.

INDIA'S UPDATED NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN 2024-2030

In alignment with **Kunming - Montreal Global Biodiversity Framework**

A ROAD MAP FOR CONSERVATION OF INDIA'S BIODIVERSITY

Meeting people's needs through sustainable use and benefit-sharing

Number	National Biodiversity Targets
NBT 9	**Sustainable use of wild species for multiple benefits:** Ensure that the sustainable management and use of wild species as per National laws, thereby providing social, economic and environmental benefits for people, especially those in vulnerable situations and dependent on biodiversity.
NBT 10	**Sustainable management of agriculture, animal husbandry, fisheries, aquaculture and forest areas:** Ensure areas under agriculture, animal husbandry, fisheries, aquaculture, forests, grasslands, inland waters, and coastal and marine ecosystems are managed sustainably so as to contribute towards food security, community resilience, restoration of biodiversity, long-term efficiency, and productivity for enhanced ecosystem services.
NBT 11	**Enhance and maintain ecosystem services and regulate air and water quality, hazards and extreme events:** Restore, maintain and enhance nature's contributions to people, including ecosystem services, such as the regulation of air, water and climate, soil health, pollination and reduction of disease risk, as well as prevention and protection from hazards and disasters, through nature-based solutions and/ or ecosystem-based approaches for the benefit of all people and nature.
NBT 12	**Enhance green and blue spaces for increased access and human well-being:** Significantly increase the area, quality, and connectivity of green and blue spaces in urban areas for enhanced access and sustainable use.
NBT 13	**Access and Benefit Sharing:** Take effective legal, policy, administrative and capacity-building measures at all levels to ensure and increase the fair and equitable sharing of benefits that arise from the utilisation of biological resources/ genetic resources and digital sequence information as well as traditional knowledge associated with biological/ genetic resources, and facilitating appropriate access and benefit-sharing instruments.

Tools and solutions for implementation and mainstreaming

Number	National Biodiversity Targets
NBT 14	**Mainstreaming biodiversity:** Ensure the full integration of biodiversity and its multiple values into policies, regulations, planning, budgeting and development processes.
NBT 15	**Sustainable production, supply chains and disclosure of risks:** Take legal, administrative or policy measures to encourage and enable businesses, particularly large and transnational companies and financial institutions to regularly monitor, assess and disclose risks, dependencies and impacts related to biodiversity.
NBT 16	**Promote sustainable consumption choices:** Ensure that people are encouraged and enabled to make choices for sustainable consumption to reduce the footprint of unsustainable consumption in an equitable manner.
NBT 17	**Strengthen biosafety regulatory capacity:** Strengthen capacity for implementation of biosafety measures
NBT 18	**Repurpose detrimental incentives for biodiversity:** Identify and repurpose incentives, including subsidies detrimental to biodiversity, and scale up positive incentives for the conservation and sustainable use of biodiversity progressively.
NBT 19	**Resource mobilization:** Ensure the flow of adequate financial resources from all sources, including public, private, international, and other innovative financial mechanisms, to implement the NBSAP, SBSAPs, and LBSAPs.
NBT 20	**Capacity-building and development, technical and scientific cooperation:** Strengthen capacity development, access to and transfer of technology, and promote access and development of innovations, technical and scientific cooperation, through South- South, North-South and Triangular Cooperation.
NBT 21	**Communication, Awareness, and Knowledge Management:** Ensure that the best information and knowledge from science, research, and evidence-based sources are accessible to decision-makers, practitioners, and the public to guide effective and equitable governance and integrated and participatory management, and strengthen communication, education, awareness-raising, research, monitoring, and knowledge management relevant to the conservation of biodiversity.
NBT 22	**Equitable and effective participation in decision-making:** Ensure the full, equitable, inclusive, effective and gender-responsive representation and participation in planning, decision-making, management, and access to justice and information related to biodiversity by youth, ethnic groups, and local communities.
NBT 23	**Gender equality in decision-making and implementation:** Ensure gender equality in the implementation of the NBSAP, SBSAPs and LBSAPs through a gender-responsive approach, where all women and girls have equal opportunity and capacity in decision-making related to biodiversity.



3

INDIA'S BIODIVERSITY: ACHIEVEMENTS, THREATS AND CHALLENGES

3.1.

Introduction

India is one of the 17 mega-diverse countries, distinguished by its wide range of geomorphic features and landforms. The country exhibits extreme variations in altitudinal gradients and climatic conditions, which contribute to its rich biodiversity. Furthermore, the presence of diverse ethnic groups with a strong tradition of nature and biodiversity conservation plays a vital role in preserving India's ecological heritage. This unique combination of geographic and cultural diversity underscores India's significance in global biodiversity efforts.The strategic location of India at the confluence of three biogeographic realms has contributed to this high biodiversity at all the three levels i.e., genetic, species and ecosystem diversity. Four of the world's 36 biodiversity hotspots *viz.,* the Himalayas, Western Ghats, Indo-Burma area (Northeast India and Andaman Islands), and Sundaland (Nicobar Islands) are located in India, emphasizing the country's responsibility to conserve its biodiversity with due emphasis on endemics.

India with land elevation ranging from –2 m to +8586 m asl, is bound by Himalayan Ranges in the north running from west to east covered by glaciers /snow at high elevations, and dense forest vegetation at low and mid- elevation zones. Other than the Himalayas, the prominent hill ranges are: Western Ghats, Northeastern hills, Aravalli, Vindhyas, Satpura, and Eastern Ghats. A substantial portion of India's geographical area is either flat or below 100 m elevation, especially in the massive Gangetic Plains, coastal region, and archipelagos. The Andaman and Nicobar Islands in the Bay of Bengal consist of about 572 islands/islets. The Lakshadweep and Minicoy Islands located in the Arabian sea are scattered and built of coral deposits. The nation's climate is strongly influenced by the Himalayas and the Great Indian (Thar) Desert. India is a tropical monsoon country. Although, country's average rainfall is 125 cm, western (Rajasthan) and northern most (Ladakh) regions receive scanty rainfall (>20cm). Mawsynram, a town in Meghalaya State is the wettest place on Earth, with an average annual rainfall of 11,872 mm. Wide altitudinal variation along with the above mentioned habitat and climatic diversities across the country greatly influenced its biodiversity. The Bay of Bengal, Indian Ocean and the Arabian sea bound India in east, south, and west respectively. Besides the marine ecosystems, large river systems such as Indus, Ganga, Brahmaputra, Narmada, Mahanadi, Godavari, Krishna, and Kaveri, and numerous lakes and other wetlands provide habitats to diverse aquatic biodiversity.

© Sanjay Shukla

3.2.

Biogeographic Regions

Based on the climatic conditions, geographic location, vegetation history, and the constituent plant and animal species, India has been divided into 10 bio-geographic zones. Further, biogeographic zones are divided into three subordinate levels *viz.*,

The Biotic Province	The Land Region	The Biome
a secondary unit within a zone	a tertiary unit within a province	an ecological unit

Source: Rodgers and Panwar, 1988.

Among these biogeographic zones, 6-Deccan peninsula has 42% of the geographical area (GA), followed by 4-Semi-arid biogeographic zone covering 16.6% country's GA. The third largest biogeographic zone is 7-Gangetic plains, covering 10.8% of the GA. The 1-Trans himalaya and 3-Indian desert biogeographic zones representing cold desert and hot desert cover 5.6% and 6.5% of the GA, respectively. (Fig 3.1 and Table 3.1)

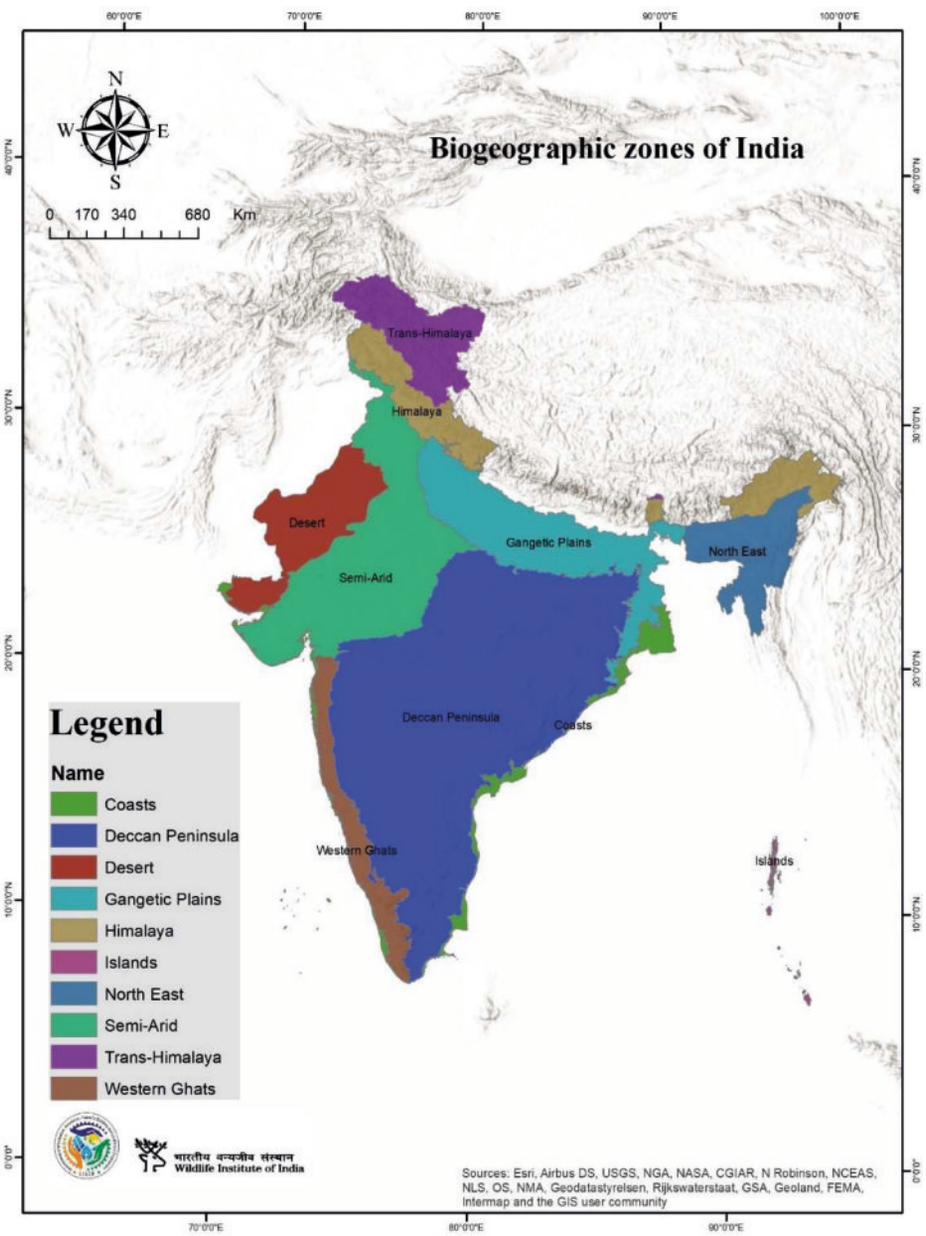


Fig 3.1. Biogeographic Classification of India

Table 3.1. Biogeographic Zones and Biotic Provinces of India

Sr. No.	Biogeographic Zone	Biotic Provinces	Per Cent of India's GA
1.	Trans-Himalayas	1A: Ladakh	3.3
		1B: Tibetan Plateau	2.2
		1C: Trans - Himalaya Sikkim	<0.1
2.	Himalayas	2A: Himalaya - North West Himalaya	2.1
		2B: Himalaya - West Himalaya	1.6
		2C: Himalaya - Central Himalaya	0.2
		2D: Himalaya - East Himalaya	2.5
3.	Indian Desert	3A: Desert – Thar	5.4
		3B: Desert – Katchchh	1.1
4.	Semi-Arid	4A: Semi-Arid - Punjab Plains	3.7
		4B: Semi-Arid – Gujarat, Rajputana	12.9
5.	Western Ghats	5A: Western Ghats - Malabar Plains	2.0
		5B: Western Ghats - Western Ghats Mountains	2.0
6.	Deccan Peninsula	6A: Deccan Peninsular – Central Highlands	7.3
		6B: Deccan Peninsular - Chotta Nagpur	5.4
		6C: Deccan Peninsular – Eastern Highlands	6.3
		6D: Deccan Peninsular - Central Plateau	12.5
		6E: Deccan Peninsular - Deccan South	10.4
7.	The Gangetic Plains	7A: Gangetic Plain - Upper Gangetic Plains	6.3
		7B: Gangetic Plain - Lower Gangetic Plains	4.5
8.	Coasts	8A: Coasts - West Coast	0.6
		8B: Coasts - East Coast	1.9
		8C: Coasts – Lakshadweep	<0.1
9.	North-East India	9A: North-East - Brahmaputra Valley	2.0
		9B: North-East – North East Hills	3.2
10.	Islands	10A: Islands– Andamans	0.2
		10B: Islands– Nicobar	0.1
		Total	**100**



© A N Shukla

3.3.

Ecosystem Diversity

Ecosystem diversity represents the variety of ecosystems in the country that includes both natural as well as man-made ecosystems in terrestrial and aquatic environment. The terrestrial ecosystem diversity includes forests, grasslands, scrublands, desert, and swamps. Similarly, aquatic ecosystem diversity encompasses marine ecosystems, river ecosystems, lake ecosystems, swamps, and estuaries.

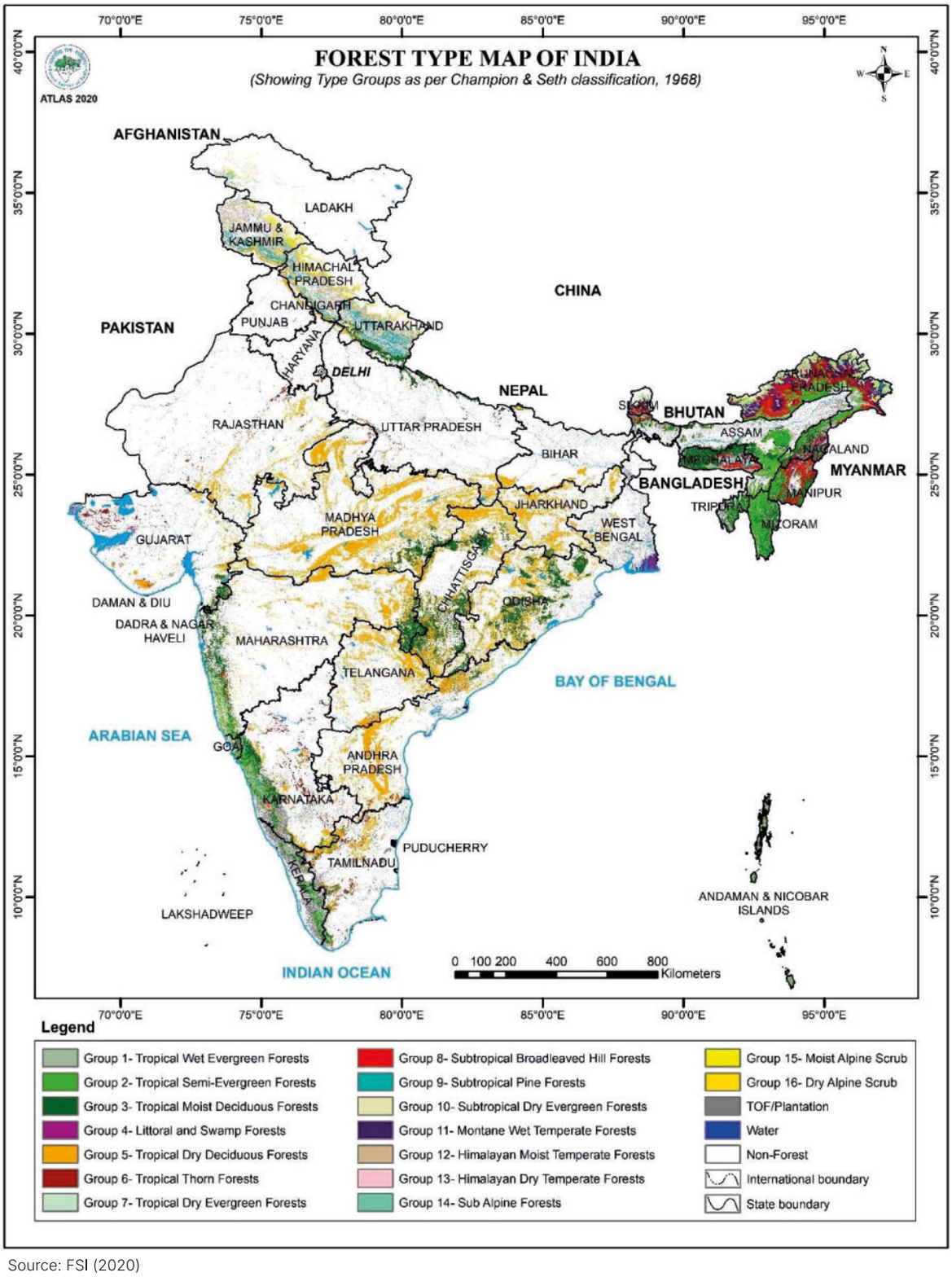
Forest Ecosystems

Champion and Seth (1968) classified diverse forests of India across different biogeographic zones into 6 Major Groups, 16 Forest Type Groups, and 221 Sub-group types. Each of these forest types is home to wide array of wild plant and animal species, and microbes. The total area under different forest types (FSI, 2021) is 7,13,789 km², and Tropical Dry Deciduous Forests cover the maximum geographical area (Fig 3.2 and Table 3.2). Country's forest cover showed a progressive increase between 2001 and 2021 (Fig 3.3)

A N Shukla



Fig 3.2. Distribution of Forest Types and TOF/ Plantation in India



Source: FSI (2020)

Table 3.2. Extent of Forest types in India

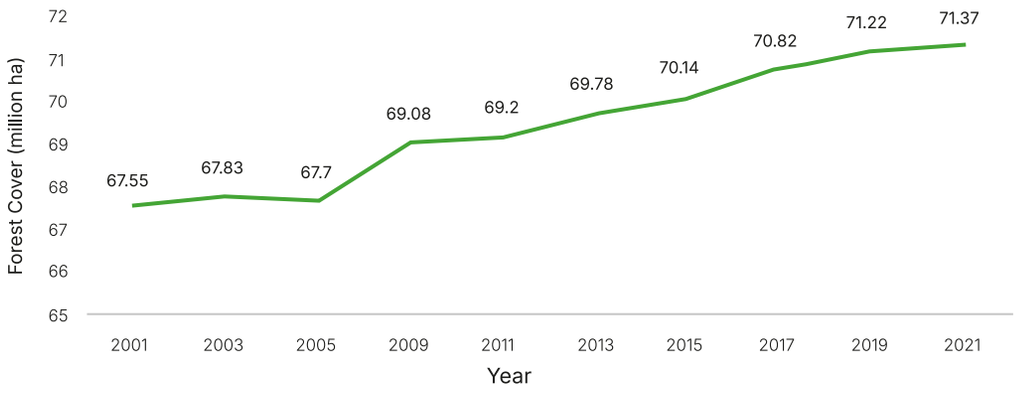
Area (Km²)

Sr.No.	Forest Type	Area (km²)	% of Forest Cover and TOF	VDF	MDF	OP
1.	Tropical Wet Evergreen Forests	19,572	2.7	9,147	7,863	2,562
2.	Tropical Semi-Evergreen Forests	69,195	9.7	8,520	29,997	30,678
3.	Tropical Moist Deciduous Forests	1,31,805	18.6	24,796	65,377	41,632
4.	Littoral and Swamp Forests	5,478	0.77	1,558	1,653	2,267
5.	Tropical Dry Deciduous Forests	2,80,547	39.3	23,634	1,25,840	1,31,073
6.	Tropical Thorn Forests	13,259	1.8	165	3,587	9,508
7.	Tropical Dry Evergreen Forests	835	0.1	133	420	282
8.	Subtropical Broadleaved Hill Forests	31,015	4.3	7,288	13,859	9,868
9.	Subtropical Pine Forests	17,801	2.5	1,787	9,077	6,937
10.	Subtropical Dry Evergreen Forests	173	0.02	8	60	105
11.	Montane Wet Temperate Forests	20,185	2.8	8,599	9,423	2,163
12.	Himalayan Moist Temperate Forests	28,727	4	8,687	13,534	6,506
13.	Himalayan Dry Temperate Forests	4,255	0.6	1,227	1,681	1,347
14.	Sub-Alpine Forests	12,672	1.8	2,785	5,662	4,225
15.	Moist Alpine Scrub	652	0.1	76	279	297
16.	Dry Alpine Scrub	2,396	0.4	194	583	1,619
17.	Plantation/ TOF	75,221	10.6	1,174	17,996	56,051
	Total	**7,13,789**	**100**	**99,778**	**3,06,891**	**3,07,120**

Source: FSI, 2021

Fig 3.3. Changes in Forest Cover (2001-2021)

Source: Compiled from FSI-ISFRs





© Siddharth P. Nair

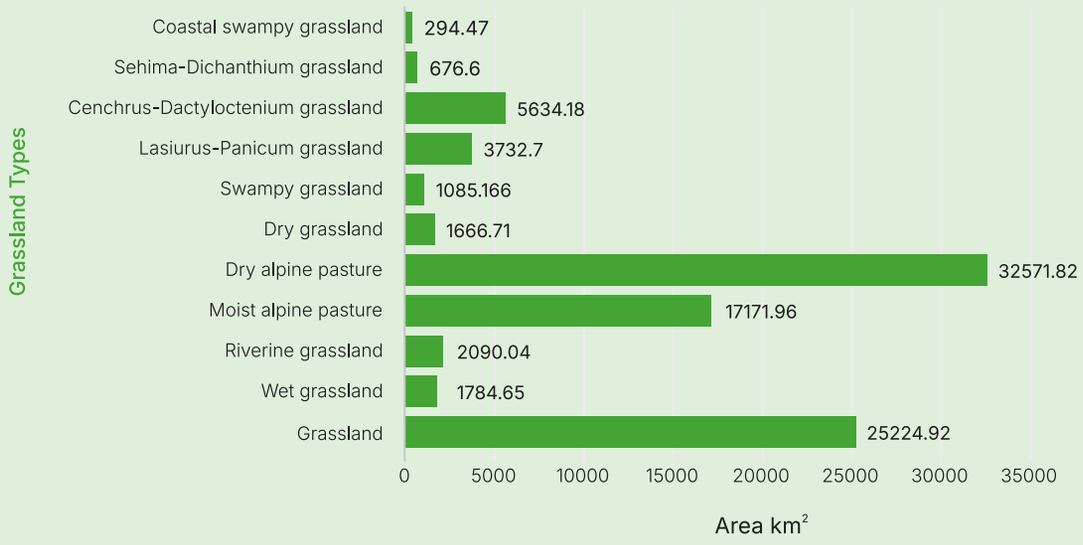


Grassland Ecosystems

Eleven categories of different grasslands covering an area of 91,933 km² exist in India. These grasslands range from coastal swampy grassland to moist alpine pasture grassland (Fig 3.4).

Fig 3.4. Extent of Different Grassland Types

Source: Roy et al., (2015)







© A N Shukla

Desert Ecosystems

Deserts are natural fragile ecosystems. Depending upon the extremities in temperature, India harbours both, cold as well as hot deserts. The cold desert is under the 1-Trans-Himalaya biogeographic zone while hot desert is under the 3-Indian Desert biogeographic zone. The Trans-Himalaya (Cold desert) biogeographic zone is represented by three biotic provinces (1A-Ladakh; 1B- Tibetan Plateau; and 1C-Trans Himalaya Sikkim), and collectively they cover ~5.6% geographical area of the country. Hot Indian Desert is represented by two biotic provinces *viz.*, 3A- Desert Thar and 3B-Desert Kutchchh, and they cover about 6.5% geographical area of the country (Rodgers and Panwar, 1988).

Inland, Coastal and Marine Water Ecosystems

At least 2,31,195 wetlands (area >= 2.25 ha) covering Inland and coastal wetlands (natural and manmade) exist in India with an estimated area of 1,59,800 km^2 in 2017-2018. Of these, inland wetlands covered 74.1% area while coastal wetlands represented 25.9% (Fig 3.5 and Fig 3.6).

Coastal water ecosystems include oceans, seas and saline groundwater while the freshwater ecosystems are lentic (slow moving water; including pools, ponds, and lakes), lotic (fast moving water; including streams and rivers) systems, and other wetland areas including swamps where the soil is saturated or inundated for a few months in a year.

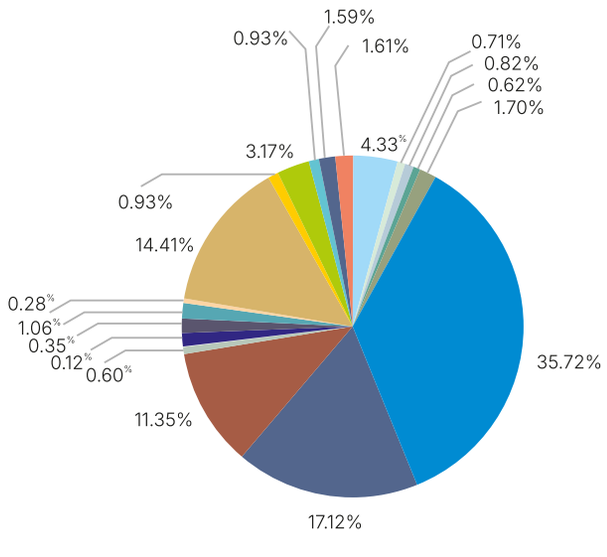


Fig 3.5. Wetland type-wise area distribution in percentage w.r.t total area of wetlands [2017-2018]

https://indianwetlands.in/uploads/wetland_atlas_LISS3_final-SAC.pdf



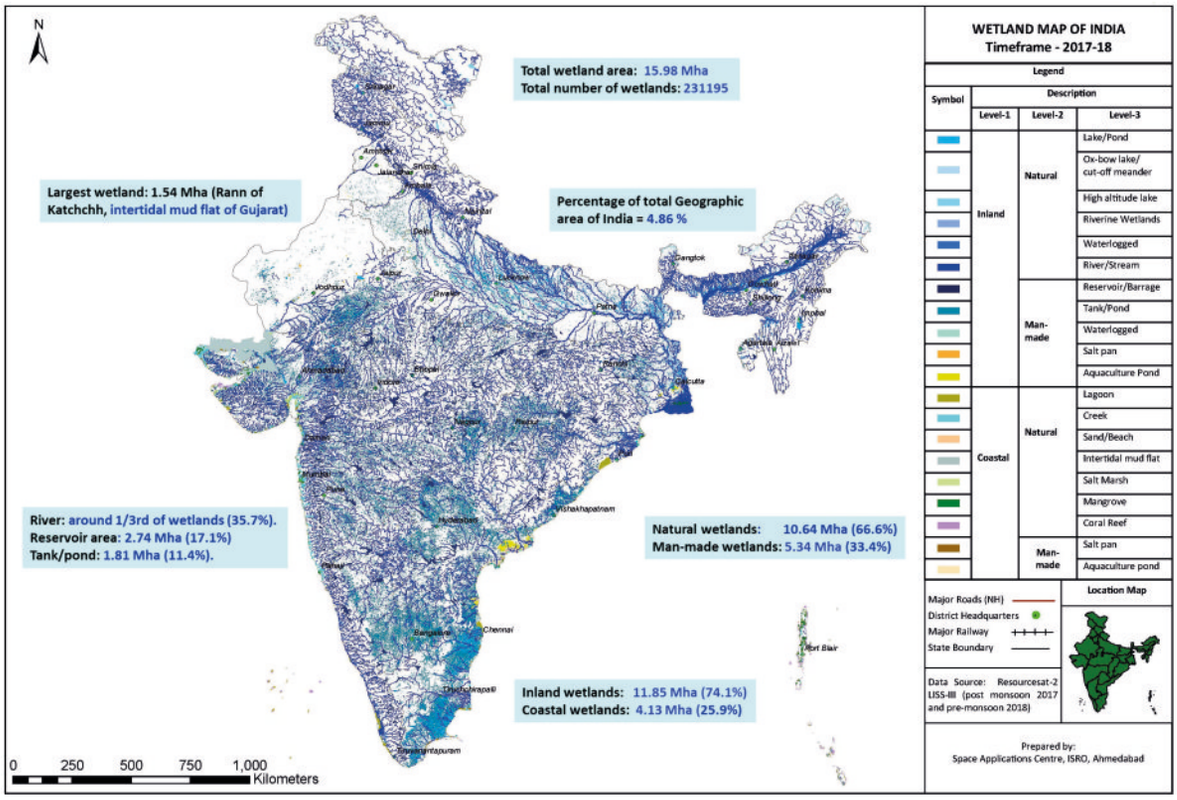


Fig 3.6. Wetland map of India

https://indianwetlands.in/uploads/wetland_atlas_LISS3_final-SAC.pdf

A N Shukla

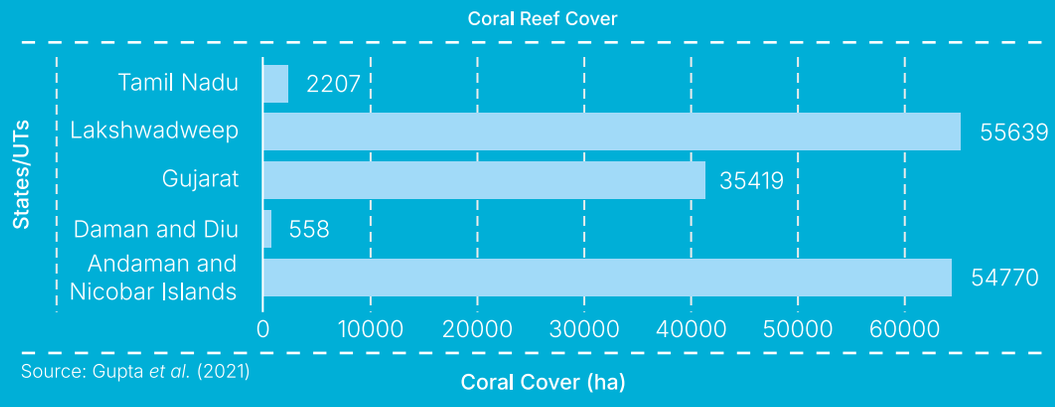


According to the Ramsar Convention (1971), wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed 6 m (Fig 3.6).

India's coastal and marine ecosystems encompass 8,118 km long coastline along peninsular India and islands, vast Exclusive Economic Zone (EEZ) covering 2.02 million km^2 area, two archipelagos (Andamans and Nicobar, and Lakshadweep Islands), and a wide continental shelf spread over 3,72,444 km^2.

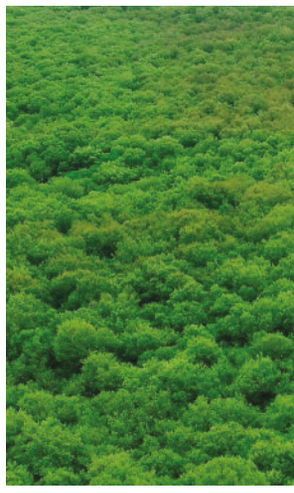
Coral reef ecosystem

Coral reef ecosystems cover an area of more than 200000 ha, spread in Lakshadweep, Tamil Nadu, Gujarat, Daman and Diu, and Andaman and Nicobar islands (Fig 3.7).



Source: Gupta *et al.* (2021)

Fig 3.7. Coral Cover in Different States/UTs in 2017-2018





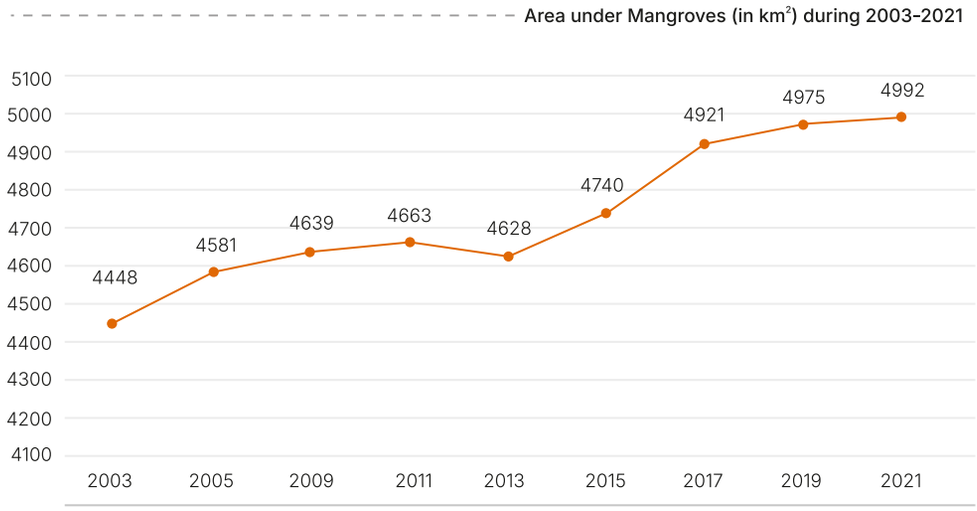


Mangrove ecosystem

Mangroves are one of the world's most productive evergreen forests found in intertidal environments predominantly at the tropical and subtropical latitudes along sheltered coastlines, shallow-water lagoons, estuaries, rivers and deltas, mainly on soft substrates (FAO, 2023). The FSI has been assessing the extent of mangroves across India since 1987 and biennial ISFRs have been providing valuable insight on the current status and temporal changes across different States/ UTs. As per the ISFR (2021, Fig 3.8), mangrove cover in the country stood at 4,992 km², i.e. 3.0% of the global mangrove cover, and 0.15% of the country's GA.

Fig 3.8. Mangrove Cover in India

Source: https://fsi.nic.in/isfr-2021/chapter-3.pdf



Estuarine ecosystems

The estuaries occur over vast coastal plains whose elevation does not exceed maximum tidal elevation which along the west and east coasts of India is a few meters only. India with long bounding coastline harbours ~220 estuaries (14 major, 44 medium and 162 minor) with total estimated surface area to 27,000 km², assessed from the mouth of the estuary to the region where tidal oscillations are almost negligible (Qasim, 2003; Rao and Sarma, 2013). Major Indian rivers such as, Ganga, Brahmaputra, Godavari, Mahanadi, Krishna, and Cauvery form estuaries on the east coast. West flowing rivers like, Sabarmati, Narmada, Tapti, Mahi and several smaller coastal rivers mainly in Kerala, Karnataka and Goa constitute several important estuaries along the west coast. Major estuarine systems on the east coast are: the Hooghly-Matlah estuarine system in West Bengal; the Mahanadi, Rushikulya, and Bahuda estuaries in Orissa; the Godavari, Krishna, and Pulicat in Andhra Pradesh; and the Adyar, Cauvery, Vellar, Vaigai, Kollidam, Muthupet, and Ennore estuaries in Tamil Nadu. Prominent estuaries of the west coast include Sabarmati, Narmada, Tapti and Mahi in Gujarat; Damanganga in Daman; Mahim and Amba estuaries in Maharashtra; Mandovi- Zuari system of Goa; Nethravati- Gurupur, Mulki, Coondapur, Pavenja, Gangoli, Kali, Aghanashin, and Sharavati estuaries in Karnataka; and Asthamudi, Vembanad, and Periyar estuaries in Kerala (Qasim and Sengupta, 1984; Mohan Raj *et al.*, 2023).

Lagoons

Lagoons are shallow, often elongated bodies of water separated from a larger body of water by a shallow or exposed shoal, coral reef, or island. Lagoons are usually located parallel to the shoreline, and are often longer than they are wide. The depth of a lagoon seldom exceeds a few metres (Kjerfve, 1994). Seventeen coastal lagoons have been described from west and east coasts of India (Saxena, 2012; Mahapatro *et al.*, 2013). This includes 8 major lagoons on the east coast and 9 on the west coast. It was estimated to cover 2,159.4 km² based on assessment of 2017-2018 (Gupta *et al.*, 2021).

Saltmarsh ecosystem

Tidal saltmarsh ecosystem, hereafter referred as saltmarshes comprise the portion in the upper intertidal zone between land and open brackish water that is regularly flooded by the tides. ISRO mapped salt marshes in India using satellite data of 2017-2018 and estimated the overall area to be 1,441.88 km² (Gupta *et al.*, 2021).

Intertidal Mudflats

Tidal flats or Mudflats are sedimentary deposits of mud, silt and clay with high organic content, made by tides or rivers along a coast. Mudflats play varied ecological and physical functions like dissipating wave energy, reducing the risk of erosion of salt marshes besides creating habitats for a wide array of invertebrates and aquatic birds. Mudflats have high biological productivity with abundant invertebrates that provides food for internationally important populations of migrant and wintering birds and are important fish nurseries for species such as place. ISRO mapped the cover of intertidal flats in the country using images of 2017-2018 and estimated the area as 23,025 km² (Gupta *et al.*, 2021). As per the recent estimate, Gujarat harboured the largest chunk of intertidal flats, being 2,142.21 km² or 93.03% of country's total cover of intertidal flats. Other important states *viz.*, Andhra Pradesh, Tamil Nadu, Odisha, and Maharashtra had intertidal flats to the extent of 474.75 km², 297.97 km², 247.57 km², and 204.98 km², respectively.

Coastal Sand Dunes and Sandy Beaches

Coastal sand dunes and sandy beaches as natural structures and coastal landforms are fragile ecosystems. They occur in a variety of shapes, sizes, compositions, and coastal settings. Beaches and costal dunes are naturally dynamic environments and fluctuate in size and shape based on the effect of wind, waves, tides, and storm events. ISRO, based on satellite data of 2017-2018, has assessed the extent of coastal sandy dunes and beaches along the coastal states and two archipelagos (Gupta *et al.*, 2021). Altogether, an area of 448.21 km² under coastal sand dunes and beaches was estimated on the west and east coasts of India including archipelagos. The highest extent of coastal sand dunes and sandy beaches, being 80.19 km² was recorded on the coast of Andhra Pradesh, followed by 64.98 km² and 64.65 km² on the West Bengal and Gujarat coasts, respectively. Coastal sand dunes and beaches are among the most effective natural defenses against storms, cyclones and tsunamis. Sea turtles rely on natural beaches to lay their eggs. India has major nesting ground beaches for five endangered species of marine turtles namely green sea turtle, Hawksbill, Leatherback, Loggerhead and Olive Ridley (Marale and Mishra, 2011). While turtles' nest both on the east and west coasts of India, trusted mass nesting by Olive Ridley Sea turtle has been reported at three sites in Orissa.

Seaweed dominated ecosystems

Seaweeds, a group of photosynthetic non-flowering, primitive macroscopic marine algae without root, stem and leaves, play a major role as one of the important primary producers of marine ecosystem. The Indian coastline, with its wide range of coastal ecosystems, supports luxuriant growth of diverse seaweed populations (Vagh *et al.*, 2022).

Agroecosystems

Agroecosystems are manmade ecosystems consisting of plant and animal communities interacting with their physical and chemical environments that have been modified by people to produce food, fibre, fuel and other products for human consumption and processing. The diversity of agroecosystems in India is numerous ranging from primitive shifting cultivation-based agroecosystem to modern energy subsidized mechanization-based agro-ecosystems that vary widely with edapho-climatic conditions, elevations and cultural practices of the local farmers.



© Threesh Kapoor

3.4.

Species Diversity

Plants, animals, and microorganisms are the fundamental components of species diversity. Taxonomic information on plant and animal species in India is being constantly updated based on field surveys/ explorations, descriptions, and acceptance of new species. The microbial diversity of India is now being studied extensively and new strains / species are being discovered and described following molecular approach to identification such as metagenomics. The number of known species is increasing every day and the total numbers of species / taxa in India is continuously changing. The Botanical Survey of India (BSI) and Zoological Survey of India (ZSI) have been undertaking field surveys to identify and describe new plant and animal species, respectively for more than a century. In addition, botanists, zoologists, and microbiologists working with other organizations/universities across the country also contribute towards the discovery of new flora and fauna.



A N Shukla

3.4.1

Floral Diversity

Pimm and Joppa (2015) provided an estimate of 4,50,000 plant species. The IUCN (2023) documented 5,99,259 species of plants, fungi and protists across the globe representing varied taxonomic groups *viz.*, angiosperms (3,69,000), gymnosperms (1,113), pteridophytes (11,800), bryophytes (21,925), algae (44,000), fungi (1,51,316), and lichens (17,000) (Table 3.3).

Table 3.3. Number of plant species in India vis-a-vis global

Source : BSI, 2024

Taxonomic Groups of Plant Kingdom	Global Plant Species		Number of Plant Species in India				
	Christenhusz *et al.*, (2016)	IUCN (2023)	Plant Species in India BSI (2023)	Per Cent of India's Plant Diversity	Per Cent Species in India IUCN (2023)	Endemic Species[@]	Threatened Species[#]
Angiosperms	2,95,383	3,69,000	22,214	39.86	5.99	4,662	1,242
Gymnosperms	1,079	1,113	83	0.15	7.46	12	7
Pteridophytes	11,850*	11,800	1,321	2.31	12.86	76	414
Bryophytes	21,925**	21,925	2,835	5.09	11.18	656	80
Algae	44,000	44,000	9,085	16.30	34.98	2,015	Not Known
Fungi	NA	1,51,316	15,812	28.37	10.38	4,351	580
Lichens	NA	17,000	3,088	5.54	17.91	626	Not Known
Microbes (Virus and Bacteria)	NA	NA	1,288	2.31	NA		
Total	**3,74,237**	**5,99,259**	**55,726**	**100**	**9.24**	**12,398**	**1,663**

*- includes lycopods; ** - includes liverworts, hornworts, and mosses;

New Discoveries and New Records

Botanical Survey of India (BSI), Ministry of Environment, Forest & Climate Change, Government of India, was established on 13th February 1890. The BSI and its 13 regional centres have been annually updating information and publishing plant discoveries on the basis of new discoveries and new records. During the year 2023, new discoveries included one family, 14 genera, 165 species, and 6 infraspecific taxa. Of these 186 taxa are new to science and 174 taxa are new distributional record for India. Cumulative number of plant species discovered and described in India during 2013-2023 (Fig 3.9).

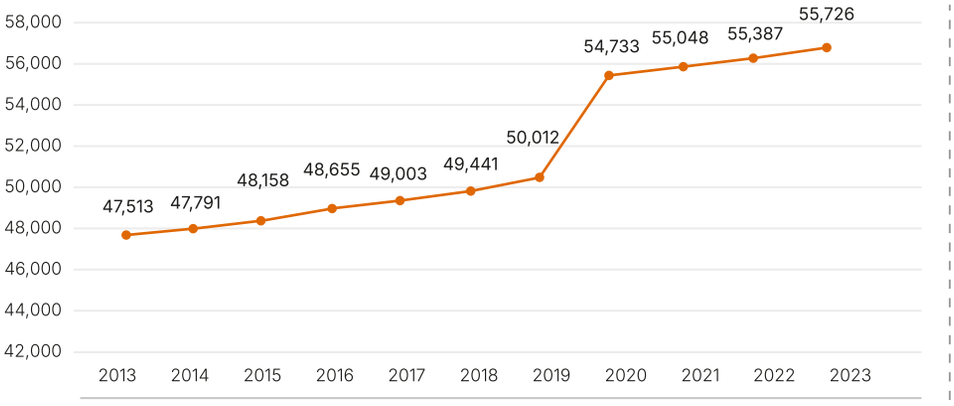


Fig 3.9. Number of plant species discovered and described in India (2013-2023)

Source : https://bsi.gov.in/page/en/national-wild-life-action-plan

A N Shukla



Endemic and Threatened Plant Species

In India, altogether 1,663 plant species have been listed so far as threatened. Out of this, 1,242 species were angiosperms (74.68%), 414 species of pteridophytes, and 07 species of gymnosperms (MoEFCC, 2019). The Sixth National Report (NR6) to CBD reported that in compliance of Section 38 of the Biological Diversity Act, 2002, 159 plant species were notified as threatened species in states.

At least 12,095 plant species or 21.83% species of country's plant diversity have been described as endemic. Among these, 4,556 were flowering plants. High endemism has been reported from the four global biodiversity hotspot regions i.e., the Himalayas, the Western Ghats, North East India (part of Indo- Burma), and Nicobar islands, a part of Sundaland.

3.4.2

Faunal Diversity

Presently, the total number of animal species in the world including Animalia and Protista stands at 16,05,325 (IUCN, 2023). Out of these, India has 1,03,920 faunal species which represent 6.47% of the world's faunal species (ZSI, 2023) (Table 3.4). Zoological Survey of India, established in 1916, is in the forefront of discovery of new faunal species in the country, duly supported by other institutions and universities.



© Dogra

Table 3.4. Faunal Diversity in the World and in India

					Number of Animal Species in India		
Taxonomic Groups of Animal Kingdom	Global Animal Species IUCN (2023	ZSI (2023)	Per Cent of India's Animal Diversity	Per Cent Species in India IUCN (2023)	Endemic Species# GoI (2022)	Percentage Endemism# GoI (2022)	Threatened Species# GoI (2022)
Vertebrates							
Fishes	36,367	3,532	3.40	9.71	500	14.16	228
Amphibians	8,707	450	0.43	5.17	296	65.78	75
Reptiles	12,060	738	0.71	6.12	255	34.55	54
Birds	11,197	1,346	1.30	12.02	81	6.02	89
Mammals	6,631	436	0.42	6.58	46	10.55	94
Sub Total-Vertebrates	74,962	6,502	6.26	8.67	1,178	18.12	540
Chordates-Sub Phylum's Chephalochordata and Tunicata	-	542	0.52	-	-	-	-
Invertebrates							
Sub Total - Invertebrates	14,80,351	93,306	90.31	6.34	27,125	29.07	135
Total Animalia (Vertebrates and Invertebrates)	15,55,313	1,00,350	96.56	6.45			675
Protozoans							
Sub Total - Protozoans	50,012@	3,570	3.44	-	645	18.21	-
Grand Total (Animalia + Protista)	**16,05,325**	**1,03,920**	**6.47**	**-**	**28,948**	**28.98**	**675**

Source: IUCN (2023) Red List of Threatened Species version 2023-1; ZSI (2023); # - GoI (2022) Envi Stats India 2022, Vol: II; MoSPI, Information from ZSI -2022;@ - ZSI (2023)

New Discoveries and New Records

Since 2007, ZSI has been publishing the Animal Discoveries of India- New Species and New Records annually based on the published information available in India. In the year 2022, 467 new species, 195 new records to India and 18 new genera were reported by the scientific community across the country (Banerjee *et al.*, 2023). The maximum number of new discoveries were recorded from invertebrates with 583 species, while the vertebrate group registered 79 species. Insects dominated among invertebrates with 384 species. In case of vertebrates, new discoveries of fish fauna dominated, followed by reptiles, amphibians, and mammals.The analysis of 10-year (2013-2022) data on animal discoveries revealed that total 4,528 species (3,319 new species; and 1,209 new records) were added to the Indian fauna (Fig 3.10).

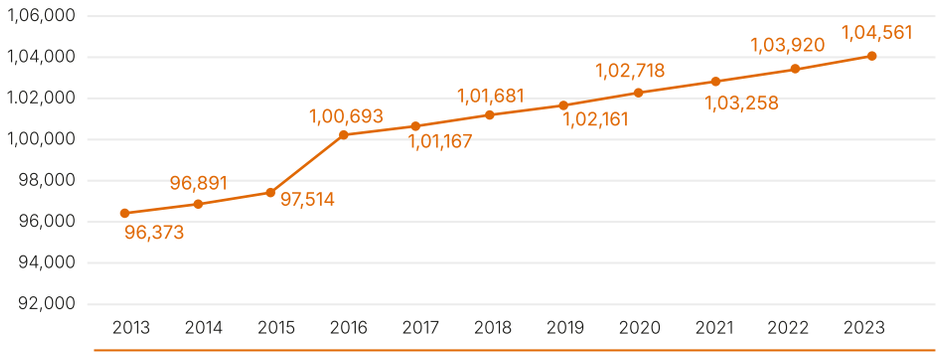


Fig 3.10. Number of faunal species discovered and described in India (2013-2023)



Sanjay Shukla

Endemic and Threatened Faunal Species

India has 28,948 endemic faunal species (29%) including 500 fishes, 296 amphibians (65.78% of endemic), 255 reptiles (34.55%), 81 birds, 46 mammals (18.12%), and 27,125 invertebrates (81.88%).

The IUCN also assessed total 62,493 or 83% vertebrate (mammals, birds, reptiles, amphibians, and fishes) species out of 74,962 globally described vertebrate species. Out of total assessed faunal species, nearly 18% vertebrate species were listed as threatened. In addition, the IUCN also assessed 27,363 species of invertebrates, and 790 species of fungi and protists. ZSI regularly updates information on threatened species. As per the most recent documentation, country had described altogether 675 animal species under vertebrates and invertebrates (GoI, 2022). Out of 436 mammalian species reported from the country, 94 mammalian species have been placed in various categories of extinction risk or threatened species.



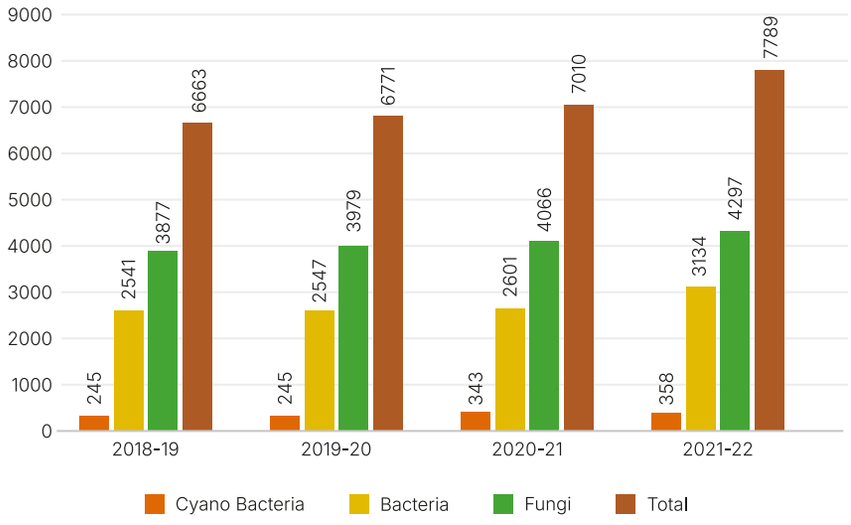


Fig 3.11. Annual increment in holdings of microbial diversity

3.4.3

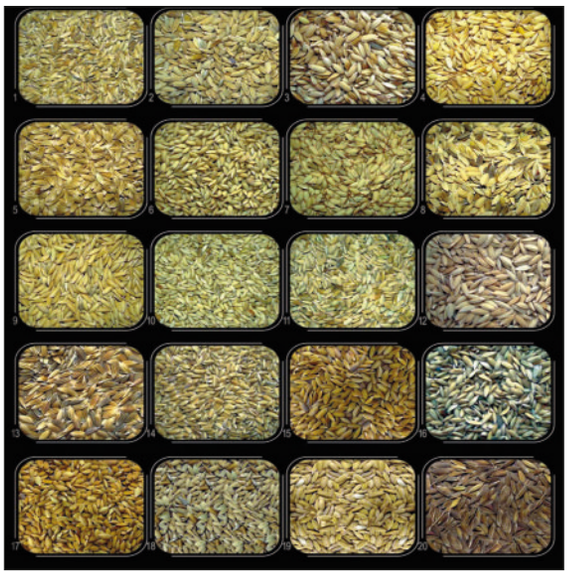
Microbial Diversity

Although consolidated data on total microbial diversity of India is still under compilation, the total holdings in different microbial repositories show a continuously increasing trend (Fig 3.11).

3.4.4

Genetic Diversity

The documentation of genetic diversity in plants, microbes, and animals in India has witnessed tremendous progress with the advent of high throughput sequencing platforms. The amount of genetic resources generated for different plant, animal and microbial groups are increasing exponentially every year.



M.S.Swaminathan Research Foundation

3.5

Ecosystem - specific species diversity

Corals

Out of 25 families and 1,574 species of Scleractinia's (hard corals, hermatypic) corals reported from the world, 12 families, 110 genera and 686 species were ahermatypic (soft corals)/ azooxanthellate. Various researchers from India have reported coral diversity from the Indian Ocean represented by 12 families, 71 genera, and 227 species (Venkatraman, 2011). The status report by Venkatraman (2011) documented 208 species of hermatypic corals belonging to 15 families and 60 genera from the four major reefs of India. Reefs in Andaman and Nicobar Islands were most diverse (177 species, 57 genera); followed by reefs in Lakshadweep (91 species, 34 genera), and Gulf of Mannar and Palk Bay (82 species, 27 genera).

Mangrove Biodiversity

Ragavan *et al.,* (2016) documented that Indian mangroves consist of 46 true mangrove species belonging to 14 families and 22 genera. Thus, about 57% of the world's mangrove species are represented in India. The East coast has 40 mangrove species while the West coast has 27 species and the Andaman and Nicobar Islands have 38 species. About 4,580 faunal species associated with mangroves and 920 floral mangrove species have been recorded from India (MoEFCC, 2019).

Diversity and Distribution of Seagrass in India

Fifteen species and one sub-species of seagrasses belonging to three plant families and seven genera have been reported from Indian

waters. Genus Halophila is represented by highest six species and one sub-species, while genera Halodule and Cymodocea were represented by three and two species, respectively. Genera Enhalus, Ruppia, and Thalassia were represented by one species each (Pandey *et al.,* 2021). Species diversity in major seagrass beds in India follows the order: Gulf of Mannar, Palk Bay, Andaman and Nicobar Islands, Lakshadweep, Gulf of Kachchh, Chilika Lagoon (Ramesh *et al.*, 2019). Geevarghese *et al.*, (2017) estimated the total seagrass extent of 516.59 km² in the country. They also documented overall distribution of seagrass meadows in India from the intertidal zone to a maximum depth of 15m with varying species diversity. Six sites (i) Palk Bay, Tamil Nadu; (ii) Gulf of Mannar, Tamil Nadu; (iii) Gulf of Kachchh, Gujarat; (iv) Chilika Lake, Odisha; (v) Islands of Andaman and Nicobar; and (vi) lagoons of Lakshadweep Islands have been recognized as the major seagrass sustaining regions in India.

Seaweed

India has reported the highest number of seaweed taxa compared to all the other nations bordering the Indian Ocean (Sahoo *et al.*, 2001). The most comprehensive estimates for seaweeds present in Indian waters reported diversity of 841 species belonging to 216 genera of 68 families (Oza and Zaidi, 2001). The study also reported representation of 434, 194, and 216 species of red, brown, and green seaweeds, respectively. Later, Kaliaperumal (2017) estimated 871 species from Indian waters. The floristic work, compiled by the Botanical Survey of India, enumerated the occurrence of 865 taxa from Indian waters of which 212 species belong to Chlorophyta, 211 to Ochrophyta, and 442 to Rhodophyta (Rao and Gupta, 2015). Seaweeds are found in abundance on the west coast, Andaman and Nicobar Islands and Lakshadweep, but less frequently along the east coast.

3.6

Area Based Conservation

Historically, world communities and governments have set aside areas of scenic, geomorphic, environmental, biological, spiritual, cultural, and other outstanding importance and protected them for their unique conservation values. In India, two types of concurrent conservation approaches have evolved over a long period of time towards protection of nature and biodiversity governance. These were described as five 'Biodiversity Governance Models' as a continuum that operate and focus on conservation, sustainable use, and fair and equitable sharing of biological resources across landscapes under the: (a) state-driven conservation, and (b) community-driven conservation approaches (Fig 3.12). (Krishnan *et al.*, 2012)

Two governance models namely, Protected Areas (PAs) and Managed Forests (Mfs)/ Territorial Forests represent the state driven conservation approach of biodiversity governance while three models *viz.,* Autonomous Community Efforts, Co-management of Forests, and Decentralized Governance of Biodiversity align more closely with community driven conservation efforts.

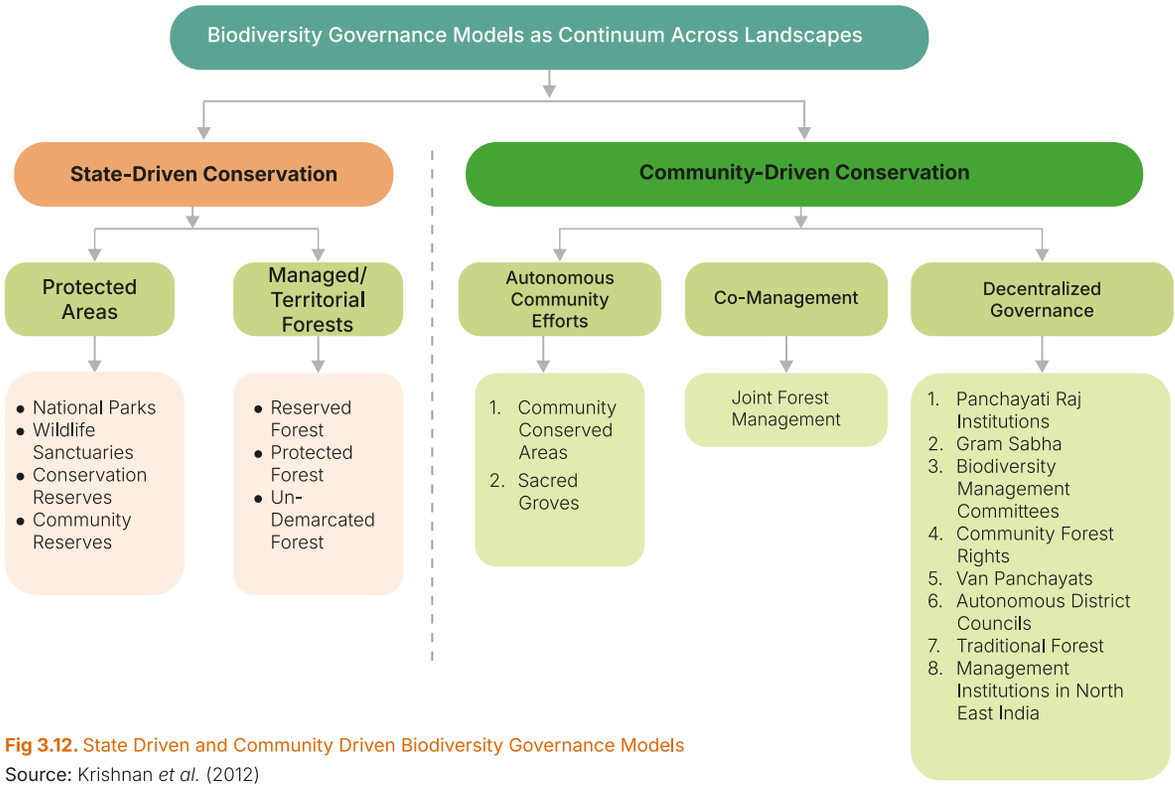


Fig 3.12. State Driven and Community Driven Biodiversity Governance Models
Source: Krishnan *et al.* (2012)

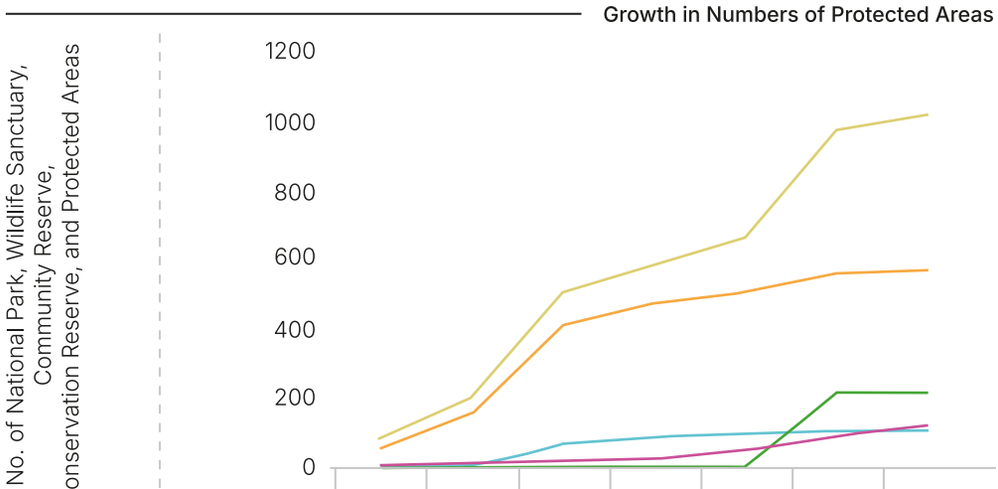
Two broad categories of biodiversity governance models *viz.,* (a) Protected Areas (PAs), and (b) Managed Forests (MFs) constitute the 'state driven conservation'. Primarily, the State Forest Department (SFD) is the custodian of PAs and MFs in each State/ UT. However, some states also have small extent of MFs represented by Civil Soyam Forests (Revenue Department) or Private Forests under the control of Municipal Bodies or Cantonments. PAs are being established and managed as per the provisions of the Wildlife (Protection) Act, 1972 while MFs are being established and managed as per the provisions of Indian Forest Act, 1927. Some other Indian laws relevant to biodiversity, environment, forest conservation, are also applicable. CBD has recognized PAs as the cornerstone of biodiversity conservation as they maintain key habitats, provide refugia, facilitate species migration and movement, and allow evolutionary and ecological processes across the landscape besides offer a wide range of ecosystem services. Thus, PAs are connected to their surroundings through ecological, economic and cultural relationships (Zube, 1995).

3.6.1

Protected Areas

India has four legally designated categories of PAs: (i) National Parks, (ii) Wildlife Sanctuaries, (iii) Conservation Reserves, and (iv) Community Reserves established as per the provisions of the WPA, 1972. (Fig 3.13). PAs serve as the building blocks for protection and safeguarding of terrestrial and aquatic (fresh water and marine) biodiversity so as to allow *in situ* conservation and facilitate essential ecological and evolutionary processes to unfold alongside the maintenance of ecological, species, and genetic diversity.

Fig 3.13. Growth in number of Protected Areas during 1970 - July, 2023



	1970	1980	1990	2000	2010	2020	Till July, 2023
National Park	5	24	68	87	101	104	106
Wildlife Sanctuary	59	160	412	478	510	562	573
Community Reserve	0	0	0	0	7	216	220
Conservation Reserve	19	19	28	29	49	94	123
No. of Protected Areas	**83**	**203**	**508**	**594**	**667**	**976**	**1022**

In India, PAs are being managed under the overall supervision of State/ UT's Chief Wildlife Warden. Current regulations envisage management of PA as per the approved management plan. No human use is permitted in the National Park (NP), except wildlife tourism and thus, receives highest and stricter protection. After the amendment to the WPA in 1991, the finally notified Wildlife Sanctuary (WLS) also enjoys stricter protection but law has provisioned for regulated livestock grazing and tourism activities. In 2003, an amendment to the WPA provisioned for two new categories of PAs namely, the Conservation Reserve, and the Community Reserve. The former can be created on the government land while the latter category can be established on private lands with due consent of local communities.

Further, the Government of India (GoI) in view of the dwindling populations of the 'iconic' or a 'flagship' species i.e., tiger (*Panthera tigris tigris*) amended the country's wildlife law in 2006 and introduced a separate chapter on the 'National Tiger Conservation Authority' (NTCA) and provisioned for creation of legally notified 'Core area' (inviolate space or sanctum sanctorum) comprising of NP and WLS, and 'buffer area' comprising managed/ territorial forests or other government/ private lands forming a 'Tiger Reserve'

(TR). The core area has stricter protection and allows only regulated tourism activities in a smaller designated tourism zone. The concept of buffer area allows the agenda of 'co-existence' of humans with wildlife and thereby, permits regulated production activities by different sectors while promoting mainstreaming biodiversity concerns in varied production sectors.

In 1988, country was privileged to develop the biogeographical basis for assessing the conservation status of India's spectacular biodiversity across 10 biogeographic zones and 27 biotic provinces. At that time, a comprehensive review of PAs and gap analysis revealed that up to 1970, the country had just 63 PAs, represented by 4 National Parks and 59 Wildlife Sanctuaries and together they covered total area of 12,199.77 km². By 1988, the network of PAs in the country has grown to total 426 PAs including 54 National Parks and 372 Sanctuaries, and they collectively covered an extent of 1,09,652 km² or represented 3.34% GA of the country (Rodgers and Panwar, 1988). By July, 2023, the PA network has increased to total 1,022 PAs covering 1,78,640.69 km² extent or representing 5.43% geographical area of the country (Fig 3.13.) (EIACP- National Wildlife Database, WII). These PAs included 106 National Parks, 573 Wildlife Sanctuaries, 123 Conservation Reserves, and 220 Community Reserves.

Marine Protected Areas

In India, PAs that fall entirely or partially within the swathe of 500 m from the high tide line and the marine environment are considered to be in the Marine Protected Area (MPA) network (Sivakumar, 2013). The PA network of India include 25 Marine Protected Areas (MPAs) covering 8231.49 km² on the mainland and 106 Island MPAs comprising an area of 1569.63 km² on the offshore island archipelagos of the Andaman and Nicobar and Lakshadweep. The 25 MPAs of the mainland represent nearly 5% of the total PA network of India and less than 0.3% of the country's GA (Sivakumar *et al.,* 2013). The Gulf of Mannar Marine National Park, Sundarbans National Park, Gulf of Kachchh National Park, Gahirmatha Marine Sanctuary, Coringa Wildlife Sanctuary and Chilika Wildlife Sanctuary on the mainland harbour unique marine biodiversity and provide a range of ecological services to the local communities. Sundarbans National Park and Gulf of Mannar Biosphere Reserve are two transboundary protected areas.

Important Coastal and Marine Biodiversity Areas

Saravanan *et al.*, (2013) surveyed 350 potential coastal and marine ecosystem sites of peninsular India to identify and prioritize the 'Important Coastal and Marine Biodiversity Areas (ICMBA)' for their better management. The standardized global, national and regional level approaches were followed to develop a comprehensive criterion incorporating several indicators relevant to (a) ecosystem resilience, (b) ecosystem functions, (c) biodiversity values and uniqueness, (d) socio-cultural values, (e) socio-economic potential, and (f) land tenure. The study identified 106 sites and prioritized as ICMBA. Along the west coast of India, total 62 ICMBAs were identified while 44 ICMBAs were listed and described along the east coast (Saravanan *et al.,* 2013). Out of identified 106 ICMBAs, 22 ICMBAs were prioritized for immediate conservation actions. The study recommended ICMBAs as proposed PAs e.g. Conservation Reserves or Communities Reserves.

Management of PAs

The emerging approaches of 'ecosystem-based management' and 'landscape/ riverscape/ seascape approach to conservation', country's Environmental (Protection) Act, 1986 (EPA) and the National Wildlife Action Plan (2017-2031) (NWAP) recognize that PAs should not be seen in isolation, instead they should be well connected to other PAs or local economy. Thus, areas outside PAs in 'matrix' are often vital ecological corridor links and must be protected to prevent isolation of fragments of biological diversity which will otherwise not survive in the long run. The Government of India is obliged as per the provisions of EPA and NWAP and the directives of the Apex Court to delineate and notify 'Eco-sensitive Zone (ESZ)' around each National Park and Wildlife Sanctuary so as to serve some kind of 'shock absorber' for the PAs and they would serve as the transition zone from areas of high protection and biodiversity to areas of lesser protection and relatively lower biodiversity values. The existing environmental law requires delineation and final notification of ESZ around a National Park or Sanctuary, preparation of Master Zonal Plan within two years of final notification of ESZ, and constitution of a Monitoring Committee. The notification of ESZ in each case furnishes details of prohibited, regulated and permitted activities within the ESZ.

India is among the pioneer countries in the world that have institutionalized the Management Effectiveness Evaluation (MEE) process. India has made a beginning in evaluating the management effectiveness of its Natural World Heritage Sites, National Parks, Wildlife Sanctuaries and Tiger Reserves in 2006 (Mohan *et al.,* 2020). So far, India has conducted in-depth evidence-based MEE for three natural WHSs during 2003-2008. Later, MoEFCC successfully completed one full cycle of evaluating all terrestrial National Parks and Wildlife Sanctuaries of the country from 2006 to 2019. Results of MEE of 146 PAs (National Parks

and Wildlife Sanctuaries) conducted in 2018-2019 revealed an overall mean MEE score of 62.01% ranging from 26.66% to 84.17%. Rating-wise, 13% PAs were in 'very good' category, 52% PAs are in 'good' category, 29% PAs in 'fair' category and only 6% PAs were rated in 'poor' category. Over the years, the outcomes of MEE process have demonstrated that despite all odds, India's PA management is effective in meeting conservation goals.

Under India's Project Tiger, MEE of 28 TRs in 2006, 39 TRs in 2010, 43 TRs in 2014, 50 TRs in 2018, and 51 TRs in 2022 was carried out (Yadav *et al.,* 2022). The overall mean MEE score in second cycle of TRs in 2010 was 65%, 69% in third cycle in 2014, and 70% in fourth cycle of evaluation in 2018 and 77.92% in assessment of 2022. In the 5th cycle there were 12 Tiger Reserves out of 51 that have scored 90% and above and, therefore, a new category of 'Excellent' was added besides previous four categories (Poor - <50%, Fair - 50-59%, Good - 60-74% and Very Good- >75%). Slight modification of these four categories by introduction of the category 'Excellent' was done to accommodate substantial improvement (higher scores of >= 90%) made by the TRs during 5th cycle of MEE. Care was taken to ensure that these categories are comparable with previous cycles of MEE, i.e., very good category of the previous cycles was split into two categories, *viz.,* very good and excellent categories in recent cycle. Thus, the fifth cycle of assessment in 2022 reported an overall increase of 8% in mean MEE Score (77.92%) in comparison to fourth cycle of MEE. In short, 12 Tiger Reserves have achieved 'Excellent' category, followed by 20 TRs in 'Very Good' category, 14 TRs in 'Good' category and 5 TRs in 'Fair' category. There was no TR rated in the 'Poor' category in the 5th cycle of MEE TR assessment (Yadav et al., 2022).

Managed Forests

Besides PAs, country has important and much older legal categories of 'Reserved Forests (RFs), Protected Forests (PFs), and Un-Demarcated Forests (UDFs) or Un-Classified Forests (UCFs), falling under the purview of state-driven MFs or territorial/ production forests. Details on country's and Forest Cover provided biennially by FSI have been described RFA across different States/ UTs was 7,75,288 km². This covered three legal categories of Managed Forest (MFs - RFs, PFs, and UDFs) and represented 23.57% of GA (FSI, 2021). Forest cover and Scrub together within RFA contributed 17.13% of GA. Temporal changes in the overall extent of MFs across the country during 2001 to 2021 are presented in (Table 3.5)

Table 3.5. Trends in forest cover in India during 2001-2021

Year	2001	2003	2005	2009	2011	2013	2015	2017	2019	2021
Forest Cover (million ha)	67.55	67.83	67.70	69.08	69.20	69.78	70.14	70.82	71.22	71.37
Per Cent of Country's GA	20.55	20.64	20.6	21.02	21.05	21.23	21.34	21.54	21.67	21.71

Source: Compiled from FSI's ISFR 2001, 2003, 2005, 2009, 2011, 2013, 2015, 2017, 2019, and 2021

3.6.2

Community Driven Conservation

The community-driven conservation approach includes the following three types of biodiversity governance models:

Autonomous Community Efforts

This biodiversity governance model includes the community-driven oldest initiatives *viz.,* Community Conserved Areas (CCAs), and Sacred Groves (SGs) for conservation of biodiversity across the country (Fig 3.12). CCAs are defined as natural and modified ecosystems with significant biodiversity, ecological and related cultural values, voluntarily conserved by indigenous peoples and local communities through customary laws or other effective means (Pathak and Kothari, 2009). Sacred groves i.e. forests conserved on the basis of religious/cultural beliefs, have been a central aspect of Indian tradition, ethics and culture and named differently across the country (Amrithalingam, 2016). Besides SGs, several plant species have also been recognized as sacred plants in Hindu mythology. Kandari *et al.,* (2014) documented state-wise distribution of 13,720 sacred groves and a list of 31 sacred plants. Insufficient database, biodiversity

information, monitoring, and even inadequate policy support specific to CCAs and SGs constraints their effective conservation, especially in changing scenario. Certainly, CCAs and SGs are important natural or semi-natural areas as they immensely contribute towards conservation of many threatened species besides the gene pool of endemic species.

Co-management

The formal experiment of co- management by way of Joint Forest Management (JFM) was conceptualized and launched in 1980s wherein SFDs had entered into an agreement with local communities which allowed them access to forest resources as well as a share in revenue in lieu of protection of forests from illegal activities. In 1988, this innovative idea was widely adopted through a major policy intervention i.e., the National Forest Policy (NFP), 1988. The policy aimed a paradigm shift in India's forestry and advocated for the participatory approaches in forest management and a nation- wide JFM programme was designed, institutionalized and supported by the MoEFCC so as to fulfil the requirements of national agenda on afforestation/ reforestation, production of NTFPs, and conservation of forests. Over the past decades, in some states/ UTs, JFM program has grown meaningfully.

Decentralized Governance Institutions

Third community-driven biodiversity governance model pertains to decentralized village/ community level institutions working at the grassroots level (Krishnan *et al.,* 2012). Several decentralized institutions *viz.,* Autonomous District Councils, Van Panchayats, Gram Sabha, Panchayati Raj Institutions (PRIs), Biodiversity Management Committees (BMCs), etc. are in place across the country and facilitating the bottom up and decentralized approaches towards conservation of forests and other natural resources. Predominantly, most forests in the north- eastern region are under the control of Autonomous District Tribal Councils instead of SFD as in other parts of the country. The Councils have their own legal instruments and regulatory framework for the management and use of forest resources. The 'Van Panchayats (Forest Councils) in Uttarakhand initiated a century ago under the provisions of the Van Panchayat Act, 1921 is a well-known and probably the oldest successful initiative of decentralized governance. Nearly 13,000 VPs entrusted each with small forest land parcels have been protecting, managing, and sustainably using assigned forest lands for a century or so. In 1992, the 73rd Amendment to the Constitution of India provisioned for the three- tier governance system in the country by constituting the PRIs- Gram Panchayats and Gram Sabhas as the basic units at the lowest hierarchical level in the village. The Amendment also listed 29 Subjects devolved to PRIs including minor forest produce, social forestry, farm forestry, etc. The PRIs also play a pivotal role in the implementation of the Biological Diversity Act, 2002 (BD Act) at the grassroots level by way of legally defined Biodiversity Management Committees (BMCs). Presently, the country has 2,77,688 BMCs across the country under the control of State Department of Panchayati Raj while the SFD and State Biodiversity Boards provide technical backstopping and help in capacity development so as to implement programs related to biodiversity conservation, access and benefit sharing of genetic resources. BMCs are also responsible for the preparation of People's Biodiversity Registers (PBRs) facilitating documentation of comprehensive information on availability and use of local biological resources including traditional knowledge associated with them.

Conservation Areas

In addition to the abovementioned categories, India adopted several well- known and internationally acclaimed 'Management Concepts' and accordingly set aside 'Conservation Areas (CAs)', focusing on conservation of species like tiger, elephant, snow leopard, etc. or ecosystems/ special habitats like, wetlands, coastal regulation zones (CRZ), and eco sensitive zones (ESZ) either under various national/ state laws relevant to forests, environment and biodiversity (e.g., Environment Protection Act, 1986; Biological Diversity Act, 2002) or some of the important international Conventions/ Agreements (e.g., WHC, Ramsar Convention, UNESCO MAB Programme) (Table 3.6.). Further, communities, private and public entities have also been creating/ setting aside smaller CAs across the country under different nomenclature recognized as 'Other Effective Area-Based Conservation Measures (OECMs)'. The following section provides an overview of various management concepts that have evolved over time, focusing on area-based conservation approaches and Other Effective Area-Based Conservation Measures (OECMs).

Table 3.6. Range of area-based conservation measures under different legal instruments, international conventions/ agreements.

Area Based Conservation Measures		
Legal Instruments Based Measures	Under International Conventions/ Agreements	Other Effective Area-Based Conservation Measures
Protected Areas (PAs) under WPA, 1972	Ramsar Sites under the Ramsar Convention	Community Conserved Areas (CCAs)
Tiger Reserves (Core and Buffer Areas) under WPA,1972	World Heritage Sites under the World Heritage Convention	Sacred Groves (SGs)
Managed Forests (MFs) under IFA, 1927	Biosphere Reserves under the UNESCO's Man and Biosphere's Programme	Key Biodiversity Areas (KBAs)
Eco Sensitive Zones (ESZs) under EPA, 1986		Important Bird Areas (IBAs)
Wetlands Under Wetlands (Conservation and Management Rules, 2017		Privately Owned Conserved Areas e.g., Educational Institutes, and Industrial Estates, Rehabilitated Mines
Biodiversity Heritage Sites (BHSs) under the BD Act, 2002		

Source : MoEFCC (2018)

3.7

Tiger Conservation Area

Tiger (*Panthera tigris tigris*), being India's national animal, and considering the ecological significance of the species, India launched the 'Project Tiger' scheme in 1973 with broad aims of not only protecting the declining populations of tiger across the country but also to harness the functional role and its charisma to garner resources and elicit public support for conservation of representative ecosystems and associated biodiversity in different biogeographic zones. Initially, the Government of India launched the scheme with the establishment of nine tiger reserves (ca. 18,278 km²) in different prominent forest types across the country and adopted the concept of 'core' and 'buffer' zones. Project Tiger adopted ecosystem-based conservation approach in the country and promoted several allied management activities relevant to protection, wireless communication, fire prevention and control, habitat improvement/ management, wildlife research, population estimation of tiger (pug mark census) and prey, monitoring of habitat and wildlife health, wildlife tourism and nature interpretation, and voluntary village relocation and ecodevelopment. After 1973, Project Tiger continued to establish newer TRs and review its decadal success by the tiger population census based on pug mark technique that indicated approximately 3,500 tigers across the country by 1990s.

Now the country has 55 tiger reserves collectively protecting an area of 75,796.83 km² or ~ 2.3% of the country's GA of which is nearly 41,499.37 km² or 54.75% of inviolate space or legally designated 'core', and 34,297.46 km² or 45.25% of buffer (Fig 3.14) (NTCA, 2023). Presently, the extant tiger populations have been confined to < 7% of their historical range across 12 regional tiger conservation landscapes (TCLs) in southern and north-eastern Asia, out of which six global priority TCLs belong to India alone (50%). The country harbours nearly 70% of global wild tiger population and its annual growth rate is increasing at 6% (NTCA, 2023).

The minimum estimated tiger population in 2022 was estimated to be 3,167 individual tigers. Population increase was substantial in Shivalik and Gangetic flood plains, followed by Central India, North Eastern Hills and Brahmaputra floodplains and Sundarbans. The success of India in conserving and doubling its wild tiger population in a span of about 12 years, much before the targeted year of 2022 as per St. Petersburg Declaration, is admirable.



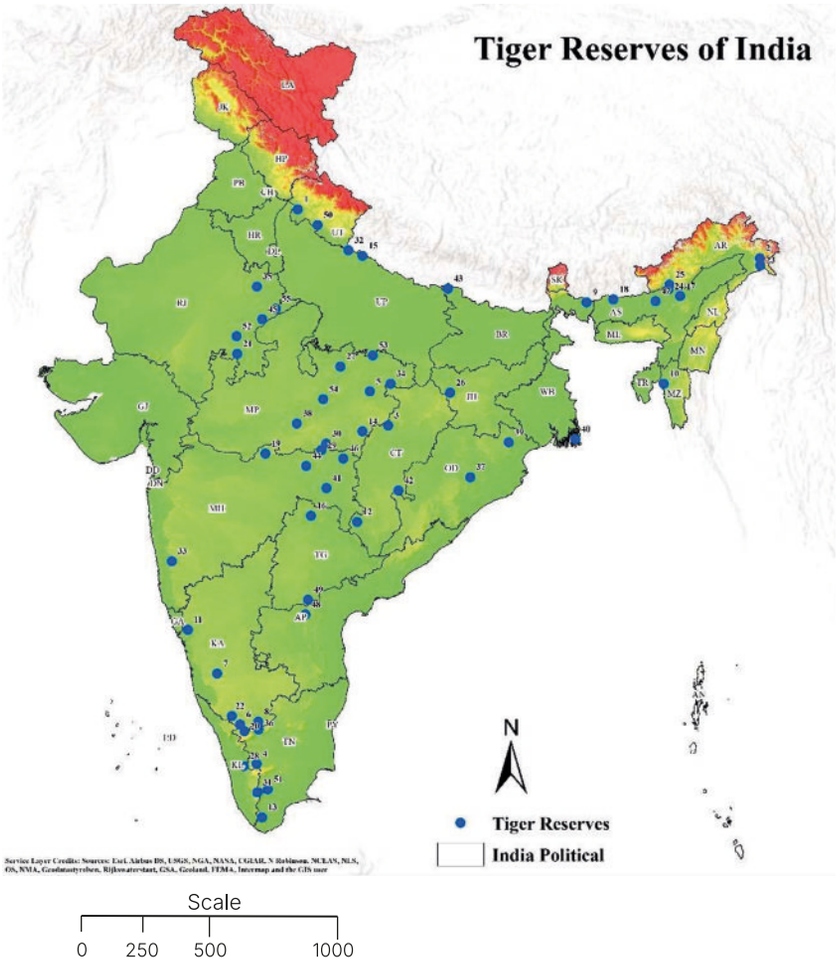


Fig 3.14. Network of 55 Tiger Reserves in India

1. Rajaji Tiger Reserve
2. Kamlang Tiger Reserve
3. Achanakmar Tiger Reserve
4. Anamalai Tiger Reserve
6. Bandhavgarh Tiger Reserve
7. Bhadra Tiger Reserve
8. Biligiri RanganathaTemple Tiger Reserve
9. Buxa Tiger Reserve
10. Dampa Tiger Reserve
11. Dandeli-Anshi Tiger Reserve
12. Indravati Tiger Reserve
13. Kalakad-Mundanthurai Tiger Reserve
14. Kanha Tiger Reserve
15. Dudhwa Tiger Reserve
16. Rajaji Tiger Reserve
17. Kaziranga Tiger Reserve
18. Manas Tiger Reserve
19. Melghat Tiger Reserve
20. Mudumalai Tiger Reserve
21. Mukundara Tiger Reserve
22. Nagarahole Tiger Reserve
23. Namdapha Tiger Reserve
24. Nameri Tiger Reserve
25. Pakke Tiger Reserve
26. Palamau Tiger Reserve
27. Panna Tiger Reserve
28. Parambikulam Tiger Reserve
29. Pench-MH Tiger Reserve
30. Pench-MP Tiger Reserve
31. Periyar Tiger Reserve
32. Pilibhit Tiger Reserve
33. Sahyadri Tiger Reserve
34. Sanjay-Dubri Tiger Reserve
35. Sariska Tiger Reserve
36. Sathyamangalam Tiger Reserve
37. Satkosia Tiger Reserve
38. Satpura Tiger Reserve
39. Similipal Tiger Reserve
40. Sunderbans Tiger Reserve
41. Tadoba-Andhari Tiger Reserve
42. Udanti-Sitanadi Tiger Reserve
43. Valmiki Tiger Reserve
44. Bor Tiger Reserve
45. Ranthambore Tiger Reserve
46. Nawegaon-Nagzira Tiger Reserve
47. Orang Tiger Reserve
48. Nagarjunasager Srisailam Tiger Reserve
49. Amrabad Tiger Reserve
50. Corbett Tiger Reserve
51. Srivilliputhur Megamali Tiger Reserve
52. Ramgarh Tiger Reserve
53. Ranipur Tiger Reserve
54. Veerangana Durgavati Tiger Reserve
55. Dholpur karauli Tiger Reserve

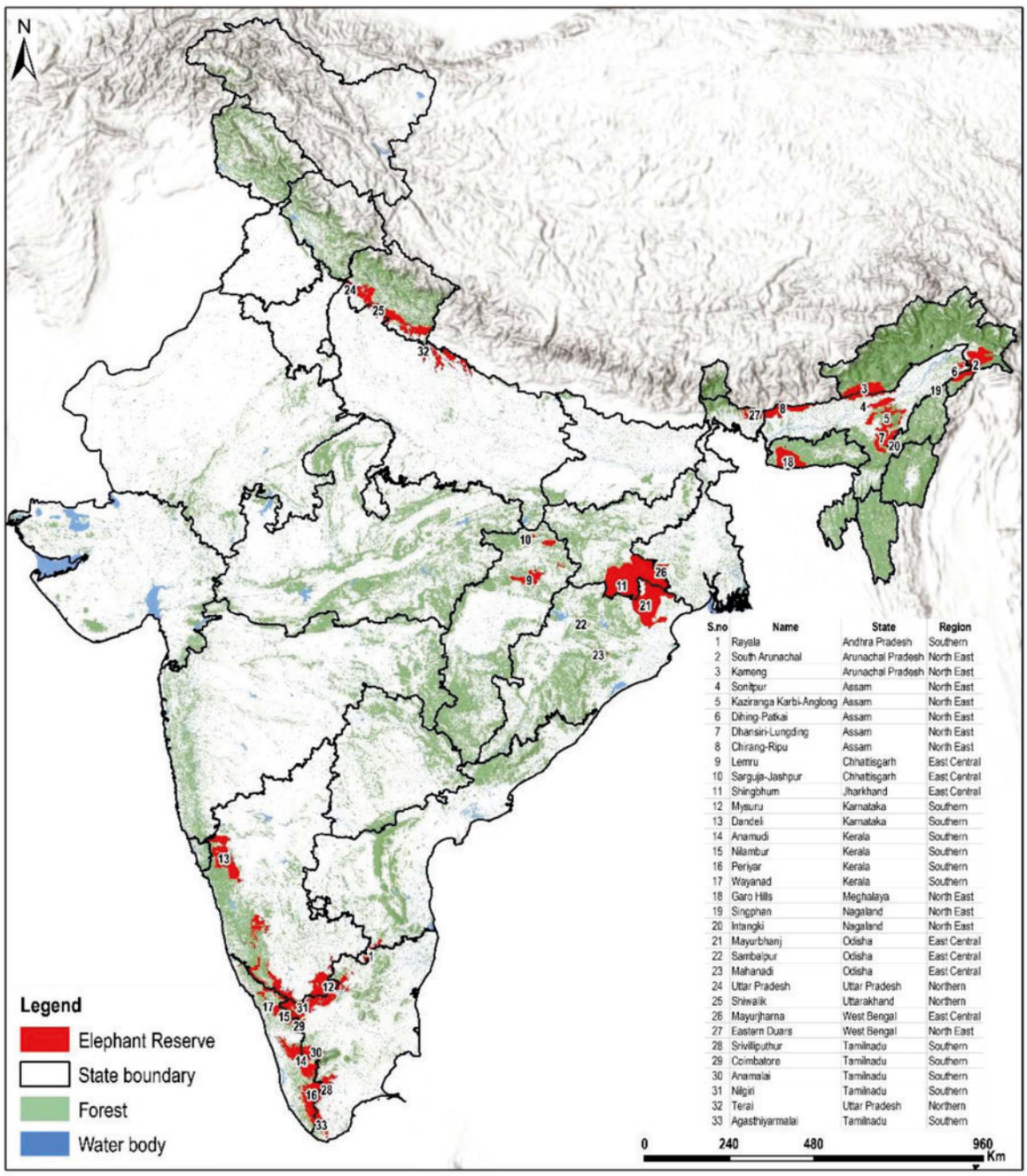
India has been the major stronghold for the Asian elephants and great one horned rhinoceros. Elephant habitats are all within the range of the tiger habitat and therefore investments made for tiger have also been beneficial for elephant conservation. Conservation problems that affect tigers also affect elephants, such as demand for illegal wildlife trade, fragmentation of habitat and corridors by rapid changing land use patterns and conflict with humans. In view of this, Project Elephant, Division of Ministry of Environment, Forest and Climate Change and NTCA decided to merge country wide elephant estimation with tiger monitoring in 2022 based on a pilot study (NTCA, 2023).

Ecosystem Services: Study on the assessment of flow of ecosystem services and economic evaluation undertaken in TRs revealed that value of annual flow of benefits from a tiger reserve ranged between 76,900 and 2,92,300 US$/ km². Tiger Reserves also conserve carbon stock between 1.95 billion US$ and 13.08 billion US$. Approximately 571 million US$ to 1,801 million US$ monetary benefit was derived annually from the forest ecosystem services (NTCA, 2023). On the basis of VALUE+ approach, monetary value for provisioning of water from ten Tiger Reserves ranged from 4.6 million US$ to 847.6 million US$ annually.

3.8

Elephant Conservation Area

Through Project Elephant, launched in the year 1992 by the Government of India, today India has 33 Elephant Reserves covering an area of 80,777.78 km² in 14 major elephant States (Fig 3.15 and Fig 3.16). Elephant Reserves are critical elephant habitats, which have been notified for focused management and synergy needed for elephant conservation and to reduce conflict. Thus, ERs are basic field management units for elephant conservation and management.



S.no	Name	State	Region
1	Rayala	Andhra Pradesh	Southern
2	South Arunachal	Arunachal Pradesh	North East
3	Kameng	Arunachal Pradesh	North East
4	Sonitpur	Assam	North East
5	Kaziranga Karbi-Anglong	Assam	North East
6	Dihing-Patkai	Assam	North East
7	Dhansiri-Lungding	Assam	North East
8	Chirang-Ripu	Assam	North East
9	Lemru	Chhattisgarh	East Central
10	Sarguja-Jashpur	Chhattisgarh	East Central
11	Shingbhum	Jharkhand	East Central
12	Mysuru	Karnataka	Southern
13	Dandeli	Karnataka	Southern
14	Anamudi	Kerala	Southern
15	Nilambur	Kerala	Southern
16	Periyar	Kerala	Southern
17	Wayanad	Kerala	Southern
18	Garo Hills	Meghalaya	North East
19	Singphan	Nagaland	North East
20	Intangki	Nagaland	North East
21	Mayurbhanj	Odisha	East Central
22	Sambalpur	Odisha	East Central
23	Mahanadi	Odisha	East Central
24	Uttar Pradesh	Uttar Pradesh	Northern
25	Shiwalik	Uttarakhand	Northern
26	Mayurjharna	West Bengal	East Central
27	Eastern Duars	West Bengal	North East
28	Srivilliputhur	Tamilnadu	Southern
29	Coimbatore	Tamilnadu	Southern
30	Anamalai	Tamilnadu	Southern
31	Nilgiri	Tamilnadu	Southern
32	Terai	Uttar Pradesh	Northern
33	Agasthiyarmalai	Tamilnadu	Southern

Fig 3.15. Elephant Reserves of India

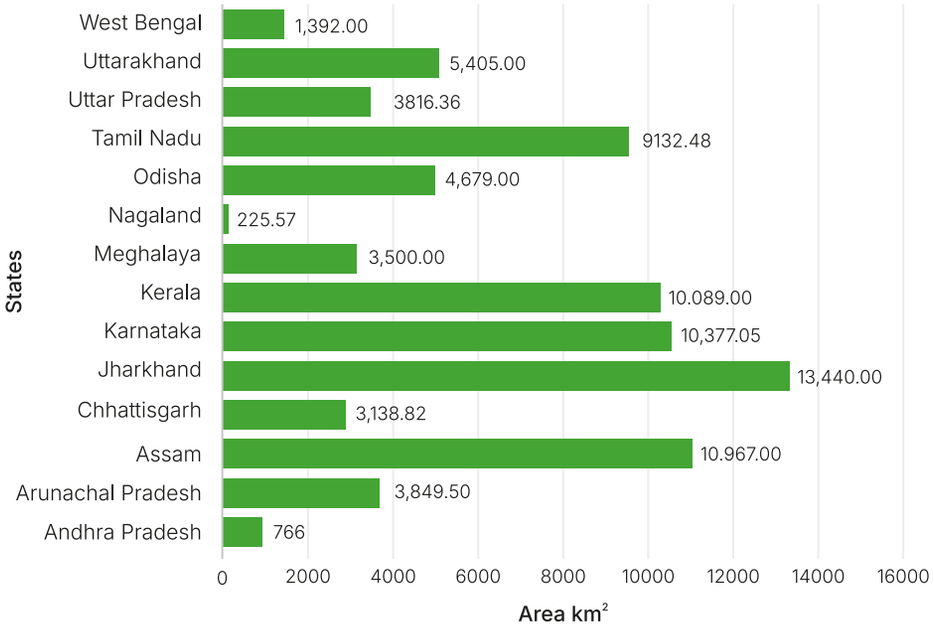


Fig 3.16. State-wise Extent of Elephant Reserves

Source: Compiled from WII-EIACP

Harsh Rawat



Elephant Population:

India holds more than 60% of the Asian wild elephant population. The last exercise on estimation of wild population across elephant range states in 2017 revealed estimated population of about 30,000 elephants in the country. Within India, Asian elephants are predominantly found in the central and southern Western Ghats, North-east India, eastern India and northern India and in some parts of southern peninsular India.

Elephant Corridors:

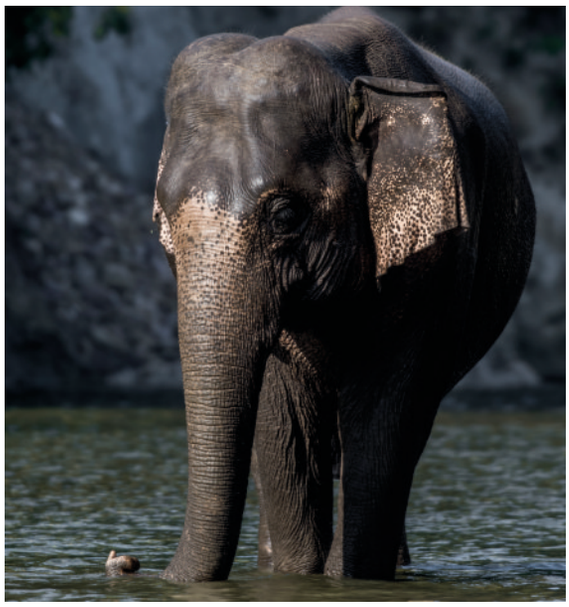
The MoEFCC in coordination with the SFDs of elephant range states have ground- validated elephant corridors across the country and informed the State Governments/ UT Administrations to take necessary steps to protect and conserve the elephant corridors. A comprehensive survey across 15 elephant range states in India revealed a total of 150 elephant corridors, (Project Elephant, 2023).

Elephant Conservation:

The main activities under PE are geared towards: (a) protection and conservation of wild elephants; (b) restoration of natural habitats and traditional corridors/ migratory routes or movement paths; (c) control of poaching and protection from other threats; (d) inter-state and regional/ national level coordination for conservation of elephants; (e) development of required infrastructure and execution of activities relevant to veterinary care, (f) humane methods of capture, and translocation, etc. of wild elephants; (g) care and efficient management of captive elephants; and mitigation of human-elephant conflict.

Human-Elephant Conflict:

Enhanced instances of crop depredation, property damage, human injuries and deaths are being reported from different parts of the country. In past three years i.e., 2020-2021, 2021-2022, and 2022-2023, range states reported total 461, 535, and 605 human casualties due to elephant attack, respectively. The State of Odisha registered highest number of 148 human casualties in 2022-2023. Other prominent states in human casualties due to elephants in a descending order were: West Bengal- 97, Jharkhand - 96, Assam - 90, Chhattisgarh - 69, Tamil Nadu - 40, Karnataka -29, and Kerala – 22. Remaining states recorded <10 cases of human casualties. As many as 605 deaths across a few elephant range states in a year indicates the severity of the problem. Understanding the pattern of conflict, its causes, and stakeholder responses is necessary for managing human-elephant conflict. Cultivation of alternate crops by the forest/forest fringe dwellers such as medicinal and aromatic plants (MAPs) with high levels of secondary metabolites are possible solutions for reducing crop damage caused by wild animals as well as preventing and mitigating human-elephant conflict and ensuring livelihood sustainability and coexistence.



Harsh Rawat

3.9

Eco Sensitive Zones

The Wildlife Conservation Strategy-2002 adopted by the Indian Board for Wildlife during its XXI meeting envisaged that 'lands falling within 10 km of the boundaries of NPs and WLSs should be notified as eco-fragile zones under section 3 (v) of the Environment (Protection) Act, 1986 and Rule 5 Sub-rule (viii) and (x) of the Environment (Protection) Rules'. The National Wildlife Action Plan (2002-2016) also envisaged that 'Areas outside the protected area network are often vital ecological corridor links and must be protected to prevent isolation of fragments of biodiversity which will not survive in the long run. Land and water use policies will need to accept the imperative of strictly protecting ecologically fragile habitats and regulating use elsewhere'.

The purpose of declaring Eco-Sensitive Zone (ESZ) is to create some kind of 'Shock Absorber' for specialized ecosystems such as Protected Areas, which include National Parks and Wildlife Sanctuaries.There are a total of 106 National Parks and 573 Sanctuaries (Protected Areas) declared in the country. Notifying Eco-Sensitive Zones around the PAs is an important objective of the MoEFCC for sustainable development and for conservation of biodiversity around PAs. As part of Wildlife Conservation Strategy, in the year 2002, it was decided that an area around each Protected Area (National Park, Wildlife Sanctuary, Tiger Reserve etc.) requires to be notified as Eco-Sensitive Zone with the purpose of creating a buffer as an added layer of protection around Protected Areas. Country has made notable progress of declaration of ESZs around Protected Areas since 2014 onwards. The number of notifications on ESZs have increased from just 17 in 2014 to 475 in 2023. The progress in terms of expansion in notified area and the areas in km^2 covered under ESZ regulations is presented in Fig 3.17.

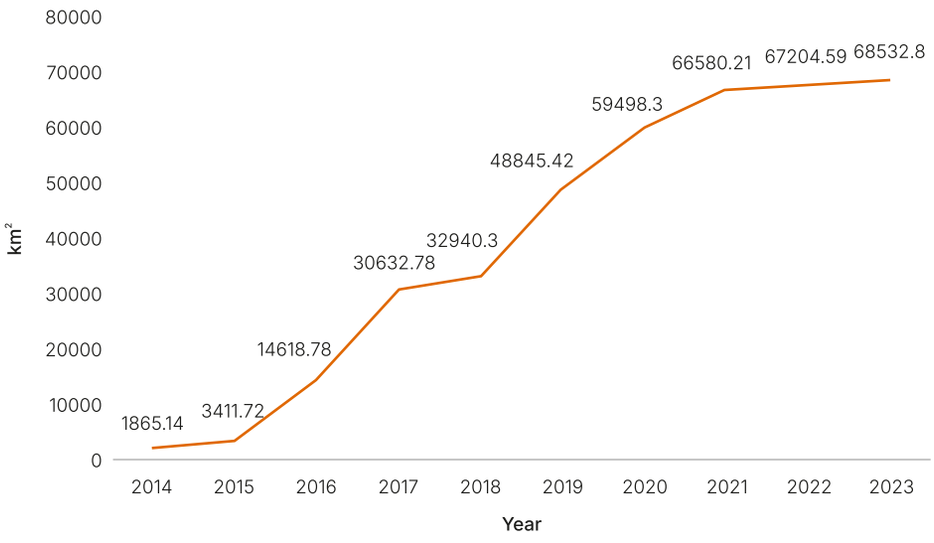


Fig 3.17. Progress in Area of Eco Sensitive Zones in India

3.10

Ecologically Sensitive Areas (ESA)

Ecologically Sensitive Areas (ESAs) are regions recognized for their unique environmental resources and exceptional ecological values, necessitating special conservation measures. In India, the Ministry has notified several ESAs, including: Doon Valley, Dahanu Taluka, Aravalli Range, Mahableshwar-Panchgani, Matheran, Mount Abu, Bhagirathi. These areas are crucial for biodiversity conservation and require focused management strategies to protect their ecological integrity. The designation of ESAs helps in prioritizing conservation efforts and ensuring sustainable development in regions that are particularly vulnerable to environmental degradation.

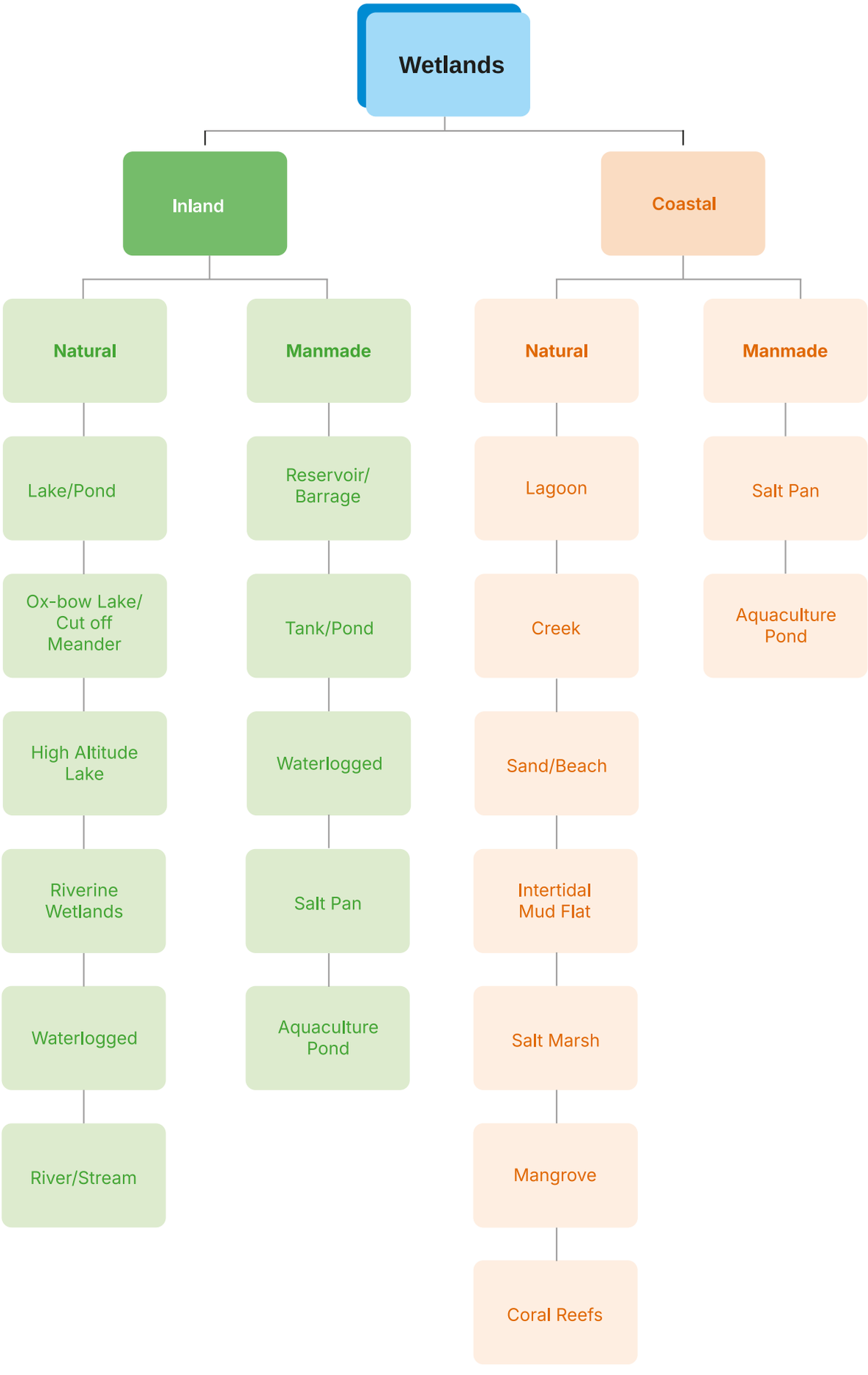
Wetlands

India is signatory to the Ramsar Convention on Wetlands, 1971. So far, 85 sites have been declared as Ramsar sites covering an area of 13580.68 km^2. India framed Wetlands (Conservation and Management) Rules, 2010, and amended in 2017 to fulfill the national commitments and aspirations, and global obligations towards various multilateral environmental agreements and UN Agenda on SDGs. New rules framed under the Environment (Protection) Act, 1986 were referred as the Wetlands (Conservation and Management) Rules, 2017 in supersession of the previous rules of 2010.

The first ever scientific database on Indian wetlands of 2006-2007 using LISS-III data on board Resource sat-I, was published as National Atlas on Wetlands-2011 which is considered as baseline information in the context of wetlands of India (SAC-MoEF 2011). For the purpose, the SAC adopted a classification system following definition of wetland given by the Ramsar Convention. Twenty types of wetlands were categorized (Fig 3.18). Wetlands (area>= 2.25 ha) were delineated, numbered, mapped while areal extent in each case was recorded.



Fig 3.18. Three-Level Classification of Wetlands Adopted for the Preparation of National Atlas of Wetlands



The second cycle of the National Wetland Inventory and Assessment was undertaken using Resource sat-2/2A satellite LISS III data of 2017/18 (Gupta et al., 2021).

Coral reef areas

Several Government of India organizations have been working on various aspects of coral reefs such as taxonomy, distribution and status, mapping, impact of developmental activities, and climate change and they have documented varying extent of coral reefs in the Indian territorial waters (Muley et al., 2000; Venkatraman 2006 and 2011; Saroj et al., 2016; Gupta et al., 2021). All the species of corals were extended protection under the Wildlife (Protection) Act, 1972 and declaration of Marine Protected Areas including Marine National Parks effectively reduced exploitation of corals. Coral cover in the country also gets protection under the Coastal Regulation Zone (CRZ) notification by the MoEFCC originally issued in 1991 and revised in 2019 under the ambit of the Environment (Protection) Act 1986. After the implementation of these protection measures, the corals reefs are recovering from their status in the 1960s. The collection of corals either dead or live is strictly prohibited except for scientific research by identified institutions (Pillai, 2010).



3.11

Sustainable Use of Biodiversity

Sustainable utilization of biodiversity, particularly for plant resources has an increasing trend. For example, cultivation of MAPs for AYUSH industries, and Essential oil industry sector has been steadily increasing (CSIR and AYUSH). Ganesan *et al.*, (2019) have provided an overview of Indian seaweed resources, their utilization and the associated seaweed industry. They also described recent initiatives to develop and transform seaweed farming into social enterprises besides highlighted opportunities and challenges for building a successful seaweed industry in India. Seaweeds are known to remove or consume the nutrients like nitrogen and phosphorus from domestic sewage and other effluents, thus, reducing eutrophication. They contain bioactive substances and are important sources of fertilizers and many other commercially important substances. In India, seaweeds have been utilized exclusively for the production of phycocolloids but recently they are being used for the production of plant growth stimulants for agricultural applications. The domestic agar and alginate industry totally depends on the supplies from natural seaweed beds with some occasional imports. While seaweed is traditionally harvested from wild stocks, the vast majority is now farmed.

3.12

Assessment of Extinction Risk and Conservation of Threatened Species

The SBBs take action for regulation of harvest/ extraction of the species, promote R&D and measures for rehabilitation and restoration of threatened species. Certainly, considering the vastness of country, and wider distribution of enormous diversity of plants, fungi and protists in different terrestrial, inland waters and coastal and marine ecosystems, current efforts to assess floral species for their extinction risk are grossly inadequate. At the same time, a number of biodiversity monitoring indicators developed at the global and national levels mainly rely on important attributes like, diversity, distribution, population size, and status of ecosystems and species and their periodic assessment. Thus, much needs to be done to assess the extinction risk of plant species, especially in a megadiverse and populous country like India, following IUCN criteria and guidelines on a priority basis. The Department of Biotechnology (DBT)'s pan India project 'Preventing Extinction and Improving the Conservation Status of Threatened Plants' has demonstrated that application of biotechnological tools such as the Ecological Niche Modelling (ENM) can be a potential, economical, and effective alternative tool to guide surveys. It

helps in overcoming the constraints regarding the availability of primary data on the distribution and population of species and problems in the correct categorization of the threatened species. The project led to the discovery and characterization of several new populations of 70 threatened species. Nevertheless, till such time, protocols of alternative tools are standardized and accepted by the wider global community for consistent assessment across the world. Resolute support of national/ subnational governments, conservation organizations, and NGOs is highly desirable for augmenting and strengthening current efforts towards assessment of extinction risk and listing of threatened species for priority conservation actions.

3.13

Challenges in Taxonomic Research and Digitalized Databases

Various prominent herbaria, botanical gardens, natural history and zoological museums, two biological survey organizations, and a larger number of organizations of national/ state level repute engaged in taxonomic research relevant to flora and fauna of the country face enormous challenges. These include, (i) insufficient system/ mechanism to organize previous taxonomic knowledge or databases with regular updates, (ii) inadequate subject matter specialists/ experts dealing with systematics of several important and major taxonomic groups, and (iii) inadequate financial and human resources for digitalization of existing specimens, updating databases, assessment of distribution, population dynamics, species characterization, extinction risk, and overall status of prioritized species.

3.14

Agrobiodiversity

Agricultural biodiversity or 'agrobiodiversity' is an important sub-set of biodiversity, vital for food and food security. Current agrobiodiversity is the outcome of natural selection, and inventive, innovative development processes and careful selection, adopted by farmers, herders and fishers over millennia. FAO (1999) defined agrobiodiversity as the variety and variability of animals, plants and micro- organisms that are necessary for sustaining key functions of the agro-ecosystem, including its structure and processes for, and in support of, food production and food security.

Thus, agrobiodiversity includes, harvested crop varieties, livestock breeds, fish species and non-domesticated (wild) resources within field, forest, range land including tree products, wild animals



Koj Mama

hunted for food and in aquatic ecosystems (e.g., freshwater or marine fish). Non-harvested species in the wider environment that support food production ecosystems (agricultural, pastoral, forest and aquatic ecosystems) include soil micro-biota, pollinators, symbionts, pests, parasites, predators, decomposers, and competitors besides other insects such as bees and butterflies; earthworms, and greenflies (Natrajan *et al.*, 2018).

Species used for fodder, fiber, fuel and pharmaceuticals are also part of agrobiodiversity. Traditional and local knowledge besides inventive practices and culture are considered as integral parts of agrobiodiversity as wide range of agriculture, herding, and fishing activities not only shape agriculture, livestock, aquafarms, and fish fauna but also conserve this part of biodiversity important to food production, and food and nutritional security (Fig 3.19). The genetic resources for agriculture and food including cultivated and domesticated species, managed wild plants and animals, as well as wild relatives of cultivated and domesticated species together constitute the primary units of production in agriculture or animal husbandry.

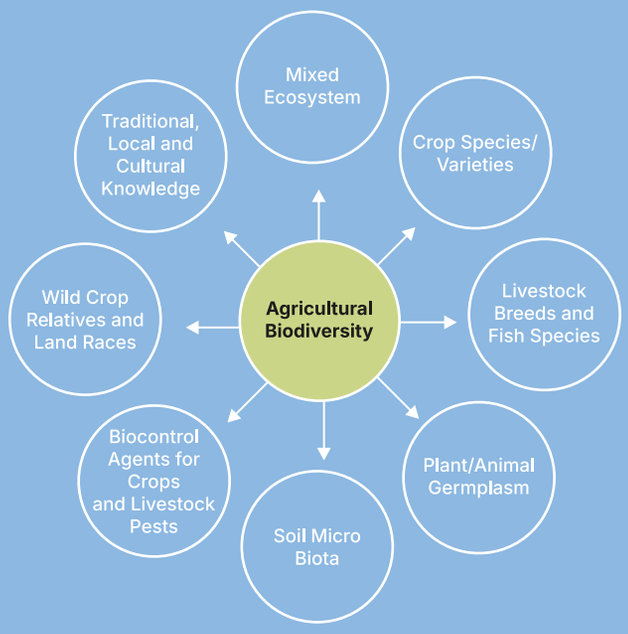


Fig 3.19.
Integral Parts of Agrobiodiversity

Source: Natarjan *et.al.*, (2018)

Agrobiodiversity in India

India - a Centre of Origin of Crop Plants and Domestication

India, recognized as one of the Vavilov's centers of origin of cultivated plants (Vavilov, 1935). Globally, it was considered as the fourth in coarse warm-weather annual cereal production of short duration crops such as sorghum, pearl millet, maize, and finger millet. Zhukovsky (1968) proposed the idea of mega-gene centres where the species were domesticated. About 166 crop taxa have originated and/or developed in India. Indian Gene Centre has particularly contributed to the origin and evolution of rice, sugarcane, green gram, black gram, jute, mango, citrus, banana, cucumber, snake gourd, yam, taro, turmeric, ginger, cardamom, black pepper, and jack fruit. Recently, some more crops, *viz.*, horse gram, sesame, okra, and muskmelon were added to this list.







The global biodiversity persists within the human dominated and managed landscapes, especially agricultural ecosystems and utilize them as habitat. Management actions influence the spatial and temporal patterns, particularly the 'matrix' and thus affects the presence and distribution of biodiversity. India with vast geographical area presents a complex mosaic of distinct agroclimatic zones, characterized by varied climatic, geological, hydrological, soil, vegetational, crop-growing seasons, and other features. An 'Agroclimatic zone' is a land unit in terms of major climate, more specifically the length of growing period (LGP), suitable for a certain range of crops, cultivars, and other vegetation. The effective planning aims at scientific management of regional resources to meet the food, fiber, fodder and fuel wood without adversely affecting the status of natural resources and environment. Thus, several attempts have been made to delineate major agro- ecological regions in respect to soils, climate, physiographic and natural vegetation for macro- level scientific planning.

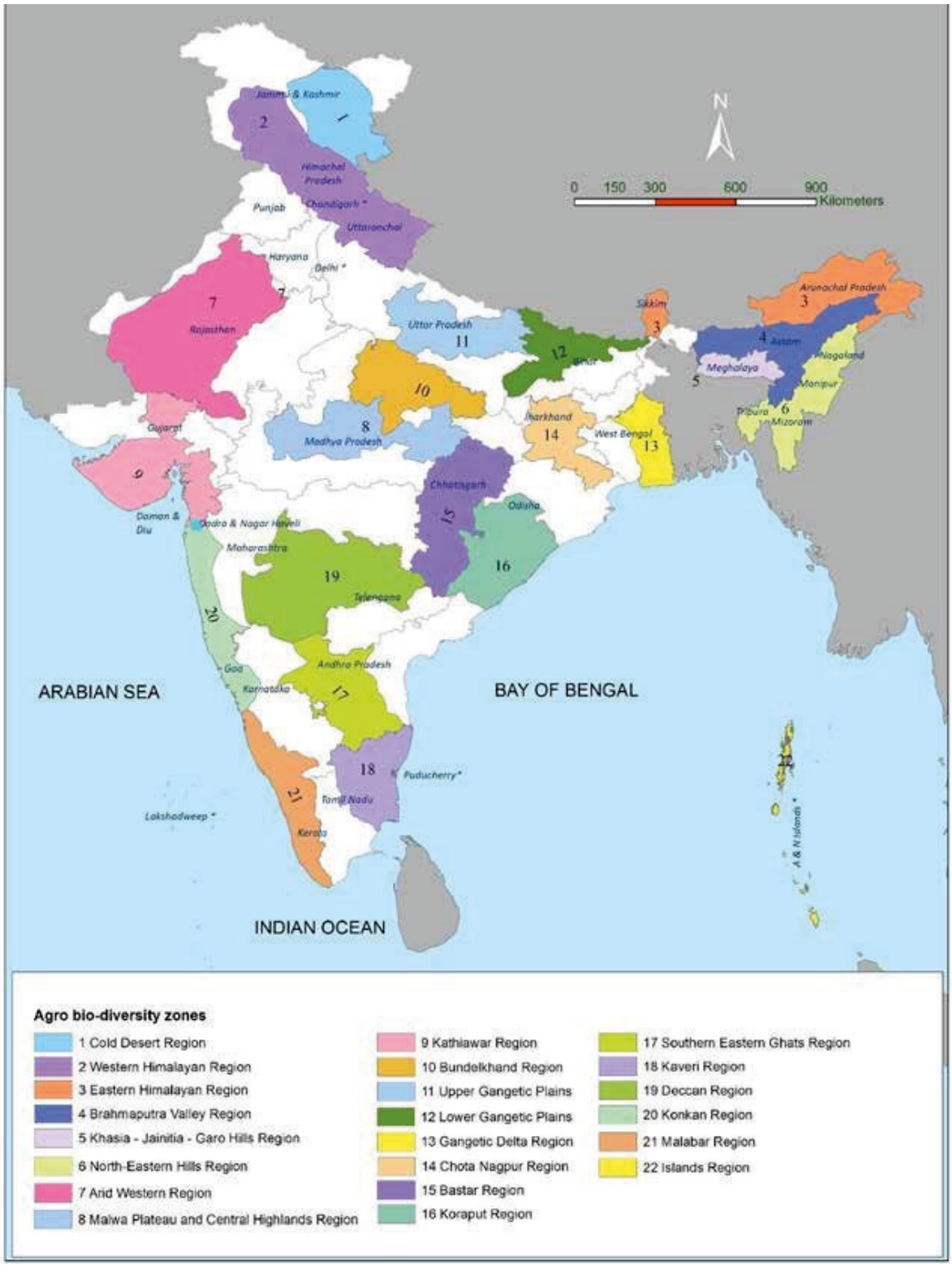
The erstwhile Planning Commission of India in 1988-89 has divided the country into fifteen broad agroclimatic zones based on physiography, soils, geological formation, climate, cropping patterns, and development of irrigation and mineral resources for broad agricultural planning and developing future strategies. The National Agricultural Research Project (NARP) was launched by the Indian Council of Agricultural Research (ICAR) for initiating and planning country-wide agricultural research in different agro-climatic zones. The emphasis was on technology generation, and therefore, the country was divided into 127 agroclimatic zones under NARP. A recent classification by the National Bureau of Soil Survey & Land Use Planning (NBSS&LUP) distinguished twenty agro-ecological zones in the country based on the growing period as an integrated criterion of effective rainfall, soil groups, delineated boundaries adjusted to district boundaries with a minimal number of regions (Sehgal *et al.*, 1992).

Each agroclimatic zone creates a rich array of landraces and traditional varieties of crops and other elements of agrobiodiversity. These landraces, traditional varieties and Crop Wild Relatives (CWRs) are important for sustainability of crops, particularly for adaptation and sustainability against the impacts of climate change.

Agrobiodiversity Hotspots

The Protection of Plant Varieties and Farmers' Rights Authority (PPVFRA) has identified 22 agrobiodiversity hotspots in India based on the number of species, crop varieties, wild relatives of cultivated crop species, social relevance, ancientness of agriculture, number of species domesticated and the uniqueness of the agroecosystem (Fig 3.20), which need to be protected.

Fig 3.20.
Agrobiodiversity Hotspots in India



Plant Genetic Resources

Plant genetic resources (PGR) consist of: (a) landraces, (b) improved cultivars, (c) wild relatives, and (d) related taxa of crop plants along with their wild progenitors and potential domesticates, and they are one of the key components of agrobiodiversity. The spectrum of PGR comprises diversity from the gene pool and centres of cultivation and material developed through breeding programmes. Among these, the diversity in wild relatives and related taxa of crop plants is central for the improvement of crops. The genes for various traits stored in the wild gene pool have been extensively used in improvement of many crops. Interestingly, in some crops they are the only available genetic resources. These facts necessitate urgent measures for collection and conservation of this diversity. The search for genetic diversity in economic plants is a constant goal for the breeders. This diversity can be greatly enhanced using wild relatives of crop plants (WRCPs). Adaptation to varied biotic and abiotic stresses has made the local landraces and wild relatives extremely useful in various breeding programmes. The National Bureau of Plant Genetic Resources (NBPGR), New Delhi is the nodal organization in India for the management of PGR. Since, its inception in 1976, efforts have been made for the collection and conservation of plant genetic resources including crop wild relatives constitute an important but scarcely exploited component of the gene pool of domesticated species available to plant breeders. Weedy races are the close companions of cultivated plant species, and together form a genetically compatible complex. CWRs are pivotal source for maintaining genetic variability in crop plants (Table 3.7.). Thus, they are widely used in resistance breeding. Hence, it is a prerequisite to identify and map state-wise on-farm conservation sites of crops protected by local farmers and also get an insight about cultivation practices adopted by them. Farmers involved in protecting traditional varieties of food crops need incentives and support.

About 168 species of crops including 25 major and minor crops have been domesticated and developed significant unique diversity in the country. The National Bureau of Plant Genetic Research (NBPGR) has prioritized and shortlisted CWRs of 171 native crops belonging to 769 species, which include cereals, millets, pseudocereals, grain legumes, oilseeds, fibers, forages, fruits and nuts, vegetables, spices and condiments, ornamental plants, medicinal and aromatic, plantation crops, etc. (Pradheep *et al.*, 2021).

Table 3.7. Crop wild relatives of India

Sl.No.	Crop-Group*	Number of Crops		Crop Wild Relatives (CWR) Species		Taxa	
		Initially Prioritized	Further Prioritized	Initially Prioritized**	Further Prioritized	Initially Prioritized	Further Prioritized
1.	Cereals	5	3	52 (2)	46	58	50
2.	Millets	8	5	23 (1)	8	27	9
3.	Pseudocereals	3	1	14 (1)	1	14	1
4.	Grain legumes	10	9	51 (4)	27	59	30
5.	Oilseeds	5	4	13 (1)	10	14	10
6.	Fibers	5	4	19 (3)	9	21	9
7.	Forages	16	4	58 (14)	4	63	5
8.	Fruits and nuts	36	14	130 (17)	55	148	65
9.	Vegetables	26	21	87 (13)	46	102	54
10.	Spices and condiments	12	7	58 (8)	22	62	24
11.	Ornamental Plants	13	2	141 (59)	5	153	8
12.	Medicinal and aromatic plants	20	7	74 (19)	8	85	11
13.	Plantation crops	3	1	12 (0)	1	14	1
14.	Others	9	3	37 (8)	15	41	15
Total		**171**	**85**	**769 (150)**	**257**	**861**	**292**

*One crop may involve more than one species **Figures in parenthesis are crop taxa having wild/ weedy form(s) or wild populations occurring in India, which are also included for counting as CWR.

Conservation of Plant Genetic Resources

Cereal crops have the highest number of accessions of PGR with ICAR-NBPGR (Table 3.8). Stored genetic resources of medicinal plants, forages, vegetables, agroforestry, and cereal crop were represented by 707, 228, 222, 195, and 148 species.

Table 3.8. Accession of Plant Genetic Resources Conserved

Crop Groups/ Crop Name	No. of Accessions Conserved (January, 2022 – December, 2022)			Total No. of Species	Status (31 December, 2022)
	Regenerated	New Accessions	Addition of New Species		
Cereals	89	1597	2	148	1,73,487
Millets	622	209	0	31	60,222
Forages	306	79	7	228	7,477
Pseudocereals	0	80	0	57	8,097
Grain legumes	512	628	6	117	68,465
Oilseeds	0	299	0	88	63,260
Fibre	58	153	1	81	16,920
Vegetables	46	487	0	222	28,679
Fruits and nuts	0	2	1	72	300
Medicinal and aromatic plants	120	420	19	707	9,146
Ornamental	2	47	6	134	734
Spices, condiments and flavour	1	159	0	28	3,641
Agroforestry	0	16	1	195	1,696
Duplicate safety samples	0	0	0	0	10,235
Trial material (Wheat, Barley)	0	0	0	0	10,771
Total	**1,576**	**4,176**	**43**	**2,108**	**4,63,130**

Source: ICAR-NBPGR (2023)

Crop Improvement

A total of 467 high yielding varieties/ hybrids comprising 218 of cereals, 57 of oilseeds, 65 of pulses, 98 of commercial crops, 29 of forage and other crops were released for commercial cultivation (ICAR, 2023). In horticultural crops, total 122 varieties were notified for cultivation under different agroclimatic conditions. These included 15 varieties of fruits, 1 of plantation crops, 97 of vegetables, 2 of tropical tubers and 7 of spices.

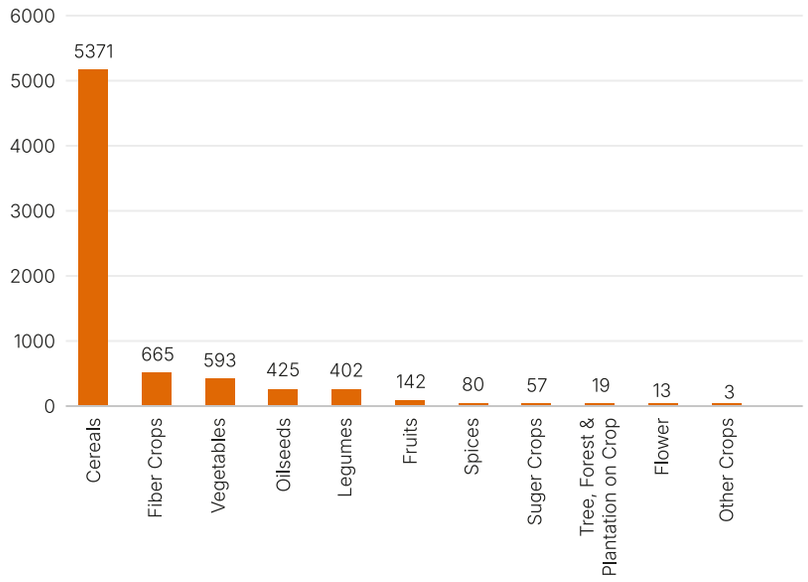
Till date, ICAR has released more than 6,000 varieties for cereals, oilseeds, pulses, fibre crops, forage crops, sugar crops and other crops. This list includes 55 varieties developed through marker- assisted selection to fulfill the various requirement of the farmers. In recent years (2014-2021), 1,575 high yielding varieties of field crops were released, more than 1,300 varieties of which are climate resilient. Specific traits such as drought and submergence tolerance, disease resistance and improved nutrition quality have been introgressed in 47 varieties of field crops using genomic tools. Simultaneously, the PPVFRA is engaged in the registration of new varieties to protect the rights of farmers and plant breeders. The new varieties registered under the PPVFRA authority are illustrated (Fig 3.21).

© Sindhuduru



Fig 3.21. New varieties (Farmers and Breeders) Registered under the PPVFRA

Source : https://plantauthority.gov.in



Livestock Breeds and Production

Among over 40 animal species domesticated by man, 14 major species contribute 82% of global food and agricultural production. Animal husbandry is an integral part of India's agricultural system. Animal genetic resources are nation's traditional strength and provide a good option to manage agriculture sector in more profitable and sustainable manner. India has the largest bovine population of the world. Mixed farming of crops and livestock is the predominant farming system in India. Total livestock population in the country stood at 536.76 million heads with 36% constituted by cattle and 20% by buffaloes. Genetic improvement of livestock species has been carried out to increase milk yield, body growth and reproductive performance. Several breeds of cattle, goat, sheep, camel and poultry have been conserved in their original habitats as well as in the form of embryo, semen and DNA. Production of cloned buffalo calves has been carried out from dead progeny tested buffalo bull and wild buffalo through inter- species cloning.

Registered Breeds and Non-Descript Animals

ICAR has characterized the livestock population of India in their natural home tracts and so far, registered and gazette notified altogether 205 animal breeds including 180 breeds of livestock (cattle 50, buffalo 19, goat 34, sheep 44, pig 10, horses/ ponies 7, donkey 3, camel 9, yak 1, dog 3, poultry 22). For *ex situ* conservation, semen doses and somatic cells are being cryo conserved at the National Gene Bank, National Bureau of Animal Genetic Resources (NBAGR), Karnal. The National Gene Bank has cryo conserved altogether 2,27,362 semen doses of 47 livestock breeds. This includes semen doses of 24 breeds of cattle (1,63,108), 12 breeds of buffalo (59,703), five breeds of goat (12,584), one breed each of sheep (8,375) and camel (928), three breeds of equine (1,750), and a breed of yak (460).

Large proportion of non-descript animals of different species indicates that the characterization and inventorization of animal genetic resources of India is still incomplete. After the establishment of NBAGR, phenotypic characterization of domestic animal diversity of India has been accelerated.

Fish diversity, Fisheries and Aquaculture

Fisheries and aquaculture are fast-growing sectors of India's economy that support the nutritional and livelihood security of millions of dependent populations. During 2018-19, the fisheries sector contributed as much as Rs 2,129 billion to the national gross value added (GVA) which accounted for 7.28% of the GVA of agricultural and allied sectors. Natrajan *et al.,* (2018) reported an overall diversity of 2,563 fish species from the inland waters, coastal and marine ecosystems, and aquaculture. This included diversity of 877 species in fresh water, 113 species in brackish water, and 1,573 species in marine water.

Agriculturally Important Insects

Beneficial insects provide ecosystem services to agriculture such as pollination and the natural regulation of plant pests which are extremely important from a conservation and production perspective. These beneficial insects regulate the pest population of many harmful pest species, generate natural products, dispose waste and recycle nutrients. The National Bureau of Agricultural Insect Resources (NBAIR) maintains accessions of genetic diversity of agriculturally important insects. The repository of NBAIR currently holds nearly 2,25,948 specimens, and the 379 types.

Microorganisms

National Agriculturally Important Microbial Culture Collection (NAIMCC), a unit of National Bureau of Agriculturally Important Microorganisms (NBAIM) conserves microbial cultures from all over India including from the unique ecosystems such as hot and cold deserts and thermal springs. So far, 1,540 bacteria, 157 archaea, 260 fungi and 200 actinomycetes have been isolated after surveys. NAIMCC holds 6,350 agriculturally important microorganisms which include 2,319 bacteria, 3,804 fungi and 228 cyanobacteria from different agro ecological zones of India.

Agriculture Research, Education and Extension

The Indian Council of Agriculture Research (ICAR) under the Ministry of Agriculture and Farmers Welfare (MoAFW) leads one of the largest National Agricultural Research and Education System (NARES) in the world. Presently, ICAR has 113 research institutes, 74 agricultural universities, 4 deemed-to-be-universities, 3 central universities and 731 Krishi Vigyan Kendras (KVKs) spread across the country. With these, India has one of the world's largest agricultural research human resource capital.

3.15

Conservation Challenges and Threats

Drivers of Biodiversity Loss, Trends, and Relevant Sectors

Preceding Chapters have provided a valuable insight on the status and trends in India's biodiversity while highlighting different drivers, stressors and challenges influencing wild and domestic biodiversity. The following section summarises positive and negative factors impacting biodiversity including causes for vulnerability.

Positive Factors Impacting Biodiversity:

Historically, India's culture, traditions, and ethos have immensely helped in conservation of country's rich and unique biodiversity including agrobiodiversity across its vast expanse. India paid an early attention in setting aside areas of high biodiversity values and even in conservation of land races, crop varieties and animal breeds. Well laid infrastructure, several national/ state level scientific organizations, innovative activities, and huge investments made by the central ministries, especially 'life owning' and 'life supporting', state/ UT governments, state departments, and field level interventions by local communities supported by much desired enabling conditions (policy, legal and institutional framework; research and monitoring; capacity development; participatory approaches, etc.) have immensely helped in protection, management and conservation of natural and manmade ecosystems and associated plant and animal diversity. The core sectors (Forest, Agriculture, Horticulture, Animal Husbandry, and Fisheries) have long history and experience of managing vital biodiversity resources under their control. Conservation of wild diversity is ensured through a large number of PAs, TRs, ERs, Ramsar Sites, IBAs, KBAs, and numerous Sacred Groves. India is not only considerate of conservation of natural ecosystems, associated flora and fauna, and agrobiodiversity but has developed the National Action Plan on Climate Change, and Vision 2030 for Sustainable Development Goals. Currently, the country has support of 2,77,688 BMCs at the grassroots level for conservation of biodiversity, and access and equitable benefit sharing of benefits arising due to use of biological resources.

Negative Factors Impacting Biodiversity:

Starting with the turn of 20th century, several factors emerged and intensified in the country as negative drivers for biodiversity. The main factors adversely impacting biodiversity are: (i) burgeoning human population with high density and growth; (ii) large rural population traditionally dependent upon natural resources; (iii) substantial population as deprived, poor, illiterate, landless, and with small land holdings; (iv) wide spread land and soil degradation; (v) gradual disappearance of grasslands, natural inland wetlands, and fragile coastal and marine ecosystems; (vi) expansion and intensification of agriculture imposing pressure on the environment with the application of fertilisers, herbicides and pesticides; (vii) declining indigenous animal breeds; (viii) genetic erosion; (ix) enhanced human wildlife interactions; (x) rapid expansion of physical infrastructure (hydroelectric projects, road network, power transmission lines, and others); (xi) mining and destructive impact on biodiversity through habitat fragmentation, soil and water pollution; (xii) urbanisation with expanding settlements, declining urban biodiversity and hydrologically stressed groundwater resources; (xiii) pollution and waste; (xiv) harmful subsidies; (xv) enhanced events of natural disasters; and (xvi) intensity of climate change and its implications.

The SWOT Analysis in the context of conservation of biodiversity in India yielded valuable insight on strengths, weaknesses, threats, and opportunities (Table 3.9).

Table 3.9. Conservation of Biodiversity - SWOT Analysis

Strengths

- Strategically located vast country is endowed with rich and unique natural treasure of diverse natural ecosystems and associated wild flora and fauna.
- India is one of the megadiverse countries, represented by four global biodiversity hotspots. Country has nearly 8% diversity of world's known plant and animal species.
- Country continues to harbour several charismatic, iconic and threatened species (tiger, lion, snow leopard, elephant, rhino, wild buffalo, swamp deer, Great Indian Bustard, river dolphin, gharial, dugong, Sarus crane, pheasants, vultures, etc.).
- India has been gifted with enormous freshwater resources including basins of prominent Himalayan River Systems (Indus, Ganga, Brahmaputra) and other major rivers (Narmada, Godavari, Mahanadi, Krishna, Cauvery, etc.) besides numerous natural and manmade inland water and coastal and marine wetlands. National River Ganga traverses through five states and drains a larger part of India.
- Country is a cradle of Indian Civilization.
- India is one of Vavilov's Centres of plant diversity. Country harbours exceptionally rich, diverse, and productive agrobiodiversity (land races, crop varieties, indigenous animal breeds) that significantly contribute towards production of agriculture, horticulture, and livestock systems and milk production of the country.
- Country's biodiversity is supported by appropriate policy and legal regulatory mechanisms, research and training institutions, and three tier hierarchical governance system.

Weaknesses

- Highly fragmented natural ecosystems occur as small, widely distributed patches amidst human dominated landscapes, burdened by traditional resource dependence and high biotic pressure.
- Nearly, 15,106 km long porous international land border with seven neighbouring countries, and 8,118 km coastal line poses including of island territories having maritime boundaries with multiple countries pose enormous challenges for terrestrial and marine biodiversity. Natural ecosystems in some stretches along the international borders are prone to encroachment, wildlife poaching and illegal wildlife trade.
- Growing human population. Nearly, two-third population is rural. High human density with small land holdings. Substantial population is poor and illiterate. Increasing net out migration in some states/ UTs with growing urban populations.
- Agriculture intensification, industrialization and urbanization resulting into chemical pollutants and issues of waste and sewage disposal causing soil, air and water pollution.
- Inadequate capacity, information base and ecological understanding, particularly knowledge of biology and conservation requirements of threatened species, ecosystem restoration, control of pollution and invasive alien species.
- Inadequate finances for biodiversity, and wide gap between demand and available funds.

Opportunities

- Conservation of biodiversity (wild and domestic) is supported by relevant policies, laws and institutional framework relevant to varied sectors and backing of 2,77,688 BMCs.
- Some of the small and poorly managed PAs and remnant forests, grasslands, wetlands and riverine ecosystems, particularly crucial corridors have potential to revive through eco-restoration, effective management and conservation.
- Experience of successful management of reintroduced populations of rhino, gaur, pygmy hog, tiger, swamp deer, etc. and technical support for undertaking conservation breeding programmes of threatened species.
- Availability of the National Action Plan on Climate Change supported by eight Missions, and Vision 2030 for Sustainable Development Goals, and relevant planning and strategies on resource mobilization.
- Available human resources and political will besides opportunities for sectoral integration, mainstreaming biodiversity concerns in production sectors, and convergence.
- Engagement of local communities, adoption of participatory approaches, and promotion of wildlife/ ecotourism.

Threats

- Burgeoning human and livestock populations. Shrinking wilderness and degrading ecosystems, and declining wild diversity with small and fragmented populations.
- Eroding native agrobiodiversity, particularly local land races, crop varieties and even indigenous breeds. Preponderance of exotics/ crossbreds, and selective breeding towards female progeny of cattle and alarming decline of male indigenous/ native cattle.
- Wide spread land and soil degradation, and proliferation of invasive and alien species in terrestrial and aquatic environments.
- Enhanced human-wildlife interactions and increased wildlife damage.
- Rapid development (agriculture expansion, infrastructure and urban centres) leading to loss of biodiversity, groundwater exploitation, water crisis, and reduced ecosystem services.
- Climate change and its wider implications.

The achievements, gaps, key issues and future requirements of conservation of biodiversity in the context of India are summarized in (Table 3.10)

Table 3.10. Achievements, gaps, key issues and future requirements of conservation of biodiversity in the context of India

Achievements	Gaps
• Enhanced awareness and interest in biodiversity conservation. • Country documented ~8% world's plant and animal diversity; a megadiverse nation, description of 22 agrobiodiversity hotspots. • Biogeographic basis for conservation planning. • Support of policies, laws, authorities and institutions. • Establishment of PAs, TRs, ESZs, and OECMs. • Enhanced science-based planning and conservation of wild biodiversity and agrobiodiversity; technology advancements; and increased use of technologies. • Increased protection to wild biodiversity; emphasis on *in situ* conservation; improved management of PAs/ TRs; significant reduction in biotic pressure in case of prominent PAs/TRs. • Support of *ex situ* conservation measures. • Institutionalization of monitoring of tiger, elephant, and other threatened species; spatial and temporal monitoring of forests and wetlands; management evaluation effectiveness of PAs. • Crop diversification; conservation of land races, crop wild relatives, animal breeds, and native fish fauna. • Attempts to engage communities and adoption of participatory approaches; Establishment of hierarchical organizations at all levels for conservation including CBOs. • Considerable inputs towards capacity building of professionals and communities, and organizational development. • Efforts to improve rural livelihoods; positive demonstration of conservation measures. • Documentation of best practices and success stories.	• Inadequate protection to grasslands, inland wetlands and coastal and marine ecosystems. • Several threatened species under higher risk awaits conservation breeding, recovery and rehabilitation. • Insufficient knowledge and understanding of nature-people relationship, and human impact on biodiversity. • Inadequate understanding and investments on control of pollution, and invasive alien species. • Insufficient investments and least documented methods and success stories of ecorestoration. • Inadequate attention and investments towards genetic diversity, ecosystem management, urban environment, and sustainable management of forests, wetlands, coastal and marine ecosystems, wildlife health, agriculture, animal husbandry, fisheries, and aquaculture. • Ineffective community engagement, participatory approaches, ecodevelopment, and sustainable livelihoods. • Inaccessible research and monitoring information and inadequate databases. • Limited access and inequitable benefit sharing while subsidies to all irrespective of economic status. • Problems in coordination and implementation process. • Insufficient monitoring and evaluation procedures.

Key Issues
• Slow percolation, poor understanding and realization of biodiversity concepts, conservation priorities, and impact of interconnected triple crises at the grassroots level. • Enhanced biotic pressure on natural ecosystems, adverse impact of developmental activities on wild biodiversity, and PAs; enhanced ecosystem degradation and overexploitation of species; and increased human-wildlife interaction. • Incompatible land use in surrounds of PAs or other areas of high biodiversity; loss of corridors/ river connectivity; and declining ecological integrity. • Ineffective participatory approaches that too solely during the planning phase. • Poor recognition of social structures and heterogeneity; and institutional complexities at village level and functioning. • Issues of sustainability of ecosystems, viability of populations, and ecosystem health. • Issues of sectoral integration, coordination, convergence, mainstreaming, consensus building and conflict resolution • Adopt holistic ecosystem approach; focus on landscape/ riverscape/ seascape approach to conservation; transboundary landscapes; ecological and evolutionary processes; and interconnected themes of sustainability, livelihoods, and equity through participatory principles and democratic decentralization. • Involve vulnerable communities and lay emphasis on women empowerment. • Backstopping for planning, monitoring, and evaluation. • Thrust on natural resource regeneration, institutional coherence, resource mobilization and inclusion of indigenous traditional knowledge. • Promote and support sustainable farming and small and micro entrepreneurships; supply chain management, linkages with market, and cost benefits. • Ensure transparency, flexibility, accountability, and ownership. • Develop functional and behavioral capacities. • Establish Knowledge Management Center with focus on people, processes, technological innovations, and dissemination.

3.16

Policies, Legislations and Institutional Framework

Nature has always been very vibrant, giving and resilient to a very large extent. The eco-centric approach of the Indian culture lies in the concepts of 'Vasudhaiv Kutumbkam' (Earth is one family), 'Aranya Sanskriti' (Forest Culture), and the 'Prakriti Purush' (Natural Human) which are deeply embedded in the traditions and the customs of the Indian society. Based on traditional conservation practices, the community manages the local natural heritage (Mehra, 2023). The diversity of customs and traditions results in the vividness of the conservation practices. Thus, the socio- ecological systems are of immense significance for site-specific conservation programs and policies. Conservation of nature, and wildlife have been a part of Indian ethos, which encourages compassion and coexistence. Further, it has been widely recognized that conservation of biodiversity for a populous nation like India is not only crucial as it offers a wide range of goods and services vital for human survival, but also because it is directly linked with providing livelihoods and improving socio-economic conditions for millions of local people, thereby contributing to sustainable development and poverty alleviation.

India's vision and commitment towards conservation of biodiversity was abundantly reflected when the country enacted the WPA, 1972 and started establishing protected areas actively on the biogeographic basis. This vision and commitment were reinforced once India joined global movement by ratifying the CBD, and subsequently adopting Convention's Vision 2050 of 'Living in harmony with nature.' Notably, the Indian Constitution, as adopted in 1950, did not deal with the subject of environment, or prevention and control of pollution as such until the 42nd Constitutional Amendment. A constitutional amendment in 1976 incorporated Article 48 A and Article 51 A (g) under Directive Principles of State Policy and Fundamental Duties, respectively so as to strengthen the environmental laws in India. Article 48A imposes a duty on State to protect the environment from pollution by adopting various measures while the Article 51 A(g) directs that it shall be the duty of each and every citizen of India to protect and improve the natural environment that includes lakes, rivers, forests, and wildlife. In addition to ratification of CBD, and the Constitutional Amendment, India has also signed several related Conventions besides other multilateral environmental agreements including the UN 2030 Agenda on Sustainable Development. Simultaneously, India also made concerted efforts for conservation of agrobiodiversity. Collectively, these interrelated and concurrent efforts have placed India on a high pedestal in the international arena, especially in the field of conservation of biodiversity.

International Conventions and Treaties

India, especially in past five decades or so has signed several Conventions, and other multilateral agreements relevant to biodiversity and wider discipline of environment in response to her international obligations. In view of these agreements, and also keeping the national agenda in perspective, the country initiated a wide range of innovative programmes and action plans (Table 3.11). Most of them are of great significance from the perspective of conservation of biodiversity.

Table 3.11. Conventions and Multilateral Environmental Agreements

Conventions, and other Multilateral Environmental Agreements (MEAs)
Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat (1971): The Convention focuses on the conservation and sustainable management of wetlands, identifies and designates wetlands of international importance as Ramsar Sites. Currently, India has 80 Ramsar Sites covering approx. 1.33 million ha. In terms of total number of Ramsar Sites, India ranks second in Asia and first in South Asian country.
World Heritage Convention (1972): The UNESCO's WHC is responsible for the protection and conservation of World Heritage Sites, encompassing both natural and cultural sites of outstanding universal values. There are 42 World Heritage Sites in India. Out of these, 34 are cultural, seven are natural, and one, Khangchendzonga National Park is of mixed type. The Western Ghats, a serial natural site has 39 components (National Parks, Sanctuaries and Reserved Forests).
Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973): CITES strives to prevent the international trade of wild animals and plants from endangering their survival in the wild. It provides protection to over 35,000 species of animals and plants.

Convention on the Conservation of Migratory Species (CMS) of Wild Animals (1979): Popularly known as the Convention on Migratory Species or the Bonn Convention is dedicated to conserving migratory species across their entire ranges. Given India's location within the Central Asian Flyway, this convention holds significant importance for the country.

Basel Convention on the control of Transboundry Movements of Hazardous Wastes and their Disposal (1989): Popularly known as the Basel Convention aims to protect human health and the environment against the adverse effects resulting from the generation, management, transboundary movements and disposal of hazardous and other wastes.

UN Convention on Biological Diversity (1992): The UNCBD addresses biodiversity comprehensively, covering wildlife and domestic biodiversity. It focuses on three key objectives related to conservation, sustainable resource use, and access and benefit sharing arising due to use of biological resources. In alignment with the convention, India enacted the Biological Diversity Act, 2002, established the National Biodiversity Authority, and formed State Biodiversity Boards/ UT Biodiversity Councils. In past, India has also developed the National Biodiversity Strategy and Action Plan (NBSAP) and periodically submits National Reports in accordance with its commitments under the UNCBD.

UN Framework Convention on Climate Change (1992): This international treaty addresses challenges stemming from climate change, which are closely linked with biodiversity objectives and Sustainable Development Goals (SDGs). It focusses on both mitigating climate change and adapting to its impacts.

United Nations Convention to Combat Desertification (1994): The UNCCD strives to combat desertification and alleviate drought impacts by implementing national action programmes.

The Kyoto Protocol (1997): The Kyoto Protocol translates the objectives of the UNFCCC into action by requiring industrialized nations and transitioning economies to curb and reduce greenhouse gas (GHG) emissions based on specific targets. While the UNFCCC mandates these countries to adopt mitigation policies and report regularly, the Protocol holds them accountable to enforce actual emission reduction measures. India ratified the protocol on 26 August, 2002.

The Cartagena Protocol on Biosafety to the Convention on Biological Diversity (2000): This Protocol seeks to guarantee the safe handling, transportation, and utilization of living modified organisms (LMOs) produced through modern biotechnology, which could potentially pose risks to biological diversity and human health. India is a signatory to the Cartagena Protocol and ratified it on January 23, 2003.

International Treaty on Plant Genetic Resources for Food and Agriculture (2001): Aligned with the CBD, this treaty focuses on ensuring food security by conserving, exchanging, and sustainably utilizing global plant genetic resources for agriculture. It also highlights fair and equitable benefit sharing and recognizes farmers' rights.

The Nagoya Protocol on Access and Benefit Sharing (2010): The Protocol establishes an international legally binding framework for access to genetic resources (GRs) and ensuring the fair and equitable sharing of benefits derived from their utilization. This aligns with the third objective of the UNCBD,

UN 2030 Agenda for Sustainable Development (2015): The UN Agenda for the 17 Sustainable Development Goals (SDGs) is intricately linked with the objectives of the CBD, UNFCCC, and other above-mentioned Conventions and MEAs.

The Paris Agreement (2015): The Paris Agreement is a legally binding international treaty focused on addressing climate change. Its primary objective is to limit the global average temperature increase to well below 2°C above pre-industrial levels, with a further goal to cap the temperature rise at 1.5°C. India signed the agreement on 22 April, 2016.

Policies

The ethos of environmental harmony and wildlife protection can be traced back to ancient scriptures in the Indian subcontinent. The country has developed a comprehensive framework of policies and legislations over the past several decades to address various facets of biodiversity conservation. The foundation and legal support for biodiversity conservation and environmental protection are rooted in the Constitution, which creates an undying responsibility for the people of the country to take affirmative actions towards safeguarding natural resources. This section delineates the policy framework contributing to the conservation of biodiversity and effective implementation of the NBSAP in alignment with the Constitution's mandate, global obligations, and other international commitments under the CBD, MEAs, and SDGs (Table 3.12).

Table 3.12. National Policies/ Guidelines/ Rules/ Action Plan

National Forest Policy, 1952	In 1952, the Independent India revised its earlier forest policy formulated during the colonial period and articulated to cover one-third, or 33%, of the total land area under forests. It suggested the extension of tree lands on river/ canal banks, roads, railways, cultivable waste and degraded lands besides advising forest dwellers and tribal people for weaning from the practice of shifting agriculture.
The Prevention of Cruelty to Animals Rules, 1978	The GoI has established distinct rules aimed at preventing cruelty to animals, covering areas such as licensing of farriers, treatment of draught and pack animals, regulations for performing animals, and the imposition of fines. These rules are periodically reviewed and revised.
National Forest Policy, 1988	In 1988, the MoEF revised the National Forest Policy of 1952. This updated policy aimed to ensure environmental stability and the maintenance of ecological balance including atmospheric equilibrium which are crucial for sustaining all forms of life, be it human, animal, or plant. It emphasized that pursuing direct economic benefits should be secondary to this fundamental goal. The policy advocated for the involvement of local communities in forest protection, conservation, and management through initiatives like the Joint Forest Management Programme. Its objectives included increasing forest cover, restoring degraded forests, and placing greater emphasis on conservation efforts, both *in situ* and *ex situ*. In addition, the policy aimed to meet the fuelwood, fodder, minor forest produce, and small timber needs of rural and tribal populations, while also making a significant contribution to environmental preservation and ecological stability in the country.
Policy Statement for the Abatement of Pollution, 1992	The statement aims to strengthen environmental compliance and enforce pollution control norms across the country through the Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCBs).
National Zoo Policy, 1998	The policy aims to provide proper guidance and impetus for the effective management of zoos by promoting cooperation and participation from all stakeholders. Its primary objective is to enhance and supplement national conservation efforts, particularly focused on the country's rich biodiversity, especially its fauna. The NZP primarily supports the conservation of endangered species by offering a lifeline to those unable to survive in the wild, through coordinated breeding programs in controlled environments (*ex situ* conditions). These efforts aim to build stocks for potential reintroduction into the wild when feasible and appropriate. Moreover, the policy endeavors to raise awareness about conservation issues among the public.
National Agriculture Policy, 2000	The NAP of 2000 aims to tap the vast potential of Indian agriculture, targeting an annual growth rate of more than 4% in the sector. Emphasizing equitable growth across regions and farmers, it also prioritizes catering to domestic markets and maximizing benefits from agricultural product exports. Several initiatives have been implemented to operationalize the policy effectively, including the formulation of national policies concerning sectors such as cooperation, seeds, and extension services.
Municipal Solid Waste (Management and Handling) Rules, 2000	These rules include measures for the proper collection, segregation, and disposal of solid waste, and aims to address the significant environmental risks posed by the disposal of untreated municipal and industrial waste, especially to freshwater ecosystems and riverine networks. Furthermore, the rules authorize CPCB and SPCBs to not only monitor but also enforce compliance with groundwater leachate standards.

National Seeds Policy, 2002	The NSP of 2002 focuses on enhancing agricultural productivity by facilitating the development and dissemination of new and improved plant varieties. It focuses on timely access to high-quality seeds, compulsory registration of seeds, establishment of infrastructure, quality assurance measures, and the promotion of the seed industry. Moreover, it advocates for the removal of licensing requirements for seed dealers, facilitates the import of top-quality seeds, promotes seed export, and supports the establishment of Seed Banks and a National Seed Grid. Furthermore, the policy encourages investments in research and development initiatives related to seeds.
National Environment Policy, 2006	In response to the nation's Constitutional Amendment in 1976 and commitment to a clean environment as outlined in Articles 48 A and 51 A (g), the GoI initiated several policy frameworks to address environmental concerns. The National Conservation Strategy and Policy Statement on Environment and Development was introduced in 1992 to establish a foundation for environmental protection. Recognizing the need for a comprehensive environmental policy, the National Environment Policy (NEP) was formulated and released in 2006. The NEP aims to integrate environmental considerations into all developmental activities and emphasizes that people dependent on resources obtain better livelihoods from resource conservation rather than degradation. Furthermore, the NEP advocates that environmental protection is an inherent aspect of development and that environmental degradation often leads to poverty and poor health outcomes. The policy document highlights the following principles: (i) human beings being at the centre of sustainable development concerns, the right to development, both for the present and future generations, environmental protection as an integral part to the development process, the precautionary approach with regard to developmental activities, economic efficiency, etc., polluter pays and cost minimization, need for economic evaluations and cost benefit analyses for utilizing or exploiting natural resources, equitable access to nature and natural resources *viz.*, clean air, water, etc., strict liability for actions or inactions of a person or a company causing damage, public trust doctrine meaning the State is not an absolute owner but only a trustee of the natural resource wealth, decentralization, integration, setting of environmental standards, adoption of preventing advance towards environmental damage, and environmental offsetting measures.
Environment Impact Assessment Notification, 2006	The EIA notification delineates the procedure for conducting Environmental Impact Assessments (EIAs) and obtaining environmental clearances. Typically, the clearance issued recommends a set of management and mitigation measures.
Recognition of Zoo Rules, 1992 and 2009	These rules, established under the Wildlife (Protection) Act of 1972, govern the establishment and recognition of zoos and play a vital role in *ex situ* conservation efforts.
National Water Policy, 2012	The NWP was formulated in 1987 to oversee the planning and development of water resources and to ensure their optimal utilization. Since its inception, the NWP has been reviewed and undergone two revisions (in 2002 and 2012) to enhance efficiency in managing challenges related to water availability and utilization. The policy acknowledges the impact of land use and land cover changes on catchment areas and aquifer recharge zones, which in turn affect water resource availability and quality. In line with the principles of the NWP, the GoI has undertaken various initiatives, including amendments to the Inter- State River Water Disputes Act and the drafting of bills such as the National Water Framework Bill and the River Basin Management Bill in 2018. In addition, the Dam Safety Bill of 2019 was prepared and passed by the Lok Sabha, and the National Water Informatics Centre was established. A web-based Water Resources Information System (India WRIS) was launched to provide access to unclassified data from the Central Water Commission and Central Ground Water Board. However, since the adoption of the NWP in 2012, various challenges like water scarcity have emerged which have prompted the Central Ministry of Jal Shakti to initiate a revision of the policy in 2019. A drafting committee was formed for this purpose that aimed to address current water sector challenges. The NWP also encourages states to develop their own water policies in alignment with national objectives.
National Livestock Policy, 2013	The NLP of 2013 focuses on the comprehensive development of the animal husbandry sector. The Government is executing several schemes aimed at promoting the growth of this sector nationwide, including initiatives for dairy development, the establishment of cooperatives for milk and livestock producers, livestock mission programs, the improvement of animal husbandry infrastructure, and measures for livestock health and disease control.
Guidelines for Conservation, Development and Management of Urban Greens, 2013	As urbanization in India accelerates and existing urban centers experience exponential growth, these guidelines prioritize the integration of green areas into city master plans to enhance tree cover. Numerous cities have been included in the broader Smart Cities program, highlighting the importance of these guidelines.

National Agroforestry Policy, 2014	The National Agroforestry Policy of 2014 seeks to promote sustainable agricultural practices by integrating tree cultivation with agriculture.
Guidelines on Felling and Transit regulations for Tree Species Grown on Non-Forest Private Lands, 2014	These guidelines offer states the prospect to develop a simple and consistent regulatory process concerning tree felling and transit pass, particularly for trees cultivated on non-forest private lands. Various national and state-level programs and schemes are encouraging villagers and farmers to engage in afforestation activities.
Urban Greening Guidelines, 2014	These Guidelines is the outcome of blatant concretization of pavements in Indian cities, resulting in destruction of trees by making them weak and reducing their lives. The Guidelines suggests steps for protection of trees and enhancing their lives while undertaking concretization of pavement.
Guidelines on Sustainable Sand Mining, 2015	These guidelines were issued due to rising concerns about the escalating levels of sand mining in riverbeds across the country and its adverse effects on riverbed structure, channel morphology, aquatic life, and overall river ecology. They mandate a compulsory cumulative impact assessment for all mining proposals.
Green Highways Policy, 2015	The Green Highways (Plantation, Transplantation, Beautification & Maintenance) Policy, 2015 covers all National Highways of India, focusing on promoting greening of corridors. A total of 244.68 lakh plants have been planted up to December 2021 across 869 National Highway projects, spanning a length of 51,178 kms.
Wetlands (Conservation and Management) Rules, 2017	In 2010, the Government introduced the Wetland Rules to address the declining state of wetlands and their crucial conservation. These regulations expanded the definition of wetlands, aligning with the Ramsar Convention's standards. A revised version in 2017 empowers states to manage wetlands within their territories, including identification, notification, and supervision of prohibited activities. The updated rules also introduce the principle of 'wise use,' granting state-level wetland authorities' discretion over permitted activities in the larger interest. Notably, the new rules exclude rivers/ streams and man-made wetlands for drinking water, hydropower, and paddy fields under the respective categories of natural and manmade wetlands from regulatory supervision.
Fertilizer (Control) Order, 1985 (amended 2017)	This order regulates the production, storage, sale, and quality of fertilizers.
National Fish Policy, 2020	The Government has introduced the National Fisheries Policy of 2020, merging existing policies on marine fisheries with draft policies on inland fisheries, aquaculture, and mariculture. This integrated approach aims to provide a strategic framework for the development, management, and regulation of both capture and culture fisheries in a sustainable manner. Additionally, the policy highlights productive collaboration with other economic sectors like agriculture, coastal area development, and ecotourism to advance the objectives of the 'Blue Economy'. It also underscores the importance of center-state and interstate cooperation for socio-economic progress and the economic well-being of fishing communities and fish farmers, particularly those engaged in traditional and small-scale fisheries.
India's National Wildlife Action Plan, 2017-31	The GoI prepared the initial National Wildlife Action Plan (NWAP) in 1983 to establish a unified strategy for safeguarding, conserving, and managing wildlife across India. Subsequent to its completion and in light of evolving challenges, the NWAP underwent revision, leading to the second plan spanning from 2002 to 2016. Further revisions ensued and resulted in the current operational third plan covering the period from 2017 to 2031.
National Plan for Conservation of Aquatic Ecosystems, 2013	The National Plan for Conservation of Aquatic Ecosystems (NPCA) scheme, implemented on a cost-sharing basis between the Central Government and State Governments, focuses on the conservation and management of wetlands, including lakes, across the country. Previously, the MoEFCC provided financial assistance to states and union territories through the National Wetlands Conservation Programme (NWCP) and the National Lake Conservation Plan (NLCP) until 2012-13. NWCP and NLCP were merged into the NPCA scheme in February, 2013 to streamline efforts and avoid overlap,

Legislations

Several legislations concerning forests, wildlife, biodiversity, environment, agriculture, pollution control and various other sectors have been enacted in post- independence India (Fig 3.22 and Table 3.13).

Institutional Framework

Conservation of biodiversity involves a wide range of stakeholders operating at global, national, state, and local levels, each playing crucial roles in formulating policies, enacting legislations, developing guidelines, regulating mechanisms and rules, and field level protection, along with management and conservation of biodiversity resources. Another set of stakeholders include which either use biodiversity or impact biodiversity, or both. Stakeholders encompass governmental agencies at various hierarchical levels, as well as multilateral partners of the government, international NGOs, biodiversity related organizations (including professional, private, non- governmental, and community-based organizations), and private entities. Sectors (central ministries) relevant to biodiversity can be broadly categorized into three main groups: (i) sectors owning life or custodians of biodiversity, or supporting sectors responsible for the protection, regulation, management, and conservation; (ii) sectors using biodiversity; and (iii) sectors impacting biodiversity.

The institutional framework for conservation of biodiversity also comprises a wide range of organizations operating at different scales, including international organizations, national/ state/ local government structures, business enterprises, NGOs, and community groups. Institutions are a form of capital, and they can be formal (official organisations) as well as informal (customs and norms of behaviour). Natural systems are intricate, with essential biological processes occurring across various spatial and temporal scales. Despite rural communities (at the local level) often being unfamiliar with the term 'biodiversity', they possess extensive knowledge of sustainable practices that are compatible with biodiversity conservation efforts. In India, biodiversity conservation relies significantly on the engagement of local communities and community-based organizations. These local institutional actors managing natural resources typically depend upon central/ state governments for legal recognition of their rights.

Fig 3.22. Policy, Laws, Guidelines, Rules and Action Plans relevant to Forest, Wildlife, Biodiversity and Environment

Forest, Wildlife, and Biodiversity

- National Forest Policy, 1988
- National Zoo Policy, 1998
- National Seeds Policy, 2002
- Recognition of Zoo Rules, 1992 and 2009
- National Agroforestry Policy, 2013
- National Livestock Policy, 2013
- State Forest Policy, 2017
- National Agriculture Policy, 2000
- National Fish Policy, 2020
- Indian Forest Act, 1927 (last amended 2017)
- Wildlife (Protection) Act, 1972 (last amended in 2022)
- Forest (Conservation) Act, 1980 (last amended in 2023)
- Forest (Conservation) Rules, 1980
- Biological Diversity Act, 2002 (last amended in 2023)
- Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006;
- Guidelines of Felling & Transit Regulations for Trees Species Grown on Non-Forest Private Lands, 2014
- The Prevention of Cruelty to Animals Rules, 1978
- Wetlands (Conservation and Management) Rules, 2017
- National Plan for Conservation of Aquatic Ecosystems, 2013
- National Wildlife Action Plan, 2017-31
- Fertilizer (Control) Order, 1985 (amended 2017)

Environment

- National Environment Policy, 2006
- National Water Policy, 2012;
- Guidelines on Sustainable Sand Mining, 2015;
- Policy Statement for the Abatement of Pollution, 1992;
- Green Highways Policy, 2015;
- Guidelines on Sustainable Sand Mining, 2015
- Environment (Protection) Act, 1986 (last amended in 1991);
- National Green Tribunal Act, 2010;
- Water (Prevention and Control of Pollution) Act, 1974 (last amended in 1988);
- The Water (Prevention and Control of Pollution) Cess Act, 1977 (last amended in 2003);
- Air (Prevention and Control of Pollution) Act, 1981 (last amended in 1987);
- Coastal Regulation Zone (CRZ) Notification, 1991;
- Environment Impact Assessment Notification, 2006;
- Guidelines for Conservation, Development & Management of Urban Greens, 2013;
- Wetlands (Conservation and Management) Rules, 2017;
- Municipal Solid Waste (Management and Handling) Rules, 2000;

National Legislations

Table 3.13. Prominent National Level Legislations pertaining to Biodiversity Conservation

Indian Forest Act, 1927 (last amended in 2017): IFA establishes criteria and procedures for the reservation and designation of forests for conservation and legal protection. It also governs the management of forest produce, including regulations on transit and the corresponding fees and duties. Implementation of IFA occurs through the Director General of Forests at the national level, SFDs, and their lower field level formations. The Act previously included bamboos in its definition of trees, necessitating permits for their inter-state movement. The amendment of 2017 removed bamboos from this definition. Consequently, felling or transporting bamboos from non-forest areas no longer requires permits.

Wildlife (Protection) Act, 1972 (last amended in 2022): WPA empowers states to designate areas of ecological, faunal, floral, or geomorphological significance as protected areas (PAs) under four legal categories. Enforcement of the Act is carried out by the central and state governments, with the Chief Wildlife Warden of each state vested with the requisite authority. Following the amendment, the number of schedules has been reduced to four: Schedule I containing animal species receiving the highest level of protection, Schedule II for animal species subject to a lesser degree of protection, Schedule III for protected plant species, and Schedule IV for scheduled specimens under CITES.

Forest (Conservation) Act, 1980 (last amended in 2023): FCA regulates the diversion of forest lands for non-forestry purposes and has helped significantly limit such activities across the country. It imposes rigorous scrutiny and mandates the recovery of Net Present Value (NPV) and compensatory afforestation costs equivalent to the diverted area from the user agency, besides necessary provisions for the protection and conservation of wildlife and biodiversity. Following the amendment, the revised Act will solely be applicable to lands notified as forests under the Indian Forest Act, 1927, or those officially recorded as forests on or after October 25, 1980. It permits diversion of forest lands within 100 km of projects for national security and defense purposes. It also permits projects such as zoos, safaris, and other ecotourism facilities within forest lands.

Environment (Protection) Act, 1986 (last amended in 1991): EPA, an umbrella legislation empowers the GoI to develop rules and policies aimed at safeguarding the environment. It encompasses all aspects related to environmental protection and grants authority to the State to issue notifications accordingly. The government is mandated to issue notifications designating Eco-Sensitive Zones (ESZs) around PAs and other key environmentally sensitive sites. It also includes provisions for the preparation of Zonal Master Plans outlining prohibited, regulated, and permissible activities within these zones. Under the provisions of EPA, coastal-stretches have been notified as Coastal Regulation Zone (CRZ) and various activities in the CRZ are regulated. Thus, extend support to ecologically sensitive coastal and marine habitats. The Act was amended for inclusion of new provisions on hazardous substances, air pollution, water pollution, noise pollution, and environmental impact assessment.

Biological Diversity Act, 2002 (last amended in 2023): The BD Act recognizes India's rich and unique biological diversity and the associated traditional and contemporary knowledge systems. It highlights the country's commitment to implementing the CBD by providing for the conservation of biological diversity, sustainable use of its components, and fair and equitable sharing of the benefits arising from the use of biological resources. The BD Act mandates the establishment of NBA at the national level while SBBs/UTBCs at the state/UT level, the framing of biodiversity rules, the constitution of BMCs for implementation of BD Act at the field level, and the preparation of PBRs. It also promotes *in situ* and *ex situ* conservation, the development of national and state-level strategies and action plans, biodiversity monitoring, public awareness, research, and training. Following the amendment, exemption has been granted to AYUSH practitioners and traditional knowledge holders from paying Access and Benefit Sharing (ABS), a compensatory amount typically paid to tribal and other communities who traditionally gather, protect, and utilize herbs and medicinal plants crucial to the AYUSH industry. It also removes criminal penalties for violations and replaces them with fines.

The Scheduled Tribes and Other Traditional Forest Dwellers (Reorganisation of Forest Rights) Act, 2006: The FRA 2006 recognizes and vests the forest rights in forest lands in the forest dwelling STs and other traditional forest dwellers who had been living in such forests for generations besides the Act seeks to balance these rights with the responsibilities for conservation of biodiversity, sustainable use and maintenance of ecological balance.

The National Green Tribunal Act, 2010: The NGT Act pertains to the establishment of the National Green Tribunal and its benches across the country for effective and expeditious disposal of legal cases related to environmental protection, conservation of forests and other natural resources. The NGT follows varied principles incorporated in the National Environment Policy (NEP), 2006 for decision making.

Conservation Authorities

There are a few statutory conservation authorities operating at the national and state levels that are primarily tasked with overseeing efforts towards conservation of biodiversity (Fig 3.23; Table 3.14).

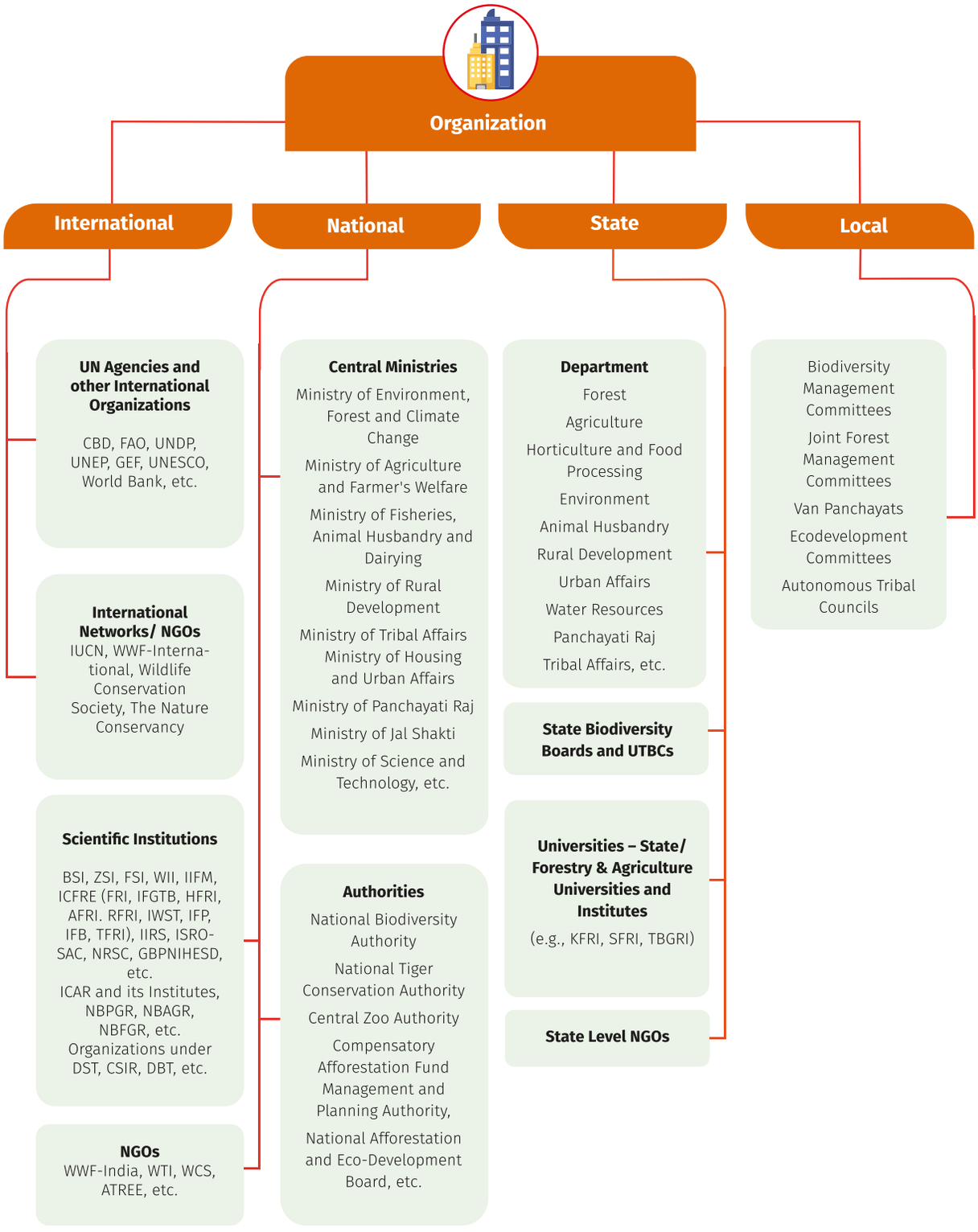


Fig 3.23 Organizations Involved in Conservation of Biodiversity at Different Levels

Table 3.14. Conservation Authorities and Regulatory Bodies

Authorities and other Regulatory Bodies

National Biodiversity Authority (NBA): The NBA, a statutory body was established in 2003 to implement India's Biological Diversity Act, 2002 through a decentralized three tier hierarchical system. It performs facilitative, regulatory, and advisory functions for the GoI on matters concerning the conservation and sustainable use of biological resources, as well as access and benefit sharing. In addition, it provides guidance to State Governments in identifying and managing areas of biodiversity significance to be notified under Sub-Section (1) of Section 37 as Heritage Sites.

National Tiger Conservation Authority (NTCA): The NTCA was established as a statutory body under the provisions of the WPA, 1972, following the Act's amendment in 2006. This was done to bolster tiger conservation efforts in the country, as per powers and functions assigned to it under the said Act. By retaining an oversight through advisories and normative guidelines, based on appraisal of the status of tigers, ongoing conservation initiatives, and recommendations from specially constituted committees, the NTCA fulfils its mandate. The 'Project Tiger' which is a Centrally Sponsored Scheme (CSS) administered by the MoEFCC provides financial support to tiger range States for *in situ* conservation of tigers within designated tiger reserves. This initiative has significantly contributed to the recovery of the endangered tiger population and has saved it from extinction, as indicated by recent assessments conducted through the All India Monitoring of Tigers, Co-Predators, Prey, and Habitat, using refined methodologies and a multi-faceted strategy.

Central Zoo Authority (CZA): Sections 38 A to 38 J of the WPA, 1972, pertain to the establishment of the CZA in India. Established as a statutory body in 1992, the primary objective of the CZA is to enhance and support national conservation efforts on the preservation of the country's diverse fauna, being in alignment with the National Zoo Policy, 1998. In addition, the CZA is tasked with enforcing minimum standards and norms for the upkeep and healthcare of animals housed in Indian zoos. It also aims to prevent the proliferation of unplanned and inadequately managed zoos. Through the Recognition of Zoo Rules of 1992, amended in 2009 and 2013, the CZA sets standards and norms for the appropriate housing, upkeep, healthcare, diet, etc. of animals in zoos, and ensures their overall well-being and effective management.

Protection of Plant Variety and Farmers' Rights Authority (PPV&FRA): The PPV&FRA provides a robust system for protecting plant varieties and ensuring the rights of farmers.

National Wetlands Committee: To ensure effective supervision of the initiatives undertaken by States and Union Territories, the Wetlands (Conservation and Management) Rules, 2017 mandate the establishment of a National Wetlands Committee. This committee which is headed by the Secretary, MoEFCC oversee the implementation of wetland rules. In addition, the Committee provide recommendations to the Central Government on suitable policies and action programmes for wetland conservation and their wise use. It also offers guidance on the identification of wetlands of international significance under the Ramsar Convention and advise on partnerships with international organizations on matters related to wetlands, etc

Central Water Commission (CWC): The CWC operates as a technical body within the Ministry of Jal Shakti in the Government of India. Its role involves providing consultancy to state governments on water bodies related matters, and coordinating governmental schemes for water resource conservation, control, and utilization. Additionally, it aids state governments in devising as well as analysing flood control strategies and conducts flash flood forecasts. The Commission offers professional support to the Government for irrigation and drinking water supply projects and is involved in the investigation, construction, and execution of hydropower development.

Central Pollution Control Board (CPCB): The CPCB is responsible for overseeing all aspects of pollution (air, water, soil, noise) and providing guidance to the central government. It collaborates with State Pollution Control Boards (SPCBs) and sets standards for effluent discharge.

State Biodiversity Boards (SBBs): States have established SBBs as per the provisions of the BD Act, 2002 and they deal with conservation, sustainable use and access and benefit sharing of biological resources. SBBs are also responsible for the constitution of the BMCs and their functioning including the preparation of PBRs.

National Mission for Clean Ganga (NMCG): NMCG under the MoJS is responsible to ensure effective abatement of pollution and rejuvenation of the river Ganga by adopting a river basin approach to promote inter-sectoral co-ordination for comprehensive planning and management and to maintain minimum ecological flows in the river Ganga with the aim of ensuring water quality and environmentally sustainable development.

The Central Empowered Committee (CEC): CEC at the national level constituted as per the directives of the Hon'ble Supreme Court and it is meant to monitor implementation of the Hon'ble Court's orders and to place the non-compliance cases before it, including in respect of encroachment removals, implementation of working plans, compensatory afforestation, plantations and other conservation issues. The CEC was reconstituted on December 8, 2023.

The National Green Tribunal (NGT) : Established under the NGT Act, 2010, is a quasi-judicial body responsible for adjudicating civil matters related to the environment and the enforcement of specified environmental laws. It consists of both judicial and technical expert members and its decisions can be appealed to the Supreme Court. Since its establishment, the NGT has played an important role in issuing important judgments and directives aimed at the conservation of natural resources and environmental management.

Expert Appraisal Committee (EAC): The EAC constituted under the EIA notification is tasked with appraisal and granting clearance for developmental projects.

The following section highlights some of the recent initiatives and ongoing schemes (Table 3.15).

Table 3.15. New Initiatives and Ongoing Schemes

New Initiatives/ Schemes	
Green Growth Priority in Budget 2023	In the Union Budget 2023, 'Green Growth' emerged as a key focus area among the seven priorities outlined, aligning with India's trajectory towards achieving net zero carbon emissions by 2070. This underscores the nation's commitment to fostering a green industrial and economic transition. By prioritizing green growth initiatives, India aims to decrease the carbon intensity of its economy while simultaneously creating significant opportunities for green jobs creation on a large scale.
Green Credit Programme	The objective of the initiative is to incentivize environmentally sustainable practices and actions by companies, individuals, and local bodies.
The Mangrove Initiative for Shoreline Habitats and Tangible Incomes	The MISHTI initiative holds particular significance due to the crucial role of mangroves and coastal ecosystems in mitigating climate change. This initiative aims to extensively expand mangrove development across ~ 540 km², spanning 11 States and 2 Union Territories over a five-year period starting from FY 2023-24. The scheme is designed to facilitate the exchange of best practices regarding plantation techniques, conservation measures, management practices, and resource mobilization through Public Private Partnerships.
PM Programme for Restoration, Awareness Generation, Nourishment, and Amelioration of Mother Earth	PM-PRANAM represents an initiative aimed at nurturing and preserving the health of living planet. Programme emphasizes care for Mother Earth and the importance of maintaining a healthy environment. It involves allocating 50% of the saved fertilizer subsidy, resulting from reduced chemical fertilizer usage compared to previous three-year average, to the respective States or Union Territories. This innovative approach aims towards adoption of sustainable agricultural practices and promotion of environmental conservation. As a primary goal, PM-PRANAM addresses the pressing issue of excessive chemical fertilizer and pesticide use in agriculture.
Amrit Dharohar	The scheme aims to promote the conservation of wetlands by encouraging their optimal utilization to enhance biodiversity, carbon stock, ecotourism opportunities, and income generation for local communities. Key features include integrating their management for green growth, developing nature and culture-based tourism, and fostering community stewardship for wetland-based livelihoods, heritage, and culture. The scheme also seeks to establish collaboration with various stakeholders including Ministries, State Governments, research institutions, and the industrial sector across India.
India Business and Biodiversity Initiative	IBBI serves as a national platform for furthering dialogue, sharing knowledge, and facilitating learning among businesses and stakeholders, leading to mainstreaming of sustainable biological diversity management into businesses. Upon invitation by the MoEFCC and launched by the Confederation of Indian Industry (CII) with support from the German International Cooperation (GIZ), IBBI adopts a multi-stakeholder approach involving businesses, government agencies, NGOs, and academia. Its primary goal is to raise awareness among businesses about Biodiversity and Ecosystem Services (B&ES) and to integrate B&ES considerations into their operations and supply chains.
Biodiversity Samrakshan Internship Programme	This joint initiative of the NBA and the UNDP aims to recruit 20 postgraduate students for a one-year engagement period through a transparent and competitive online selection process. This program seeks to involve enthusiastic and innovative students who are eager to gain knowledge in natural resource management and biodiversity conservation. Its objective is also to provide technical support to NBA projects across different States and Union Territories, as well as to assist SBBs/ UTBCs in fulfilling their mandates.

New Initiatives/ Schemes	
National Mission on Biodiversity and Human Well-Being	The Mission is spearheaded by MoEFCC and coordinated by the Office of the Principal Scientific Adviser to the GoI (PSA Office) and provides a comprehensive framework for biodiversity conservation. It integrates various aspects including biodiversity, ecosystem services, climate change, agriculture, health, bioeconomy, and capacity building within the realm of biodiversity science. Its objective is to establish a strong link between biodiversity and the economic prosperity of the people of India, thereby transforming biodiversity science in the country. The mission seeks to leverage the country's diverse biodiversity to address challenges in climate change, health, and agriculture. It stresses upon collaboration among governments, NGOs, and other institutions to effectively catalogue, assess, map, and monitor biodiversity in a sustainable way.
Integrated Development of Wildlife Habitats.	The GoI extends financial and technical support to State/ UT governments or wildlife conservation efforts under this CSS.

3.17

Lifestyle for Environment

Mission Lifestyle for Environment (LiFE) recognizes that Indian cultures and living traditions are inherently sustainable. Ancient scriptures have emphasized on conservation of natural heritage and living in harmony with nature. The Vision 2050 for conservation of biodiversity is 'Living in harmony with nature'. Hence, there is a felt need to tap into the ancient wisdom and spread the message to as many people as possible. Mission LiFE seeks to channelize the efforts of individuals and communities into a global mass movement of positive behavioural change. Thus, India took a lead in propagating the idea of Mission LiFE during the COP 26 to UNFCCC in Glasgow in November, 2021 as a mass movement for sustainable consumption to protect and preserve the environment. Subsequent to the launch of Mission LiFE, all central ministries have made efforts at all levels to spread the message of immense utility to everyone and the wider cause of environmental management. Sincere and resolute efforts are required to ensure that Mission LiFE is successful and it brings desired behavioural change in masses so they can help in improving the environment and the conservation of biodiversity.



4

NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN

4.1.

Introduction

Since 2008, India has been actively framing and updating its strategies and action plans for biodiversity to address emerging needs and challenges in line with international frameworks. The country has implemented various action plans using a range of approaches, resulting in significant progress and numerous success stories in the field of biodiversity conservation.

To achieve the ambitious National Biodiversity Targets, it is essential to upscale lessons learned from past conservation efforts, contributing to Mission 2030 and making strides toward Vision 2050. The National Biodiversity Targets, adopted through a comprehensive consultative process, encompass both wild diversity and agrobiodiversity. They address the elements of the Convention on Biological Diversity (CBD), conservation, sustainable use, and access and benefit-sharing (ABS), while considering a multitude of threats and cross-cutting issues.

The updated National Biodiversity Strategy and Action Plan (NBSAP) aims to support both national and global conservation agendas. It seeks to effectively address key national challenges such as water crises, food insecurity, unsustainable livelihoods, growing human-wildlife interactions, pollution, emerging diseases, disaster risks, and the overall vulnerabilities of communities and ecosystems.

4.2.

KM-GBF Themes and National Biodiversity Targets

KM-GBF segregated 23 Global Targets under the following three themes:

i. Reducing threats to biodiversity,

ii. Meeting people's needs through sustainable use and benefit-sharing, and

iii. Tools and solutions for implementation and mainstreaming.

Twenty three National Biodiversity Targets (NBTs) for India were aligned with Global Targets as all of them are relevant to country's biodiversity, national circumstances, priorities, and capabilities. Through the consultation process, the NBTs were segregated under the three themes as follows:

The first set of eight targets (NBT 1 to NBT 8) are covered under the first theme of 'Reducing threats to biodiversity'. Out of these, five targets directly emanate from the five major threats to biodiversity viz., (i) land and sea use change, (ii) pollution, (iii)



species overexploitation, (iv) climate change, and (v) invasive alien species. Remaining three targets relates to important priority conservation actions viz., (i) ecosystem restoration, (ii) management of species and genetic diversity, and (iii) use, harvest, trade of wild species is legal and sustainable as they have been necessitated due to cumulative impact of five threats or underlying causes leading into wide spread degradation of ecosystems and aggravated human induced extinction of species.

The second set of five targets (NBT 9 to NBT 13) under the theme of 'Meeting people's needs through sustainable use and benefit-sharing' focuses on sustainable management of agrobiodiversity including agriculture, animal husbandry, aquaculture, fisheries besides forest areas as they predominantly help to meet needs of food and livelihoods of rural people, especially farmers, herders, fisher folks, tribal people, and other forest dwellers. In addition, NBTs under the theme also focuses on sustainable use of wild species, management of ecosystem services, enhanced access and quality of green and blues spaces vital for growing urban population, and access and equitable benefit sharing arising from the use of biodiversity to people so that they can well connect with conservation agenda and their support for field level conservation can be elicited.

The third theme of 'Tools and solutions for implementation and mainstreaming' include a set of ten targets (NBT 14 to NBT 23). These targets emphasize on actions relevant to mainstreaming biodiversity, sustainable production, sustainable consumption and reduction in waste, repurposing harmful subsidies, capacity development, knowledge management, resource mobilization, participatory approaches, and equitable and gender responsive planning, decision making, and implementation.

4.3.

India's National Biodiversity Targets and Action points

NBT 01

Biodiversity inclusive integrated land / sea use planning

"Ensure that all areas are under participatory and integrated biodiversity inclusive spatial planning and effective management processes addressing land-and sea-use change, to bring the loss of areas of high biodiversity importance, including ecosystems of high ecological integrity, close to zero by 2030, while respecting the rights of Local Communities (LCs)."

India developed a biogeographic classification for conservation planning in the country and established a network of wildlife protected areas. PAs under four legal categories covering little more than 5% GA of the country is the outcome of this pioneer initiative. Certainly, these PAs (terrestrial, inland waters, and coastal and marine ecosystems) are the repository of the country's rich and unique biodiversity. India has been assessing land use and land cover (LULC) changes in the country for past five decades or so. The FSI biennially provides valuable insight on forest cover revealing large intact as well as widely scattered small forest patches. On similar lines, the ISRO has carried out mapping for all natural and man-made wetlands across the country twice so as to make an assessment on decadal changes in wetlands. The National Remote Sensing Centre (NRSC) has been maintaining a valuable web portal (Bhuvan) featuring geographical content in GIS layers of much relevance to this target. Some other agencies undertake similar exercises on generating much desired information base on coastal and marine ecosystems. Nevertheless, efforts are urgently required to integrate and strengthen ongoing initiatives.

This target is of immense relevance for India where formal land use planning is taking place but such processes may not be focusing on 'participatory and biodiversity inclusive integrated land/ sea use planning'. Efforts are needed for proper and proactive assessments so as to enhance protection to areas of high biodiversity and ecological integrity, connectivity, and for directing developmental activities on a national/ regional/ state level. The NBT 1 will contribute towards Goals A and B, and it is linked with Global Targets 2, 3, 5, 10, and 12; and SDGs 14.2, 15.1, 15.5, and 15.9.

ACTION POINTS

1. Prepare national and state level spatial plans using high resolution geospatial data for delineating areas of high biodiversity importance and degraded ecosystems.
2. Prepare Forest Working Plan(s) as per the National Working Plan Code to mainstream biodiversity conservation.
3. Prepare management plan for all categories of PAs, and conservation plans for BHS, CRZs, wetlands and OECMs
4. Promote integrated approaches to the management of river basins considering upstream and downstream inflows and withdrawals by season, pollution loads and natural regeneration capacities, in particular, for maintenance of in-stream ecological values.
5. Adopt a comprehensive approach to integrated coastal management by addressing linkages between coastal areas, wetlands, and river systems in relevant policies, regulations and programmes.

NBT 02

Ecosystems restoration

"Ensure that by 2030, at least the prioritized 30 per cent areas of degraded terrestrial, inland water, and marine and coastal ecosystems are under effective restoration, in order to enhance biodiversity and ecosystem functions and services, ecological integrity and connectivity."

NBT 2 acknowledges widespread degradation of varied ecosystems, and focuses on an ambitious target of at least 30% areas of degraded terrestrial, inland waters, and coastal and marine ecosystems are under effective restoration by 2030. The target also envisages that restoration efforts should contribute towards enhanced ecological integrity and connectivity within and among ecosystems.

Agricultural expansion, industrialization, development of linear infrastructure, mining, urbanization, and other developmental activities besides overexploitation of natural ecosystems by resource dependent communities in the country, especially post-independence have led to large- scale degradation of ecosystems, ultimately reducing ecosystem services they once used to offer. Hence, this target is not only relevant for the country but of utmost priority for result-oriented actions. NBT 2 is aligned with Goals A and B; Global Targets 3, 8, 11, and 12; and SDGs 6.6, 14.2, 15.1, and 15.3.

ACTION POINTS

1. Undertake mapping of degraded terrestrial, inland water and marine and coastal ecosystems for prioritizing areas for rehabilitation and restoration.
2. Strengthen and augment the existing programmes, schemes and activities of the Central and State Governments relating to restoration of all prioritized degraded ecosystems.
3. Undertake restoration of degraded ecosystems through multi-stakeholder partnerships to enhance ecological connectivity, and restore ecosystem functions and services.
4. Institutionalize a system of monitoring projects in all approved mining plans to ensure safe disposal of tailings and ecosystem rehabilitation following the principles of ecological succession.
5. Strengthen capacity and make available techniques and technologies for the regeneration and restoration of ecosystems.
6. Prepare and implement thematic action plans incorporating watershed management strategies to arrest and reverse desertification and expand green cover.
7. Mitigate and manage the impacts on biodiversity due to river valley projects, power plants, industries, linear infrastructure, and mines.
8. Initiate actions to restore vital spatial and temporal connectivity (longitudinal, horizontal, vertical and temporal) within riverscapes and ensure Environmental flow.

NBT 03

Conserve biodiversity in land, water and sea

"Ensure and enable that by 2030, at least 30 per cent of terrestrial, inland waters, and coastal and marine areas, especially areas of importance of biodiversity, ecosystem functions and services, are effectively conserved through ecologically representative, well-connected protected areas and Other Effective Area-based Conservation Measures (OECMs). Also, integrate tribal areas wherever applicable into wider landscapes/ seascapes and ensure that sustainable use is legal and consistent with conservation outcomes while respecting the rights of Local Communities (LCs), including their traditional territories."

Besides enhancing the areas under PAs and Other Effective Area-Based Conservation Measures (OECMs) to 30%, the target aims to provide a much stronger recognition of the critical role that communities can play in conservation of biodiversity while ensuring sustainable use. It is one of the most well recognized targets as it directly contributes towards conservation of wild diversity by setting aside areas of high biodiversity importance and ecological integrity, thereby they not only serve as a repository of biodiversity and allowing evolutionary and ecological processes to persist but also offer varied ecosystem services to mankind.

India has made a notable progress towards this target by having an impressive PA (terrestrial, coastal and marine) network designated under the WPA, 1972. In addition, about 17.5% of GA as "managed forests" under the Indian Forest Act, 1927 have different legal categories and gradient of biodiversity protection and management regimes. Moreover, designated wetland areas under the Environmental (Protection) Act, 1986 and Biodiversity Heritage Sites under the BD Act, 2002 significantly contribute towards this target. The NBA's report on India's achievement against ABTs 11 and 6 highlights that about 9,14,074 km^2 or nearly 27% of GA is addressing the requirement of this target. Further, India has achieved a significant progress towards OECMs by way of identifying areas under different categories. Most states have sacred groves and other community conserved areas (CCAs). NBT 3 contributes towards Goal A and has linkages with Global Targets 4, 9, and 11; and SDGs 6.6, 11.4, 14.5, and 15.4.

ACTION POINTS

1. Promote establishment of Conservation Reserves and Community Reserves to ensure adequate representation of all biogeographic zones in the country.
2. Establish self-sustaining monitoring system for overseeing management effectiveness of the PA network.
3. Implement site-specific ecodevelopment programmes in fringe areas of PAs, to enhance livelihoods and provisioning of ecosystem services for local communities.
4. Strengthen and support research work on PAs, Biosphere Reserves and fragile ecosystems by involving research institutions and universities to develop baseline data on biological and management attributes, and ecosystem functions and services.
5. Strengthen the protection of areas of high biological diversity, rich in threatened species, endemism and genetic resources while providing alternative livelihoods and access to resources to local communities.
6. Develop partnerships with local communities for enhancement of wildlife habitats, and biodiversity conservation in Conservation Reserves and Community Reserves.
7. Ensure effective management of ecologically sensitive areas/ eco-sensitive zones through implementation of zonal master plan.
8. Integrate conservation and wise use of wetlands and river basins involving all stakeholders, in particular local communities to ensure maintenance of hydrological regimes and conservation of biodiversity.
9. Identify hotspots of agrobiodiversity under different agroclimatic zones and promote on-farm conservation.
10. Accord priority attention to mitigate potential adverse impacts on designated UNESCO's natural World Heritage Sites and Biodiversity Heritage Sites in view of their incomparable values that merit stricter standards than in otherwise comparable situations.
11. Update the database on sacred groves, ponds and landscapes and to document bioresources and associated knowledge systems.
12. Promote expansion of the extent of OECMs in land, inland waters and marine areas, and develop a centralized national/ state-level database on OECMs.

NBT 04

Manage species and genetic diversity

"Ensure urgent management actions to halt human-induced extinction of known threatened species, as well as recovery and conservation. Also, maintain and restore the genetic diversity within and between populations of native wild and domesticated species to maintain their adaptive potential through *in situ* and ex situ conservation and sustainable management practices and effectively manage human-wildlife interactions."

This target directly focuses on the prominent components of Goal A i.e., action to halt human- induced extinction, restore genetic diversity for enhanced species' adaptive potential, minimize human-wildlife conflict, all essential for halting and reversing biodiversity loss by 2030 and putting nature on a path to recovery. The target also emphasizes on reducing threats to/ from wildlife, particularly large mammals involved in crop depredation, livestock predation, and human injuries and deaths. Significance of conserving genetic resources and maintenance of genetic diversity has now been well recognized as they provide foundation for species' ability to adapt, a vital component of ecosystem functions and resilience.

A large number of wild floral and faunal species in the country have suffered on account of habitat loss, fragmentation and degradation; overharvest/ overexploitation; poaching and illegal trade; and climate change. As a result, several species now have small population size, limited distribution, poor regeneration/ reproduction, and reduced survival rate due to reduced genetic variability. Thus, the number of threatened species is on the rise and need special attention for recovery and rehabilitation. Effective *in situ* conservation supported by *ex situ* measures and sustainable management practices is the need of the hour. At the same time, some species have come back from the brink of extinction owing to concerted efforts made by the country. It is imperative to keep such efforts ongoing with more vigor and support at all levels. NBT 4 directly contributes towards Goal A; aligned with Global Targets 1, 2, 3, 5, 6, 7, and 8; and linked with SDGs 2.5 and 15.5.

ACTION POINTS

1. Undertake measures to mitigate the impacts of human-wildlife interactions through developing innovative technologies.
2. Establish viable populations of threatened plant and animal species through appropriate augmentation/ reintroduction programmes.
3. Update periodically the needs and criteria for placing particular species in different schedules of the Wildlife (Protection) Act.
4. Develop appropriate models for on-farm conservation of livestock herds maintained by different institutions and local communities.
5. Promote ex situ conservation of threatened and endemic and insufficiently known floral and faunal species.
6. Focus on conservation of genetic diversity (*in situ*, *ex situ*, in vitro) of cultivated plants, domesticated animals and their wild relatives to support breeding programmes.
7. Strengthen national ex situ conservation system for crop and livestock diversity, including poultry, linking national gene banks, clonal repositories and field collections maintained by different research centres and universities.
8. Undertake DNA profiling for assessment of genetic diversity in threatened and endemic species to assist in developing their conservation programmes.
9. Develop a unified national database covering all *in situ*, on farm and ex situ conservation sites.
10. Consolidate, augment and strengthen the network of zoos, aquaria, and ex situ conservation sites.
11. Strengthen research on reproduction biology, and management and recovery of threatened and endemic species of both terrestrial and aquatic habitats to support reintroduction programmes.
12. Update national list of threatened species including keystone, umbrella and endemic flora and fauna based on internationally accepted criteria and develop models/ packages for their conservation.
13. Expand area-specific surveys of landraces, traditional cultivars of crops, wild relatives of crop plants and breeds of domesticated animals.
14. Promote conservation of forest/ grassland genetic resources by way of documentation, characterization (morphological, chemical, molecular, and pathological), propagation, and efforts towards *in situ* and ex situ conservation.
15. Identify and map potential/ vulnerable areas from the perspective of enhanced human-wildlife interactions, create awareness, and adopt participatory approaches to manage conflict.

NBT 05

Sustainable harvest, trade, and use of wild species

"Ensure that the use, harvesting, and trade of wild species are sustainable, safe, and legal, preventing overexploitation, minimizing impact on non-target species and ecosystems, and reducing the risk of pathogen spillover. Apply the ecosystem approach while respecting and protecting customary sustainable use by Local Communities (LCs)."

Globally, direct exploitation of wild species has been recognized as the second prominent driver of biodiversity loss in terrestrial and freshwater ecosystems while this is the largest direct driver of loss in case of marine species. Overharvest/ overexploitation of wild flora and fauna for subsistence or commercial purposes through collection, harvesting, logging, fishing, and even poaching in several instances are at unsustainable levels or harmful methods are being used impacting non-target species and ecosystems. Over the years, the risk of pathogen spillover has amplified owing to increased interaction among livestock, wildlife, and humans, and also due to illegal wildlife trade.

In a human dominated country like India, a substantial section of the society continues to depend on natural resources for their subsistence. Biotic pressure on natural ecosystems has increased several-fold. Harmful methods are being used for collection and harvest of wild species and their products. Poaching of wild animals and illegal wildlife trade have always remained a serious threat in most parts of the country. Efforts are required for creation of awareness, providing alternate livelihood options to communities, and effective law enforcement to address these seemingly persistent and contentious issues. NBT 5 mainly contributes towards Goals A and B; Global Targets 4, 6, 9, and 11; and SDGs 12.2, 14.4, 14.7, 15.2, 15.7, and 15.c.

ACTION POINTS

1. Combat poaching and illegal trade in wild animal and plant species.
2. Undertake survey and bioprospecting of native economically important biological resources.
3. Encourage cultivation of plants of economic value including medicinal and aromatic plants, and marine organisms from their natural populations to prevent their decline and unsustainable extraction.
4. Promote development of innovative tools and techniques to provide fair price to collectors, ensure sustainable use, avoid over harvest, and eliminate harmful methods of collecting/ harvesting of NTFPs to prevent recurrent forest fires, poor regeneration, and impact on non-target species and ecosystems.
5. Assess the status of regeneration, recruitment, and reproduction/ breeding success of wild species that are being harvested/ exploited and ensure adequate establishment and survival rate.
6. Develop awareness and capacity of BMCs, and other stakeholders for sustainable harvest, and use of legally traded wild species.
7. Build a database of bioresources in trade.
8. Support NTFP markets to ensure fair and optimum price for collectors, in a manner that ensures sustainable use and not over extraction.
9. Develop tools and mechanism for certification of sustainable harvesting and trade of wild species.

NBT 06

Manage invasive alien species

"Eliminate, minimize, reduce and or mitigate the impact of prioritized invasive alien species on biodiversity and ecosystem services by identifying and managing pathways for the introduction of alien species and eradicating or controlling invasive alien species, especially in priority sites, such as islands."

The Global Assessment by IPBES and other documents have amply indicated that the invasive alien species are one of the main direct drivers of biodiversity loss at the global level. The number of invasive alien species and the extent covered by them are on the rise at a fast pace, resulting into loss of native biodiversity, poor productivity, and disease influx. The target focuses on identifying and managing pathways for the introduction of alien species so that the invasion of alien species can be checked.

In India, efforts have been made for inventorying, mapping of potential areas of invasion, and controlling some of the prominent invasive species. Recently, some valuable insight has been provided on the distribution of invasive species in tiger range states within the country as a part of the all-India tiger monitoring programme. However, current efforts are grossly inadequate considering the magnitude of the problem. Moreover, very little is known about pathways of their introduction. Much needs to be done on a high priority to address the requirements of this target. Local communities can play a major role in eliminating, minimizing and reducing such invasions. NBT 6 is aligned with Goals A, B, and D; Global Targets 2, 3, 4, 10, and 12; and SDG 15.8.

ACTION POINTS

1. Strengthen domestic quarantine measures to monitor introduction pathways and contain the spread of invasive species from and to neighbouring areas and other countries.
2. Develop appropriate early warning and awareness systems aganist invasive alien species, and establish a national database on the extent and control of invasive alien species reported in India.
3. Promote regional cooperation in the adoption of uniform quarantine measures and containment of invasive alien species.
4. Assess invasion potential of introduced species and develop measures for their control and management.
5. Support capacity building for managing invasive alien species at different levels especially of local bodies.
6. Provide priority funding to basic/ applied research on managing invasive species.

NBT 07

Reduce pollution risks and negative impact

"Reduce pollution risks and the negative impact of pollution from all sources by 2030 to levels that are not harmful to biodiversity and ecosystem functions and services, considering cumulative effects by (a) reducing excess nutrients lost to the environment including through more efficient nutrient cycling and use; (b) reducing the overall risk from pesticides and highly hazardous chemicals by at least half, including through integrated pest management, based on science, taking into account food security and livelihoods; and (c) preventing, reducing, and working towards eliminating plastic pollution."

Growing levels of pollution from all sources have been recognized as a major threat to biodiversity. Widespread pollution occurs prominently due to industrial effluents, urban waste and sewage, hazardous chemicals and pesticides, construction activities, and transportation, among other underlying causes. Plastic pollution has severely impacted the whole environment, particularly freshwater and marine ecosystems.

India is no exception on the matter of threat to biodiversity from pollution. Besides, there is a mismatch between current efforts towards management of waste and overall production. Excessive loss of nutrients to the environment by way of crop residue burning, soil erosion, etc. is a serious environmental concern causing issues of human health, eutrophication of wetlands, proliferation of invasive species, among other issues. The current focus of NBT 7 is on risk reduction rather than usage reduction. The target has wide-ranging implications and cascading effects from the perspective of food and water security, and 'One Health'. In past five decades or so, the national and sub-national governments in the country have made several interventions by way of regulatory policies, law enforcement, and recycling/ treatment of waste and other pollutants. NBT 7 contributes towards the Goals A, B, and D; Global Targets 4 and 10, SDGs 3.9, 6.3, 11.6, 12.5, and 14.1.

ACTION POINTS

1. Develop and implement viable models of public-private partnerships which can benefit local bodies/ authorities/ local communities for collection, segregation, and setting up/ operating secure landfills, incinerators, and deployment of other appropriate techniques for the treatment and disposal of municipal waste, toxic and hazardous wastes, both industrial and biomedical.
2. Survey and develop a national inventory of toxic and hazardous waste dumps and an online monitoring system for the movement of hazardous wastes. Strengthen the capacity of institutions responsible for monitoring and enforcement in respect of toxic and hazardous wastes.
3. Strengthen the legal instruments and response measures for addressing emergencies arising out of transportation, handling and disposal of hazardous wastes as part of the chemical accident regime.
4. Minimize and eliminate activities leading to biodiversity loss due to point and non-point sources of pollution and promote the development of clean technologies.
5. Strengthen the monitoring and enforcement of emission standards for both point and non-point sources.
6. Treat and manage domestic and industrial effluents so as to minimize adverse impacts on terrestrial and aquatic (fresh water and marine) biological resources.
7. Promote biodegradable and recyclable substitutes for non-biodegradable materials and develop and implement strategies for their recycling, reuse, and final environmentally benign disposal, including through the promotion of relevant technologies and the use of incentive-based instruments.
8. Develop and implement a strategy for strengthening regulation and addressing the impacts of ship-breaking activities on human health and coastal and marine bioresources.
9. Support assessments of e-waste and plastic pollution including micro and nanoplastics in terrestrial, inland waters, and coastal and marine ecosystems and develop innovative approaches.
10. Promote and support the approach of India Blue Flag Certification to maintaining clean beaches.
11. Develop strategies for creating awareness and enhancing capacity of all stakeholders, especially youth and school children, about the adverse effects of pollution and disseminate possible mitigating action.
12. Encourage utilization of non-hazardous industrial waste (e.g., fly ash) to reduce pollution.
13. Raise awareness of pollution risks and the negative impact of pollution from all sources on biodiversity and human health.

NBT 08

Minimize the impact of climate change

"Minimize the impact of climate change and ocean acidification on biodiversity and increase its resilience through mitigation, adaptation, and disaster risk reduction actions through nature-based solutions and/ or ecosystem-based approaches. Minimize negative impacts and foster positive impacts of climate action on biodiversity."

Climate change has been recognized as a global environmental concern and also as a driver of biodiversity loss. Moreover, suffering of humanity due to two interconnected crises i.e., biodiversity loss and climate change is starkly evident and gaining attention at all levels. This target advocates adoption of ecosystem-based approaches. India has paid due attention to the wider and overarching subject of climate change through the implementation of the National Action Plan on Climate Change (NAPCC) and its eight focused Missions. Likewise, state governments are also implementing their State Action Plan on Climate Change (SAPCCs). These combined efforts need augmenting and strengthening on an urgent basis besides ensuring participation of all stakeholders. This target aligns with Goals A, B, and D; Global Targets 2, 3, 4, 10, 11, and 12; and SDGs 13.1, 13.2, and 14.3.

ACTION POINTS

1. Identify and delineate the key ecologically rich areas of the country vulnerable to climate change at national, state and local levels and incorporate ecosystem-based approaches and relevant measures in various programmes including watershed management, coastal and marine areas planning and regulation, agricultural technologies and practices, forest management, and health programmes.
2. Explicitly consider the vulnerability of coastal areas and their biodiversity to climate change and sea level rise in coastal management plans, as well as infrastructure planning and construction norms for taking mitigation and adaptation measures.
3. Develop ecological criteria for identifying the species and ecosystems at greater risk from climate change and their priority habitats.
4. Strengthen efforts for partial substitution of fossil fuels with biofuels and other alternative energy resources.
5. Create awareness among the people for the adoption of the country's program on Lifestyle for Environment (Mission LiFE).
6. Develop capacity of diverse stakeholders for integrating climate risks into conservation of biodiversity.
7. Promote research on various aspects of climate change and its impact on biodiversity.
8. Promote ecosystem-based approaches for climate change mitigation and adaptation.
9. Promote approaches for integration of biodiversity conservation and ecosystem management into State Action Plans on Climate Change and Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS).
10. Develop/ promote methodologies for assessment of climate co-benefits of biodiversity conservation and promote conservation actions that maximizes co-benefits.
11. Promote measures and develop stakeholders' capacity for integration of ecosystem-based disaster risk management into national, state and district level disaster management plans and strategies.
12. Strengthen capacity to assess and address the interlinkages of biodiversity, climate change and human health, including through research, education, knowledge and communication tools and enhance international cooperation.

NBT 09

Sustainable use of wild species for multiple benefits

"Ensure that the sustainable management and use of wild species as per National laws, thereby providing social, economic and environmental benefits for people, especially those in vulnerable situations and dependent on biodiversity."

The target specifically focuses on multiple benefits to people from living resources, particularly from the direct human use of species and ecosystems. This obviously involves management of biodiversity, both for consumptive and non-consumptive uses as main actions related to this target will revolve around the practices of sustainable management. The target also recognizes the importance of communities/ people that are vulnerable and primarily dependent on biodiversity for their subsistence and livelihood.

In the Indian context, biodiversity is being used/ influenced by: (i) industries (e.g., pharmaceutical companies including herbal drugs, food processing, furniture and non-wood-based industries) for their raw material, (ii) communities (e.g., forest dwellers, pastoralists, fisherfolk) are solely dependent on it, and (iii) non-consumptive usage (e.g., recreation, tourism, and navigation). Thus, a considerable section of the society directly or indirectly depends on the use of biodiversity. NBT 9 contributes for Goals A and B; it is linked with Global Targets 4, 5, and 11; and SDGs 12.2, 14.7, and 15.7.

ACTION POINTS

1. Promote conservation, management and sustainable utilization of priority wild species as per the National laws for maintaining species diversity through ex situ and *in situ* measures.
2. Promote best practices based on traditional and sustainable use of biodiversity as permissible and devise mechanisms for providing benefits to local communities.
3. Build and regularly update a database on NTFPs, monitor and rationalize their use, and ensure their sustainable availability to local communities.
4. Promote sustainable use of permissible wild species by supporting studies on traditional utilization in selected areas to identify incentives and disincentives and promote best practices.
5. Promote capacity building at the grassroots level for participatory decision-making to ensure legal and sustainable use of wild species.
6. Encourage and support relevant institutions and community organizations, such as JFMCs/ EDCs/ BMCs/ Panchayats, tribal bodies, Community Forest Resource Management Committees (CFRMCs), etc., in the development of participatory management plans for sustainable use of legally approved wild species through the development of plans for micro and small entrepreneurs, sustained supply of raw material, including harvesting protocols and value addition.
7. Develop an inventory of legally permitted wild species used across India, collate and correlate with the information available in PBRs.

NBT 10

Sustainable management of agriculture, animal husbandry, fisheries, aquaculture and forest areas

"Ensure areas under agriculture, animal husbandry, fisheries, aquaculture, forests, grasslands, inland waters, and coastal and marine ecosystems are managed sustainably so as to contribute towards food security, community resilience, restoration of biodiversity, long-term efficiency, and productivity for enhanced ecosystem services."

The target focuses on sustainable management of prominent production systems such as agriculture, aquaculture, fisheries, animal husbandry and forests from the perspective of food security. Intensification of agriculture, excessive use of fertilizers, pesticides, increased use of hybrid varieties, etc. have often resulted into environmental degradation including poor soil conditions. Sectors like aquaculture and fisheries are being impacted because of overharvests, pollution, and proliferation of exotic species. Likewise, the animal husbandry sector has also been impacted mainly on account of reduced and degraded grazing lands. Forest areas are also under influence of ever-increasing resource dependence, long history of forest working, shifting cultivation, excessive livestock grazing, recurrent fires, invasive alien species, commercial plantation of cash crops, soil erosion, etc. Restoration of such degraded ecosystems through innovative approaches and sustainable management, contributing to the resilience, long term efficiency and productivity of such production sectors for enhanced contributions to people including ecosystem functions and services are urgently required.

Focused efforts are needed to address threats posed to biodiversity by production sectors and to ensure sustained food production amidst changing land pressures and climate. NBT 10 is important as it aligns with all KM-GBF goals, its several global targets as well as some pertinent actions relevant to SDGs. This target aligns with Goals A, B, C, and D; Global Targets 2, 4, 6, 7, 8, 9, 11, and 16; and SDGs 2.3, 2.4, 12.1, 12.2, 14.7, and 15.2.

ACTION POINTS

1. Encourage adoption of science-based and traditional sustainable land use practices through research and development, knowledge sharing, pilot scale demonstrations, and large-scale dissemination, including farmer's training and, wherever necessary, access to institutional finance.
2. Promote sustainable alternatives to shifting cultivation where it is no longer ecologically viable, ensuring that the culture and social fabric of the local people are not disrupted.
3. Encourage agroforestry, organic farming, agroecological approaches, environmentally sustainable cropping patterns, traditional crop varieties, and the adoption of efficient irrigation techniques.
4. Integrate wetland conservation, including management of village ponds and tanks, springs and streams, into sectoral development plans for poverty alleviation and livelihood improvement, and link efforts for conservation and sustainable use of wetlands with the ongoing rural infrastructure development and employment generation programmes.
5. Enhance restoration and strengthen sustainable management of mangroves to ensure the protection of coastal belts and conservation of flora and fauna.
6. Encourage integrated pest management practices, use of organic manures, bio-pestcides and biofertilizers and discourage use of chemical fertilizers, fungicides, herbicides, pesticides and insecticides.
7. Promote natural and sustainable farming of locally adapted and traditional crop varieties through traditional practices (draught animals) and appropriate incentives and direct access to markets duly supported by appropriate certification systems.
8. Strengthen effective management of forests for multiple benefits while ensuring sustained flow of ecosystem services.
9. Provide support for effective regulation/ enforcement of guidelines/ rules/ laws for sustainable inland and marine fisheries.
10. Promote climate-smart agriculture and water-efficient crops.
11. Promote best animal husbandry practices for semi-domesticated and indigenous livestock.
12. Support integrated and sustainable management for pastoral/grazing areas, especially for alpine pastures.
13. Support individual experts, farmers, and NGOs helping in reviving traditional practices of farming, maintaining indigenous breeds of livestock, and germplasm conservation.
14. Raise awareness of the interlinkages between biodiversity and health for nutrition, food security, livelihoods and food system resilience.

NBT 11

Enhance and maintain ecosystem services and regulate air and water quality, hazards and extreme events

"Restore, maintain and enhance nature's contributions to people, including ecosystem services, such as the regulation of air, water and climate, soil health, pollination and reduction of disease risk, as well as prevention and protection from hazards and disasters, through nature-based solutions and/ or ecosystem-based approaches for the benefit of all people and nature."

The target specifically focuses on ecosystem based approaches to support and safeguard human well-being in several ways besides enhancing the resilience of ecosystems and the provision of ecosystem services. Ecosystem based approaches are envisaged to help society from adverse impacts of climate change, natural hazards and disaster risks while providing food and water security, and improving human health. Natural coastal infrastructure such as mangrove forests, coral reefs, and barrier islands are of immense help to the society against coastal flooding, soil erosion, cyclonic storms and the impacts of sea-level rise. Conserving forests would not only help in maintaining biodiversity but would also support various ecosystem services, food and energy security, climate change adaptation and mitigation, and local incomes. Developing green infrastructure and maintaining blue spaces in urban environments would help in improving air quality, support wastewater treatment, reduce stormwater runoff and water pollution, and improve the quality of life for residents.

In view of the enhanced intensity of natural disasters in India that frequently impact human populations and their property, implementation of this target along with prioritized actions in places that are prone to natural hazards and disasters is of paramount importance. The target aims to contribute towards Goals A and B; Global Targets 2, 3, 5, 6, 7, 8, 9, 10, and 12; and SDGs 1.5 and 15.4.

ACTION POINTS

1. Scale up studies on the economic evaluation of ecosystem services and develop standardized protocols for wider use and consistency.
2. Promote ecosystem-based approaches to enhance ecosystem services and regulation of air, water, hazards and extreme events.
3. Ensure timely and effective planning and management for dealing with exigencies, disasters, and extreme events impacting PAs and other biodiversity-rich areas.
4. Strengthen and support activities relevant to forest fire prevention, mitigation, and preparedness so as to eliminate/ minimize recurrent human-induced forest fires impacting biodiversity.
5. Implement suitable measures for restoring soil health and strengthen the soil health card programme.
6. Promote the concept of biodiversity integrated 'One Health' approach and its effective implementation.
7. Scale up activities relevant to rejuvenation of mountain springs, streams, rivers and water catchment areas.
8. Maintain crop species diversity and reduce excessive use of pesticides/ insecticides to enhance pollination services.
9. Maintain refugia for biological control of pests and diseases.
10. Incentivize community participation for effective management and enhancement of ecosystem services.
11. Monitor and regulate noise levels in different ecosystems including under water noise levels.

NBT 12

Enhance green and blue spaces for increased access and human well-being

"Significantly increase the area, quality, and connectivity of green and blue spaces in urban areas for enhanced access and sustainable use."

Urbanization has been recognized as a global challenge resulting into overcrowding and congestion, concretization and crowding of high-rise buildings, environmental degradation and biodiversity loss, socio-economic disparities, and increasing health problems. The importance of green and blue spaces (e.g., areas of vegetation, and inland and coastal waters in or near urban areas) has been recognized from the perspectives of urban biodiversity as well as human physical and mental well-being. The target deserves special attention in view of the enhanced migration rate of rural populations to urban areas and in the face of growing land scarcity and competing land usages.

Given the growing urbanization trend in India, the population residing in urban areas of the country is expected to cross the 40% mark in 2030. Presently, there are about 3,700 urban local bodies (a three-tier system) comprising of Municipal Corporations, Municipal Councils, and Nagar Panchayats. These bodies have to pay much needed attention to restore, maintain, and enhance the extent and quality of green and blue spaces. NBT 12 aligns with Goals A and B; Global Targets 2, 3, 4, 8, and 11; and SDGs 11.7 and 11.b.

ACTION POINTS

1. Develop protocols and guidelines for adoption by all municipal bodies to assess the extent of green and blue urban spaces.
2. Support reclamation, restoration and expansion of quality green and blue spaces in the urban areas.
3. Promote and support the establishment of national and state-level databases on green and blue spaces and urban biodiversity.
4. Develop guidelines for safeguarding biodiversity in green and blue spaces by municipal bodies.
5. Prevent degradation, land use change, encroachment in green and blue spaces.
6. Mandate urban planners and developers to integrate blue and green spaces in plans and projects.
7. Map, recognize and expand OECMs in urban blue and green spaces.

NBT 13

Access and Benefit Sharing

"Take effective legal, policy, administrative and capacity-building measures at all levels to ensure and increase the fair and equitable sharing of benefits that arise from the utilisation of biological resources/ genetic resources and digital sequence information as well as traditional knowledge associated with biological/ genetic resources, and facilitating appropriate access and benefit-sharing instruments."

The target specifically focuses on the third objective of the CBD i.e., fair and equitable sharing of benefits arising due to use of genetic resources and caters to the requirements of the Nagoya Protocol on Access and Benefit Sharing (ABS). It also targets to ensure fair and equitable sharing of benefits from Digital Sequence Information (DSI) as well as traditional knowledge associated with genetic resources.

Notably, India has taken a lead towards contribution to this target by promoting the use of genetic resources and associated traditional knowledge, and by strengthening the opportunities for fair and equitable sharing of benefits from their use so as to create incentives to conserve biodiversity, sustainably use its resources, and enhance the contribution of biodiversity towards SDGs. The Nagoya Protocol of strategic importance to address the requirements of ABS globally came into force in October, 2010 which was ratified by India in October, 2012. Towards this, a notification titled 'Guidelines on Access to Biological Resources and Associated Knowledge and Benefit Sharing Regulations, 2014' was issued under the BD Act, 2002. These guidelines along with relevant provisions of the Act and the Biological Diversity Rules, 2014 prescribe the scheme of processing the applications, along with the template and terms for benefit sharing. The ABS process in India needs to be upscaled. This target aligns with Goal C; Global Targets 4 and 9; and SDG 15.6.

ACTION POINTS

1. Develop sui generis system for protection of traditional knowledge and related rights.
2. Raise awareness at the central, state and local levels for effective implementation of the provisions under the Biological Diversity Act.
3. Provide support and capacity building for preparation and updation of PBRs with technical help from the scientific institutions and convert them into e-PBRs.
4. Strengthen systems for documentation, application and protection of biodiversity associated traditional knowledge, providing adequate protection to these knowledge systems while ensuring benefits to communities.
5. Revive and revitalize sustainable traditional practices and other folk uses of components of biodiversity and associated benefits to local communities with a view to promoting and strengthening traditional knowledge and practices.
6. Update the modalities for operationalizing provisions for prior informed consent and benefit sharing under the Biological Diversity Act.
7. Encourage and support SBBs/ UTBCs to develop and maintain state/ UT level web portal on biodiversity management information system.
8. Establish a common platform for states with common biological resources to synergize ABS mechanisms.
9. Undertake inventorization of potential resources for commercial utilization and disseminate to BMCs/ Panchayats for effective benefit sharing.
10. Set up traceability mechanisms especially for use of Digital Sequence Information (DSI) from genetic resources and traditional knowledge linked to genetic resources.
11. Monitor various monetary modalities for benefit sharing from DSI and enable a mechanism for receiving funds from Global Multilateral Fund related to DSI.

NBT 14

Mainstreaming biodiversity

"Ensure the full integration of biodiversity and its multiple values into policies, regulations, planning, budgeting and development processes."

Despite the importance of biological diversity in daily life and human well-being, public perception and consciousness towards biodiversity is lacking. The need to mainstream biodiversity in economic growth and development is being increasingly recognized. This target seeks full integration of biodiversity and its values across all levels of government and all the sections of society by way of appropriate incorporation in relevant policies, regulations, planning and developmental processes to align with varied environmental conventions and multinational agreements, as well as National policies and practices.

NBT 14 thus aims to contribute towards Goals A, B, C, and D; Global Targets 15, 16, and 18; and SDG 15.9.

ACTION POINTS

1. Promote inter-sectoral linkages and synergies to develop and realize the full economic potential of ex situ conserved materials in crop and livestock improvement programmes.
2. Secure integration of biodiversity concerns into inter-sectoral policies and programmes to identify elements having adverse impacts on biodiversity and design policy guidelines to address such issues.
3. Ensure that valuation of biodiversity is an integral part of the pre-appraisal of projects and programmes to minimize adverse impacts on biodiversity.
4. Integrate biodiversity concerns across developmental sectors (such as industry, infrastructure, power, mining, etc.) and promote use of clean technologies.
5. Undertake environmental assessment of sectoral policies and programmes to address and mitigate potential adverse impacts on biodiversity.
6. Ensure that in all cases of forest land diversion, the essential minimum needed land for the project or activity is permitted. Restrict the diversion of dense natural forests, particularly areas of high endemism of genetic resources, to non-forest to safeguard vital national interests.
7. Give priority to impact assessment of development projects around/ near wetlands, particularly ensuring that environmental services of wetlands are explicitly factored into cost-benefit analysis.
8. Adopt best practice norms for infrastructure construction to avoid habitat fragmentation and/ or minimize damage to sensitive ecosystems and despoiling of landscapes.
9. Review enabling policies to prevent transfer of prime agricultural land to non-agricultural purposes, and promote sustainability of agricultural lands.
10. Formulate policies, guidelines, and schemes for supporting conservation and management of grasslands, pastoral lands, sacred groves and other areas significant for biodiversity conservation such as Important Bird areas, Key biodiversity areas.
11. Identify emerging areas for new legislation, based on better scientific understanding, economic and social development, and development of multilateral environmental regimes.
12. Review existing legislations relevant to biodiversity conservation to develop synergies among relevant statutes and regulations, eliminate obsolescence, and amalgamate provisions with similar objectives.
13. Effectively use the System of Environmental Economic accounting (SEEA), including the SEEA Ecosystem Accounting (EA) to reflect the ecological and economic values of biodiversity, with special attention to green accounting techniques in national accounts.

NBT 15

Sustainable production, supply chains and disclosure of risks

"Take legal, administrative or policy measures to encourage and enable businesses, particularly large and transnational companies and financial institutions to regularly monitor, assess and disclose risks, dependencies and impacts related to biodiversity."

Recognizing that large business houses, transnational companies and financial institutions have immense global biodiversity impact footprint, the target specifically focuses on the development sector and envisages 'biodiversity-related disclosure'. Such disclosures will help in identification of risks, dependencies, and impact on biodiversity. Companies are expected to provide information to consumers to promote sustainable consumption patterns, and also to report on compliance with ABS regulations and measures. India has made a modest beginning towards biodiversity disclosure by firms. In 2023, the Securities Exchange Board of India (SEBI) has introduced the Biodiversity Responsibility and Sustainability Reporting (BRSR) framework for top 1,000 companies. This effort will bring desired transparency and help in developing an Indian Index of sustainable corporate leaders.

This target aligns with Goals A, B, C, and D; Global Targets 4, 5, 6, 7, 9, 10, 13, 14, and 16; and SDGs 9.4 and 12.6.

ACTION POINTS

1. Develop appropriate liability and redress mechanisms for businesses to internalize environmental costs and address economic concerns in case of any damage to biodiversity.
2. Harmonize provisions concerning disclosure of the source of biological material and associated knowledge used in the inventions under the Patents Act, Protection of Plant Varieties and Farmers' Rights Act, and Biological Diversity Act to ensure the sharing of benefits by the communities holding traditional knowledge from such use.
3. Promote adoption of best practice norms in key sectors like tourism, renewable energy for addressing biodiversity concerns.
4. Ensure compliance with the Business Reporting and Sustainability Reporting (BRSR) framework by all major and medium-sized companies, and encourage Business Groups to adopt sustainable practices and disclose information related to their environmental, social, and governance (ESG) performance.
5. Create a cadre of biodiversity auditors and certifying agencies.
6. Expand the scope of SEBI notification on the mandatory BRSR reporting on the company's value chains.
7. Implement mandatory disclosure of the movement of biological resources that are not native to the country or from priority conservation areas.

NBT 16

Promote sustainable consumption choices

"Ensure that people are encouraged and enabled to make choices for sustainable consumption to reduce the footprint of unsustainable consumption in an equitable manner."

Since the inception of CBD, focus has predominantly been towards conservation and restoration of nature. However, this target aims to go beyond these efforts. It recognizes that overconsumption and waste generation are two root causes of biodiversity loss which need to be addressed. NBT 16 aligns with Goals A and B; Global Targets 4, 5, 6, 7, 8, 9, 10, and 11; and SDGs 4.7, 8.4, 9.4, 12.1, 12.2, 12.3, 12.5, 12.8, and 12.a.

ACTION POINTS

1. Implement mission LIFE actions to encourage citizens to adopt environment friendly actions
2. Create awareness to make choices for sustainable consumption and reduce food waste.
3. Formulate national policy and programmes on consumer information including ecolabels/product labelling and/or certification enabling consumers to make wise choices
4. Identify sources and patterns of unsustainable consumption within the government system, urban and rural societies and industries to take appropriate measures for its redressal.
5. Strengthen programmes to promote cold storages and food processing to reduce wastage of perishable commodities

NBT 17

Strengthen biosafety regulatory capacity

"Strengthen capacity for implementation of biosafety measures."

Concerns for biosafety measures arising from the advancement in recombinant DNA technology and other biotechnology products and processes, particularly the handling, transport, and use of Living modified organisms (LMOs) that may have adverse effect on biological diversity and human health, started getting attention in late eighties and early nineties. India notified in 1989 the 'Rules for the Manufacture/ Use/ Import/ Export and Storage of Hazardous Microorganisms, Genetically Engineered Organisms or Cells' under the EPA, 1986. Subsequently the Cartagena Protocol on Biosafety, a supplemental international agreement to the UNCBD, came into existence in 2000 and entered into force in September, 2003. Since then considerable progress has been made to implement the Protocol. The Genetic Engineering Appraisal Committee (GEAC) of Ministry of Environment Forest and Climate Change looks after the biosafety issues of the country in close collaboration with Department of Biotechnology, Ministry of Science and Technology, Government of India. NBT 17 is aligned with Goals A, B, C, and D; and Global Targets 4, 6, 7, 8, 10, and 13.

ACTION POINTS

1. Periodically review and update the national biosafety guidelines/ rules to ensure that these are based on current scientific knowledge.
2. Develop protocols for monitoring products based on restricted genetic engineering technologies.
3. Ensure conservation of biodiversity and human health while dealing with LMOs in transboundary movement in a manner consistent with the multilateral biosafety protocol.
4. Strengthen capacities for risk assessment, management, implementation of national rules and procedures and communication of information to government staff, researchers, students and general public, on LMOs.

NBT 18

Repurpose detrimental incentives for biodiversity

"Identify and repurpose incentives, including subsidies detrimental to biodiversity, and scale up positive incentives for the conservation and sustainable use of biodiversity progressively."

Subsidy reforms can help safeguard natural resources which are critical for human health and nutrition. The Government of India has launched 'PM- PRANAM' (PM Programme for Restoration, Awareness, Nourishment and Amelioration of Mother Earth) scheme which aims to generate awareness on Regenerative Agriculture and promote balanced use of farm chemicals (to safeguard soils and biodiversity) and contribute towards implementing NBT 18. This Target aligns with Goals A, B, and D; Global Targets 5, 7, 9, 10, 16, and 19; and SDGs 12.c and 14.6.

ACTION POINTS

1. Identify and assess the extent of detrimental subsidies eg., in agriculture, fossil fuel, construction, automobile, fisheries, etc. and plan to repurpose detrimental incentives.
2. Promote positive incentives for effective conservation and sustainable use of biodiversity.

NBT 19

Resource mobilization

"Ensure the flow of adequate financial resources from all sources, including public, private, international, and other innovative financial mechanisms, to implement the NBSAP, SBSAPs, and LBSAPs."

MoEFCC, GoI, has successfully implemented the first cycle of the UNDP led Biodiversity Finance Initiative (BIOFIN) project in collaboration with NBA, Wildlife Institute of India, 24 central ministries, 2 departments, 28 state governments and 8 Union Territory Administrations. The exercises on components of Policy and Institutional Review (PIR), Biodiversity Expenditure Review (BER), Financial Needs Assessment (FNA), and Biodiversity Finance Plan (BFP) were completed. Gaps in funds based on BER data was assessed. The BFP suggested twelve potential financial solutions to bridge the finance gap, taking into account existing financial mechanisms as well as innovative instruments. Further, besides Augmenting Public Finance, Corporate Social Responsibility (CSR), Ecological Fiscal Transfer (EFT), and Access and Benefit Sharing (ABS) were recognized as potential contributors. NBT 19 aims to address this issue and contribute towards Goals A, B, C, and D; Global Targets 14, 15, and 18; and SDGs 1.a, 10.b, 15.6, 15.b, and 17.3.

ACTION POINTS

1. Mobilize additional resources from all possible sources for biodiversity conservation.
2. Assess the utility of traditional and innovative fiscal instruments for promoting conservation and sustainable utilization of biodiversity.
3. Explore and access supplemental financial resources through private finance, international finance, and other innovative finance solutions, such as biodiversity cess, conservation license plates, cess for using biodiversity logos/ mottos, and the District Mining Fund.
4. Ensure the development of protocols for promoting biodiversity credits.
5. Develop systems for ploughing back the revenues generated in protected areas, zoological parks, botanical gardens, wetlands, aquaria, etc., for effective management of these areas through engagement of local communities.
6. Provide adequate and timely support for mobilizing resources for effective implementation of NBSAPs, SBSAPs, and LBSAPs

NBT 20

Capacity development, technology and scientific cooperation

"Strengthen capacity development, access to and transfer of technology, and promote access and development of innovations, technical and scientific cooperation, through South- South, North-South and Triangular Cooperation."

Capacity development of public and private Institutions, organizations and individuals to achieve the goals of KM-GBF cannot be overemphasized. Further, increased use of advanced technologies in biodiversity assessment and conservation, necessitates access to these technologies, capacity building for their use and enhanced inter and intra institutional scientific cooperation. Enhanced interactions between policy and decision makers, biodiversity practitioners, scientists, and communities are also required to be promoted to amalgamate traditional knowledge with modern scientific techniques to promote innovative mechanisms for achieving the CBD targets . This target is in alignment with Goals A, B, C, and D; Global Targets 1-23; and SDGs 17.6, 17.7, 17.9, 17.16, and 17.18.

ACTION POINTS

1. Develop the capacity of policy and decision-makers, professionals, BMCs, farmers, fisher folk, and communities, including youth.
2. Incorporate modules on conservation and sustainable utilization of biodiversity in foundational and professional training courses for the officers of various services.
3. Facilitate the interactions of concerned scientific institutions and NGOs to promote their technical cooperation with SBBs and BMCs.
4. Enhance capacity to promote use of geospatial tools for effective management of areas of biological importance.
5. Expand area-specific surveys of landraces, traditional cultivars of crops, wild relatives of crop plants, and breeds of domesticated animals.
6. Enhance the capacity of climate modelling in the country substantially to get a clear idea of the impacts of climate change on biodiversity at national and local levels.
7. Promote livelihood diversification opportunities for making value-added bioresource and traditional knowledge-based products and building upon traditional as well as emerging environmental technologies customized at the local/ field level.
8. Promote enabling conditions to develop transboundary collaborative actions with other countries especially in South Asia on knowledge exchange, joint monitoring, capacity building, enhancing ecological connectivity, managing illegal wildlife trade, and biodiversity conservation.
9. Promote scientific cooperation and transfer of technology at all levels, including regional and international cooperation for ecosystem restoration, recovery and conservation of threatened species, pollution control and waste management, sustainable management of coastal and marine ecosystems, addressing human wildlife interactions, control of invasive alien species, and climate change.
10. Raise awareness, capacities and international cooperation for assessment of the interlinkages between biodiversity and health, and for promotion of biodiversity integrated 'One Health' approach.

NBT 21

Communication, awareness, and knowledge management

"Ensure that the best information and knowledge from science, research, and evidence-based sources are accessible to decision-makers, practitioners, and the public to guide effective and equitable governance and integrated and participatory management. and strengthen communication, education, awareness-raising, research, monitoring, and knowledge management relevant to the conservation of biodiversity."

Effective conservation of intricate and dynamic biodiversity at ecosystem, species, and gene levels requires appropriate information and knowledge generated through research and monitoring. It is essential that policy and decision makers, practitioners, and public have access to this information and knowledge. In addition, current efforts towards biodiversity conservation also require innovative approaches for outreach programs.

India has made notable progress in this direction by setting up 62 ENVIS Nodes in all states and Union Territories which are interlinked with the MoEFCC portal.

NBA has developed an on-line Biodiversity Information System to prepare e-PBRs. Further, over the years, several 'life owning' ministries have also implemented a broad range of programmes and activities relevant to Communication, Education and Public Awareness (CEPA) concerning their sector which can be further scaled up.

NBT 21 is in alignment with Goals A, B, C, and D; Global Targets 1-23; and SDGs 14.a, 17.6, 17.7, and 17.18.

ACTION POINTS

1. Strengthen multidisciplinary research and citizen science initiatives for key areas pertaining to the conservation and management of biodiversity.
2. Undertake survey, identification and inventory activities for unexplored areas and data deficient species.
3. Undertake coordinated research to assess impacts of climate change, land use change, pollution, linear infrastructure on various facets of wild and domesticated biodiversity and develop effective solutions.
4. Develop an integrated national biodiversity information system and ICT tools for dissemination, awareness creation, and decision making.
5. Develop a National Biodiversity Monitoring System (NBMS).
6. Mandate and enable science centers, museums, Zoos and extension institutions to promote interactive biodiversity education
7. Promote traditional folk media through the usage of different folk arts and other cultural means for awareness creation.

NBT 22

Equitable and effective participation in decision-making

"Ensure the full, equitable, inclusive, effective and gender-responsive representation and participation in planning, decision-making, management, and access to justice and information related to biodiversity by youth, ethnic groups, and local communities."

The KM-GBF emphasizes on a comprehensive and transformative approach to conservation that would ensure equitable, inclusive and gender responsive participation. This target provides an opportunity in recognizing and strengthening the vital role of local communities, including women and girls, children and youth, and persons with disabilities in various endeavors towards the broader goal of biodiversity conservation. It also seeks to protect environmental human rights defenders. NBT 22 aligns with Goals A, B, C, and D; Global Targets 1, 3, 5, 9, 13, 21, and 23; and SDGs 1.4, 5.5, 5.a, 10.2, 10.3, 16.3, 16.7, and 16.10.

ACTION POINTS

1. Strengthen capacities of local bodies (PRIs, BMCs, CFRMCs, Van Panchayats, Gram Sabhas) and CBOs (JFMCs, EDCs) for inclusive and participatory management of natural resources
2. Strengthen inclusive and participatory approaches to encourage women, girls, local communities in planning and management of natural resources.
3. Design and implement gender responsive awareness and capacity development programmes especially for rural and tribal women, diverse ethnic and youth groups and communities for implementation of SBSAPs, LBSAPs and ABS.
4. Promote legal awareness amongst District Autonomous Councils, BMCs, traditional tribal bodies, tribal people, local communities and other marginalized groups for biodiversity conservation.
5. Recognize, acknowledge and document cultural practices, traditional knowledge, and customary laws which contribute towards biodiversity conservation.

NBT 23

Gender equality in decision-making and implementation

"Ensure gender equality in the implementation of the NBSAP, SBSAPs and LBSAPs through a gender-responsive approach, where all women and girls have equal opportunity and capacity in decision-making related to biodiversity."

The key role of women in biodiversity conservation and natural resource management has been well recognized. However, their participation in decision making relevant to biodiversity governance is generally insufficient. Building on this, Target 23 affirms equal rights of women and girls in Policy formulation and decision making for resource use and conservation, including access to land and associated benefits.

India has already made several interventions to bring in the desired gender equality in implementing the NBSAPs at the ground level, the most important being mandatory inclusion of 1/3rd women members in the Biodiversity Management Committees across the country as specified in the Biological Diversity Act, 2002 and Rules, 2004. Hence, they have a crucial role in decision-making and implementation of biodiversity programmes at the local level as well.

NBT 23 is in alignment with Goals A and B; Global Targets 9, 10, and 11; and SDGs 5.1, 5.5, and 5.c.

ACTION POINTS

1. Strengthen capacity of national, state and local level departments, agencies and institutions to mainstream gender responsive approaches for biodiversity conservation.
2. Ensure that women and other marginalised groups are represented in governance and decision-making at various levels in local communities, ethnic groups, PRIs, district, and state-level committees relevant to biodiversity.
3. Ensure that women and girls, have fair and equal opportunity and capacity to contribute to conservation and sustainable use of biodiversity, and have access to benefits accrued out of ABS.
4. Promote equitable, gender-responsive, and effective participation of communities to undertake actions for implementing SBSAPs, LBSAPs and ABS.

4.4.

Implementation approach

Inter-ministerial coordination

(i) Strengthening inter-ministerial coordination for fulfilling the commitments relating to biodiversity conservation, (ii) to provide more space to biodiversity activities in the relevant schemes and programmes.

Bilateral and multilateral collaborations

(i) Enhanced bilateral and multilateral engagement through international projects for capacity development in Biodiversity conservation science and actions, (ii) Exchange/sharing of technologies for sustainable utilization and management of biodiversity.

Regional cooperation

(I) India is now in a position to play a major role in biodiversity conservation in south Asia region, based on its long experience and expertise, (ii) Given the trans-boundary biodiversity conservation issues, regional cooperation among the neighbouring countries is the need of the hour for India.

Institutionalization of biodiversity conservation component across the Ministries and Private sectors

(i) Required capacity building and skilled human resources in the relevant Ministries/Private sector for the required focussed attention, (ii) Data generation in relevant sector, (iii) Biodiversity-based innovative R&D for sustainable use of biodiversity.

Bottom-up approach to NBSAP implementation

The bottom up approach of NBSAP implementation (Fig 4.1.), which has already been adopted will be further strengthened. This would require (i) strengthening of SBBs/ UTBCs to make them effective in efficient implementation of state level biodiversity strategies, action points, and activities envisaged in the NBSAP/ SBSAP by augmenting their infrastructure, manpower, expertise, and finances; (ii) engagement and full participation of BMCs at the grassroots level which would need extra effort for their capacity development; and (iii) updating the existing PBRs at BMC level, and SBSAPs at SBB/UTBC level with substantial improvement or revision aligned with the updated NBSAP.

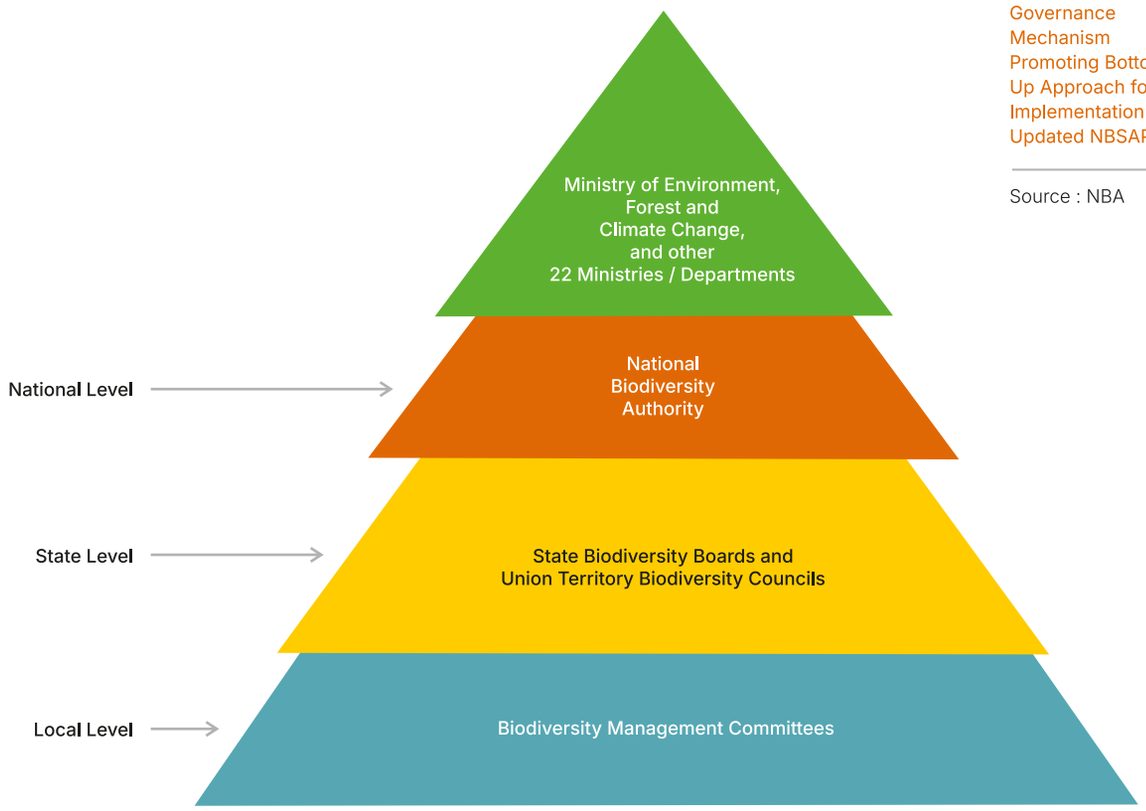


Fig 4.1. Hierarchical Governance Mechanism Promoting Bottom-Up Approach for Implementation of Updated NBSAP

Source : NBA

Biodiversity Research

A large number of government and non-governmental organizations operating at the state, national, and international level are engaged in generating vital research information on country's natural ecosystems, associated floral and faunal diversity, agrobiodiversity, and varied aspects of conservation. It is neither intended nor in the scope of NBSAP to furnish here details of all such organizations. Available research infrastructure/ facilities, human resources and finances vis-à-vis country's vastness, and its enormous diversity of natural and manmade ecosystems, and associated species and genetic diversity are insufficient, causing limited research coverage and inadequate outputs in some regions/ states. Owing to these limitations, some regions, states/ UTs, PAs, other conservation areas, ecosystems, species, or specific themes of conservation have been inadequately covered from the perspective of biodiversity research. In several instances, much of the available research information is either fragmentary or obsolete. Biodiversity research, especially field-based assessments on wild biodiversity are time consuming, cumbersome, and expensive and as they require covering vast areas, use of modern tools and technologies besides involves a number of subject matter specialists/ experts. In the past three decades, research information, reports, and peer reviewed publications in open access relevant to wild diversity and agrobiodiversity have markedly enhanced.

The country also needs to take up focused R&D programme in bioprospecting at a large scale for sustainable utilization of biodiversity, thus contributing to bioeconomy of the nation.

In addition, the crucial research-based information on some of the neglected ecosystems (e.g., grasslands, rivers, coastal and marine ecosystems, islands); biology, population dynamics and ecology of threatened flora and fauna; genetic variability, genetic erosion, and conservation of genetic resources; and contentious themes (e.g., human-wildlife interaction, forest fires, impact of linear infrastructure on biodiversity); and emerging needs (e.g., ecorestoration, mitigation of pollution, control of invasive alien species in terrestrial and aquatic environments, mainstreaming biodiversity in production sectors, sustainable natural resource management, climate change mitigation and adaptation) need to be generated.

Biodiversity Monitoring

Over the past three decades, several reputed national governmental and non-governmental organizations (FSI, ISRO-SAC, NRSC, NTCA, WII, NCSCM, FRI, NIDM, BNHS, WWF, WTI, WCS, Wetland International, Asian Wetland Bureau, etc. besides several institutions under the umbrella of ICFRE, ICAR, CSIR, DST, DBT) have been involved in carrying out monitoring of climate, land use and land cover, extent and trends in natural ecosystems, especially forests, wetlands, coastal and marine ecosystems; population estimates of tiger, Asiatic lion, snow leopard, leopard, elephant, rhinoceros, and other wild animals; wildlife habitats; groundwater resources; e-flow and water quality; wetland birds; aquatic biota, etc. Reports based on well-designed scientific monitoring protocol using modern technologies at periodic interval published by some of the leading agencies offer valuable insight on trends in extent of some of the important ecosystems and habitats; abundance, population estimate, and demography of species of conservation significance and management concerns.

Despite the above efforts, some ecosystems e.g., grasslands, inland, wetlands, rivers, floodplains, corals, estuaries, seagrasses, intertidal mudflats still need more closer attention for monitoring. A large number of threatened species representing terrestrial and aquatic (freshwater, brackish water, and marine) ecosystems also needs concerted attention and insight on distribution, status, and trends in associated species and populations. All consultative meetings on the updating of the NBSAP, as part of a wider consultative process across the country, deliberated at length on the development of a biodiversity monitoring framework. As a result, a monitoring framework was developed and presented in Chapter 7. Under the leadership of MoEFCC, a few other Ministries/Departments have been made responsible for monitoring and they need to firm up/ develop the biodiversity indicators, protocols for field level assessments, and coordinate monitoring activity as per the envisaged periodicity. The NBSAP stipulates that considering the importance of monitoring activities and emphasis given by the KM-GBF and CBD, they will need resolute support by concerned ministries, adequate finances, and commitment by the Lead/ Supporting agencies involved in the task. Further, a central digitalized database to be developed and managed based on various monitoring activities is one of the priority activities envisioned.

4.5.

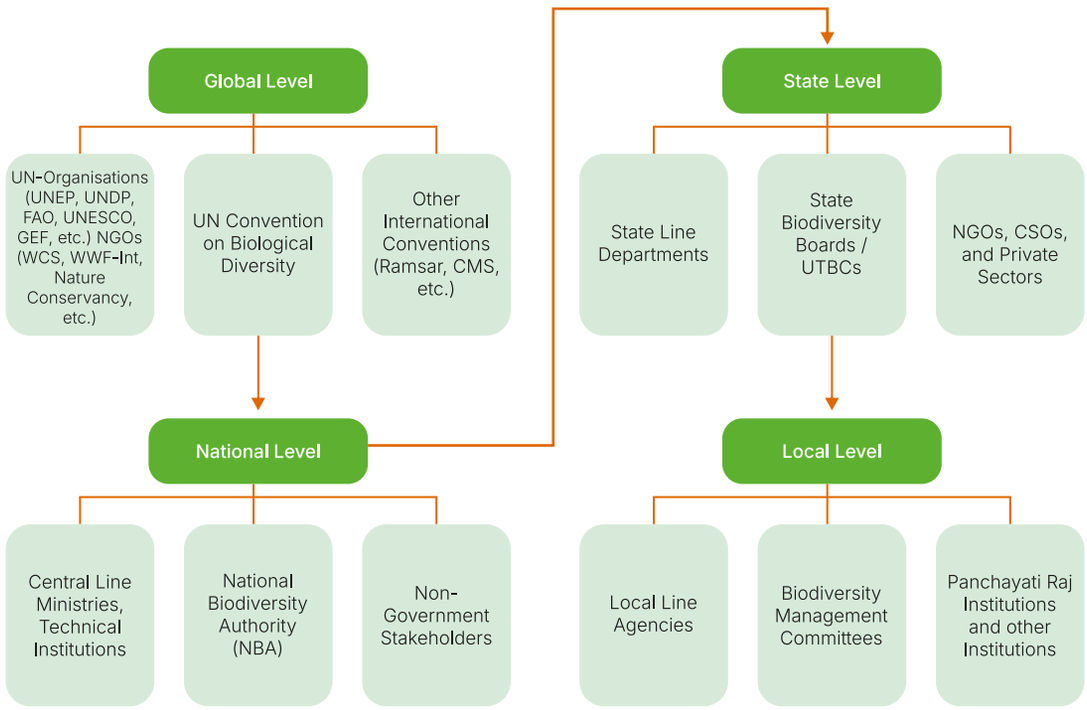
Implementation Framework

The operationalization framework envisages implementation of NBSAP across the country at different hierarchical levels of governance including the national, state and local levels while adopting participatory, inclusionary and effective approach is presented in Fig 4.2.

At the national level, prominent implementing agencies include: MoEFCC, 20 Central ministries, and 2 Departments, NBA, professional national institutions, supranational organizations, and NGOs. At the apex level, the MoEFCC, and other central ministries continue to extend the overall policy guidance, legal and financial support in matters relevant to conservation of biodiversity as mandated in each case. The MoEFCC would facilitate inter-ministerial coordination, and ensure implementation of NBSAP with the support of concerned central ministries and departments including execution of biodiversity monitoring framework through identified Lead Agencies and Supporting Agencies. Various national organizations of repute under the control of MoEFCC, MoAFW, MoFAHD, MoJS, and other Ministries would continue to provide inputs towards research based technical know-how, problem solving, development of innovative approaches, communication, education, public awareness, advocacy, capacity development, maintenance of databases, sharing of information, monitoring, and consolidating reports based on various outputs of monitoring. On behest of the MoEFCC, the NBA would play a key role in facilitating implementation of various directives and programmes relevant to conservation of biodiversity, and protocols of CBD; enforcement of the BD Act; technical support to SFDs, state departments, and SBBs/ UTBCs; and providing governance in matters related to ABS. The supranational organizations are expected to help the national/ state governments, and the national level organizations involved in formulation of biodiversity policies, education, research, capacity building by way of sharing technical know-how relevant to emerging concepts, tools and technologies; providing consultancy/ expertise in addressing global/ national issues; facilitating international cooperation and collaboration in scientific and technological advancement; and scientific exchange.

At the state level, operationalization of NBSAP envisages the technical resource inputs, financial support, facilitation, and implementation of state level strategies and programmes/ schemes by the state line departments (forest, wildlife, environment, agriculture, horticulture, animal husbandry, dairying, fisheries, water resources, etc.), SBBs/ UTBCs, NGOs, CBOs, business houses, and private entities.

Fig 4.2.
Vertical and Horizontal Integrated Architecture for Implementation of NBSAP



The SFDs, being the custodian of forests lands and wildlife areas within RFA, natural ecosystems, and wild biodiversity remain the primary Implementing Agency (IA) at the State, District, Forest/ Wildlife Division, and local levels. However, SFDs may involve other partners (i.e., the Department of Agriculture/ Urban Development, Central Para Military Force, Eco Task Force, National Yuva Kendra, NSS, NGOs, etc.) for programme implementation in different landscapes. The State Department of Agriculture/ Horticulture/ Fisheries/ Animal Husbandry/ Environment/ Water Resources/ Mines, etc. and the State Pollution Control Board would have vital role to play relevant to their specific mandates while contributing towards conservation of biodiversity. National/ State level NGOs are expected to facilitate and support various activities undertaken by the SBBs, UTBCs, SFDs, and other state departments.

The local level implementation would mainly include BMCs, local line agencies, Panchayati Raj Institutions (PRI) and CBOs. SFDs and different departments like agriculture, animal husbandry, fisheries, watershed management, rural development, water resources, AYUSH, Panchayati Raj, etc. operate a wide range of field level programmes mandated by concerned Ministries/ Department and involves JFMCs, VFPCs, EDCs, BMCs, Gram Panchayat, PRIs, etc. Several schemes operated by different sectors/ departments often have components/ activities relevant to varied aspects of conservation of biodiversity.

In addition to above three governance levels, the global and regional level agreements, directives, strategies, and innovative approaches arising as a part of the CBD, and other Conventions and multilateral environmental agreements (MEA) are of utmost importance for effective implementation of NBSAP.



© Harsh Rawat



5

CAPACITY BUILDING AND DEVELOPMENT

5.1.

Introduction

The updated NBSAP will serve as the main vehicle for implementation of the global agenda towards conservation of biodiversity. This would require upgrading of capacities on diverse cross-sectoral issues such as, conservation, protection, sustainable use, equitable benefits, finance, legal issues, traditional knowledge, gender issues, scientific research, modern tools, technology transfer, innovations and negotiations, and an overall understanding of developmental issues and societal aspirations at all levels. Accordingly, India has set forth the following agenda for capacity development of all stakeholders:

- Develop/ enhance capacities of implementing agencies and all stakeholders for mainstreaming biodiversity across sectors for successful implementation of the NBSAP to achieve 2030 National Biodiversity Targets and 2050 Vision.
- Promote scientific cooperation, transfer of technology and innovative solutions for effective conservation, sustainable use and implementation of the ABS mechanism.

5.2.

Existing Capacity Building programmes in India

Over the past four decades, a large number of governmental and non-governmental organizations are involved in capacity development activities relevant to conservation. Each Ministry concerned with either conservation/regulation or use of biodiversity has in-built programme for capacity development for which an annual budget allocation is usually made for such programme. India has established a stable institutional structure for environmental management, natural resource conservation and promotion of sustainable development. For example, the MoEFCC, MoAFW, and MoFAHD have exclusive training institutions owned, manged and financed by the concerned Ministry, where regular and structured training programmes for fresh as well as in-service technical personnel are organized. In several other Ministries/Departments, need-based training programmes are organized where biodiversity related topics are regularly covered. In addition, several supra-national organizations, national level NGOs and corporate companies also invest towards capacity development programmes. Most state level institutions/ departments related to biodiversity have also created facilities for conducting specialized trainings, specifically to cater to the requirements of frontline staff placed at various hierarchical levels and for CBOs. Efforts to reach out all sections of the society through CEPA are also going on, although many more efforts are required considering the diversity and vastness of the country. The capacity building efforts to ensure successful implementation of relevant policies and programs for conservation may follow the steps as outlined in Fig 5.1.

© Sanjay Shukla_

Fig 5.1.
Steps involved in organizing need-based Capacity Development programme for biodiversity conservation

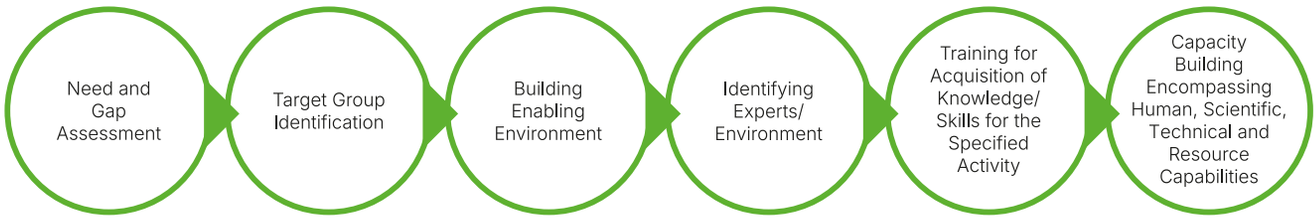


Table 5.1 provides a broad list of existing government organizations involved in capacity development at different levels of implementation of the NBSAP.

Implementation Level	Wild Biodiversity	Agrobiodiversity
National	• Life Owning Ministries – MoEFCC and MoJS • Life Supporting Ministries - MoST, MoS, MoES, MoHA, AYUSH and MoHUA • International Agencies/ supranational organizations (IUCN, UNDP, UNESCO, FAO, etc.) • National Scientific/ Training Organizations – BSI, ZSI, FRI, FSI, IGNFA, DFE/ CASFOS, ICFRE and its Institutes, WII, SACON, NCSCM, IIFM under the MoEFCC; IISC, NCBS; NRSC, IIRS, ISRO-SAC; NIDM, NIUA; Organizations/ Institutes under the DST, DBT, and CSIR • NBA, NTCA, CZA, and WCCB • National Green Tribunal • Central Pollution Control Board • National level Non-profit organizations/ NGOs (BNHS, TERI, WWF-India, TRAFFIC-India, WTI, NCF, WCS, FES, ATREE, TNC, etc.) • Corporates/ Business houses	• Life Owning Ministries – MoAFW, MoFAHD, MoJS, • Life Supporting Ministries - MoRD, MoPR, MoTA, MoWCD, MoSJE, etc. • International Agencies/ supranational organizations – FAO, IFAD, etc. • NARES – ICAR and its Institutes, ARS, NRAA, NDDB, IRMA, etc. • National Bureaus on Plant, Animal, Fish, Agriculturally Important Microorganisms and Insects • Central Pollution Control Board • NABARD, IFFCO, etc. • National level NGOs (e.g., BAIF, etc.)
State	• State Governments • State Departments (Forest, Wildlife, Environment, Fisheries, Water Resources, Soil Conservation, Tribal Affairs, Panchayati Raj, Mines, etc.) • State Biodiversity Boards/ UT Biodiversity Councils • State Wetland Authority • Central/ State/ Private Universities • State/ Regional organizations (e.g., GEER Foundation, GUIDE, NERIST, etc.) • State Forest Research Institutes, State Forest Academies, Ranger Colleges, etc.	• State Government • State Departments (Soil Conservation, Water Resources, Agriculture, Horticulture, Animal Husbandry, Dairying, Fisheries, Water Resources, Rural Development, etc.) • State Agriculture Universities • Autonomous Tribal Councils • State Pollution Control Boards • Krishi Vigyan Kendras
Local	• Panchayati Raj Institutions (PRIs), CBOs – Van Panchayat, JFMCs, EDCs, BMCs	• Panchayati Raj Institutions (PRIs) • Cooperatives – Farmers, Herders, Fisher Folk, • CBOs - Van Panchayat, JFMCs, BMCs

Table 5.1.
Indicative list of organizations involved in capacity development relevant to wild biodiversity and agrobiodiversity

A majority of these organizations have professional competence to undertake requisite programmes, however, the key to success is adequate finances and motivated trainees. The Government run training programmes, especially for professionals, are reviewed by the Research and Training (RT) Division of the MoEFCC.

In case of agro-biodiversity, specialized scientific/ training / extension organizations under the MoAFW, and MoFAHD have a network of national/ state/ local level organizations, and they primarily operate under the umbrella of ICAR/ NARES. Most of the existing organizations would require to revisit their ongoing programmes relevant to capacity development in light of the updated NBSAP and its enlarged scope and accordingly augment/ strengthen their current efforts.

Besides the Government, several non-governmental organizations and some corporate companies are also successfully implementing capacity building programs. Some examples are:

- The India Business & Biodiversity Initiative (IBBI) was taken up by CII with support from GIZ and MoEFCC, concurrent to India's Presidency of the COP-11 to CBD, when Indian companies joined hands to address the critical issue of biodiversity loss. The program has become a forerunner initiative within the CBD led Global Platform on Business and Biodiversity. A training course on 'Biodiversity Management for Businesses' has been institutionalized at the CII as a certified course. Regular training is offered to employees in the private sector. The program has helped to mainstream sustainable management of biological diversity into businesses.
- ITC has launched the women centric 'Mission Sunehra Kal' to provide livelihood training, including biodiversity based livelihoods, to rural women in the catchment area of their units.
- 'Intel Teach' empowers teachers to engage students with digital learning and STEM-related content like, Web 2.0, social networking and online tools and resources (including AI, data management, GIS etc., some of which are applied in biodiversity research). Teachers can effectively integrate technology into existing curricula. Intel® She focuses on STEM for girls, whereas, 'WiSci STEAM Camps' (Women in Science, Technology, Engineering, Arts, and Math camps) aim to bridge inequity gaps for females in knowledge and access to technology. Intel volunteers use 'Intel Future Skills curriculum' and enable girls around the world (and in India) to learn about the use of robotics, drones, coding, AI, etc. to address various societal problems, including those related to sustainability. Leadership training and mentorship, and confidence building is also provided.

In addition, several large NGOs like World Wide Fund for Nature -India, Wetland International South-Asia, Centre for Science & Environment, and many more, undertake research and capacity building exercises on various aspects of biodiversity and wildlife, focused on local communities.

Considering the complexity and multiplicity of issues, the need to consider cross- sectoral inter and intra departmental information, and evaluate the impacts of actions/interventions, an improved process for capacity development is proposed to be adopted (Fig 5.2) for Policy, Decision makers and Administrators, Professionals, CBOs and Students and Researchers.

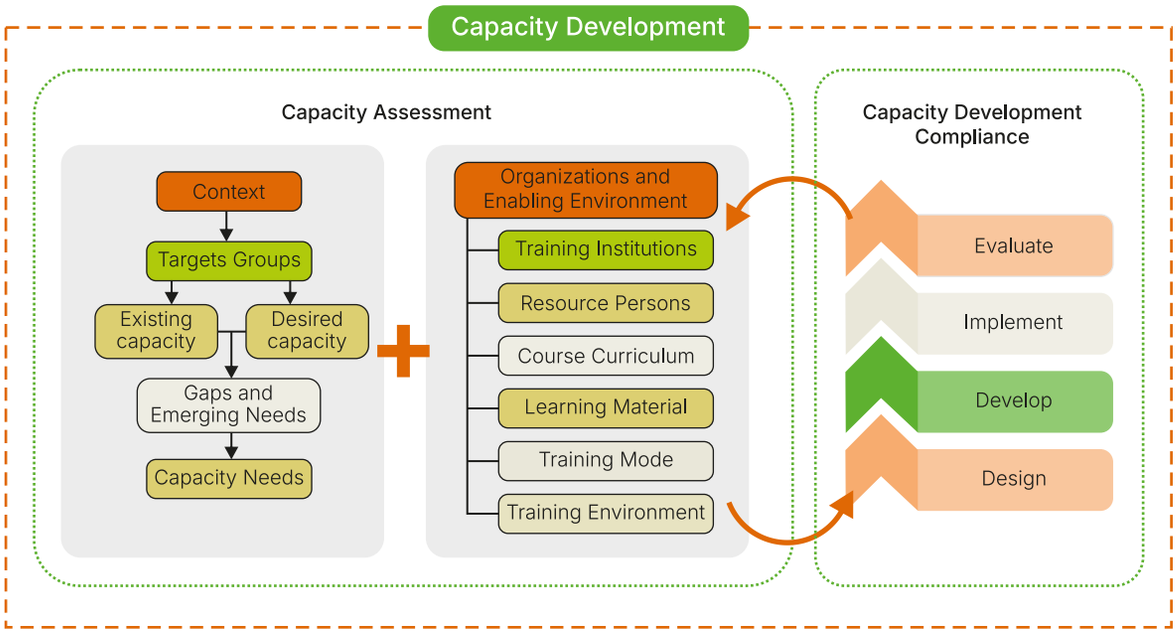


Fig 5.2. The updated process of capacity development for implementation of NBSAP

5.3.

Relevant Thrust Areas

A number of Action points have been identified against each Global/National Target and associated indicators by India (Chapter 4). In addition, to fast-track conservation, sustainable use and implementation of the ABS mechanism, India would focus on strengthening manpower and infrastructure at the Ministry, NBA, and associated R&D bodies and research Institutions at National level, SBBs; associated line departments at the State level; BMCs in rural and urban areas, and build hierarchy appropriate capacities to enable them to address new and emerging requirements in the field of biodiversity conservation and management. Priority will be accorded to:

I. Strengthening of participatory approach to biodiversity and natural resource management, especially at the ground level.

ii. Knowledge about the Legislative and Regulatory Environment, including control of Environmental and Wildlife Crime.

iii. Leadership and program management skills, including processes, procedures, performance, monitoring and evaluation, gender sensitivity, inclusion of disadvantaged groups and team building.

iv. Site/ programme appropriate modes of Operation and Governance.

v. Technology identification, use, transfer, IPRs, licensing procedures and negotiation skills.

vi. Resource Mobilization and Public Budget Allocation.

vii. Predictive Modeling, Performance Appraisal and Knowledge Sharing.

viii. Inter-institutional Linkages and cross-sectoral learning.

ix. Building upon lessons from traditional knowledge of local communities.

x. Raising a fleet of para-taxonomists to assist BMCs/ community workers.

xi. Knowledge and Information sharing and peer to peer Motivation.

To achieve the objective of building hierarchy appropriate capacities across all sections of the society, the country would endeavour to develop a consortium of lead Institutions with varied expertise which are engaged in conservation, encourage local level coordination at the administrative governance level, provide linkages and networking across public and private sector and most importantly respond to the requirements of the parliamentarians, judiciary, academia, customs, defence and paramilitary forces, police, media, and, cultural and spiritual institutions. The effort would be to amalgamate modern scientific techniques with traditional, ritualistic and cultural methods of conservation to implement KM-GBF NBSAP.

5.4.

Capacity Development Response – 'Assessment to Action'

Design and development of a capacity development plan in the context of implementation of NBSAP seeking conservation of biodiversity is not an easy task, especially when the subject is complex and it involves diverse sectors and organizations having different mandates and priorities, and people with varied educational and professional backgrounds, age groups, communication ability, experience, and availability of wide-ranging resources and tools. Implementation of NBSAP and conservation of biodiversity are strongly linked with the communities and the civil society at large. The task of capacity development becomes more challenging when the bottom-up approach of implementation is being advocated and adopted, and most inputs are meant for learning by adults, wide ranging workforce, and beneficiaries representing deprived and illiterate sections of the society. Creation of a successful programme of capacity development for such diverse stakeholders would require a careful consideration of learning objectives aiming for the development of knowledge, understanding, skills, application, and attitudes.

The next important stage is to plan for the response i.e., from 'assessment' to 'action'. The capacity development response would address capacities that could be strengthened while optimizing existing capacities that are already strong and well founded.

Capacity Development - Goals and Objectives

The CBD recognizes updated NBSAP aligned with the KM-GBF as the main vehicle for implementation of the global agenda towards conservation of biodiversity so that the global community is brought on a path towards achieving the 2050 Vision. Since NBSAP is considered as an umbrella process for achieving its goals and action-oriented targets, countries are expected to develop and implement national programmes/ strategic plans accordingly.

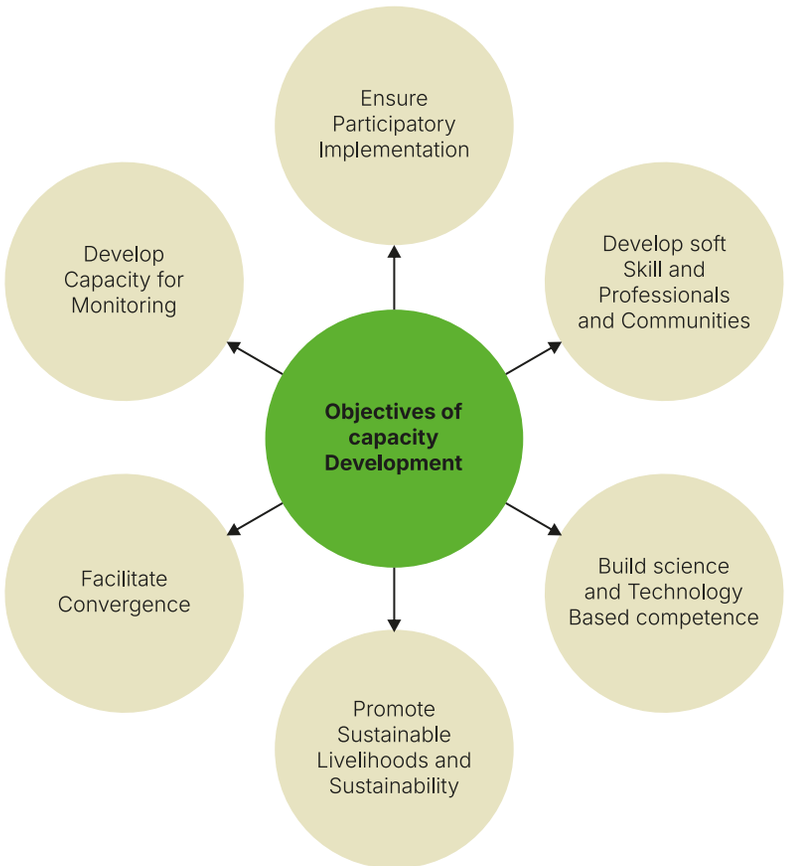
The BD Act, 2002 stipulates preparation/ development of NBSAP by the Central Government. The NBT 20 of the updated NBSAP deals with capacity development, and it reads as 'Promote scientific cooperation, strengthen capacity development, access to, and transfer of technology'.

Goals: In view of the above expectations of CBD and BD Act, the following goals are set-forth for the priority agenda on capacity development:

- Develop capacity of implementing agencies and other stakeholders for successful implementation of the NBSAP, and to achieve 2030 national biodiversity targets and 2050 vision.
- Enhance capacity to mainstream biodiversity across sectors.
- Promote scientific cooperation, transfer of technology, and capacity for effective conservation, sustainable use and ABS.

Objectives: In view of the above stated goals, six objectives have been framed for capacity development and they are presented in Fig 5.3.

Fig 5.3. Objectives of capacity development



The multi-pronged approach adopted towards capacity needs assessment reflects that individuals those are associated with conservation of biodiversity can be broadly grouped in the following three categories:

- Policy and Decision Makers – at the national, state and grassroots level including the Executive of the Panchayati Raj Institutions (PRIs) and Biodiversity Management Committees (BMCs).
- Professionals – at the concerned ministries, NBA, national/ state level scientific/ training organizations and other involved agencies; state governments; implementing agencies - state departments, and at the District and Field levels.
- CBOs, BMCs, JFMCs, Self Help Groups (SHGs), User Groups (UGs), farmers, herders, fisher folk, villagers, etc.

Thrust Areas Relevant to Three Levels of Capacity Development

Individuals grouped in above categories have different stake, roles, responsibilities, functions and expectations. The capacity assessment process also helped in identification and grouping of functions, recognition of specific activities and visualization of expected outcomes and thrust areas for capacity development in the context of individuals those are associated in any capacity or role relevant to conservation of biodiversity. Thrust areas relevant to three levels of capacity development in the context of updated NBSAP are presented in (Table 5.2).

Table 5.2. Identified Thrust Areas Relevant to Three Levels of Capacity Development in the Context of Updated NBSAP

Level of Capacity Development	Thrust Areas
Legislative and Regulatory Environment	Most sectors/ ministries/ departments connected with the subject of conservation and implementation of NBSAP at the national/ state/ field level have adequate backing of relevant policies, legislations, and institutions for enforcing desired regulations and law enforcement. However, existing efforts for ongoing activities of capacity development need continued support while initiatives and activities meant for control of illegal wildlife trade, protection of PAs, management of eco sensitive zones, management of groundwater resources, coastal zone regulation, control of pollution, enforcement of regulations on use of harmful chemicals/ pesticides, biosafety, and implementation of guidelines and directives issued at the time of forest and environmental clearances, and execution of environmental management plan in case of developmental project need strengthening. Awareness about the exiting legislative and regulatory environment is yet to percolate to the grassroots level, especially local communities living in proximity and dependent upon the inland and coastal wetlands, and marine ecosystems for subsistence and livelihoods. Since these fragile ecosystems face severe threats, ongoing awareness efforts need revamping so they can be more effective and minimize adverse impact.
Communication, Education, and Public Awareness (CEPA)	Resolute support for implementation of a comprehensive and effective strategy for CEPA in the context of three interconnected global triple crises (biodiversity loss, climate change, and pollution and waste) and their impact on ecology and socioeconomics is required to elicit people support for conservation and execution of NBSAP. As present NBSAP seeks a transformative approach, participatory approaches, a whole-of- government, and a whole-of-society approaches, importance of CEPA cannot be overemphasized. In view of the enlarged scope of NBSAP, several newer themes/ targets, and enhanced expectations, existing/ ongoing strategies and activities of CEPA being implemented by different ministries/ departments, need rethinking, reorientation, revamping, and strengthening wherever needed. BIOFIN studies undertaken at the global/ national/ state level have abundantly indicated that implementation of conservation activities at different hierarchical levels are mainly dependent upon the public funds, and also there is a wide gap between the financial resources required by various organizations and budgetary allocations by the governments. Capacity development efforts are urgently need to close this gap by creating awareness about various biodiversity financial solutions and also for the development for guidelines, rules, and facilitation of appropriate mechanism to garner finances for conservation and implementation of NBSAP from all sources. It is considered that the Sixteenth Finance Commission (XVI FC), and NITI Aayog would recognize the 'conservation of biodiversity' as a central theme. All sectors/ future developmental programmes, other interconnected global crises (climate change, pollution and waste), major environmental concerns, and agenda on disaster risk reduction, and sustainable development need to strongly link

Level of Capacity Development	Thrust Areas
National Public Budget Allocations; and Resource Mobilization	with the central theme. It is expected that the XVI FC would take note of this priority need and ensure that financial resources allocated to the MoEFCC and life owning/ life supporting ministries for the purpose of conservation are substantially enhanced, and a sustained flow to these conservation priority sectors in next five years and beyond is ensured. Harmful subsidies need reduction and repurposing. Capacity development of concerned ministries is envisaged to assess harmful subsidies as well as to develop innovative approaches to reduce and repurpose them. CBD, KM-GBF, and BIOFIN studies advocate for resource mobilization from all government and private sources. The Ministry of Finance is expected to develop broad guidelines and a mechanism to facilitate the process for receiving financial resources by government agencies from all other potential sources.
Governance and Modes of Operation	Conservation of biodiversity urgently seeks mainstreaming, sectoral integration, inter-agency cooperation, convergence, and effective coordination and cooperation among all concerned ministries/ departments, and between the central government and the state governments. In reality, nothing concrete has happened so far. Horizontal and vertical integration and appropriate mechanism for inter-ministerial cooperation are vital for conservation. As a part of the enabling environment, capacity development in this direction is urgently required.
Organizational Management Functions (Leadership, Inter-institutional Linkages and Programme Management)	Organizational management of public organizations, especially at the national and state level focuses on hierarchical governance, leadership, inter-institutional linkages, and programme management as they are well defined and streamlined. However, there is a general deficiency of organizational management functions in most private organizations, except at the large corporate houses, and also at the grassroots level. Certainly, these mechanisms are weak at the Panchayat/ field level, especially in case of CBOs like JFMCs, and newly created BMCs. It will take some more years to make most BMCs effective and functional. NBSAP not only seeks resolute support for these organizations but also advocates enhanced opportunity for capacity development. Making BMCs and other CBOs/ CSOs effective and functional in a stipulated time frame is vital, if the bottom-up approach to be adopted and effectively implemented.
Human and Financial Resources (HR Policies, Training, Knowledge Opportunities and Performance)	As in the case of organizational management functions, human resource development activities backed up by suitable HR policies, training and knowledge opportunities, performance evaluation and financial resources are somewhat taken care in case of national and state level government organizations. Certainly, support of HR policies and planned capacity development opportunities for officers/ frontline staff is needed. At the grassroots level, particularly CBOs including BMCs, there is evident deficiency of HR policies, opportunities for orientation/ sensitization and skill development, and financial resources. Capacity development activities at the grassroots level is one of the priority requirements.
Knowledge and Information (Knowledge, Technology and Innovations, Learning Material, Knowledge Sharing, and Motivation)	Opportunities for capacity development greatly varies across different sectors and hierarchies. Even in most SFDs, and other sectors, the lower frontline staff often suffer for want of knowledge and learning material, equipment/tools, and techniques and innovative technologies. Capacity development of frontline staff across most sectors need augmenting and strengthening. Official communication in several states/ UTs is in regional/ local languages. Most frontline staff hierarchies in such states/UTs deals with specialized technical field-based activities and using modern tools and technologies. Thus, they need technical manuals, illustrative field guides, other learning material,

Level of Capacity Development	Thrust Areas
	knowledge on policies, laws, guidelines, rules, and SOPs in their local/ regional language. The All-India Tiger Monitoring exercise by NTCA and WII in tiger range states thus, developed field guide in more than a dozen regional languages, other than Hindi. The same facilitation is vital while dealing with farmers, herders, fisher folk, tribal people, local communities and even BMCs. Efforts and support for publication of learning material and publicity material as far as possible must be local language.
Operational Capacity (Internal Structures, Processes, Procedures and Performance)	In general, operational capacity for conservation of wild biodiversity as well agrobiodiversity at the state and field level in case of several states/ UTs is weak due to inadequate staff strength, vacant posts, over-aged field staff, inaccessible areas, poor mobility, etc. Enhanced operational capacity would greatly increase overall efficiency of frontline staff.
Infrastructure and Facilities	In case of most states, sectors, and departments concerning biodiversity, there is general deficiency as well as poor maintenance of basic field level facilities – physical infrastructure, and vital facilities for communication and transportation (motorcycle/ four-wheel drive vehicle, motor boats, etc.) besides essential staff welfare measures. These deficiencies need to be addressed on a priority.
Job Requirements and Skill Levels (Technical and Managerial Skills)	Conservation of biodiversity, especially management of ecosystem, species, and genetic diversity in wild besides maintenance of agrobiodiversity is highly technical in nature. Technical, managerial and other specialized professional skills in case of individuals, professionals and communities' matter in overall performance of varied sectors, ministries, departments, and organizations involved in conservation agenda. Thus, most sectors, ministries, and departments and organizations associated with nurturing/ using/ regulating biodiversity make huge investments every year. Officers, staff members, and representatives of communities undergo a wide range of formal and informal capacity building programmes. Over the years, such capacity development opportunities by the national/ state governments, NGOs relevant to conservation have immensely helped individuals to perform their duties confidently and effectively. Combined efforts and substantial investments towards capacity development have made possible conservation successful. In absence of planned inputs for capacity development, so much success might have not been possible. Updated NBSAP with enlarged scope, emerging challenge, newer targets, and high expectations need revamping of current efforts for capacity development of individuals, professional and communities besides resolute support for implementation of year-round activities.
Competency Development (Formal Training and Education, Opportunities, Peer Exchange Opportunities, Access to Knowledge)	Focused resource inputs for policy and legal framework; conservation of land and sea areas rich in high biodiversity; ecosystem management and ecorestoration; landscape/ riverscape/ seascape approach to conservation; conservation, recovery and rehabilitation of threatened species; control of pollution and invasive alien species; climate change mitigation and disaster risk reduction; management of coastal and marine ecosystems; enhancing urban green, blue spaces and urban wildlife; sustainable natural resource management; maintenance of genetic diversity and conservation of germ plasm; agrobiodiversity; sustainable livelihoods; mainstreaming, sectoral integration, and convergence; CEPA; wildlife tourism; biodiversity monitoring; BIOFIN and resource mobilization; and technological advancements and innovations are needed for varied stakeholders, especially implementing agencies at the state and field levels. MoEFCC has been imparting formal training and education to the probationers of Indian Forest Service and State Forest Service/ Range Forest officers

Level of Capacity Development	Thrust Areas
	through IGNFA and DFE/ CASFOS/ State Forest Academy/ Ranger's College, respectively. These organizations are engaged in providing much desired multifaceted foundational training and education. Likewise, several other organizations (MoEFCC – IIFM, WII, ICFRE, FRI-DU; MoS – IIRS; MoHA- NIDM; MoHUA - NIHUA; MoAFW/ MoFAHD – ICAR; etc.) also offer formal training and education. Existing/ ongoing programmes and activities need revamping/ strengthening in light of updated NBSAP. A large number of organizations under different ministries have been generating information and knowledge on different aspects of biodiversity. Most current efforts need digitalization, creation of respective databases, and a centralized Knowledge Management Centre. ENVIS Nodes under the umbrella of MoEFCC also need consolidation, augmentation, improvement, strengthening, and ultimately linked with central biodiversity database maintained at the NBA to facilitate easy access of information and knowledge.
Team Building	Most aspects of conservation *viz.,* taxonomic studies, biodiversity assessments and monitoring, field-based conservation (protection, forest fire prevention and management, habitat management, natural resource management, ecorestoration, ecodevelopment, wildlife tourism, conservation of land races, crop wild relatives and animal breeds, capacity development, etc.) are not possible without vertical and horizontal integration and team work. Thus, importance of team building in different sectors and levels of implementation cannot be overemphasized. Enhancing capacity towards team building is thus one of the priority capacity development activities.

Sanjay Shukla





6

BIODIVERSITY FINANCE AND RESOURCE MOBILIZATION

6.1.

The Biodiversity Finance Initiative (BIOFIN)

COP 10 to CBD held at Nagoya, Japan, in 2010, highlighted the urgent global need to garner additional finance from all possible sources to meet the aspirations of global and respective national biodiversity goals of all Parties. In response to this, UNDP and the European Commission, during the COP 11, launched 'The Biodiversity Finance Initiative' (BIOFIN) (UNDP, 2016) with the objective to deliver a new methodological framework to facilitate identification, development, and implementation of optimal and evidence-based finance plans and solutions. The BIOFIN Workbook-2018 shifted the focus from methodology development to implementation of National Biodiversity Finance Plans and finance solutions. India was one of the first few countries to take a lead in implementation of BIOFIN project at the national level, as well as, in select states of the country.

The BIOFIN Workbook-2018 provided an innovative, step-wise and adaptable approach, starting with a deeper understanding of the drivers of biodiversity loss and helping in the identification, prioritization and implementation of actions by undertaking solutions which could lead to positive impact on biodiversity and the society. The BIOFIN process includes five key steps (Fig 6.1):

- Biodiversity Finance Policy and Institutional Review (PIR) - which includes analysis of existing drivers and challenges to biodiversity, analysis of policy environment, and understanding of existing fiscal solutions including fiscal policy options, harmful subsidies and barriers to implementation.
- Biodiversity Expenditure Review (BER) - through Biodiversity expenditure assessment and analysis from various funding sources by identification of Departments/sectors relevant to biodiversity, Identification of relevant schemes and programmes, their tagging and tracking over the years, and calculation of attributable share to biodiversity while recognizing that not all expenditures under a scheme would be specifically allocated to biodiversity conservation. This provides an improved understanding of biodiversity allocations and spending patterns by perusing budgets, allocations, and expenditures in different sectors and helps in identifying areas of potential fiscal reforms, especially where expenditures may not align with established policies/schemes. Thus, it helps to quantify direct and indirect financial resources dedicated to achieving positive biodiversity conservation outcomes and promote better biodiversity policies, financing mechanisms, and overall outcomes.

Harsh Rawat

- Financial Needs Assessment (FNA), which aims to make a comprehensive estimate of the financial resources needed to achieve national biodiversity action plans and the associated biodiversity targets.
- Development of comprehensive Biodiversity Finance Plan (BFP), which includes a shared vision of biodiversity conservation among all stake holders, an investment/ business case and an Action Plan.
- Implementation of the Action Plan leading towards execution of finance solutions; improved policies, plans and legislations; and enhanced integration of biodiversity in national and sub-national budgets.

The successful implementation of BIOFIN methodology is ultimately expected to provide multiple outcomes including insight on finance solutions; recognition of conservation as the investment priority for the private sector; revenue generation; realigned resources; and efficient resource use and cost prevention (UNDP, 2018).

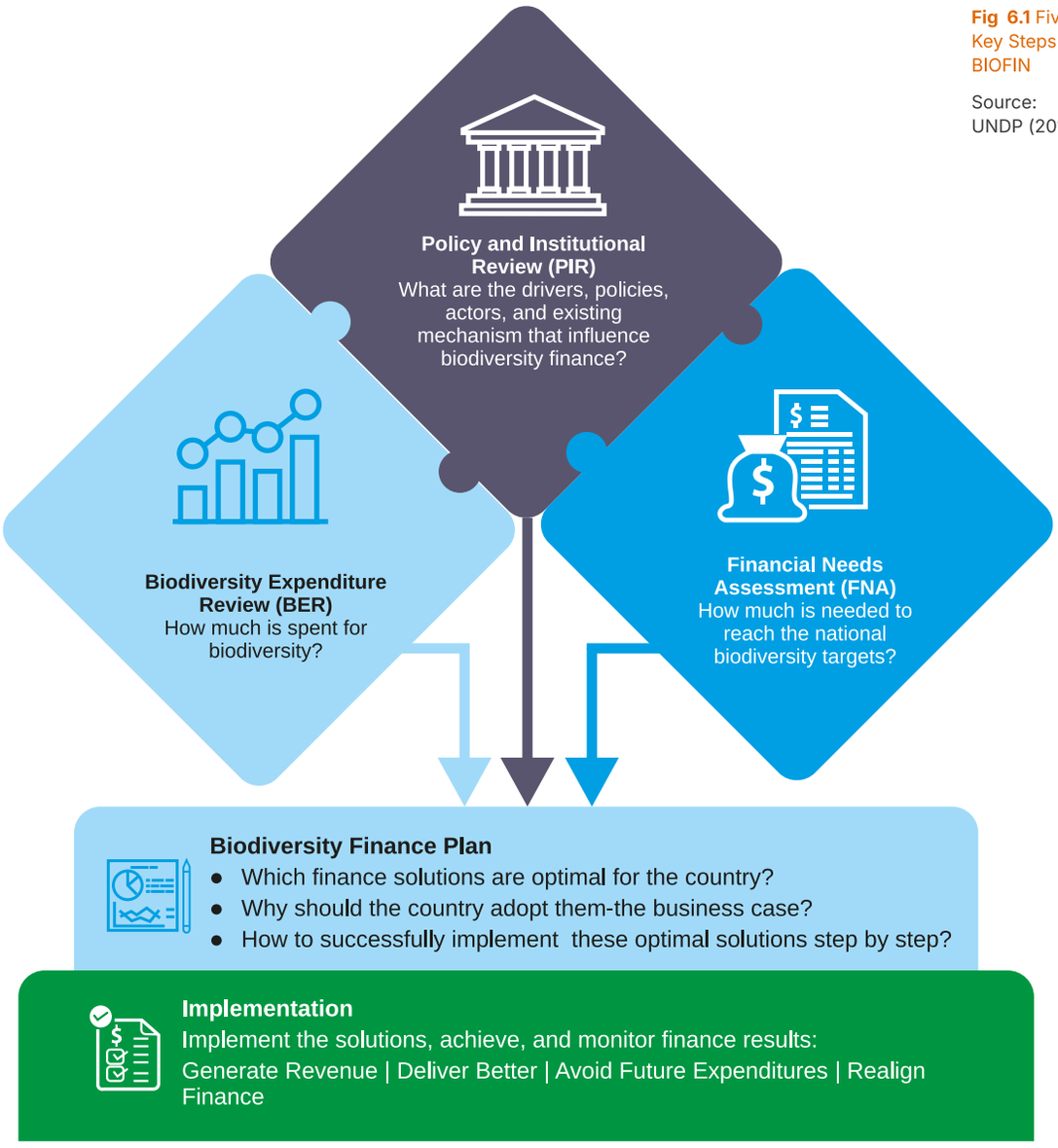


Fig 6.1 Five Key Steps of BIOFIN

Source: UNDP (2018)

6.2.

BIOFIN India- Assessment:

BIOFIN in India is anchored in the National Biodiversity Authority, while UNDP implements the programme in the country under the overall supervision of MoEFCC. India undertook the first assessment of Biodiversity Expenditure Review at the national level in 2013-2014. For this initial assessment, 77 schemes from 23 Ministries of the Government of India were considered. The overall funding for biodiversity conservation was estimated to be about 9,204.45 crore (USD 1,482.68 million). The study was based on 2013-2014 allocation figures (Nasim *et al.,* 2018).

Subsequently, another detailed assessment with expenditure figures for biodiversity- related schemes over a five-year planning period from 2012-2013 to 2016-2017 was undertaken with extensive consultations to review biodiversity expenditures in the country. This included 116 schemes from 24 Ministries and 29 Departments that were deemed to be biodiversity-related at the central government level in India. Based on the results of this extensive exercise, and recognizing that not all expenditures under a scheme were specifically allocated to biodiversity conservation, the 'attributable share' for biodiversity conservation was worked out (Soundrapandi, 2017) for each scheme individually based on Rio Markers (Fig 6.1 and Table 6.1). The biodiversity attributable expenditure was calculated to be INR 20,031.51 crore (USD 2.7 billion) approx. based on actual expenditure figures from the study period (2012-2013 to 2016-2017).

Table 6.1. Modified RIO-markers attribution adapted to Indian context

	Direct	Indirect Very High	Indirect High	Indirect Medium	Indirect Low	Indirect Marginal
Range	100-90%	90-75%	75-50%	50-25%	25-5%	5-0%
Target	95%	82.5%	62.5%	37.5%	15%	2.5%
Definition	Principal Intent of Organisation/ Activity is to accomplish one one of Three CBD objectives	Main intent to accomplish at least one of the CBD objectives coupled to a greater degree with other related / supportive intents	Main intent to accomplish at least one of the CBD objectives coupled to a lesser degree with other related/ supportive intents	One at least one of the CBD objectives or NBTs coupled with other-non biodiversity related intents/ action in balanced proportion	Intent primarily for non-biodiversity related activities but have a stated intent for positive BD impacts	Small BD impacts expected from much large non-BD programs with at least safeguards in place.
Example	Core MOEFCC schemes eg. tiger conservation, afforestation, Protection of PA and sanctuaries	Promotion of organic farming, river conservation	Groundwater management and regulation	Integrated watershed management Climate change adaptation, general awareness and training activities	Public welfare initiative such as development of WRIS of MoWR, RD & GR	Renewable energy, climate change mitigation
RIO markers	RIO markers 2			RIO markers 1		RIO markers 0

6.3.

Ministry wise Total and Attributable Expenditure of Available Funding

The BER in the form of total and attributable expenditures have been computed for five years from 2017-2018 to 2021-2022. Based on the actual expenditures of five-year data, projections till the year 2029-2030 have been computed. The 124 schemes of 21 Ministries and 2 Departments are presented in Table 6.2.

Name of the Ministries / Department	Number of Schemes				
	2017-18	2018-19	2019-20	2020-21	2021-22
MoEFCC	51	47	47	44	45
MoAFW	18	19	19	19	19
MoJS	9	8	8	8	8
MoC&I	7	7	7	6	6
MoDNER	7	6	7	5	5
MoES	4	4	5	5	5
MoNRE	4	4	4	4	5
DAE	5	5	5	5	4
MoAYUSH	3	3	3	3	4
DoS	3	4	3	3	3
MoHRD	4	4	4	3	3
MoRD	4	4	4	3	3
MoCoal	2	2	2	2	2
MoHUA	2	0	2	2	2
MoST	2	2	2	2	2
MoTA	1	1	1	1	2
MEITY	1	1	1	1	1
MoC	1	1	1	1	1
MoC&F	1	1	1	1	1
MoHA	1	1	1	1	1
MoP	2	2	1	1	1
MoT	1	1	1	1	1
MoFAHD	0	0	1	1	0
Total	**133**	**127**	**130**	**122**	**124**

Table 6.2. Ministries/ Departments having Schemes and Programmes Relevant for Biodiversity in the Country

6.4.

Biodiversity Expenditure Review (BER) for India

A brief account on previous efforts towards BER for India has already been presented in the foregoing section. For the current assessment, the biodiversity expenditure in the case of following 21 ministries and two Departments were taken into consideration: (i) Ministry of Environment, Forest and Climate Change; (ii) Ministry of Agriculture and Farmer's Welfare; (iii) Ministry of Fisheries, Animal Husbandry, and Dairying; (iv) Ministry of Jal Shakti; (v) Ministry of AYUSH; (vi) Ministry of Rural Development; (vii) Ministry of Tribal Affairs; (viii) Ministry of Housing and Urban Affairs; (ix) Ministry of Science and Technology; (x) Ministry of Power; (xi) Ministry of Earth Sciences; (xii) Department of Space; (xiii) Ministry of Tourism; (xiv) Department of Atomic Energy; (xv) Ministry of Chemicals and Fertilizers; (xvi) Ministry of Coal; (xvii) Ministry of Culture; (xviii) Ministry of Development of North Eastern Region; (xix) Ministry of Commerce and Industry; (xx) Ministry of Home Affairs; (xxi) Ministry of Education; (xxii) Ministry of Electronics and Information Technology; and (xxiii) Ministry of New and Renewable Energy.

6.5.

Ministry wise Total and Attributable Expenditure of Available Funding

The cumulative and attributed biodiversity expenditure during five financial years (2017-2018 to 2021-2022) are presented in Table 6.3 and the projected expenditures 2024-2025 till 2029-2030 is summarized in Table 6.4. The annual average attributable biodiversity expenditure for the period of 2017-2018 to 2021-2022 is estimated to be INR 32,207.13 Crores (Table 6.5). The projected annual average expenditure attributable to biodiversity till FY 2029-2030 is estimated to be INR 81,664.88 Crores. In order to arrive at an overall country-level figures, a more detailed assessment of BER incorporating State and Union Territory-level biodiversity-related expenditures, CSR, ODA and other Non-state actors needs to be carried out. The attributable and projected biodiversity expenditures are shown in Fig 6.2.

© Harsh Rawat



Table 6.3. Ministry-wise Total and Attributable Expenditure for Biodiversity Conservation for Five Year Period from 2017-18 to 2021-22

Ministry/ Department	Total Expenditure [INR Crore]					Total Expenditure (2017-18 to 2021-22) (INR Crore)	Annual Average Total Expenditure (INR Crore)	
	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022			
MoEFCC	2639.57	2617.95	2562.58	1973.62	2441.36	12235.08	2447.02	
MoAFW	10597.07	11515.80	10387.00	9838.27	7263.64	49601.78	9920.36	
MoJS	25902.23	21274.17	20361.06	17607.62	68640.28	153785.36	30757.07	
MoC&I	929.37	780.06	887.86	864.73	912.44	4374.46	874.89	
MoDNER	2217.80	1473.74	1330.81	942.34	1103.66	7068.35	1413.67	
MoES	581.13	583.04	966.23	603.01	803.28	3536.69	707.34	
MoNRE	614.90	600.22	150.87	337.05	568.06	2271.10	454.22	
MoAYUSH	408.69	519.57	559.03	452.67	508.53	2448.49	489.70	
MoHRD	315.16	205.41	38.59	14.20	21.43	594.79	118.96	
MoRD	55449.04	62107.73	71928.58	111386.47	98672.68	399544.50	79908.90	
MoCoal	508.35	206.67	103.35	60.96	71.03	950.36	190.07	
MoHUA	12001.37	0.00	10754.50	10693.36	15788.36	49237.59	3868.01	
MoST	5821.22	5850.11	6136.95	5388.64	6599.00	29795.92	5959.18	
MoTA	44.95	72.50	128.50	105.00	149.06	500.01	100.00	
MEITY	135.00	320.00	274.64	584.00	500.00	1813.64	362.73	
MoC	45.87	68.91	120.39	133.03	142.72	510.92	102.18	
MoC&F	47.64	42.50	35.51	65.00	68.50	259.15	51.83	
MoHA	70.32	108.02	127.94	113.30	238.11	657.69	131.54	
MoP	1500.95	2776.50	96.03	5.02	40.00	4418.50	883.70	
MoT	107.33	69.91	39.77	91.10	130.94	439.05	87.81	
MoFAHD	0.00	0.00	811.02	858.00	0.00	1669.02	333.80	
DAE	5.64	5.14	4.39	6.46	5.1	26.73	5.35	
DoS	2291.78	3682.28	3152.71	2121.37	1738.95	12987.09	2597.42	
Total	**122235.38**	**114880.23**	**130958.31**	**164245.22**	**206407.13**	**738726.27**	**147745.25**	

** For MoEFCC Biodiversity Attributable % represents the proportion of the total budget i.e., Rio marker-Direct criteria*

The remaining Ministries/ Departments Biodiversity Attributable % represents the proportion of the budget of biodiversity relevant schemes/ programme

Attributable Biodiversity Expenditure [INR Crore]					Total Attributable BD Expenditure (2017-18 to 2021-22) (INR Crore)	Annual Average Attributable BD Expenditure (INR Crore)
2017-2018	2018-2019	2019-2020	2020-2021	2021-2022		
2507.59	2487.05	2434.45	1874.94	2319.29	11623.33	2324.67
1794.85	1837.47	1670.75	1546.14	1173.98	8023.18	1604.64
6076.51	5721.80	4910.39	4111.29	13390.55	34210.53	6842.11
127.10	111.31	127.91	123.80	130.79	620.92	124.18
141.40	88.91	73.73	51.36	60.15	415.55	83.11
207.45	197.11	246.54	164.09	199.62	1014.81	202.96
15.37	15.01	3.77	8.43	14.20	56.78	11.36
337.17	428.65	461.20	373.45	423.46	2023.93	404.79
44.43	25.71	2.04	0.38	4.04	76.58	15.32
11654.90	13056.85	15126.39	23433.81	20758.21	84030.16	16806.03
8.67	3.96	2.12	1.23	1.36	17.33	3.47
3868.01	0.00	3631.23	3641.49	5297.94	16438.67	3287.73
145.53	146.25	153.42	134.72	164.98	744.90	148.98
6.74	10.88	19.28	15.75	22.36	75.00	15.00
3.38	8.00	6.87	14.60	12.50	45.34	9.07
2.58	3.87	6.77	7.48	8.02	28.71	5.74
1.19	1.06	0.89	1.63	1.71	6.48	1.30
1.76	2.70	3.20	2.83	5.95	16.44	3.29
37.52	69.41	2.40	0.13	1.00	110.46	22.09
2.68	1.75	0.99	2.28	3.27	10.98	2.20
0.00	0.00	506.89	536.25	0.00	1043.14	208.63
5.36	4.88	4.17	6.14	4.85	25.39	5.08
57.29	144.45	78.82	53.03	43.47	377.07	75.41
27047.48	**24367.08**	**29474.21**	**36105.21**	**44041.69**	**161035.67**	**32207.13**

Table 6.4. Ministry/ Department-wise Projected Expenditure till FY 2029-30

Ministry/ Department	Total Expenditure [INR Crore]						Total Expenditure (2024-25 to 2029-30) [INR Crore]	Annual Average Total Expenditure [INR Crore]	
	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30			
MoEFCC	2728.36	2838.67	2951.15	3065.41	3181.14	3298.13	18062.86	3010.48	
MoAFW	12452.92	13306.37	14160.76	15016.02	15872.07	16728.87	87537.01	14589.50	
MoJS	61508.45	72318.70	83144.90	93985.82	104840.35	115707.53	531505.75	88584.29	
MoC&I	979.02	1007.84	1036.98	1066.38	1096.00	1125.81	6312.03	1052.01	
MoDNER	1717.99	1793.80	1869.62	1945.44	2021.25	2097.07	11445.17	1907.53	
MoES	1043.25	1131.76	1221.34	1311.81	1403.01	1494.83	7606.00	1267.67	
MoNRE	631.48	661.72	691.97	722.22	752.46	782.71	4242.56	707.09	
MoAYUSH	528.72	539.43	550.14	560.84	571.55	582.26	3332.94	555.49	
MoHRD	392.34	463.00	534.47	606.58	679.24	752.36	3427.99	571.33	
MoRD	140397.46	155056.19	173544.68	188233.04	206749.16	221462.87	1085443.41	180907.23	
MoCoal	521.94	605.79	759.30	843.10	996.58	1080.34	4807.05	801.18	
MoHUA	19591.26	32945.61	25764.66	39119.01	31938.06	45292.41	194650.99	32441.83	
MoST	6967.29	7085.68	7446.41	7564.80	7925.49	8043.88	45033.55	7505.59	
MoTA	193.07	230.17	233.88	270.98	274.70	311.79	1514.59	252.43	
MEITY	903.25	886.56	1120.82	1104.23	1338.58	1322.08	6675.53	1112.59	
MoC	197.70	222.27	246.83	271.40	295.96	320.52	1554.68	259.11	
MoC&F	89.79	96.90	104.01	111.12	118.24	125.35	645.41	107.57	
MoHA	239.93	277.35	289.32	326.74	338.71	376.13	1848.17	308.03	
MoP	920.14	1915.63	998.67	1994.16	1077.19	2072.68	8978.48	1496.41	
MoT	141.85	151.39	160.94	170.48	180.03	189.57	994.26	165.71	
MoFAHD	841.25	852.88	863.20	872.22	880.04	886.76	5196.35	866.06	
DAE	5.74	5.36	5.74	5.72	5.71	5.75	34.01	5.67	
DoS	3093.57	3279.18	3475.93	3684.49	3905.56	4139.89	21578.61	3596.44	
Total	**256086.78**	**297672.24**	**321175.71**	**362852.00**	**386441.08**	**428199.59**	**2052427.41**	**342071.23**	

	Attributable Biodiversity Expenditure [INR Crore]						Total Attributable BD Expenditure (2024-25 to 2029-30) [INR Crore]	Annual Average Attributable BD Expenditure [INR Crore]
	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30		
	2591.94	2696.74	2803.59	2912.14	3022.08	3133.23	17159.72	2859.95
	3999.88	4274.01	4548.44	4823.14	5098.11	5373.31	28116.89	4686.15
	22321.42	26244.45	30173.28	34107.45	38046.56	41990.26	192883.44	32147.24
	136.87	140.90	144.97	149.08	153.22	157.39	882.42	147.07
	116.99	122.16	127.32	132.48	137.65	142.81	779.42	129.90
	302.13	327.76	353.70	379.90	406.31	432.90	2202.70	367.12
	25.24	26.76	28.36	30.06	31.87	33.78	176.06	29.34
	452.74	461.91	471.08	480.25	489.42	498.59	2854.00	475.67
	47.08	55.56	64.14	72.79	81.51	90.28	411.36	68.56
	23179.62	25599.78	28652.23	31077.28	34134.29	36563.52	179206.71	29867.78
	14.14	16.42	20.58	22.85	27.01	29.28	130.27	21.71
	5481.63	9218.18	7208.95	10945.50	8936.27	12672.82	54463.35	9077.22
	174.18	177.14	186.16	189.12	198.14	201.10	1125.84	187.64
	28.96	34.52	35.08	40.65	41.20	46.77	227.19	37.86
	22.58	22.16	28.02	27.61	33.46	33.05	166.89	27.81
	11.11	12.49	13.87	15.25	16.63	18.01	87.37	14.56
	2.24	2.42	2.60	2.78	2.96	3.13	16.14	2.69
	6.00	6.93	7.23	8.17	8.47	9.40	46.20	7.70
	23.00	47.89	24.97	49.85	26.93	51.82	224.46	37.41
	2.61	2.77	2.94	3.11	3.30	3.50	18.24	3.04
	525.78	533.05	539.50	545.14	550.02	554.23	3247.72	541.29
	5.45	5.09	5.45	5.43	5.43	5.46	32.31	5.38
	792.88	840.45	890.88	944.33	1000.99	1061.05	5530.60	921.77
	60264.50	**70869.55**	**76333.34**	**86964.37**	**92451.83**	**103105.69**	**489989.28**	**81664.88**

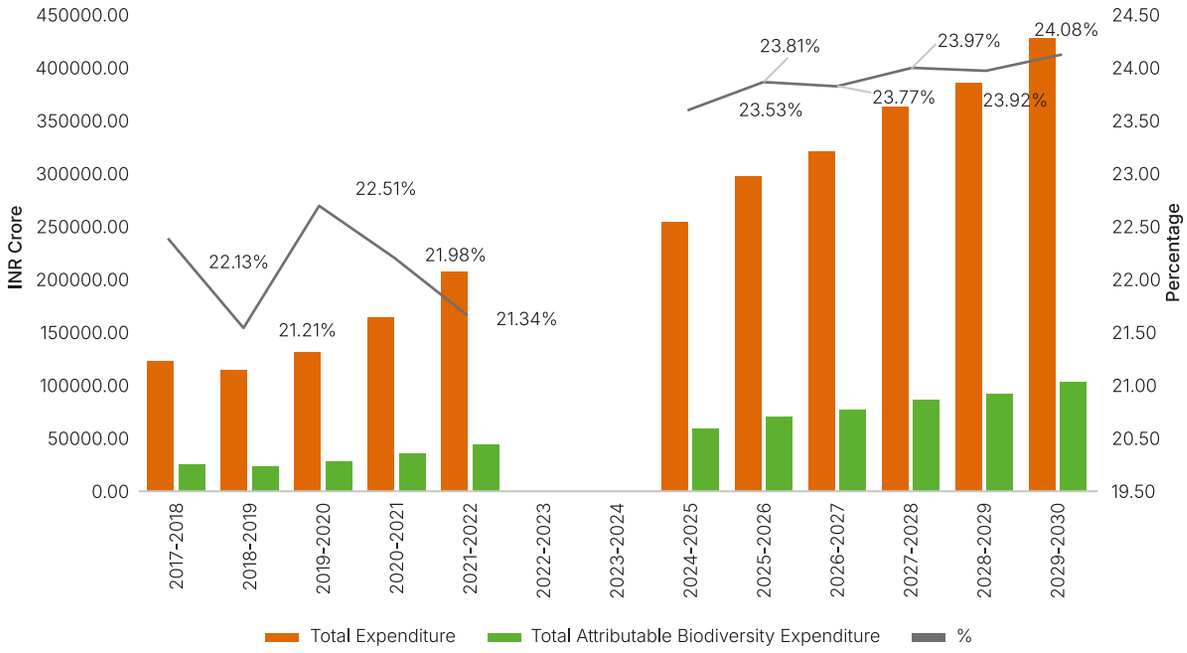
Table 6.5. Ministry/ Department-wise contribution to biodiversity expenditure for the FY 2017-18 to FY 2021-22

Sr. No.	Ministry/ Department	Total Expenditure (2017-18 to 2021-22) [INR Crore]	Annual Average Total Expenditure (2017-18 to 2021-22) [INR Crore]	Total Attributable BD Expenditure (2017-18 to 2021-22) [INR Crore]	Annual Average Attributable BD Expenditure (2017-18 to 2021-22) [INR Crore]	Percentage of Annual Average Attributable BD Expenditure
1	MoEFCC	12235.08	2447.02	11623.33	2324.67	7.22%
2	MoAFW	49601.78	9920.36	8023.18	1604.64	4.98%
3	MoJS	153785.36	30757.07	34210.53	6842.11	21.24%
4	MoC&I	4374.46	874.89	620.92	124.18	0.39%
5	MoDNER	7068.35	1413.67	415.55	83.11	0.26%
6	MoES	3536.69	707.34	1014.81	202.96	0.63%
7	MoNRE	2271.10	454.22	56.78	11.36	0.04%
8	MoAYUSH	2448.49	489.70	2023.93	404.79	1.26%
9	MoHRD	594.79	118.96	76.58	15.32	0.05%
10	MoRD	399544.50	79908.90	84030.16	16806.03	52.18%
11	MoCoal	950.36	190.07	17.33	3.47	0.01%
12	MoHUA	49237.59	3868.01	16438.67	3287.73	10.21%
13	MoST	29795.92	5959.18	744.90	148.98	0.46%
14	MoTA	500.01	100.00	75.00	15.00	0.05%
15	MEITY	1813.64	362.73	45.34	9.07	0.03%
16	MoC	510.92	102.18	28.71	5.74	0.02%
17	MoC&F	259.15	51.83	6.48	1.30	0.00%
18	MoHA	657.69	131.54	16.44	3.29	0.01%
19	MoP	4418.50	883.70	110.46	22.09	0.07%
20	MoT	439.05	87.81	10.98	2.20	0.01%
21	MoFAHD	1669.02	333.80	1043.14	208.63	0.65%
22	DAE	26.73	5.35	25.39	5.08	0.02%
23	DoS	12987.09	2597.42	377.07	75.41	0.23%
	Total	**738726.27**	**141765.75**	**161035.67**	**32207.13**	**100%**

** For MoEFCC Biodiversity Attributable % represents the porportion of the total budget i.e., Rio marker-Direct criteria*

The remaining Ministries/ Departments Biodiversity Attributable % represents the proportion of the budget of biodiversity relevant schemes/ programme

Fig 6.2. Total and Attributable Biodiversity Expenditures (INR Crore)



Finance Solutions

The BIOFIN Workbook 2018 outlines potential finance solutions for biodiversity conservation. The Biodiversity Finance Plan for India, prepared by the NBA in 2019, explores likely finance solutions while highlighting possible constraints. Globally, new and innovative finance solutions are still in experimental/trial stage. It will take some more time for GoI ministries and departments to attract and utilize finance solutions beyond government and externally aided funding. Creating an enabling environment to attract other financial resources, raise private sector awareness by presenting a business case for biodiversity, and build government capacity to use and operationalize finances from diverse sources is essential.

A broad menu of new and innovative finance solutions includes:

- Corporate Social Responsibility (CSR): It is a major potential source of private sector finance.
- Creation of Conservation Fund for PAs: This has been adopted by Tiger Reserves and prominent PAs in various states, using funds generated from ecotourism for building the Conservation Fund.
- Crowdfunding: This is gaining popularity and could be another way to finance the rehabilitation of endangered species.
- Public-Private Partnerships (PPP): It is becoming increasingly important considering the rising requirements of rapid urbanization, industrial growth, and infrastructure demands. The PPP has already emerged as an important finance solution for such departments and activities. Biodiversity conservation modalities need development in this area.
- Green Fund: Green finance deals with financing investments that generate environmental benefits.
- Green Bonds: The International Capital Markets Association's Green Bond Principles serve as a guide for international funds to invest in green projects. In addition to climate change, several other green project categories could be potential recipients of such investments.
- Payments for Ecosystem Services (PES): They are incentives provided to farmers or landowners for managing their land to deliver specific ecological services. Creating a new economy for ecosystem services necessitates innovative policies and tools to realign economic incentives, rewarding the restoration or conservation of these services. PES serves as an umbrella term for various economic arrangements designed to promote ecosystem services conservation. Different tools under PES include 'Direct Public Payments' made by the government directly to ecosystem service providers. Regarding 'Direct Private Payments', private entrepreneurs or organizations (non-profit or for-profit) act as buyers of the ecosystem service instead of the government. Moreover, tax incentives are indirect government compensations to landowners for protecting ecosystem services. In the case of certification programs, when consumers purchase certified products, they pay for both the product and the sustainable practices involved in its production and delivery.

- Access and Benefit Sharing (ABS) and Bioprospecting: Article 15 of the CBD addresses the theme of Access and Benefit Sharing (ABS), specifically how genetic resources are accessed and how users and providers agree on the fair and equitable sharing of benefits resulting from their use. The BD Act empowers the NBA and SBBs to handle matters related to research, commercial utilization, bio-surveys, and bio-utilization of biological resources, ensuring fair and equitable sharing of the benefits. Although this is a relatively new area for SBBs/ UTBCs and BMCs, it holds immense potential and benefits. Strengthening these institutions, fostering innovations, and developing appropriate mechanisms are essential. Bioprospecting, or biodiversity prospecting, involves exploring natural sources for small molecules, macromolecules, and biochemical and genetic information that can be developed into commercially valuable products in agriculture, aquaculture, bioremediation, cosmetics, nanotechnology, or pharmaceuticals. While some preliminary and pilot efforts have been made in the country, there is still much that can be learnt from Costa Rica's bioprospecting experiences.
- CAMPA: The Compensatory Afforestation Fund (CAF) Act, enacted by the Union Government in 2016, established the National Compensatory Afforestation Fund Management and Planning Authority (CAMPA). The Act mandates the creation of a fund and authority for each state, along with mechanisms to transfer the National Fund accumulated over the years. This fund is being collected for the diversion of forest land for non-forest purposes on account of compensatory afforestation, penal compensatory afforestation, net present value, penal NPV, wildlife management costs, catchment area treatment, and accrued interest. The National Fund, generated over the years, is now being transferred to and utilized by States / UTs for various purposes as specified in the CAMPA Rules of 2018.

The availability of above potential financial solutions essentially relies on the development of innovative packages, models, enterprises, and crucial facilitating /supporting mechanism by the Ministry of Finance so the central ministries/ government agencies/ departments at the national, state and field level can avail such funds. Furthermore, the shift from exclusive public funding to the adoption of these financial solutions will only be successful if there is a significant change in perspective and mindset among all stakeholders. This requires a transparent and trustworthy enabling environment created by national and sub-national governments to encourage private entrepreneurs, business houses, donors, and international agencies to support these initiatives. It is crucial for the government at the national and state levels to promptly implement measures to attract alternative funding solutions for conservation of biodiversity and other related activities.

© Harsh Rawat





7

NATIONAL BIODIVERSITY TARGETS AND MONITORING FRAMEWORK

A N Shukla

7.1

National Monitoring Framework

An overarching framework for biodiversity monitoring for the country has been built upon the previous monitoring framework through an extensive national consultative process and the valuable inputs from the Working Group - NBSAP constituted by the NBA. Further, the CBD on 18 May, 2024 circulated a document (CBD/SBSTTA/REC/26/1) on Monitoring Framework for the KM-GBF based on inputs by AHTEG. Revised indicators provided by the AHTEG in its document of 18 May, 2024 were also considered and appropriately incorporated the Biodiversity Monitoring Framework developed for the country and the same was finalized. It aligns with the requirements of KM-GBF and presented in Table 7.1. The monitoring framework highlights headline, component, complimentary, and national indicators against each NBT besides a potential lead agency has been identified for all indicators listed against each of the target. Since these indicators come under the domain of different ministries, departments, and organizations, collaborating/ supporting agencies have also been identified, and listed. The need for identification and designating a Lead Agency for each target was considered critical for effective coordination, development of relevant indicators, adoption of robust methodology and field validation, field level implementation, data collection and collation, storage of data sets and monitoring results, and reporting and dissemination of monitoring outcomes. The Lead Agency will be able to invite and involve other agencies if the need arises. The monitoring framework also highlights a periodicity of monitoring and reporting. The Lead Agency will be responsible for submitting the data sets and monitoring results to NBA for the purpose of National Reporting. It is also considered appropriate that on behest of the MoEFCC, nodal ministry for biodiversity in the country, the NBA will be responsible to coordinate monitoring efforts with all Lead Agencies identified for each NBT as well as corresponding Collaborating/ Supporting Agencies and will also be responsible for the development and management of NBMS besides National Reporting to CBD through the Clearing House Mechanism (CHM).

The National Biodiversity Monitoring Framework highlighting identified/ potential indicators, responsible lead agency and collaborating/ supporting agencies and the proposed periodicity of monitoring is presented in Table 7.1. Based on feedback from the regional consultations, and interministerial consultative process, the Monitoring Framework has been finalized. The final monitoring Framework is an integral part of the updated NBSAP. Once the Framework as a part of NBSAP would be approved and adopted, the Lead Agencies and Collaborating/ Supporting Agencies will be notified by the MoEFCC/ NBA and entrusted the target specific responsibility.

Table 7.1. National biodiversity targets and biodiversity monitoring framework

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
Target 1 **Biodiversity-inclusive integrated land/ sea use planning** Ensure that all areas are under participatory integrated biodiversity- inclusive spatial planning and effective management processes addressing land and sea use change, to bring the loss of areas of high biodiversity importance, including ecosystems of high ecological integrity, close to zero by 2030, while respecting the rights of Local Communities (LCs).	A.2 Extent of natural ecosystems 1.1 Per cent of land and seas covered by biodiversity-inclusive spatial plans	Protected Area Representativeness & Connectedness (PARC-Connectedness)	Forest area as a proportion of total land area Proportion of transboundary basin area with an operational arrangement for water cooperation	1.1. Trends in reflection of biodiversity and ecosystem services in policy decisions, planning and reporting processes	i. Forest Survey of India (FSI) ii. National Centre for Coastal Research (NCCR) iii. National Remote Sensing Centre (NRSC) iv. Indian Institute of Forest Management (IIFM)	**Lead Agencies:** Forest Survey of India (FSI), National Remote Sensing Centre (NRSC), National Centre for Coastal Research (NCCR), Indian Institute of Forest Management (IIFM) **Collaborating/ Supporting Agencies** Space Applications Centre (ISRO-SAC), Wildlife Institute of India (WII), National Centre for Sustainable Coastal Management (NCSCM), National Institute of Oceanography (NIO), Central Marine Fishery Research Institute (ICAR-CMFRI), Directorate of Economics and Statistics (DES) – MoAFW, State Forest Department (SFDs), State Wetland Authorities, State Remote Sensing Applications Centre(s), CSIR-National Institute of Oceanography, BSI, ZSI, MoPR, MoRD, ICFRE, NBA, SBBs.	2 Year
				1.2. Changes in area under riverine ecosystems and wetlands (inland and coastal)	i. Space Applications Centre (ISRO-SAC) ii. National Centre for Sustainable Coastal Management (NCSCM) iii. State Wetland Authorities		
				1.3. Number of wetlands under integrated management plans	i. State Wetland Authorities ii. State Remote Sensing Applications Centre(s)		
				1.4. Extent of area under shifting cultivation on 10-year/ 5-year/ 3-year cycle	i. Directorate of Economics and Statistics (DES) ii. Ministry of Agriculture and Farmers Welfare (MoAFW)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
				1.5. Trends in finalizing Integrated Coastal Zone Management (ICZM) plan for identified priority stretches – those with sensitive ecosystems, facing severe antropogenic pressure due to tourism, etc	i. National Centre for Sustainable Coastal Management (NCSCM) ii. State Forest Department (SFDs)		
				1.6. Trends in preparing management plans for specific areas identified within Critically Vulnerable Coastal Areas (CVCAs) to reduce anthropogenic pressure	i. National Centre for Sustainable Coastal Management (NCSCM) ii. State Forest Department (SFDs)		
Target 2 **Ecosystem restoration** Ensure that by 2030, at least the prioritized 30 per cent areas of degraded terrestrial, inland water, and marine and coastal ecosystems are under effective restoration, in order to enhance biodiversity and ecosystem functions and services, eco logical integrity and connectivity.	2.1 Area under restoration	Land degradation (Sustainable Development Goal indicator 15.3.1)	Proportion of Key Biodiversity Areas in favourable condition	2.1. Trends in forest cover	i. Forest Survey of India (FSI) ii. Indian Council of Forestry Research and Education (ICFRE) iii. Forest Research Institute (FRI)	**Lead Agencies:** Indian Council of Forestry Research and Education (ICFRE) **Collaborating/ Supporting Agencies** National Afforestation and Ecodevelopment Board (NAEB), Green India Mission (GIM), Forest Survey of India (FSI), Space Applications Centre (ISRO-SAC), National Remote Sensing Centre (NRSC), National Institute of Hydrology (NIH), Eco Task Force, Wildlife	2 Year
				2.2. Trends in aquatic ecosystems	i. Space Applications Centre (ISRO-SAC) ii. National Centre for Sustainable Coastal Management (NCSCM) iii. National Institute of Hydrology (NIH) iv. Wetland Division, MoEFCC		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
				2.3. Trends in mangrove cover and coastal area management	i. Coastal Zone Management Authorities ii. State Wetland Authorities iii. National Mission for Clean Ganga (NMCG) iv. National River Conservation Directorate (NRCD)	Institute of India (WII), ICFRE- Centre of Excellence for Sustainable Land Management, Forest Research Institute (FRI), Ministry of Jal Shakti (MoJS), Ministry of Rural Development (MoRD), National Mission for Clean Ganga (NMCG), National River Conservation Directorate (NRCD), National Centre for Sustainable Coastal Management (NCSCM), Central Mine Planning and Design Institute (CMPDI), Indian Council of Agricultural Research (ICAR), State Forest Department (SFDs), MS Swaminathan Foundation; State Forest Research Institutes (SFRI); CPCB, State Pollution Control Boards/ Committees, Jawaharlal Nehru Tropical Botanic Garden & Research Institute (JNTBGRI), Kerala; State Agricultural Institutes; Coastal Zone Management Authorities; State Wetland Authorities; WWF-India; International Agricultural Research Centre(s), Nature Conservation Foundation, Ecological Restoration Al-	
				2.4. Trends in river water quality in river stretches of high concern	i. National River Conservation Directorate (NRCD) ii. National Mission for Clean Ganga (NMCG) iii. Ministry of Jal Shakti (MoJS) iv. Central Pollution Control Board (CPCB)/ State Pollution Control Boards (SPCBs)		
				2.5. Trends in afforestation and restoration	i. National Afforestation and Ecodevelopment Board (NAEB) ii. Green India Mission (GIM) iii. State Forest Department (SFDs) iv. Forest Research Institute (FRI)		
				2.6. Trends in Combating desertification	i. National Afforestation and Ecodevelopment Board (NAEB) ii. ICFRE- Centre of Excellence for Sustainable Land Management		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
					iii. ICAR-Central Arid Zone Research Institute (CAZRI) iv. Forest Research Institute (FRI) v. Nature Conservation Foundation vi. Ecological Restoration Alliance	liance, MoPR, MoRD, DBT, ICAR-Central Arid Zone Research Institute (CAZRI), ICAR-National Bureau of Soil Survey & Land Use Planning (NBSSLUP	
				2.7. Trends in the maintenance of natural fertility in agricultural lands	i. Indian Council of Agricultural Research (ICAR) ii. ICAR-National Bureau of Soil Survey & Land Use Planning (NBSSLUP)		
				2.8. Extent of abandoned areas of shifting cultivation	i. Indian Council of Agricultural Research (ICAR)		
				2.9. Extent of restoration of degraded wetlands	i. State Wetland Authorities ii. Coastal Zone Management Authorities iii. Ecological Restoration Alliance		
Target 3 **Conserve biodiversity in land, water and sea** Ensure and enable that by 2030, at	3.1 Coverage of protected areas and Other effective area-based conservation measures	Protected Area Connectedness Index (PARC-connectedness)	Proportion of Key Biodiversity Areas in favourable condition	3.1. Trends in PA coverage under four legal categories (National Park, Wildlife Sanctuary, Community Reserve and Conservation Reserve)	i. Wildlife Institute of India (WII) ii. Wildlife Division, MoEFCC	**Lead Agencies:** Wildlife Institute of India (WII), Ministry of Earth Science (MoES) - Centre for Marine Living Resources and Ecology (CMLRE)	2 Year

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
least 30 per cent of terrestrial, inland waters, and coastal and marine areas, especially areas of importance of biodiversity, ecosystem functions and services, are effectively conserved through ecologically representative, well-connected protected areas and Other Effective Area-based Conservation Measures (OECMs). Also, integrate tribal areas wherever applicable into wider landscapes/ seascapes and ensure that sustainable use is legal and consistent with conservation outcomes while respecting the rights of Local Communities (LCs), including their traditional territories.			The number of protected areas that have completed a Site-level Assessment of Governance and Equity	3.2. Trends in Other Area-Based Conservation Measures	i. National Biodiversity Authority (NBA) ii. State Biodiversity Boards (SBBs)	**Collaborating/ Supporting Agencies** Forest Survey of India; National Remote Sensing Centre (NRSC); National Biodiversity Authority (NBA), National Tiger Conservation Authority (NTCA), Bombay Natural History Society (BNHS), Wetland Division, MoEFCC, Wetland International – South Asia, National Centre for Sustainable Coastal Management (NCSCM), State Biodiversity Boards (SBBS), International Union for Conservation of Nature (IUCN), UNESCO C2C, Botanical Survey of India (BSI), Zoological Survey of India (ZSI), Central Pollution Control Board (CPCB), State Pollution Control Boards (SPCBs), Ministry of Agriculture & Farmers Welfare (MoAFW), and Indian Council of Agriculture Research (ICAR); State Agriculture Department (SADs): Biodiversity related Centre(s) of Excellence, WWF-India, UNDP-India, MOPR, MoRD, Foundation for Ecological Security,	
				3.3. Trends in coverage under Biodiversity Heritage Sites (BHS)	i. National Biodiversity Authority (NBA) ii. State Biodiversity Boards (SBBs)		
				3.4. Trends in wetlands brought under integrated management	i. Wetland Division, MoEFCC ii. State Wetland Authorities iii. Wetland International – South Asia		
				3.5. Trends in Important Bird Areas (IBAs)	i. Bombay Natural History Society (BNHS) ii. Zoological Survey of India (ZSI)		
				3.6. Trends in forest cover in four canopy density categories	i. Forest Survey of India (FSI) ii. National Remote Sensing Centre (NRSC)		
				3.7. Trends in areas of exceptionally rich agrobiodiversity and their threat status	i. Indian Council of Agriculture Research (ICAR) ii. State Agriculture Department (SADs) iii. State Biodiversity Boards (SBBs)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
				3.8. Trends in extent and conservation of coastal and marine areas	i. National Centre for Sustainable Coastal Management (NCSCM) ii. Wildlife Institute of India (WII)	Corbett Foundation, National Institute of Disaster Management (NIDM).	
				3.9. Trends in extending additional protection to coastal areas identified as highly sensitive within coastal ESAs	i. National Centre for Sustainable Coastal Management (NCSCM) ii. Wildlife Institute of India (WII)		
				3.10. Trends in approved master plans for notified ESZs around protected areas	i. Ministry of Environment, Forest and Climate Change (MoEFCC) ii. State Forest Department (SFDs)		
				3.11. Trends in approved management plans for PAs/ BHSs/ OECMs	i. Wildlife Division, Ministry of Environment, Forest and Climate Change (MoEFCC) ii. National Biodiversity Authority (NBA)		
Target 4 **Manage species and genetic diversity** Ensure urgent management actions to halt human-induced extinction	A.3 Red list Index	Number of plant and animal genetic resources for food and agriculture secured in medium or long-term conservation	Red List Index (wild relatives of domesticated animals) Number of island invasive alien species eradications	4.1. Population trends of selected species	i. Wildlife Institute of India (WII) ii. Zoological Survey of India (ZSI) iii. Botanical Survey of India (BSI) iv. Indian Council of Forestry Research and Education (ICFRE)	**Lead Agencies:** Wildlife Institute of India (WII), Zoological Survey of India (ZSI), Botanical Survey of India (BSI), Indian Council of Forestry Research and Education (ICFRE)	2 Year

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
of known threatened species, as well as recovery and conservation. Also, maintain and restore the genetic diversity within and between populations of native wild and domesticated species to maintain their adaptive potential through *in situ* and *ex situ* conservation and sustainable management practices and effectively manage human-wildlife interactions		facilities Proportion of local breeds classified as being at risk of extinction		4.2. Status and population trends of terrestrial and marine species under the Integrated Development of Wildlife Habitats (IDWH) Scheme	i. Wildlife Institute of India (WII) ii. Wildlife Division, Ministry of Environment, Forest and Climate Change (MoEFCC)	**Collaborating/ Supporting Agencies** Central Zoo Authority (CZA), National Tiger Conservation Authority (NTCA), Indian Council of Agriculture Research (ICAR), Indian Veterinary Research Institute (IVRI), Centre for Cellular and Molecular Biology (CCMB), National Bureau of Plant Genetic Resources (NBPGR), National Bureau of Animal Genetic Resources (NBAGR), National Bureau of Fish Genetic Resources (NBFGR), National Bureau of Agriculturally Important Insects (NBAII), National Bureau of Agriculturally Important Microorganisms (NBAIM), Wildlife Institute of India (WII), Indian Council of Forestry Research and Education (ICFRE), Central Inland Fishery Research Institute (CIFRI), Central Marine Fisheries Research Institute (CMFRI), National Fish Development Board (NFDB), National Centre for Sustainable Coastal Management (NCSCM), MoAFW, MoFAHD, MoJS, MoRD, SFDs, International	
				4.3. Trends in the status of Indian plant and animal species included in the Red Data Book	i. Botanical Survey of India (BSI) ii. Zoological Survey of India (ZSI) iii. International Union for Conservation of Nature (IUCN)		
				4.4. Conservation status of species.	i. International Union for Conservation of Nature (IUCN) ii. National Tiger Conservation Authority (NTCA) iii. National Bureau of Plant Genetic Resources (NBPGR) iv. National Bureau of Animal Genetic Resources (NBAGR) v. National Bureau of Fish Genetic Resources (NBFGR) vi. National Bureau of Agriculturally Important Insects (NBAII) vii. National Bureau of Agriculturally Important Microorganisms (NBAIM)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
				Animal genetic diversity 4.5. Trends in number of indigenous/ domesticated breeds *(in situ)*	i. Indian Council of Agriculture Research (ICAR) ii. National Bureau of Animal Genetic Resources (NBAGR) iii. National Bureau of Fish Genetic Resources (NBFGR) iv. National Bureau of Agriculturally Important Insects (NBAII) v. National Bureau of Agriculturally Important Microorganisms (NBAIM)	Union for Conservation of Nature (IUCN), World Wide Fund for Nature-India (WWF-India), TRAFFIC-India, and Nature Conservation Foundation (NCF); National Institute of Biotic Stress Management (NIBSM); Kerala Forest Research Institute (KFRI), M S Swaminathan Botanical Garden (MSSBG), UNDP-India, MoAYUSH, Protection of Plant Varieties and Farmers' Rights Authority (PPVFRA).	
				4.6. Trends in populations of domestic breeds (*in situ*)			
				4.7. Initiatives/ measures taken to conserve indigenous animal breeds			
				4.8. Trends in Animal Genetic Resources accessions in *ex situ* collection			
				Plant genetic diversity 4.9. Trends in numbers of indigenous varieties (*in situ*)	i. Indian Council of Forestry Research and Education (ICFRE)– IFGTB ii. Indian Council of Forestry Research and Education (ICFRE) – FRI iii. Indian Council of Agriculture Research (ICAR) iv. Protection of Plant Varieties and Farmers' Rights Authority (PPVFRA) v. National Bureau of Plant		
				4.10. Trends in area under cultivation and production/ yield (*in situ*)			

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
				4.11. Initiatives/ measures taken to conserve indigenous crop varieties and their wild relatives	Genetic Resources (NBPGR), vi. Kerala Forest Research Institute (KFRI)		
				4.12. Trends in germplasm accessions in *ex situ* collection			
				4.13. Trends in management of human wildlife interactions	i. Wildlife Division, Ministry of Environment, Forest and Climate Change (MoEFCC) ii. National Tiger Conservation Authority (NTCA) iii. Project Elephant iv. Chief Wildlife Wardens (CWLWs) v. State Forest Department (SFDs)		
				4.14. Trends in species recovery	i. National Tiger Conservation Authority (NTCA) ii. Wildlife Institute of India (WII) iii. Central Zoo Authority (CZA) iv. Indian Council of Forestry Research and Education (ICFRE),		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
					v. World Wide Fund for Nature (WWF) vi. Wildlife Trust of India (WTI) vii. Indian Council of Agricultural Research (ICAR) viii. State Forest Department (SFDs)		
Target 5 **Sustainable harvest, trade, and use of wild species** Ensure that the use, harvesting, and trade of wild species are sustainable, safe, and legal, preventing overexploitation, minimizing impact on non-target species and ecosystems, and reducing the risk of pathogen spillover. Apply the ecosystem approach while respecting and protecting customary sustainable use	5.1 Proportion of fish stocks within biologically sustainable levels	Red List Index for used species Degree of implementation of international instruments aiming to combat illegal, unreported and unregulated fishing	Red List Index (for internationally traded species) Marine Stewardship Council Fish Certified Catch Bycatch of vulnerable and non-target species Biodiversity-based trade, growth rate	5.1. Proportion of fish stocks within biologically sustainable levels	i. ICAR-Central Marine Fisheries Research Institute (CMFRI) ii. ICAR-Central Inland Fisheries Research Institute (CIFRI) iii. ICAR-Central Institute for Brackish water for Aquaculture (CIBA)	**Lead Agencies:** Central Marine Fisheries Research Institute (CMFRI), National Fisheries Development Board (NFDB), National Medicinal Plant Board (NMPB), Indian Council of Forestry Research Institute (ICFRE), **Collaborating/ Supporting Agencies** Botanical Survey of India (BSI), Ministry of AYUSH (MoAYUSH), Foundation for Revitalization of Local Health Traditions (FRLHT), State Forest Department (SFDs), Wildlife Crime Control Bureau (WCCB),	2 Year
				5.2. Trends in collection of plants from wild / natural sources providing raw drugs used in Indian systems of medicine	i. National Medicinal Plant Board (NMPB) ii. Agricultural & Processed Food Products Export Development Authority (APEDA) iii. Indian Council of Forestry Research Institute (ICFRE) iv. Botanical Survey of India (BSI)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
by Local Communities (LCs).					v. State Forest Department (SFDs) vi. Directorate of Plant Protection, Quarantine & Storage -MoAFW vii. Directorate General of Foreign Trade (DGFT) viii. CSIR - Central Institute of Medicinal and Aromatic Plants (CIMAP)	Wildlife Institute of India (WII), TRAFFIC-India, , and, State Fisheries Department(s), Customs, Plant Quarantine Department, Marine Products Export Development Authority (MPEDA), Indian Council of Medical Research (ICMR), Keystone Foundation, Defense Research and Development Organization (DRDO), ZSI, NBA, SBBs, UTBCs, NMCB, TRIFED, GBPNIHE, Directorate General of Foreign Trade (DGFT), Fishery Survey of India, CSIR - Central Institute of Medicinal and Aromatic Plants (CIMAP), Agricultural & Processed Food Products Export Development Authority (APEDA).	
				5.3. Management measures to sustainable fisheries harvest	i. ICAR-Central Marine Fisheries Research Institute (CMFRI) ii. ICAR-Central Inland Fisheries Research Institute (CIFRI) iii. ICAR-Central Institute for Brackish water for Aquaculture (CIBA)		
				5.4. Trends in illegal trade of wild flora and fauna	i. Wildlife Crime Control Bureau (WCCB) ii. TRAFFIC India		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
				5.5. Number of Medicinal Plant Conservation Areas (MPCAs) established in the country	i. National Medicinal Plant Board (NMPB) ii. Foundation for Revitalization of Local Health Traditions (FRLHT) iii. CSIR-Institute of Medicinal and Aromatic Plants (CIMAP), iv. State Forest Department (SFDs)		
				5.6. Trends in collection of Non-Timber Forest Products (NTFPs)	i. Indian Council of Forestry Research and Education (ICFRE) ii. State Forest Department (SFDs) iii. Tribal Cooperative Marketing Development Federation of India (TRIFED)		
Target 6 **Manage Invasive alien species** Eliminate, minimize, reduce and or mitigate the impact of prioritized invasive alien species on biodiversity and ecosystem ser-	6.1 Rate of invasive alien species establishment 6.b Number of countries adopting relevant regulations, processes and measures to reduce the impact	-	Red List Index (impacts of invasive alien species)	6.1. Number and coverage of management plans developed for prioritized invasive species and integration with PA management plans and wetland management plans	i. Indian Council of Forestry Research and Education (ICFRE) ii. Wildlife Institute of India (WII) iii. National Tiger Conservation Authority (NTCA) iv. National Centre for Sustainable Coastal Management (NCSCM)	**Lead Agencies:** Indian Council of Forestry Research & Education (ICFRE), Directorate of Plant Protection, Quarantine and Storage (MoAFW), Ministry of Earth Sciences (MOES), ICAR-National Bureau of Fish Genetic Resources (NBFGR)	2 Year

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
vices by identifying and managing pathways for the introduction of alien species and eradicating or controlling invasive alien species, especially in priority sites, such as islands.	of invasive alien species.			6.2. Change in areas affected by priority invasive species in PAs	i. National Tiger Conservation Authority (NTCA) ii. Indian Council of Forestry Research and Education (ICFRE) iii. State Forest Department (SFDs)	**Collaborating/ Supporting Agencies** National Tiger Conservation Authority (NTCA), Project Elephant, Wildlife Institute of India (WII), National Centre for Sustainable Coastal Management (NCSCM), MoJS, NFDB, Central Marine Fisheries Research Institute (CMFRI), Central Inland fisheries Research Institute (CIFRI) and ICAR-Directorate of Weed Research, SFDs, State Agricultural Department(s), State Fisheries Department(s), NBFGR, National Institute of Biotic Stresses Management (NIBSM), NRSC, Ashoka Trust for Research in Ecology and the Environment (ATREE), KFRI, BSI, ZSI and Fisheries Survey of India, Indian Institute of Forest Management (IIFM), Corbett Foundation, Indian Council of Medical Research, MOAFW - Directorate of Plant Protection, Quarantine and Storage, ICAR-Directorate of Weed Research, NBFGR	
				6.3. Rate of invasive species establishment and their impact	i. National Tiger Conservation Authority (NTCA) ii. Indian Council of Forestry Research & Education (ICFRE) iii. Wildlife Institute of India (WII) iv. ICAR-Directorate of Weed Research v. Central Inland fisheries Research Institute (CIFRI) vi. Central Marine fisheries Research Institute (CMFRI) vii. State Forest Department (SFDs)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
				6.4. Number of invasive alien species on the national list	i. Indian Council of Forestry Research and Education (ICFRE) ii. Botanical Survey of India (BSI) iii. Zoological Survey of India (ZSI) iv. Fisheries Survey of India (FSI) v. Indian Institute of Forest Management (IIFM) vi. Indian Council of Medical Research vii. MOAFW - Directorate of Plant Protection, Quarantine and Storage viii. ICAR-Directorate of Weed Research ix. ICAR-Central Marine Fisheries Research Institute (CMFRI), x. ICAR-Central Inland Fisheries Research Institute (CIFRI) xi. ICAR-Central Institute for Brackish water for Aquaculture (CIBA)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
				6.5. Number of invasive pests detected and quarantined	i. MOAFW - Directorate of Plant Protection, Quarantine and Storage ii. Customs, Plant Quarantine Department iii. MoFAHD, Department of Animal Husbandry and Dairying - Animal Quarantine and Certification Services		
Target 7 **Reduce pollution risks and negative impact** Reduce pollution risks and the negative impact of pollution from all sources by 2030 to levels that are not harmful to biodiversity and ecosystem functions and services, considering cumulative effects by (a) reducing excess nutrients lost to the environment including through more efficient nutrient	7.1 Index of coastal eutrophication potential	Cropland nutrient budget Proportion of domestic and industrial wastewater flow safely treated Floating plastic debris density (by micro and macro plastics (Sustainable Development Goal indicator 14.1.1(b)) Red List Index (impact of pollution)	Trends in nitrogen deposition Municipal solid waste collected and managed Hazardous waste generation Plastic debris density	7.1. Extent of restored forest cover in India	i. Forest Survey of India (FSI) ii. State Forest Department (SFDs) iii. National Afforestation and Ecodevelopment Board (NAEB)	**Lead Agencies:** Central Pollution Control Board (CPCB) **Collaborating/ Supporting Agencies** State Pollution Control Boards (SPCBs)/ Committees, Botanical Survey of India (BSI), Zoological Survey of India (ZSI), Wildlife Institute of India (WII), National Institute of Urban Affairs (NIUA), CSIR – Indian Institute Of Toxicology Research (IITR), MoHUA, Indian Council of Agriculture Research (ICAR), MoAFW, Ministry of Chemicals and Fertilizers (MoCF), MoJS, National Mission for Clean	2 Year
				7.2. Trends in natural farming/ agricultural products and their certifications	i. National Centre for Organic and Natural Farming (NCONF) ii. Wetland Division, MoEFCC iii. Indian Council of Agriculture Research (ICAR) iv. Agricultural & Processed Food Products Export Development Authority (APEDA)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
cycling and use; (b) reducing the overall risk from pesticides and highly hazardous chemicals by at least half, including through integrated pest management, based on science, taking into account food security and livelihoods; and (c) preventing, reducing, and working towards eliminating plastic pollution.				7.3. Trends in wetlands area being brought under integrated management for delivering freshwater	i. State Wetland Authorities, ii. Ministry of Jal Shakti (MoJS)	Ganga, (NMCG), National River Conservation Directorate (NRCD), Fishery Survey of India (FISI), and Central Ground Water Board (CGWB), Ministry of Earth Sciences, State Urban Affairs Department(s), Ministry of Panchayati Raj, Ministry of Rural Development, Centre for Science and Environment, Ministry of Drinking Water and Sanitation, Confederation of Indian Industry (CII), Federation of Indian Chambers of Commerce and Industry (FICCI), The Energy and Resources Institute (TERI), Forest Survey of India (FSI), Wetland Division, MoEFCC and State Wetland Authorities, National Centre for Sustainable Coastal Management (NCSCM).	
				7.4. Trends in the proportion of people using improved water services	i. National Institute of Urban Affairs (NIUA) ii. Ministry of Drinking Water and Sanitation iii. Central Ground Water Board (CGWB)		
				7.5. Trends in the management of e-waste and biomedical waste	i. Central Pollution Control Board (CPCB) ii. State Pollution Control Boards (SPCBs)		
				7.6. Trends in coastal water quality near metropolitan/ cities	i. Central Pollution Control Board (CPCB) ii. State Pollution Control Boards (SPCBs) iii. National Mission for Clean Ganga, (NMCG) iv. National Centre for Sustainable Coastal Management (NCSCM)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
Target 8 **Minimize the impact of climate change** Minimize the impact of climate change and ocean acidification on biodiversity and increase its resilience through mitigation, adaptation, and disaster risk reduction actions through nature-based solutions and/ or ecosystem-based approaches. Minimize negative impacts and foster positive impacts of climate action on biodiversity.	8.b. Number of countries with policies to minimize the impact of climate change and ocean acidification on biodiversity and to minimize negative and foster positive impacts of climate action on biodiversity.	Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030 which include biodiversity	Above-ground biomass stock in forest (tonnes/ ha) National greenhouse gas inventories from land use, land-use change and forestry Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies Sustainable Development Goal indicator 14.3.1 (Marine Acidity)	8.1. Trends in biodiversity-inclusive climate change adaptation and mitigation measures formulated/ implemented through State Action Plans on Climate Change (SAPCC)	i. Ministry of Environment, Forest, Climate Change (MoEFCC) ii. National Institute of Disaster Management (NIDM) iii. Indian Meteorological Department (IMD) iv. Advanced Centre for Atmospheric Radar Research (ACARR) v. National Centre for Ocean Information Services (INCOIS) vi. National Center for Coastal Research (NCCR) vii. State Forest Department (SFDs) viii. State Environment Department(s) ix. State Climate Cells	**Lead Agency** National Institute of Disaster Management (NIDM) **Collaborating/ Supporting Agencies** Forest Survey of India (FSI), Indian Institute of Tropical Meteorology – Centre for Climate Change Research (IITM-CCCR), Indian Institute of Science (IISc), The Energy and Resource Institute (TERI), Indian Meteorological Department (IMD), Indian Council of Forest Research Institute (ICFRE), National Afforestation and Ecodevelopment Board (NAEB), National CAMPA, IIFM, SFDs, State Environment Department(s), State Climate Cells, MoAFW, MoRD, MoJS, MoNRE, and MoHUA, NRSC, CII, FICCI, Advanced Centre for Atmospheric Radar Research (ACARR), CSIR, UNDP-India, ICAR, Wadia Institute of Himalayan Geology, GB Pant National Institute of Himalayan Environment, NIO, Indian National Centre for Ocean Information Services (INCOIS), National Center for Coastal Research (NCCR),	2 Year
				8.2. Number of state / UT governments that adopt and implement ecosystem-based disaster risk reduction strategies.	i. National Disaster Management Authority (NDMA) ii. National Institute of Disaster Management (NIDM) iii. State Disaster Management Authority (SDMAs)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
				8.3. Trends in the decline of availability of drinking water	i. Ministry of Drinking Water and Sanitation ii. National Institute of Disaster Management (NIDM) iii. Indian Institute of Tropical Meteorology – Centre for Climate Change Research (IITM-CCCR) iv. Indian National Centre for Ocean Information Services (INCOIS) v. ICARS (IIT-Roorkee)	Centre for Marine Living Resources and Ecology (CMLRE), MoES, ICARS (IIT-Roorkee), WWF-India, Indian Institute of Forest Management (IIFM), Wildlife Institute of India (WII)	
				8.4. Trends in the number of studies on biodiversity-inclusive environment impact assessment, cumulative environment impact assessment (CEIA) and strategic environment assessment (SEA)	i. State Environment Department(s) ii. State Climate Cells iii. Central Pollution Control Board (CPCB) iv. State Pollution Control Boards (SPCBs)		
				8.5. Trends in identification, assessment, establishment and strengthening of incentives that reward positive contributions to biodiversity and ecosystem services	i. Ministry of Statistics and Programme Implementation (MoSPI)		
Target 9 **Sustainable use of wild species for multiple benefits**	9.1 Benefits from the sustainable use of wild species	Red List Index (species used for food and medicine)	Degree of implementation of international instruments aiming to	9.1. Number of folk users of medicinal plants documented from Peoples Biodiversity Registers (PBRs) prepared by BMCs	i. National Biodiversity Authority (NBA) ii. State Biodiversity Boards (SBBs)	**Lead Agencies** Indian Council of Forestry Research Institute (ICFRE), National Biodiver-	2 Year

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
Ensure that the sustainable management and use of wild species as per National laws, thereby providing social, economic and environmental benefits for people, especially those in vulnerable situations and dependent on biodiversity.	9.b Number or countries with policies to sustainably manage use of wild species, providing social, economic and environmental benefits for people, and to protect and encourage customary sustainable use by indigenous peoples and local communities.		combat illegal, unreported and unregulated fishing Number of Marine Stewardship Council Chain of Custody Certification holders by distribution country Spawning stock biomass (related to commercially exploited species) Number of plant and animal genetic resources for food and agriculture secured in medium- or long-term conservation facilities	9.2. Number of wild species used as per PBRs	i. National Medicinal Plants Board (NMPB) ii. Indian Council of Forestry Research Institute (ICFRE) iii. National Fish Research and Development Institute (NFRDI) iv. Central Marine Fishery Research Institute (CMFRI) v. Botanical Survey of India (BSI) vi. Zoological Survey of India (ZSI) vii. Foundation for Revitalisation of Local Health Traditions (FRLHT) viii. National Biodiversity Authority (NBA)/State Biodiversity Boards (SBBs) ix. National Bureau of Plant Genetic Resources (NBPGR) x. National Bureau of Animal Genetic Resources (NBAGR) xi. and National Bureau of Fish Genetic Resources (NBFGR) xii. CSIR- National Botanical Research Institute (CSIR-NBRI) xiii. G.B. Pant 'National Institute of Himalayan Environment' (NIHE) xiv. Indian Council of Agricultural Research (ICAR)	sity Authority (NBA), and State Biodiversity Boards (SBBs). **Collaborating/ Supporting Agencies** National Medicinal Plants Board (NMPB) - MoAYUSH, National Fish Research and Development Institute (NFRDI), Central Marine Fishery Research Institute (CMFRI), Botanical Survey of India (BSI), Zoological Survey of India (ZSI), Foundation for Revitalisation of Local Health Traditions (FRLHT), MoAFW, National Bureau of Plant Genetic Resources (NBPGR), National Bureau of Animal Genetic Resources (NBAGR), and National Bureau of Fish Genetic Resources (NBFGR), CSIR- National Botanical Research Institute (CSIR- NBRI), G.B. Pant 'National Institute of Himalayan Environment' (NIHE), Indian Council of Agricultural Research (ICAR), National Centre for Sustainable Coastal Management (NCSCM)	2 Year

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
					xv. National Centre for Sustainable Coastal Management (NCSCM)		
				9.3. Percentage of national marine catch that is Marine Stewardship Council (MSC) certified	i. Central Marine Fishery Research Institute (CMFRI) ii. World Wide Fund for Nature (WWF-India) iii. Seafood Exporters Association of India (SEAI)		
Target 10 **Sustainable management of agriculture, animal husbandry, fisheries, aquaculture and forest areas** Ensure areas under agriculture, animal husbandry, fisheries, aquaculture, forests, grasslands, inland waters, and coastal and marine ecosystems are managed sustainably so as to contribute	10.1 Proportion of agricultural area under productive and sustainable agriculture 10.2 Progress towards sustainable forest management	Average income of small-scale food producers, by sex and indigenous status	Agrobiodiversity Index Soil organic carbon stocks (Sustainable Development Goal indicator 15.3.1) Red List Index (wild relatives of domesticated animals) Red List Index (forest-specialist species) Proportion of local breeds	10.1. Trends in area under natural farming and its certification.	i. National Centre for Organic and Natural Farming (NCONF) ii. ICAR-Indian Agriculture Research Institute (IARI) iii. Indian Council of Agriculture Research (ICAR)	**Lead Agency** Indian Council of Agriculture Research (ICAR) **Collaborating/ Supporting Agencies** Central Ground Water Board (CGWB), National Centre for Organic and Natural Farming, Indian Agriculture Research Institute (IARI), National Fish Research and Development Institute (NFRDI), Central Marine Fishery Research Institute (CMFRI), National Fish Development Board (NFDB), National Centre	2 Year
				10.2. Trends in area under integrated pest management	i. Indian Council of Agriculture Research (ICAR)		
				10.3. Trends in the production/ usage of agrochemical fertilizers	i. Department of Fertilizers - Ministry of Chemicals (MoCF) ii. Ministry of Agriculture and Farmers Welfare (MoAFW)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
towards food security, community resilience, restoration of biodiversity, long-term efficiency, and productivity for enhanced ecosystem services.			classified as being at risk of extinction Proportion of land that is degraded over total land area Area of forest under sustainable management: total forest management certification by the Forest Stewardship Council and the Programme for the Endorsement of Forest Certification	10.4. Trends in the use of bio-fertilizers/ biofuels, organic manure and vermicomposting	i. Department of Fertilizers - Ministry of Chemicals (MoCF) ii. Indian Council of Agriculture Research (ICAR)	for Sustainable Coastal Management (NCSCM), Centre For Marine Living Resources & Ecology (CMLRE), National Institute of Oceanography (NIO), ICFRE-Forest Research Institute (FRI), Forest Survey of India (FSI), Botanical Survey of India (BSI), Zoological Survey of India (ZSI), Foundation for Revitalisation of Local Health Traditions (FRLHT), Ministry of Statistics and Programme Implementation (MoSPI), Ministry of Commerce and Industry (MoCI), MoRD, MoCF - Department of Fertilizers, NITI Aayog, MoFAHD, MoAYUSH, NBPGR, NBAGR, NBFGR, ICAR-National Bureau of Soil Survey and Land Use Planning (NBSSLUP), ICAR-Indian Institute of Water and Soil Conservation (IIWSC), CGWB, MoAFW.	
				10.5. Trends in soil quality	i. ICAR-National Bureau of Soil Survey and Land Use Planning (NBSSLUP) ii. ICAR-Indian Institute of Water and Soil Conservation (IIWSC) iii. Indian Council of Agriculture Research (ICAR)		
				10.6. Trends in groundwater table	i. Central Ground Water Board (CGWB)		
				10.7. Trends under organic production on farms of agricultural research institutions and universities	i. Indian Council of Agriculture Research (ICAR) ii. National Bureau of Plant Genetics Resources (NBPGR)		
				10.8. Trends in the proliferation of traditional crops and varieties that are more adapted to the environment, requiring less external inputs and therefore more integrated into the ecosystem, at the same time enhance prospects of greater household food security	i. Indian Council of Agriculture Research (ICAR) ii. Ministry of Agriculture and Farmers Welfare (MoAFW) iii. State Agriculture Department (SADs)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
				10.9. Percentage of forest area covered in terms of approved Working Plans under National Forest Working Plan Code	i. Forest Conservation Division, Ministry of Environment, Forest and Climate Change (MoEFCC) ii. Indian Council of Forestry Research and Education (ICFRE) iii. State Forest Department (SFDs)		
				10.10. Trends in area of restored forests.	i. National Afforestation and Ecodevelopment Board (NAEB) ii. Green India Mission (GIM) iii. Forest Survey of India (FSI) iv. National Mission for Clean Ganga (NMCG) v. State Forest Department (SFDs)		
				10.11. Extent of use of non-selective fishing gears	i. ICAR-Central Marine Fishery Research Institute (CMFRI) ii. National Fish Research and Development Institute (NFRDI) iii. National Fish Development Board (NFDB)		
				10.12. Trends in the certification of fish produce	i. Central Marine Fishery Research Institute (CMFRI) ii. National Fish Research and Development Institute (NFRDI)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
					iii. National Fish Development Board (NFDB)		
				10.13. Trends in NTFP production	i. State Forest Department (SFDs) ii. Forest Research Institute (FRI) iii. Indian Council of Forestry Research and Education (ICFRE)		
				10.14. Wild relatives of cultivated plants	i. National Bureau of Plant Genetics Resources (NBPGR) ii. Indian Council of Agriculture Research (ICAR) iii. Indian Agriculture Research Institute (IARI)		
Target 11 **Enhance and maintain ecosystem services and regulate air and water quality, hazards and extreme events** Restore, maintain and enhance nature's contributions to people, including ecosystem services, such as the regula-	B.1 Services provided by ecosystems	Annual mean levels of fine particulate matter (e.g., PM2.5 and PM10) in cities Proportion of bodies of water with good ambient water quality Level of water stress	Air emission accounts Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management	11.1. Status and trends of ambient air quality in metropolitan cities and critically polluted areas; monitoring water quality for physico-chemical and bacteriological parameters, trace metals, pesticides at selected sites;	i. Central Pollution Control Board (CPCB) ii. State Pollution Control Board (SPCBs)	**Lead Agency:** Central Pollution Control Board (CPCB) **Collaborating/ Supporting Agencies** Indian Institute of Forest Management (IIFM), National Fish Research and Development Institute (NFRDI), Central Marine Fishery Research Institute (CMFRI), Indian Council of Forestry Research	2 Year

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
tion of air, water and climate, soil health, pollination and reduction of disease risk, as well as prevention and protection from hazards and disasters, through nature-based solutions and/ or ecosystem-based approaches for the benefit of all people and nature.			Proportion of population using safely managed drinking water services Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All (WASH) services Number of deaths, missing persons and directly affected persons, attributed to disasters per 100,000 population	11.2. Trends in Soil health parameters in agricultural ecosystems	i. ICAR-National Bureau of Soil Survey and Land Use Planning (NBSSLUP) ii. Ministry of Agriculture and Farmers Welfare (MoAFW)	and Education (ICFRE), ICAR, SPCBs, MoAFW, MoFAHD, MoJS, MoHUA, National Disaster Management Authority (NDMA), National Institute of Disaster Management (NIDM), Central Ground Water Board (CGWB), and ICAR-NBSSLUP, GBPNIHE, MoEFCC, Ministry of New and Renewable Energy (MoNRE), Ministry of Road Transport and Highways of India (MoRTH), ICARS -IIT-Roorkee	
Target 12 **Enhance green and blue spaces for increased access and human well-being.** Significantly increase the area, quality, and connectivity of green and blue spaces in urban areas for	12.1 Average share of the built-up area of cities that is green/blue space for public use for all 12.b Number of countries with biodiversity-inclusive urban planning refer-	Singapore Index on Cities' Biodiversity index		12.1. Trends in the availability of urban green and blue spaces	i. National Institute of Urban Affairs (NIUA) ii. Ministry of Housing and Urban Affairs (MoHUA) iii. State Forest Department (SFDs) iv. Forest Survey of India (FSI)	**Lead Agency** National Institute of Urban Affairs (NIUA) **Collaborating/ Supporting Agencies** Ministry of Housing and Urban Affairs (MoHUA), MoEFCC, Ministry of Drinking Water and Sanitation (MoDWS), ICFRE, FSI, NRSC, SFDs, BSI, CZA, Local Municipal Bodies, Au-	2 Year

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
enhanced access and sustainable use.	ring to green or blue urban spaces			12.2. Number of Biodiversity Parks, Botanical / Public Gardens, Orchards, Water Bodies, Heritage Sites and Nature Learning and Interpretation Centers (NILC) in urban areas	i. National Institute of Urban Affairs (NIUA) ii. Ministry of Housing and Urban Affairs (MoHUA) iii. Botanical Survey of India (BSI) iv. State Forest Departments (SFDs)	tonomous Tribal District Councils (ATDCs), SBBs, GBPNIHE, CSIR-National Botanical Research Institute (NBRI) .	
				12.3. Number of cities prepared City Biodiversity Index	i. National Institute of Urban Affairs (NIUA) ii. ICLEI – Local Governments for Sustainability iii. State Biodiversity Boards (SBBs)		
				12.4. Number of sacred trees and sacred groves in urban areas	i. National Institute of Urban Affairs (NIUA) ii. State Biodiversity Boards (SBBs) iii. Botanical Survey of India (BSI)		
Target 13 **Access and Benefit Sharing** Take effective legal, policy, administrative and capacity-building measures at all levels to ensure and increase the fair and equi-	C.1 Monetary benefits received in accordance with applicable internationally agreed Access and Benefit-sharing instruments	Total number of internationally recognized certificates published in the Access and Benefit-sharing Clearing-House	Total number of transfers of crop material from the Multilateral System of the International Treaty on Plant Genetic Resources for Food and Agriculture received in a	13.1. Trends in number of proposals for intellectual property rights	i. National Biodiversity Authority (NBA) ii. Controller General of Patents, Designs and Trade Marks - India Patent Office	**Lead Agency** National Biodiversity Authority (NBA) Controller General of Patent, Design and Trademarks-India Patent Office.	2 Year

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
table sharing of benefits that arise from the utilisation of biological resources/ genetic resources and digital sequence information as well as traditional knowledge associated with biological/ genetic resources, and facilitating appropriate access and benefit-sharing instruments.	C.2 Non-monetary benefits arising from applicable international Access and Benefit-sharing instruments		country Number of users that have provided information relevant to the utilization of genetic resources to designated checkpoints Number of checkpoint communiqués published in the Access and Benefit-sharing Clearing-House Number of internationally recognized certificates of compliance for non-commercial purposes in the Access and Benefit-sharing Clearing-House	13.2. Trends in number of cases seeking third party transfer for accession of biological resources and associated traditional knowledge	i. National Biodiversity Authority (NBA)	**Collaborating/ Supporting Agencies** State Biodiversity Boards (SBBs)/ UTBCs, MoAFW, Ministry of Commerce and Industries (MoCI), NBPGR, NBAGR, and NBFGR, NBAIR, NBAIM and BMCs, Protection of Plant Varieties and Farmers' Rights Authority (PPVFRA)	
				13.3. Trends in number of cases for seeking prior approval of National Biodiversity Authority (NBA) for transferring the results of research to foreign nations, companies, Non-Resident Indians (NRIs) for commercial purposes	i. National Biodiversity Authority (NBA)		
				13.4. Trends in number of cases seeking approval to bio-resources and associated traditional knowledge for commercial utilization	i. National Biodiversity Authority (NBA) ii. State Biodiversity Boards (SBBs)/ UTBCs		
				13.5. Trends in number of Genome Saviour Awards to communities and individuals	i. Protection of Plant Varieties and Farmers' Rights Authority (PPVFRA)		
				13.6. Trends in the number of accessions in repositories and gene banks	i. ICAR-National Bureau of Animal Genetic Resources (NBAGR) ii. ICAR-National Bureau of Fish Genetic Resources (NBFGR) iii. ICAR-National Bureau of Agriculturally Important Micro-organisms (NBAIM) iv. ICAR-National Bureau of Agricultural Insect Resources (NBAIR)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
				13.7. Number of Benefit Sharing Agreements with Stakeholders and Biodiversity Management Committees (BMCs)	i. National Biodiversity Authority (NBA) ii. State Biodiversity Boards (SBBs)/ UTBCs		
				13.8. Number of Certificates of Origin issued by Biodiversity Management Committees (BMCs) to industries and traders.	i. National Biodiversity Authority (NBA) ii. State Biodiversity Boards (SBBs) iii. Biodiversity Management Committees (BMCs)		
				13.9. Number of Memorandum of Understandings (MoUs) signed between SBBs/BMCs and industries/ traders.	i. State Biodiversity Boards (SBBs) ii. Biodiversity Management Committees (BMCs)		
Target 14 **Mainstreaming biodiversity** Ensure the full integration of biodiversity and its multiple values into policies, regulations, planning,	14.b Number of countries integrating biodiversity and its multiple values into policies, regulations, planning, development processes, poverty eradication strategies and, as appropriate,	Integration of biodiversity into national accounting and reporting systems, defined as implementation of the System of Environmental-Economic Accounting (Sustainable		14.1.Trends in preparation of State Biodiversity Strategy Action Plans (SBSAPs)	i. National Biodiversity Authority (NBA) ii. State Biodiversity Boards (SBBs)	**Lead Agency** Forest Conservation Division, MoEFCC **Collaborating/ Supporting Agencies** Forest Survey of India (FSI), MoAFW, MoFAHD, MoJS, MoUA, MoRD, Ministry of Statistics and Programme Implementation (MoSPI), NITI Aayog, State Biodiversity Boards (SBBs), Ministry of Tribal Affairs	2 Year
				14.2.Trends in implementing the activities envisaged under Local Biodiversity Strategy and Action Plans (LBSAPs)	i. National Biodiversity Authority (NBA) ii. State Biodiversity Boards (SBBs) iii. Biodiversity Management Committees (BMCs)		
				14.3.Annual trends in diversion of forest for non-forest purposes	i. Forest Conservation Division, MoEFCC		



National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
budgeting and development processes.	national accounts, within and across all levels, across all sectors, and progressively aligning all relevant public and private activities and fiscal and financial flows with the goals and targets of this Framework.	Development Goal indicator 15.9.1b)		14.4. Trends in percentage of biodiversity attributable expenditure under large multi-purpose schemes such as Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA)	i. Ministry Rural Development (MoRD)	(MoTA), North Eastern Council (NEC), Ministry of Finance, Ministry of Commerce, Ministry of Power, Ministry of Mines, Ministry of Steel, BNHS, NDMA, NIDM, ICARS (IIT – Roorkee), MoNRE, Ministry of Tourism.	
				14.5. Compliance on earlier strategic environmental impact assessments	i. Environmental Appraisal Committee-MoEFCC ii. Forest Conservation Division, MoEFCC iii. Project Monitoring Committees iv. Integrated Regional Offices (IROs)		
Target 15 **Sustainable production, supply chains and disclosure of risks** Take legal, administrative or policy measures to encourage and enable businesses, particularly large and transnational companies and financial institutions to regularly monitor, assess and disclose risks, dependencies	15.1 Number of companies disclosing their biodiversity- related risks, dependencies and impacts 15.b Number of countries with legal, administrative or policy measures aimed at encouraging and enabling business and financial institutions, and in particular, ensuring that large and transnational	Number of companies publishing sustainability reports (Sustainable Development Goal indicator 12.6.1)	Number of organizations within the country that have signalled an intent to start adopting the Taskforce on Nature-related Financial Disclosures Recommendations	15.1. Number of/ Trends in Companies submitted Business responsibility and sustainability reporting, sector wise and follow up action taken	i. Securities and Exchange Board of India (SEBI) - Ministry of Finance (MoF) ii. Ministry of Corporate Affairs (MoCA) iii. All Chambers of Commerce and Industries iv. Ministry of Micro, Small and Medium Enterprises (MSME) v. Department of Economic Affairs - Ministry of Finance (MoF)	**Lead Agency** National Biodiversity Authority (NBA) **Collaborating/ Supporting Agencies** Ministry of Corporate Affairs (MoCA), and Ministry of Statistics and Programme Implementation (MoSPI), SEBI, All Chambers of Commerce and Industries, Ministry of Commerce, Ministry of Micro, Small and Medium Enterprises (MSME), Department of Economic	2 Year
				15.2. Trends in sector-specific biodiversity reporting.	i. Securities and Exchange Board of India (SEBI) - Ministry of Finance (MoF)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
and impacts related to biodiversity.	companies and financial institutions progressively reduce their negative impacts on biodiversity, increase their positive impacts, reduce their biodiversity-related risks and promote actions to ensure sustainable patterns of production.			15.3. Trends in reporting biodiversity related risks in disclosures	i. Securities and Exchange Board of India (SEBI) - Ministry of Finance (MoF) ii. Confederation of Indian Industry (CII)- India Business and Biodiversity Initiative (IBBI)	Affairs, Ministry of Chemical and Fertilizers, MoFAHD	
Target 16 **Promote sustainable consumption choices** Ensure that people are encouraged and enabled to make choices for sustainable consumption to reduce the footprint of unsustainable consumption in an equitable manner.	16.b Number of countries developing, adopting or implementing policy instruments aimed at encouraging and enabling people to make sustainable consumption choices.	Food Waste Index Material Footprint per Capita Global Environmental Impacts of Consumption Ecological Footprint	Extent to which (a) global citizenship education and (b) education for sustainable development, including gender equality and human rights, are mainstreamed at all levels in: (i) national education policies; (ii) curricula; (iii) teacher education; and (iv) student assessments Recycling rate Change in water-use	16.1. Trends in Consumer awareness enabling consumer choices	i. Indian Council of Agricultural Research (ICAR) ii. Ministry of Agriculture and Farmers Welfare (MoAFW) iii. CSIR- Central Food Technological Research Institute (CFTRI) iv. Food Corporation of India (FCI)	**Lead Agency** National Biodiversity Authority (NBA) with the support of Mission LiFE Cell **Collaborating/ Supporting Agencies** Centre for Environmental Education (CEE), Ministry of Education (MoE), Ministry of Agriculture and Farmers Welfare (MoAFW), Ministry of Housing and Urban Affairs (MoHUA), Food Corporation of India (FCI),Ministry of Fisheries, ICAR-Animal Husbandry and Dairying (MoFAHD), Ministry of Statistics and Programme	2 Year
				16.2. Post-harvest storage and distribution losses of Central/ State Pool Stocks of wheat and rice	i. Food Corporation of India (FCI) ii. CSIR- Central Food Technological Research Institute (CFTRI) iii. Ministry of Agriculture and Farmers Welfare (MoAFW)		
				16.3. Number of municipal corporations using waste segregation techniques	i. Ministry of Housing and Urban Affairs (MoHUA) ii. Municipal corporations/ councils		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
			efficiency over time Indicators from the Life Cycle Impact Assessment Poverty level	16.4. Number of companies taking up Extended Producer Responsibility (EPR) for Hazardous Waste, Plastic Wastes, Used Batteries and Tyres and following circular economy principles	i. Ministry of Environment, Forest and Climate Change (MoEFCC) ii. Ministry of Consumer Affairs (MoCA)	Implementation (MoSPI), Ministry of Fisheries, Animal Husbandry and Dairying, MoAYUSH, CMFRI, Ministry of Consumer Affairs, NC-SCM, CSIR- Central Food Technological Research Institute (CFTRI), Central Inland Fisheries Research Institute-CIFRI.	
				16.5. Quantifiable Indices from Mission Life adopted.	i. National Biodiversity Authority supported by Mission LiFE Cell		
Target 17 **Strengthen biosafety regulatory capacity** Strengthen capacity for implementation of biosafety measures	17.b Number of countries that have taken action to implement biosafety measures as set out in Article 8(g) of the Convention and measures for the handling of biotechnology and the distribution of its benefits as set out in Article 19		Indicators related Cartagena Protocol on Biosafety to the Convention	17.1. Number of Biosafety Laboratories for Living Modified Organisms (LMOs) detection in place	i. Indian Council of Medical Research (ICMR) – National Institute of Virology (NIV) ii. Department of Biotechnology (DBT) iii. Indian Council of Agricultural Research (ICAR) iv. Indian Veterinary Research Institute (IVRI) v. Council of Scientific and Industrial Research (CSIR) vi. ICAR- Central Institute for Cotton Research vii. National Bureau of Plant Genetic Resources (NBPGR)	**Lead Agency** Ministry of Environment, Forest and Climate Change (MoEFCC) - Genetic Engineering Appraisal Committee (GEAC) **Collaborating/ Supporting Agencies** Department of Biotechnology (DBT) - Ministry of Science and Technology, Indian Council of Agricultural Research, Biotech Consortium India Limited (BCIL), Council of Scientific and Industrial Research (CSIR), Indian Veterinary Research Institute (IVRI), Department of Pharma-	2 Year

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
				17.2. Number of guidelines and procedures for new categories of iving Modified Organisms (LMOs) and emerging technologies	i. Genetic Engineering Appraisal Committee (GEAC) - Ministry of Environment, Forest and Climate Change (MoEFCC) ii. Department of Biotechnology (DBT) iii. Council of Scientific and Industrial Research (CSIR)	ceuticals – Ministry of Chemicals and Fertilizers, Indian Council of Medical Research (ICMR), Drug Controller General of India (DCGI), Food Safety and Standards Authority of India (FSSAI), Directorate General of Foreign Trade (DGFT), Central Pollution Control Board, State Pollution Control Board, State Agriculture Departments, State Agriculture Universities, State Biotechnology Coordination Committees, District Level Committees, Department of Customs Excise and Narcotics, Directorate of Revenue Intelligence (DRI), Ministry of Commerce, Ministry of Home Affairs, NBA, SBBs	
				17.3. Number of technical resources prepared for training and a number of trainings conducted at the regional and national levels	i. Department of Biotechnology (DBT) ii. Indian Council of Medical Research (ICMR) iii. Council of Scientific and Industrial Research (CSIR) iv. Indian Veterinary Research Institute (IVRI) v. Indian Council of Agricultural Research (IARI)		
				17.4. Number of online resources for information access and sharing	i. Council of Scientific and Industrial Research (CSIR) ii. Indian Veterinary Research Institute (IVRI) iii. Indian Council of Medical Research (ICMR) iv. Department of Biotechnology (DBT) - Ministry of Science and Technology		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
					v. Indian Council of Agricultural Research (IARI)		
				17.5. Number of training programmes for monitoring personnel such as seed inspectors, food safety inspectors, State Biotechnology Co-ordination Committee (SBCC) members and District Level Committee (DLC) members	i. Indian Council of Agricultural Research (IARI) ii. Food Safety and Standards Authority of India (FSSAI) iii. State Biotechnology Coordination Committees (SBCC) – GEAC iv. District Level Committees (DLC) – GEAC		
				17.6. Number of Living Modified Organisms (LMOs) undergone Risk Assessment and Risk Management (RARM)	i. Genetic Engineering Appraisal Committee (GEAC) - Ministry of Environment, Forest and Climate Change (MoEFCC)		
Target 18 **Repurpose detrimental incentives for biodiversity** Identify and repurpose incentives, including subsidies detrimental to biodiversity, and scale up positive	18.1 Positive incentives in place to promote biodiversity conservation and sustainable use	[Revenue generated from biodiversity-relevant taxes, fees and charges] [Monetary value of biodiversity-positive subsidies]		18.1. Number of policy instruments adopted to repurpose subsidies for sustaining biodiversity	i. Ministry of Chemicals and Fertilizers (MoCF) supported by the National Institute of Agricultural Extension Management (MANAGE)	**Lead Agency** Ministry of Chemicals and Fertilizers supported by the National Institute of Agricultural Extension Management (MANAGE).	2 Year

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
incentives for the conservation and sustainable use of biodiversity progressively.	18.2 Value of subsidies and other incentives harmful to biodiversity	Revenue generated by biodiversity-relevant tradable permits (if auctioned) Monetary value of payments for ecosystem services [Number of other positive incentives in place for biodiversity (by type)] [Monetary value of other positive incentives in place for biodiversity]		18.2. Percentage of budget aligned to green budgeting.	i. Ministry of Finance (MoF) ii. National Institution for Transforming India (NITI Aayog)	**Collaborating/ Supporting Agencies** Ministry of Environment, Forest and Climate Change (MoEFCC), Ministry of Statistics and Programme Implementation (MoSPI), MoAFW, Ministry of Fisheries, Animal Husbandry and Dairying (MoFAHD), Ministry of Petroleum and Natural Gas (MoPNG), Ministry of Road Transport and Highways (MoRTH), Central Marine Fishery Research Institute (CMFRI), National Fish Development Board, National Centre for Coastal Management (NCSCM), Ministry of Mines, Ministry of Development of North Eastern Region (MoDNER), MoAYUSH, Ministry of New and Renewable Energy (MNRE), Ministry of Commerce and Industry, Ministry of Finance (MoF), National Institution for Transforming India (NITI Aayog).	
				18.3. Trends in states availing incentive to reduce chemical fertilizer subsidy	i. Ministry of Chemicals and Fertilizers (MoCF)		
				18.4. Trends in market development assistance made available to promote organic/ bio-fertilizers under Galvanizing Organic Bio-Agro Resources Dhan (GOBAR-dhan) scheme	i. Department of Drinking Water and Sanitation, Ministry of Jal Shakti (MoJS)		
				18.5. Trends in under-recovery and writting off of power charges in the agriculture sector by state level power utilities	i. Ministry of Power (MoP) ii. State Agriculture Department (SADs)		
Target 19 **Resource mobilization** Ensure the flow of adequate financial	D.1 International public funding, including official development assistance for conservation and sustainable use of biodiversity and ecosystems		Monetary value of the annual budget for biodiversity from total national budget Percentage	19.1. Trends in financial resources made available (public, private including Corporate Social Responsibility (CSR) and philanthropic sources, international	i. CS-III Biodiversity Division - Ministry of Environment, Forest and Climate Change (MoEFCC) ii. National Biodiversity Authority (NBA)	**Lead Agencies** CS-III Biodiversity Division - Ministry of Environment, Forest and Climate Change (MoEFCC) and National Biodiversity Authority (NBA)	2 Year

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
sources, including public, private, international, and other innovative financial mechanisms, to implement the NBSAP, SBSAPs, and LBSAPs.	D.2 Domestic public funding on conservation and sustainable use of biodiversity and ecosystems D.3 Private funding (domestic and international) on conservation and sustainable use of biodiversity and ecosystems		of annual biodiversity expenditure of total national government budget Total amount of funding for developing countries to promote the development, transfer, dissemination and diffusion of environmentally sound technologies Volume of official development assistance flows for scholarships by sector and type of study	fund flow) for implementing KM-GBF and National Biodiversity Targets		**Collaborating/ Supporting Agencies** NITI Aayog, Ministry of Statistics and Programme Implementation (MoSPI), MoAFW, MoJS, MoRD, Ministry of Corporate Affairs (MoCA), MoAYUSH, Ministry of Panchayati Raj (MoPR), Ministry of Fisheries, Animal Husbandry and Dairying (MoFAHD), Ministry of Finance, and Other Central Ministries and Departments, State Governments, UNDP India, Securities and Exchange Board of India (SEBI), Ministry of Commerce and Industries, NABARD, Ministry of Road Transport and surface transport, Department of Atomic Energy (DAE), SBBs	
				19.2. Trends in human resources made available for implementing KM-GBF and National Biodiversity Targets	i. CS-III Biodiversity Division - Ministry of Environment, Forest and Climate Change (MoEFCC) ii. National Biodiversity Authority (NBA)		
				19.3. Trends in technical resources made available for implementing KM-GBF and National Biodiversity Targets	i. CS-III Biodiversity Division - Ministry of Environment, Forest and Climate Change (MoEFCC) ii. National Biodiversity Authority (NBA)		
				19.4. Percentage of Corporate Social Responsibility (CSR) funds to meet National Biodiversity Targets	i. Ministry of Corporate Affairs (MoCA) ii. CS III Biodiversity Division - Ministry of Environment, Forest and Climate Change (MoEFCC)		
				19.5. Trends in innovative financial solutions e.g., Green Credits, Green Bonds, Access and Benefit Sharing (ABS), Carbon Credits, etc.	i. National Biodiversity Authority (NBA) ii. CS III Biodiversity Division - Ministry of Environment, Forest and Climate Change (MoEFCC)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
Target 20 **Capacity development, technical and scientific cooperation** Strengthen capacity development, access to and transfer of technology, and promote access and development of innovations, technical and scientific cooperation, through South-South, North-South and Triangular Cooperation	20.b Number of countries that have taken significant action to strengthen capacity-building, development and access to and transfer of technology and to promote the development of and access to innovation and technical and scientific cooperation	Total amount of funding for developing countries to promote the development, transfer, dissemination and diffusion of environmentally sound technologies	Volume of official development assistance flows for scholarships by sector and type of study Proportion of total research budget allocated to research in the field of marine technology Joint scientific papers published (in Ocean Biodiversity Information System) by sector	20.1. Trends in training/ capacity building and development and Human Resource Development (HRD) by institutions at local and community levels	i. National Institute of Rural Development and Panchayati Raj (NIRDPR) ii. State Institute of Rural Development and Panchayat Raj (SIRDPRs) iii. National Biodiversity Authority (NBA) iv. State Biodiversity Boards (SBBs) v. State Forest Department (SFDs) vi. State Forest Training Institute (SFTI) vii. Research and Training (R&T) Division of MoEFCC viii. Indira Gandhi National Forest Academy (IGNFA) ix. Indian Council of Forestry Research and Education (ICFRE) x. Central Academy for State Forest Service (CASFOS), xi. Wildlife Institute of India (WII)	**Lead Agencies** National Biodiversity Authority (NBA), NCSCM, IGNFA, NAARM **Collaborating/ Supporting Agencies** State Biodiversity Boards (SBBs), State Forest Department , Directorate of Forestry Education (DFE), Indira Gandhi National Forest Academy (IGNFA), Wildlife Institute of India (WII), Indian Institute of Forest Management (IIFM), Ministry of Statistics and Programme Implementation (MoSPI), MoAFW, MoJS, MoRD, MoAYUSH, Ministry of Fisheries, Animal Husbandry and Dairying (MoFAHD), Ministry of Science and Technology (MoST), Controller General of Patents, Design and Trademarks, Zoological Survey of India (ZSI), Botanical Survey of India (BSI), Ministry of Education, ATI, SIRD, State Forest Training Institute (SFTI), NAARM, Indian Council of Forestry Research and Education (ICFRE), LBSNAA, CASFOS, NIRD, Ministry of Women	2 Year

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
				20.2. Numbers of State Biodiversity Boards (SBBs), Biodiversity Management Committees (BMCs), Panchayati Raj Institutions (PRI) institutions and other related line department personnel trained	i. National Institute of Rural Development and Panchayati Raj (NIRDPR) ii. State Institute of Rural Development and Panchayat Raj (SIRDPRs) iii. State Biodiversity Boards (SBBs) iv. State Forest Department (SFDs) v. Wildlife Institute of India (WII) vi. Indian Institute of Forest Management (IIFM)	and Child Development, R&T Division of MoEFCC, National Institute of Disaster Management (NIDM), ICAR, National Institute of Rural Development and Panchayati Raj (NIRDPR), NCBS – Bangalore, WWF-India, Centre of Excellence for Animal Husbandry (CEAH)-MoFAHD, Centre for Environment Education (CEE), Ministry of Electronics and Information Technology.	
				20.3. Documentation of awareness meetings/ capacity building and development workshops/ seminars/ conferences for various target groups (NGOs, CBOs, Mahila Mandals, academicians, Youth groups), preferably done in regional/local languages	i. National Biodiversity Authority (NBA) ii. State Biodiversity Boards (SBBs) iii. Research and Training (R&T) Division of MoEFCC iv. Wildlife Institute of India (WII) v. Indian Institute of Forest Management (IIFM) vi. State Biodiversity Boards (SBBs) vii. Central Academy for State Forest Service (CASFOS) viii. State Forest Department (SFDs)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
				20.4. Trends in the number of MoUs signed between scientific, educational institutions, user agency, and industry for the development of innovative technology and technology transfer for conservation and sustainable utilization of bioresources	i. National Biodiversity Authority (NBA)		
				20.5. Trends in technology developed and transferred	i. Department of Scientific and Industrial research (DSIR) ii. Department of Science and Technology (DST) iii. Biotechnology Industry Research Assistance Council (BIRAC) iv. Technology Information, Forecasting & Assessment Council (TIFAC) v. State Innovation Councils		
				20.6. Trends in updation of PBRs.	i. National Biodiversity Authority (NBA) ii. State Biodiversity Boards (SBBs)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
				20.7. Number of active portals of various ministries documenting biodiversity-related information	i. National Biodiversity Authority (NBA) ii. State Biodiversity Boards (SBBs) iii. Centre for Environment Education (CEE) iv. Research and Training (R&T) Division of MoEFCC v. World Wide Fund for Nature-India vi. National Centre for Sustainable Coastal Management (NCSCM) vii. Indira Gandhi National Forest Academy (IGNFA) viii. Wildlife Institute of India (WII) ix. Ministry of Fisheries, Animal Husbandry and Dairying (MoFAHD) x. Zoological Survey of India (ZSI) xi. Botanical Survey of India (BSI)		
				20.8. Number of start-ups that are involved in developing technological solutions for sustainable management of biodiversity	i. State Biodiversity Boards (SBBs) ii. Ministry of Electronics and Information Technology		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
				20.9. Trends in funding made available to developing countries for promoting development, transfer, dissemination and diffusion of environmentally sound technologies through South –South and Triangular Cooperation	i. National Biodiversity Authority (NBA) ii. State Biodiversity Boards (SBBs) iii. Centre for Environment Education (CEE) iv. Research and Training (R&T) Division of MoEFCC v. World Wide Fund for Nature-India vi. National Centre for Sustainable Coastal Management (NCSCM) vii. Indira Gandhi National Forest Academy (IGNFA) viii. Wildlife Institute of India (WII) ix. Ministry of Fisheries, Animal Husbandry and Dairying (MoFAHD) x. Zoological Survey of India (ZSI) xi. Botanical Survey of India (BSI)		
Target 21 **Communication, Awareness, and Knowledge Management**	21.1 Indicator on biodiversity information for monitoring the Kunming-Montreal Global Biodiversity Framework	Participation in decision-making of indigenous peoples and local communities in the implementation	Growth in number of records and species in the Living Planet Index database	21.1. Trends in digitization of biodiversity, associated traditional knowledge related data including number of e-PBRs prepared.	i. National Biodiversity Authority (NBA) ii. Ministry of Environment, Forest and Climate Change (MoEFCC)	**Lead Agency** Ministry of Environment, Forest and Climate Change (MoEFCC)- Environment Information, Awareness, Capacity Building and Livelihood Program (EIACP)	2 Year

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
Ensure that the best information and knowledge from science, research, and evidence-based sources are accessible to decision-makers, practitioners, and the public to guide effective and equitable governance and integrated and participatory management. and strengthen communication, education, awareness-raising, research, monitoring, and knowledge management relevant to the conservation of biodiversity		of the Convention at all levels Index of Linguistic Diversity	Growth in species occurrence records accessible through the Global Biodiversity Information Facility Growth in marine species occurrence records accessible through the Ocean Biodiversity Information System Proportion of known species assessed through the International Union for Conservation of Nature - Red List of Threatened Species™ Number of assessments on the International Union for Conservation of Nature - Red List of Threatened Species™		iii. Environment Information, Awareness, Capacity Building and Livelihood Program (EIACP) iv. State Biodiversity Boards (SBBs) v. National Agriculture Research and Education System (ICAR -NARES) vi. PPVFRA	**Collaborating/ Supporting Agencies** State Forest Department (SFDs), Indian Council of Forestry Research and Education (ICFRE), Central Zoo Authority (CZA), NTCA, WII, Botanical Survey of India (BSI), Zoological Survey of India (ZSI), National Centre for Sustainable Coastal Management (NCSCM), Ministry of Tribal Affairs (MoTA), Ministry of Education (MoE-department of school education and literacy), Ministry of Communications (MoC), Indian Institute of Mass Communication (IIMC), International Union for Conservation of Nature (IUCN India), BNHS, Ministry of Agriculture and Farmer's Welfare (MoA&FW), R& T Division of MoEFCC, National Council of Science Museums - Ministry of Education (MoE), ADRES (ICAR), Centre for Environment Education (CEE), Indian National Agricultural Research & Education System (NARES), Protection of Plant Varieties and Farmers Rights Act (PPVFRA)	
				21.2. Number of documentaries and feature films related to biodiversity	i. State Biodiversity Boards (SBBs) ii. State Forest Department (SFDs) iii. Indian Institute of Mass Communication (IIMC) iv. International Union for Conservation of Nature (IUCN India) v. Centre for Environment Education (CEE) vi. Ministry of Environment, Forest and Climate Change (MoEFCC) vii. Environment Information, Awareness, Capacity Building and Livelihood Program (EIACP) viii. Research & Training (R&T) Division of MoEFCC		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
			World Association of Zoos and Aquariums bio-literacy survey (biodiversity literacy in global zoo and aquarium visitors)		ix. National Biodiversity Authority (NBA)		
				21.4. Number of exhibits and galleries on biodiversity in science centres/ museums	i. National Council of Science Museums (NCSM) – Ministry of Culture (MoC) ii. Ministry of Environment, Forest, Climate Change (MoEFCC) iii. Ministry of Agriculture & Farmers' Welfare (MoAFW) iv. Ministry of Fisheries, Animal Husbandry and Dairying (MoFAHD) v. Indian Council of Agricultural Research (ICAR) vi. National Biodiversity Authority (NBA) vii. State Biodiversity Boards (SBBs) viii. Ministry of Communications (MoC) ix. Indian Institute of Mass Communication (IIMC)		
				21.5. Trends in visits to Protected Areas/ Natural History Museums/ Science Centers, conservation exhibitions, and zoological and	i. Central Zoo Authority (CZA) ii. National Council of Science Museums and Science Cities under State Governments iii. Centre for Environment Education (CEE) iv. Botanical Survey of India (BSI)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
				botanical gardens, urban parks, city forests and eco-tourism areas	v. Zoological Survey of India (ZSI) vi. National Tiger Conservation Authority (NTCA) vii. Research & Training (RT) Division of MoEFCC viii. National Museum of National History (NMNH)		
Target 22 **Equitable and effective participation in decision-making** Ensure the full, equitable, inclusive, effective and gender-responsive representation and participation in planning, decision-making, management, and access to justice and information related to biodiversity by youth, all genders and local communities (LCs).	22.b Number of countries taking action toward the full, equitable, inclusive, effective and gender responsive representation and participation, in decision-making, and access to justice and information related to biodiversity by indigenous peoples and local communities respecting their cultures and their rights over lands, territories, resources, and traditional knowledge,, as well as by, women, and	Proportion of total adult population with secure tenure rights to land, (a) with legally recognized documentation, and (b) who perceive their rights to land as secure, by sex and type of tenure.	Percentage of positions in national and local institutions, including: (a) the legislatures; (b) the public service; and (c) the judiciary, compared to national distributions, by sex, age, persons with disabilities and population groups Number of countries with systems to track	22.1. Number of awareness and capacity development programmes organized	i. National Biodiversity Authority (NBA) ii. National Institute of Rural Development and Panchayati Raj (NIRDPR) iii. State Biodiversity Boards (SBBs) iv. Union Territory Biodiversity Councils (UTBCs) v. Indian Council of Forestry Research and Education (ICFRE) vi. Ministry of Statistics and Programme Implementation (MoSPI)	**Lead Agencies** Ministry of Tribal Affairs (MoTA), Ministry of Social Justice and Empowerment (MoSJE) **Collaborating/ Supporting Agencies** State Biodiversity Boards/ UT Biodiversity Councils, Indian Council of Forestry Research and Education (ICFRE), Ministry of Environment, Forest and Climate Change (MoEFCC), MoAFW, MoFAHD, MoJS, MoSPI, MoRD, MoPR, Autonomous Tribal District Councils (ATDCs), and National Human Rights Commission (NHRC), Ministry of Education (MoE), Ministry of Youth	2 Year

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
	girls, children and youth and persons with disabilities, and the full protection of environmental human rights defenders		and make public allocations for gender equality and women's empowerment Proportion of total agricultural population with ownership or secure tenure rights over agricultural land, by sex; and share of women among owners or rights-bearers of agricultural land, by type of tenure Number of countries where the legal framework (including customary law) guarantees women's equal rights to land ownership and/or control Proportion of population who believe decision-making is inclusive and responsive, by sex, age, disability and population group	22.2. Trends in number of Civil Society Organizations/ Non-governmental organizations working in the field of conservation of biodiversity	i. Ministry of Panchayat Raj (MoPR) ii. Ministry of Tribal Affairs (MoTA) iii. Ministry of Social Justice and Empowerment (MoSJE) iv. Autonomous Tribal District Councils (ATDCs)	Affairs (MoYA), Nehru Yuva Kendra Sangathan, NSS, Nature/ Eco Clubs, Himal Rakshaks, Ministry of Panchayat Raj (MoPR), Management of Community Forest Resources (CFR).	2 Year
				22.3. Trends in number of Biodiversity Management Committees (BMCs), Joint Forest Management Committees (JFMCs), Ecodevelopment Committees (EDCs), Panchayati Raj Institutions (PRIs), Management of Community Forest Resources (CFRMC) constituted/ operationalized	i. National Biodiversity Authority (NBA) ii. State Biodiversity Boards (SBBs) iii. Ministry of Environment, Forest and Climate Change (MoEFCC), iv. State Forest Department (SFDs) v. Ministry of Panchayat Raj (MoPR) vi. Ministry of Tribal Affairs (MoTA)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
Target 23 **Gender equality in decision-making and implementation** Ensure gender equality in the implementation of the NBSAP, SBSAPs and LBSAPs through a gender-responsive approach, where all women and girls, and all genders have equal opportunity and capacity in decision-making related to biodiversity.	23.b Number of countries with legal, administrative or policy frameworks, inter alia, the Gender Plan of Action, to ensure that all women and girls have equal opportunity and capacity to contribute to the three objectives of the Convention, including by ensuring women's equal rights and access to land and natural resources.	Proportion of seats held by women in (a) national parliaments and (b) local governments Indicator on national implementation of the Gender Plan of Action	Percentage of positions in national and local institutions, including: (a) the legislatures; (b) the public service; and (c) the judiciary, compared to national distributions, by sex, age, persons with disabilities and population groups Proportion of population who believe decision-making is inclusive and responsive, by sex, age, disability and population group (Sustainable Development Goal indicator 16.7.2)	23.1. Trends in budget allocation for gender-responsive schemes linked to biodiversity	i. Ministry of Statistics and Programme Implementation (MoSPI) ii. Rashtriya Mahila Kosh (RMK) iii. National Commission for Women (NCW) iv. Ministry of Women and Child Development	**Lead Agency** Ministry of Women and Child Development **Collaborating/ Supporting Agencies** RT Division of MoEFCC State Biodiversity Boards (SBBs), MoSPI, ICFRE, MoEFCC, MoAFW and MoTA, National Commission for Women (NCW), Ministry of Health and Family Welfare, Ministry of Panchayati Raj, RT Division of MoEFCC, Rashtriya Mahila Kosh (RMK), Centre for Environment Education (CEE), National Institute of Rural Development and Panchayati Raj (NIRDPR), State Institute of Rural Development and Panchayat Raj (SIRDPRs).	2 Year
				23.2. Trends in training of women members of Biodiversity Management Committees (BMCs)	i. Rashtriya Mahila Kosh (RMK) ii. National Commission for Women (NCW) iii. Ministry of Women and Child Development iv. National Institute of Rural Development and Panchayati Raj (NIRDPR) v. State Institute of Rural Development and Panchayat Raj (SIRDPRs) vi. Ministry of Statistics and Programme Implementation (MoSPI)		

National Target	Headline Indicator	Component Indicator	Complementary Indicator	Other National Indicator	Responsible Agencies	Lead/ Collaborating/ Supporting Agencies (indicative list)	Periodicity
			Proportion of countries where the legal framework (including customary law) guarantees women's equal rights to land ownership and/or control	23.3. Trends in women self-help groups dealing with bioresources for economic and social empowerment	i. Ministry of Women and Child Development ii. Rashtriya Mahila Kosh (RMK) iii. National Commission for Women (NCW)		
				23.4. Trends in the representation of women in governance and decision-making at various levels in local communities, groups, Panchayati Raj Institutions, districts and state	i. Ministry of Women and Child Development ii. National Commission for Women (NCW)\ iii. Rashtriya Mahila Kosh (RMK) iv. Ministry of Panchayati Raj (MoPR)		
				23.5. Gender Plan of action for biodiversity conservation in all sectors	i. National Biodiversity Authority (NBA) ii. State Biodiversity Board (SBBs)		

REFERENCES

Amrithalingam, M. 2016. Sacred Groves of India- An Overview. Int. J. Curr. Res. Biosci. Plant Boil., 3(4), 64-74.

Ansari, N.A., Hembrom N., Barthwal D., Mathur V.B. 2018. Biodiversity Expenditure Review (BER) at Central Government Level, India. Final Report, WII-UNDP Biodiversity Finance Initiative (BIOFIN) Project, Wildlife Institute of India, Dehradun. 75p.

Banerjee, D., Raghunathan, C., Rizvi, A.N., and Das, D. (eds.). 2023. Animal Discoveries 2022: New Species and New Records. Zoological Survey of India, Kolkata.

Banerjee, D., Raghunathan, C., Rizvi, A.N., and Sengupta. J, 2024. Animal Discoveries 2023: New Species and New Records. Zoological Survey of India, Kolkata, 1-356.

BSI. 2023. Plant Discoveries 2022 (including Algae, Fungi & Microbes), New Genera, Species and New Records. June-2023. Botanical Survey of India, Ministry of Environment, Forest and Climate Change, Government of India 139Pp.

Champion, H. G., & Seth, S. K. 1968. A revised survey of the forest types of India. Manager of publications.

FAO. 1999. Agricultural Biodiversity, Multifunctional Character of Agriculture and Land Conference, Background Paper 1, Maastricht, September 1999.

FAO. 2023. The World's Mangroves 2000–2020. Food and Agriculture Organization of the United Nations. Rome.

FSI. 1995. India State of Forest Report, Forest Survey of India., Dehra Dun.

FSI. 2011. India State of Forest Report, Forest Survey of India., Dehra Dun.

FSI 2021. India State of Forest Report (2021), Forest Survey of India. Vol. 17 (2019-2020), Dehra Dun. 586 pp.

Ganesan, M., Trivedi, N., Gupta, V., Madhav, S.V., Reddy, C.R., Levine, I.A. 2019. Seaweed Resources in India – Current Status of Diversity and Cultivation: Prospects and Challenges. Botanica Marina, 62 (5): 463-482.

Geevarghese, G. A., Akhil, B., Magesh, G., Krishnan, P., Purvaja, R., and Ramesh, R. 2018. A Comprehensive Geospatial Assessment of Seagrass Distribution in India. Ocean and Coastal Management, 159, 16-25.

GoI. 2022. Envi Stats India 2022, Vol: II Environment Accounts, Social Statistics Division, National Statistical Office, Ministry of Statistics and Programme Implementation, Government of India, 288Pp.

Gupta, P.K., Patel, J.G., Singh, R.M., Bahuguna, I.M., Kumar, R. et al. 2021. Space Based Observation of Indian Wetlands, Space Applications Centre, ISRO Ahmedabad, India.

IUCN, 2023. IUCN Red List of Threatened Species, International Union for Conservation of Nature, Ver. 2023.1.

Kaliaperumal, N. 2017. Studies on Phycocolloids from Indian Marine Algae – A Review. Seaweed Res. Utilin., 39:1-8.

Kandari, L.S., Bisht, V.K., Bhardwaj, M. and Thakur, A.K., 2014. Conservation and management of sacred groves, myths and beliefs of tribal communities: a case study from north-India. Environmental Systems Research, 3(1), pp. 1-10.

Kjerfve B., 1994, Coastal Lagoons, In: Kjerfve B., (ed.), Coastal Lagoon Processes, Elsevier, Amsterdam: 1-8.

Krishnan, P., Ramakrishnan, R., Saigal, S., Nagar, S., Faizi, S., Panwar, H.S., Singh, S. and Ved, 2012. Conservation Across Landscapes: India's Approaches to Biodiversity Governance. United Nations Development Programme, New Delhi, India.

Mahapatro, D., Panigrahy, R.C., Panda, S. 2013. Coastal Lagoon: Present Status and Future Challenges, International Journal of Marine Science, 3(23):178-186.

Marale, S.M., and Mishra, R.K. 2011. Status of Coastal Habitats and its Management in India. International Journal of Environmental Protection, 1(1):31-45.

Mehra, S.P. 2023. Nature Conservation in Communities of Rural India through Perspective of UN SDGs. Journal of Pollution and Effects on Community Health 1(1). DOI: 10.58489/2836-3590/007.

MoEF, GOI, 1999, India's National Policy and Macrolevel Action strategy on Biodiversity, Ministry of Environment, Forest and Climate Change, Government of India.

MoEFCC.2019 - Implementation of India's National Biodiversity Action Plan – An Overview 2019, Ministry of Environment, Forest and Climate Change, Government of India. 182Pp.

Mohan, D., Talukdar, G.H., Sen M., and Ansari N.A. 2020. Management Effectiveness Evaluation (MEE) of National Parks and Wildlife Sanctuaries in India. Process and Outcomes, 2018-19 (Volume IV). Wildlife Institute of India, Dehradun.

Mohan Raj, V., Sangeetha, R., and Susan, G. 2023. Biodiversity and Conservation of Estuaries in India – A Report on the Status, Threats and Challenges International Journal of Zoological Investigations. Vol. 9, No. 1, 506-514.

Muley, E. V., Venkataraman, K., Alfred, J. R. B., and Wafar, M., 2000. Status of coral reefs of India. In: Proceedings of 9th International Coral Reef Symposium, Bali, Indonesia, 23–27 October, 2000, Vol. 2, pp. 847–854.

Natarajan, S., Sunil, N., Kumar, R., Reddy, M.D. 2018. Agrobiodiversity in India: Status and Concerns. In: (eds.) Kumar, B., and Singh, R. Sustainable Agriculture for Food Security: Concepts and Approaches, Biotech Books, New Delhi. Chapter: 8: 121-137.

NBA. 2019. Biodiversity Finance Plan (Working Document). GoI-UNDP Project on Biodiversity Finance Initiative (BIOFIN), National Biodiversity Authority, Chennai. 114PP.

NTCA. 2023. Project Tiger - 50 Years of Tiger Conservation in India. National Tiger Conservation Authority, Government of India.

Oza, R.M., and Zaidi, S.H. 2001. A Revised Checklist of Indian Marine Algae. CSMCRI Publication, Bhavnagar, India: 296Pp.

Pathak, N. and Kothari, A. 2009. Indigenous and Community Conserved Areas: The Legal Framework in India. IUCN-EPLP No. 81

Pillai, C.S.G. 2010. A review of the status of corals and coral reefs of India. Indian Journal of Animal Sciences 80 (4) (Suppl. 1): 53–56.

Pimm, S.L., and Joppa, L.N. 2015. How many plant species are there, where are they, and at what rate are they going extinct? Ann. Missouri Bot. Gard.100:170-176.

Pradheep, K., Ahlawat, S.P., Nivedhitha, S., Gupta,V., and Singh, K. 2021. Crop Wild Relatives in India: Prioritisation, Collection and Conservation. ICAR-National Bureau of Plant Genetic Resources, New Delhi 110 012: i-viii +180Pp.

Project Elephant, MoEF&CC, Government of India (2023), Elephant Corridors of India 2023 (Edition – 1/2023).

Qasim, S. Z. 2003. Indian Estuaries. Allied, Mumbai, ISBN: 81-7764.369-X.

Qasim, S. Z. and Sengupta, R. 1984. Marine Environment. In: State of the Environment, Some Aspects. Pp29. (Mimeo).

Qureshi, Q., Jhala, Y.V., Yadav, S.P., and Mallick, A. (eds.), 2023. Status of Tigers, Co-Predators and Prey in India, 2022. National Tiger Conservation Authority, Government of India, New Delhi, and Wildlife Institute of India, Dehradun. TR. No./2023/03.

Ragavan, P., Saxena, A., Jayaraj, R. S. C., Mohan, P. M., Ravichandran, K., Saravanan, S., and Vijayaraghavan, A. 2016. A Review of the Mangrove Floristics of India. Taiwania, 61(3).

Ramesh, R., Banerjee, K., Paneerselvam, A., Raghuraman, R., Purvaja, R., and Lakshmi, L. 2019. Importance of Seagrass Management for Effective Mitigation of Climate Change. In: (eds.) Krishnamurthy, R. R., Jonathan, M.P., Srinivasalu, S., and Glaese, B. Coastal Management Global Challenges and Innovations, Academic Press, Elsevier Inc, London, United Kingdom. Chapter 14:284-299.

Ramsar Convention. 1971. Ramsar Information Paper no. 1, Article 1.1, The Ramsar Convention on Wetlands.

Rao, P.S.N., and Gupta, R.K. 2015. Algae of India, A Checklist of Indian Marine Algae (Excluding Diatoms & Dinoflagellates), Botanical Survey of India: Kolkata, India, 93Pp.

Rao, G.D., and Sarma, V.V. S. S. 2013. Contribution of N2O Emissions to the Atmosphere from Indian Monsoonal Estuaries, Tellus B: Chemical and Physical Meteorology, 65:1, 19660

Rodgers, W.A., and Panwar, H.S. 1988. Planning A Wildlife Protected Area Network in India. A Report Prepared for the Ministry of Environment, Forests and Wildlife, Government of India, Volumes 1 and 2.

Roy, P. S., Behera, M. D., Murthy, M. S. R., Roy, A., Singh, S., Kushwaha, S. P. S., ... & Ramachandran, R. M. 2015. New vegetation type map of India prepared using satellite remote sensing: Comparison with global vegetation maps and utilities. International Journal of Applied Earth Observation and Geoinformation, 39, 142-159.

SAC-MoEF, Ramsar Convention. 1971. Ramsar Information Paper no. 1, Article 1.1, The Ramsar Convention on Wetlands.

Sahoo, D., Sahu, N., and Sahoo, D. 2001. Seaweeds of Indian Coast; A. P.H. Publication: New Delhi, India. 283Pp.

Saravanan, K., Chowdhury, B.C. and Sivakumar, K. 2013. Important Coastal and Marine Biodiversity Areas on East Coast of India. In Sivakumar, K. (ed.) Coastal and Marine Protected Areas in India: Challenges and Way Forward, ENVIS Bulletin: Wildlife & Protected Areas. Vol. 15 Wildlife Institute of India, Dehradun-248001, India:292-298.

Saroj, J., Gautam, R.K., Joshi, A. and Tehseen, P. 2016. Review of Coral Reefs of India: Distribution, Status, Research and Management, International Journal of Science, Environment and Technology, Vol. 5, No 5: 3088 -3098.

Saxena, A., 2012. Marine Biodiversity in India: Status and Issues, International Day for Biological Diversity, Marine Biodiversity, Uttar Pradesh State Biodiversity Board, Lucknow (Uttar Pradesh): 127-134.

Sehgal, J., Mandal, D.K., Mandal, C. and Vadivelu, S. 1992. Agro-Ecological Regions of India. Second Edition, Tech. Bull. No. 24, National Bureau of Soil Survey and Land Use Planning (NBSS&LUP). 130Pp.

Sivakumar, K., Mathur, V.B., and Pande, A. 2013. Coastal and Marine Protected Areas in India: Challenges and Way Forward. In Sivakumar, K. (ed.) Coastal and Marine Protected Areas in India: Challenges and Way Forward, ENVIS Bulletin: Wildlife & Protected Areas. Vol. 15. Wildlife Institute of India, Dehradun-248001, India. Chapter 2:51-61.

Soundrapandi, J. 2017. Biodiversity Financial Needs Assessment for the Implementation of India's National Biodiversity Action Plan. National Biodiversity Authority, Chennai, India, pp. 46.

UNDP. 2016. BIOFIN - The Biodiversity Finance Initiative, Progress Report, United Nations Development Programme, New York, USA.

UNDP. 2018. The BIOFIN Workbook 2018: Finance for Nature. The Biodiversity Finance Initiative. United Nations Development Programme: New York.

Vagh, S.N., Bhatt, A.J., Kardani, H. K., Kumar, V., Vagh, R.G., Mahavadiya, D. R., Solanki, H. K. and Vasava, R. J. 2022.Study of Seaweed Diversity along Okha Coast, Gulf of Kachchh, Northwest Coast of India. Exp. Zool. India, 25(1):755-759.

Vavi1ov, N. I. 1935. Theoretical Basis for Plant Breeding, Vol. 1 Moscow Origin and Geography of Cultivated Plants. In: (Love, D. transl.). The Phytogeographical Basis for Plant Breeding Cambndge University Press, Cambridge, UK: 316-366.

Venkataraman, K. 2006. Coral reefs in India. National Biodiversity Authority, Chennai

Venkataraman, K. 2011. Coral Reefs of India. In: Hopley, D. (eds.) Encyclopedia of Modern Coral Reefs. Encyclopedia of Earth Sciences Series. Springer, Dordrecht. https://doi.org/10.1007/978-90-481-2639-2_64

Yadav, S.P., Tiwari, V.R., Mallick, A., Garawad, R., Talukdar, G., Sultan, S., Ansari, N.A., Banerjee, K. and Das, A. 2023. Management Effectiveness Evaluation of Tiger Reserves in India, 2022 (Fifth Cycle), Summary Report. Wildlife Institute of India, Dehradun and National Tiger Conservation Authority, Government of India, New Delhi. 37Pp.

Zhukovsky, P., 1968. "New Centres of Origin and New Gene Centres of Cultivated Plants Including Specifically Endemic Microcentres of Species Closely Allied to Cultivated Species." Plant Breeding. Bot Zhurnal.53:430-460 [in Russian]

Zube, E.H. 1995. No Park is an Island. In: (ed.). Mcneely, J.A. Expanding Partnerships in Conservation. IUCN-The World Conservation Union, Island Press, Washington, DC, USA:169-177.



Ministry of Environment,
Forest and Climate Change

Ministry of Environment, Forest and Climate Change

Indira Paryavaran Bhawan,
Jorbagh, New Delhi 110003