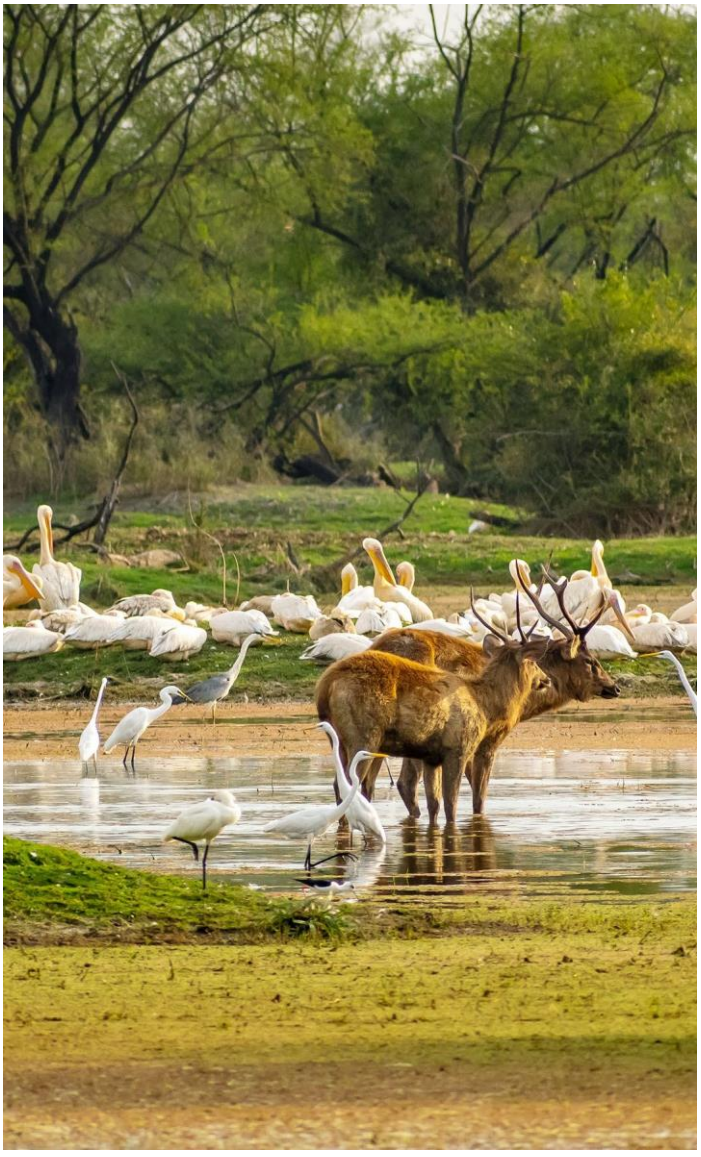
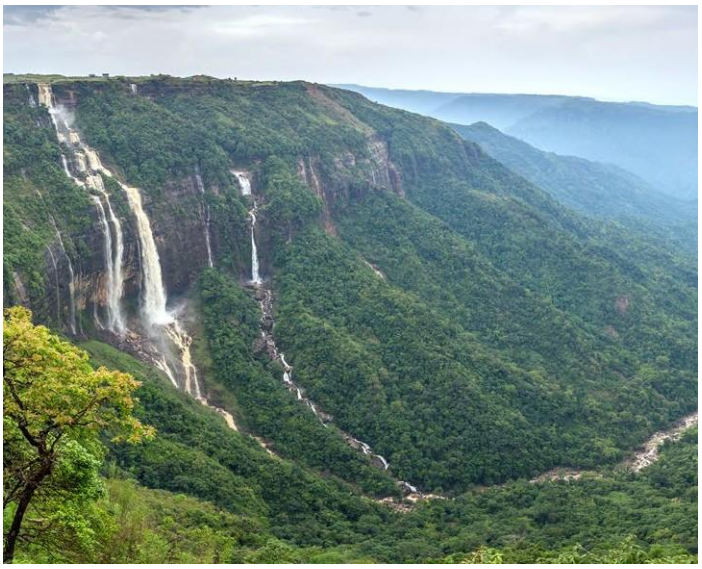
NITI Aayog

DEVELOPMENT MONITORING AND EVALUATION OFFICE

Environment and Forest

Sector Report





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Preface

The Government of India (GoI) spends close to Rs. 14 lakh crores annually on development activities, through nearly 750 schemes implemented by Union Ministries. To improve the effectiveness and efficiency of public finance, and the quality of service-delivery to citizens, all schemes have been mandated to undergo third party evaluations, to provide an evidentiary foundation for scheme continuation from 2021-22 to 2025-26. In 2019, the Development Monitoring and Evaluation Office (DMEO), NITI Aayog was assigned the task of evaluating 28 Umbrella Centrally Sponsored Schemes (UCSS), which are schemes/programmes funded jointly by the Centre and the States and implemented by the States. This historic exercise, undertaken between April 2019 and February 2021, evaluated 125 Centrally Sponsored Schemes (CSS), under 10 Sectors, together covering close to 30% of the GoI's development expenditure, amounting to approximately Rs. 3 lakh crore (USD 43 billion) per annum.

In order to fulfil this mandate to the highest standard possible, to optimize both the robustness and the uptake of the evidence generated, DMEO adopted a nationally representative mixed methods evaluation methodology and a consultative review process for the reports. Through qualitative and quantitative analysis of secondary literature, analysis was done at three levels: the sector, the umbrella CSS and the scheme itself. The studies thus produced then underwent a review process involving consultations with NITI Aayog subject matter divisions, concerned Ministries and Departments, and external experts.

The present report is an outcome of this evaluation study and presents an analysis of the Water Resources, Environment and Forest Sector based on primary and secondary data collection. In this Report, we seek to cover the environment and forest sector in India, identifying the intended and actual contribution of GoI schemes to sector outcomes. This includes areas for more focused effort to achieve national priorities/SDGs. It also identifies opportunities for convergence of the schemes within the sector to other developmental programmes of the Central and the State Governments as well as with private sector, corporate social responsibility (CSR) efforts, international, multilateral and bilateral aid, etc.

We hope that this Report will further our understanding of the Water Resources, Environment and Forest Sector and help us move towards achieving the Sustainable Development Goals and the National Development Agenda, to promote the well-being of all sovereign citizens of India.

Acknowledgements

We would like to express our gratitude to Dr. Rajiv Kumar, Vice-Chairman NITI Aayog, and Shri Amitabh Kant, Chief Executive Officer, who have been the driving force, first in entrusting this important responsibility to the Development Monitoring and Evaluation Office (DMEO) and subsequently as mentors throughout the study, in providing all necessary support and guidance for the completion of the project. We also express our gratitude to the Ministry of Finance for recognizing the crucial need for evidence in the deliberations and decisions pertaining scheme budget allocations.

Our invaluable partners in this exercise have been the Department of Water Resources, River Development & Ganga Rejuvenation (D/o WR, RD & GR), Department of Agriculture, Cooperation and Farmer's Welfare (DAC&FW), Department of Land Resources (DoLR), and Ministry of Environment, Forest and Climate Change (MoEFCC) and all its officials, without whose cooperation this evaluation would not have been possible. We are grateful to them for giving us access to available data, for patiently sharing their expertise through Key Informant Interviews, and for providing their vital comments on the draft reports during various stages of the study. A detailed list of Key Informant Interviews can be found in the annexures to this report.

In our federal structure, equally important partners in this endeavour have been the State Governments of Assam, Andhra Pradesh, Bihar, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Maharashtra, Madhya Pradesh, Manipur, Mizoram, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttarakhand and West Bengal and their Chief Secretaries. Officials across the State governments have extended their gracious cooperation to the study, for which we are deeply thankful.

Next, we must thank our external experts, Dr. Amarjit Singh, ex-Secretary (D/o WR, RD & GR), and Dr. Deepak Khare, Professor (Department of Water Resources Development and Management, IIT Roorkee) for helping refine and rationalize the report through their insightful comments, corrections and feedback. From the fundamentals of the sector to the latest developments, they helped ensure that the report was as comprehensive, cogent and technically robust as possible, within the short timeframes available.

M/s KPMG Advisory Services Private Ltd., the consultant firm, has done a remarkable job, particularly given the significant challenges of scale, time and resources presented by this project. Adding to the constraints, the global pandemic and the COVID-19 lockdown did not stop them from delivering top quality work. Particular appreciation is due to Mr. Manpreet Singh, Partner, Mr. Sumouleendra Ghosh, Director, and Mr. Anand Kulkarni, Technical Director and their team, Ankush Chakraborty, Deputy Team Leader, Sandip Keswani, Monitoring and Evaluation Expert, Gaurang Meher Diljun, Economist), Ranjan Roy, Water Resources Lead), Manpreet Singh (Environment, Forestry, Wildlife and Climate Change Lead), Shibabrata Chakraborty (Finance Specialist), Anandajit Goswami (Statistician), Ruchi Khurana (Gender and

Social Inclusion Specialist), Rumjhum Raychaudhuri (Safeguards Specialist), Kartik Chandra Sanati (Water Resources Management Specialist), Ashok Kumar Sahu (Aquatic Habitats Sector Specialist), Jignesh Thakkar (Tribal Welfare Specialist), Arghya Paul (Associate Director), Sakshi Ghilidiyal (Consultant), Rutu Patel (Consultant) and Rachel Rojy (Consultant), from the KPMG support team and the field partners – IPSOS Team Tripti Sharma Team Lead, Sutapa Ray (Research Manager), Sayantika Palit (Research Executive) and Gangotri Dash (Research Executive).

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DMEO team has been at the core of the evaluation studies - in this package specifically, Ms. Sumitra K, Monitoring and Evaluation Lead, Ms. Fatima Mumtaz, Young Professional and Sh. Kuldeep Pal, Economic Investigator worked on every last detail of this herculean endeavour, under the guidance of Deputy Director Generals Sh. Alok Mishra and Ms. Harkiran Sanjeevi. Across packages, Deputy Director General Sh. Ashutosh Jain also oversaw coordination, standardization and monitoring of the study design, analysis and implementation processes across packages. Across packages, Deputy Director General Mr. Ashutosh Jain also oversaw coordination, standardization and monitoring of the study design, analysis and implementation processes. They were supported by the Evaluations Core Team: Dr. Shweta Sharma, Mr. Anand Trivedi, Ms. Sanjana Manaktala, Ms. Vatsala Aggarwal, Mr. O.P. Thakur and Mr. Jayanta Patel. The DMEO administration and accounts officers, including Mr. D. Bandopadhyay, Mr. Munish Singhal, Mr. D.S. Sajwan, Mr. Manoj Kumar and others provided vital support on documentation, approvals, payments etc.

In accordance with the massive scope and scale of the exercise, this report owes its successful completion to the dedicated efforts of a wide variety of stakeholders.

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Sector Report – Environment and Forests

1.1 Introduction

The National Environment Policy was developed in 2006 after extensive consultations with experts in different disciplines, Central Ministries, Members of Parliament, State Governments, Industry Associations, Academic and Research Institutions, Civil Society, NGOs and the Public. The dominant theme of the policy is that **while conservation of environmental resources is necessary to secure livelihoods and well-being of all, the most secure basis for conservation is to ensure that people dependent on particular resources obtain better livelihoods from the fact of conservation, than from degradation of the resource.** However, the challenges for India are significant as the need for maintaining high economic growth coupled with increasing trends of urbanisation, population growth, industrialisation, and lifestyle changes which tend to result in environmental degradation.

Therefore, the National Environment Policy along with sectoral aspects identified in the Terms of Reference were used to prepare the areas of enquiry for the sectoral analysis.

Table 1: List of sector objectives and areas of enquiry

Sector objectives	Area of enquiry
Ecological restoration of existing natural habitats and migratory routes	Change in quantity of forest cover
	Change in quality of forest cover
	Increase in developmental activities leading to encroachment on natural habitats
	Rise of pollution in lakes and wetlands
Mitigation of human-wildlife conflicts and community engagement	Degradation and fragmentation of existing natural habitats
	Compensatory policies for conflict situations
Wildlife population stabilization and improvement	Comprehensive census data of wildlife species
Wildlife health	Poaching of wildlife and illegal trading of animal goods
Preparedness against disasters such as forest fires	Infrastructure for prevention and control of forest fires
Promoting eco-tourism for sustainable development	Revenue from eco-tourism in national parks and wildlife sanctuaries
Climate Change Resilience	Impact of climate change on vulnerable sectors
	Availability of finance for undertaking adaptation interventions
Intra-generational Equity: Livelihood Security for the Poor	Improvement in livelihood for forest-dependent communities
Inter-generational Equity	Decline in country's natural capital

Integration of Environmental Concerns in Economic and Social Development	Diversion of forest land for development purposes
Efficiency in Environmental Resource Use	Increase in air pollution leading to environmental degradation
	Insufficient waste management and processing infrastructure
Environmental Governance	Consultation with local communities in management and regulation of use of environmental resources
Enhancement of Resources for Environmental Conservation	Availability of finance for undertaking conservation measures
	Multi-stakeholder partnerships with research and development agencies

The environment sector needs to respond to a diverse range of dynamic challenges, however for the purposes of this analysis, these challenges have been discussed within three broad areas that are global as well as national priorities:

- Forests and wildlife
- Pollution abatement
  - Air pollution
  - Noise pollution
  - Marine pollution
  - Water pollution
  - Waste management
- Climate change

1.2 Forests and wildlife

1.2.1 Background

Brief overview

India has a huge diversity of ecological habitats including forests, grasslands, wetlands, mountains, desert, coastal and marine ecosystems. Its diverse topography includes 100 million hectares of mountainous regions, 30 million hectares of arid and semi-arid zones and 7500 kms of coastline which has resulted in a huge diversity[1]. The country inhabits 7-8% of the world's recorded species including 45,000 species of plants and 91,000 species of animals, covers 4 out of 34 global biodiversity hotspots[2] namely the Himalaya, Indo-Burma, the Western Ghats-Sri Lanka and Sundaland[3] in 2.4% of the world's total geographic area[4]. Among the 17 megadiverse countries, India has 10 bio-geographic zones and inhabits

[1] Compendium on Indian biosphere reserves: progression during two decades of conservation, 2012, UNESCO, accessed on 18 October 2019
[2] India's intended nationally determined contributions, 2015, Government of India, accessed on 16 October 2019
3 India's fifth national report to the convention on biological diversity, 2014, MoEFCC, accessed on 16 October 2019
[4] National Biodiversity Action Plan, MoEFCC, accessed on 16 October 2019

8.58% of the mammalian species, 13.66% avian species, 7.91% reptiles, 4.66% amphibians, 11.72% fishes and 11.80% plants[5].

Fresh water ecosystems comprise 9,456 species which is approximately 9.4% of India's total faunal diversity as estimated by Zoological Survey of India. India's wetlands comprise 4.6% of its geographical area[6]. Further, as per the National Wetlands Atlas, India comprises 15.26 million hectares of wetlands, of which 69.22% are inland wetlands and 12% of the inland wetland area are in the form of lakes and ponds[7]. The forests occupy one fifth of the geographical area of the country which are essential for social, cultural and economic life of people. These forests are sources of fuel wood for energy, fodder, raw material for industrial requirements, medicinal among other purposes. It has been estimated that more than 300 million people depend on the forests for their livelihoods and forest cover meets the livelihood needs of people living in about 1,73,000 villages and act as carbon sinks and regulate water cycles[8,9]. Forests contribute to human well-being and maintain the ecological balance which has led to significant focus on their conservation in climate change mitigation matters.

Wildlife, biodiversity and forests in India have been under threat due to habitat destruction, population explosion, developmental activities, anthropogenic activities, poaching, different types of pollution (land, water, air), climate change, diseases etc. The conservation of small water bodies such as lakes and wetlands are imperative for sustaining unique diversity and ecosystem services such as water irrigation, water supply, ground water recharge etc. Therefore, conservation and protection of wildlife, forests, land and aquatic biodiversity has been considered important to ensure environmental balance and support livelihoods by introducing various measures to protect the significant and endangered flora and fauna and their habitats, increase and rehabilitate forests covers, protect areas of important biodiversity on land and water along with sustainable development of the local communities inhabiting around these zones.

Agroforestry practices have developed over a long time in India and it is currently practiced on 13.5 million hectares in India. It is the practice of integrating trees, crops and livestock on farmlands and rural landscapes to enhance productivity, profitability, diversity and ecosystem sustainability. The climate change mitigation and adaptation benefits of agroforestry drove India to adopt the National Agroforestry Policy in 2014 at World Congress on Agroforestry. The policy aims at amending unfavourable legislation and simplifying regulations relating to forestry and agriculture, security of land tenure, promoting research and capacity building, felicitating participation of industries dealing with agroforestry produce and offering incentive to farmers. It is not limited to India's ambitious goal of achieving 33 per cent tree cover, but it also aims at providing many other benefits, such as increasing food and nutrition, supplying fodder, fuelwood and timber for India's growing population. Approximately 65 per cent of the country's timber and almost 50 per cent of fuel wood comes from trees grown on farms. Agroforestry would therefore help in reducing rural unemployment and boost timber production on farms which is currently generating 450 employment-days per hectare per year in India.

[5] India's fifth national report to the convention on biological diversity, 2014, MoEFCC, accessed on 16 October 2019
6 India's sixth report for convention on biodiversity diversity, 2018, MoEFCC, accessed on 19 October 2019
[7] National Plan for Aquatic Ecosystems, MoEFCC, accessed on 18 October 2019
[8] Green growth and Forestry in India, TERI, accessed on 18 October 2019
[9] About CAMPA, e-Green Watch, accessed on 16 October 2019

Wetlands play a significant role in maintain the ecological sustainability. They are crucial for critical needs such as drinking water, water purification, fodder, biodiversity, flood storage, transport, recreation, research, sinks and climate stabilizers. The wetlands are environmentally sensitive areas and provide habitat to various organisms including fishes, non-fish aquatic organisms like frogs and other amphibians, snakes and birds. According to The National Wetland Atlas 2013 (ISRO, 2013), India has more than 7.5 lakh wetlands covering 15.26 million ha area, which is approximately 4.6% of India's land area. National Plan for Conservation of Aquatic Ecosystems (NPCA), the CSS which aims to conserve wetlands and lakes, has identified wetlands and lakes for conservation, however, none of the wetlands have been notified under the scheme as informed by the national division that looks over the NPCA scheme. Currently, there is a policy shift towards Integrated Management Planning. Prioritised proposals forwarded by State Govt./Union Territory Administration/State Wetlands Authority/ UT Wetlands Authority following the framework of NPCA guidelines will be duly considered for funding support under NPCA scheme. India is also a signatory to Ramsar Convention for Wetlands of International Importance which is international treaty for the conservation and sustainable use of wetlands. India has recognized 37 wetlands as Ramsar sites under the convention till date.

India is known for its huge biodiversity including wildlife. The conservation and protection measures has led to significant rise in the number of tiger reserves, bird sanctuaries, national parks which offer vast opportunity for tourists to explore and learn about the ecosystems. The Ecotourism Policy and Guidelines were developed by Ministry of Tourism (MoT) in 1998. Subsequently, Guidelines for Ecotourism in and around Protected Areas (2011) were developed which provide a detailed framework on the selection, planning, development, implementation and monitoring of ecotourism in India. MoT also constituted Ecotourism Society of India (ESOI) which works closely with the central and state government bodies responsible for sustainable tourism along with regional and state players across the country to facilitate and support policies and initiatives. ESOI has launched several national workshops on environmental law, responsible tourism and best practices, in partnership with WWF-India, supported by the MoT and state governments to allow for knowledge sharing, capacity building and a better understanding of ecotourism

Several states in India have promoted eco-tourism in several national parks and sanctuaries by developing their own policies on ecotourism practices through state forest departments or ecotourism boards such as Uttarakhand, Odisha, Assam, Gujarat, Kerala, Karnataka, Madhya Pradesh, Maharashtra, Uttar Pradesh, West Bengal, Rajasthan. This has helped in the conservation of wildlife, tourist education, and socio-economic development of the local communities. For example, local people are employed for guiding services, transportation, and interpretative jobs and in some states. Locals are given permission to run food, snack, and souvenir shops, and women sensitivity and employment training programs are conducted by the forest departments for these protected areas. Many privately branded eco-friendly accommodations in India have provided job employment and training opportunities to the local people.

Targets

India has developed targets specific to wildlife, biodiversity and forest sector to strengthen the national conservation goals and develop frameworks to achieve goals under international conventions such as Aichi Biodiversity Targets, Sustainable Development Goals, Nationally Determined Contributions etc.

India's Third National Wildlife Action Plan (NWAP) developed important goals and targets to enhance conservation and protection to the wildlife sector in India for 2017–2031. The goals include strengthening and improving the protected area network, landscape level approach for wildlife conservation, integrating climate change in wildlife planning, management of tourism, people's participation, conservation awareness, conservation of inland aquatic systems, conservation of coastal and marine ecosystems, ensuring sustained funding, integrating wildlife plans with sectoral programmes etc.[10]

The National Bio-diversity Action Plan 2008 was updated in 2014 with 12 National Bio-Diversity Targets (NBTs) for 2011–2020 which were further aligned with the Aichi Biodiversity Targets (developed by CoP 2010 in Nagoya, Japan). The indicators and monitoring framework of these NBTs was also incorporated in this plan. Some of the NBTs that have been developed aim to generate awareness on biodiversity and its conservation, develop strategies for reducing degradation and fragmentation of natural habitats, identification and management of alien species, sustainable management of agriculture, fisheries, forests etc., conservation of important marine and coastal waters, measures to safeguard the ecosystem services relating to water, human health are implemented by taking into account needs of women, local communities, vulnerable sections[11].

India's national goal is to bring 33% of its geographical area under forest cover which has also been emphasized in the **India's Nationally Determined Contribution (NDCs)** report for 2021 to 2030. One of the NDCs is to create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent through additional forest and tree cover by 2030 [12]. The target of 33% forest cover is also mentioned as National Target Value in the SDG India Index Baseline Report[13]. Further, one of the NBTs aims to identify under-terrestrial waters, coastal and marine sites which are important for species and biodiversity to ensure they are conserved effectively and further integrated into wider landscapes and seascapes covering 20% of geographic area of the country by 2020[14].

According to The SDG India Index, some indicators and national targets have been developed for the following SDG goals:

Table 2: Indicators and national targets for India SDG Goals

SDG targets	Indicators	National targets
SDG target 15.1 (Life on Land) to ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and dry lands, in line with obligations under	Percentage of total land area covered under forest and Decadal change in extent of water bodies within forests from 2005 to 2015 (%).	Achieve 33% forest cover which has been set as the target for this indicator. In line with the internationally agreed Aichi Biodiversity Targets, the target for rate of loss of natural habitats has been set at 0.

10 Third National Wildlife Action Plan, MoEFCC, accessed on 17 October 2019
11 National Biodiversity Action Plan, MoEFCC, accessed on 16 October 2019
12 India's intended nationally determined contributions, 2015, Government of India, accessed on 16 October 2019
13 SDG India Index, 2018, Baseline Report, accessed on 16 October 2019
14 National Biodiversity Action Plan, MoEFCC, accessed on 16 October 2019

international agreements is by 2020.		
SDG target 15.2 (Life on Land) - to promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally by 2020	Change in Forest area from 2015 to 2017 (%)	In line with the internationally agreed Aichi Biodiversity Targets, the target for rate of loss of forests has been set to 0
SDG target 15.7 (Life on Land) – to take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products.	Percentage change in estimated population of wild elephants over 5-year period	The national target value of 0 is set to at least maintain the wild elephant population.

The Strategy for New India @ 75 also provides for certain targets in this sector which were developed by Niti Aayog. These include declaration of inviolate sites by Ministry of Environment, Forest and Climate Change (MoEFCC) specifying whether underground mining is permitted at these sites, power to be decentralized to local forest officials to permit exploration of forests, encourage state PSUs and private sector to undertake compensatory afforestation on degraded forestlands, improving quality of existing forests and encouraging farm forestry[15].

Conservation initiatives and stakeholders

The Wildlife Protection Act 1972 (latest amended in 2013) has been the primary legislation that was enacted for protection of animals, birds and plants through a series of schedules. These are categorized into Schedule I and II that provide for absolute protection of selected species (offences under these are prescribed the highest penalties), Schedule III and Schedule IV provide for protection of species for which penalties are much lower and Schedule V includes the animals which may be hunted. Further, the National Biodiversity Authority (NBA) was established by the Central Government to implement India's Biological Diversity Act (2002) and perform as regulatory and advisory function on conservation, sustainable use of biological resource and fair equitable sharing of benefits of use[16]. The wildlife and biodiversity conservation efforts have been primarily implemented by Government of India through identifying and mapping protected areas as defined by The Wildlife (Protection) Act 1972 and international organizations such as International Union for Conservation of Nature (IUCN) and UNESCO (World Network of Biosphere

[15] Strategy for New India @75, November 2018, Niti Aayog, accessed on 22 October 2019
[16] Welcome to National Biodiversity Authority, National Biodiversity Authority, accessed on 17 October 2019

Reserves). The National Tiger Conservation Authority, Central Zoo Authority, Animal Welfare Board, National Biodiversity Authority, Wildlife Crime Control Bureau and research institutes for forestry and wildlife were also constituted by the Government of India to enhance the implementation of conservation policies.

Several legislative policies have been introduced over the years for the conservation of forests such as Forest Conservation Act 1980 (FCA 1980) and Nation Forest Policy 1988 (NFP 1988). The FCA 1980 was the biggest initiative in forestry sector to control deforestation and NFP 1988 was a major paradigm shift from earlier forest policies to a participatory approach which led to the Joint Forest Management initiative to encourage role of local and tribal communities in the protection of forests since they are direct beneficiaries of conservation benefits[17]. The Green India Mission aims to increase the forest/tree cover to the extent of 5 million hectares (mha) and improve quality of forest/tree cover on another 5 mha of forest/non forest lands[18] along with providing support for livelihood to local communities[19]. National Agro-Forestry Policy, National Afforestation Programme were also introduced to increase the forest cover in the country. Compensatory Afforestation Fund Management and Planning Authority (CAMPA) was constituted to promote afforestation and regeneration activities for compensating diversion of forest lands to non-forest uses. Further, Central government has included forestry training and capacity building under the Central Sector projects.

Presently, the CSS Scheme of Environment, Forestry and Wildlife has a budget of Rs. 2,675.42 crores in 2018–19, covering 4 schemes[20]. The covered sub-schemes represent management of protected areas with the objective of conservation of flora and fauna such as Project tiger, Project Elephant and Development of Wildlife Habitats, Biodiversity conservation and Aquatic ecosystem conservation. The Government of India introduced guidelines for protection and management of Biosphere reserves with the objective to conserve zones of important genetic variety along with sustainable development of local communities. Currently, 11 out of 18 biosphere reserves from India have been included in the UNESCO world biosphere network. National Wetland Conservation Programme (NWCP) and National Lake Conservation Plan (NLCP) were introduced and later merged under National Plan for Conservation of Aquatic Ecosystems (NPCA) to maintain and conserve a network of wetlands and lakes which contribute to human well-being, sustain diversity of wetland-dependent species[21]. NPCA has identified approximately wetlands and lakes for conservation. Currently, there is a policy shift towards Integrated Management Planning. Prioritised proposals forwarded by State Govt./Union Territory Administration/State Wetlands Authority/ UT Wetlands Authority following the framework of NPCA guidelines will be duly considered for funding support under NPCA scheme. Further, 37 wetlands have been included under the Ramsar Convention on Wetlands of International Importance which is international treaty for the conservation and sustainable use of wetlands[22]. It also covers conservation of forest cover through Green India Mission which includes plantation in forests and non-forest areas and forest fire prevention programmes.

17 Forest Conservation Laws and Policies, Mr. Videh Upadhyay, accessed on 16 October 2019
18 About the mission, Green India Mission
19 Green growth and Forestry in India, TERI, accessed on 18 October 2019
20 Union budget - MoEFCC, MoEFCC, accessed on 17 October 2019
21 National Plan for Conservation of Aquatic Ecosystems (NPCA), April 2019, MoEFCC, accessed on 16 October 2019
22 Ramsar Sites in India, Ramsar website, accessed on 17 October 2019

The national targets and priorities covered by National Biodiversity Action Plan and existing policies also align with some SDG targets covered under SDG 15 (Life on Land) and SDG-14 (Life under Water). The following table provides an few examples on how SDG goals that can be achieved through NBTs and existing policies as mapped by Niti Aayog and Sixth National Report Convention on Biodiversity[23,24]:

Table 3: Policies and targets for environment-related SDG goals

SDG	Policy/Targets
SDG target 15.1, 15.2	National Afforestation Programme, Green India Mission,
SDG target 15.7	Project Tiger, Project Elephant
SDG 15.8- by 2020 introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems, and control or eradicate the priority species	NBT 4 By 2020 invasive alien species and pathways are identified and strategies developed to manage them developed so that populations of prioritized invasive alien species are managed.
SDG 14, 15	NBT 3: Strategies for reducing rate of degradation, fragmentation and loss of all-natural habitats are finalized and action put in place by 2020 for environmental amelioration and human well-being.

Institutional Structure

Biological Diversity Act incorporates a well-designed administrative infrastructure to implement the objectives of Convention on Biodiversity, National Biodiversity Strategies and Action Plans through National and States Biodiversity Boards. Further, Biodiversity Management Committees are also mandated to be created to encourage active involvement of local communities and women. Similarly, the Wildlife Protection Act and National Forest Policy also provide an institutional structure for National and State governments to implement the objectives by involving participation of local and tribal communities.

Private sector stakeholders

The Companies Act 2013 mandated corporates crossing a certain threshold to contribute 2% of the average net profits of the company made during the three immediately preceding financial years in accordance with Schedule VII of the Act. The listed activities in Schedule VII include environmental sustainability and social business projects among others. Several companies have taken CSR initiatives towards wildlife, biodiversity and forest conservation over the years following the introduction of this mandate. Sony India partnered with WWF to enhance capacity of the local community and strengthen their institution for human-wildlife conflict in the Western Arunachal Landscape. Tata Chemicals along with Sate Government of Gujarat undertook project to save Asiatic Lions from open wells by barricading

23 India's sixth report for convention on biodiversity diversity, 2018, MoEFCC, accessed on 19 October 2019
24 Existing Governmental Policy Framework and Schemes contributing towards the SDG 15 and its Targets, MoEFCC, accessed on 19 October 2019

the wells which was completed at a cost of US$126,840[25]. Tata Chemicals in partnership with Wildlife Trust of India developed Save the Whale shark Initiative to educate and create awareness on conserving endangered species. Tata Housing has also collaborated with WWF India for conservation of Great Indian bustard in Rajasthan; Red Panda in Arunachal Pradesh, and One-Horned Rhinoceros in, Assam. The 'My Ganga, My Dolphin' campaign was initiated by HSBC to raise awareness among local communities regarding the conservation significance of dolphins as well as helped in the capacity building of stakeholders[26]. Wipro has initiated several biodiversity projects such as the butterfly park and wetland ecology zones. One of the most expended CSR activities is afforestation and tree plantation in which many companies have participated over the years. Cummins India used CSR funds to create forests in Pune to combat pollution. Excel industries spent INR2.66 crores on plantation drives and biodiversity parks[27]. DCB Bank contributed INR3.87 crores on CSR activities in environment sector which included tree plantation to rejuvenate buffer areas around forests[28].

Other stakeholders

Wildlife and Biodiversity

Several other key players in in the wildlife and biodiversity sector are international and domestic non-governmental organizations, multilateral and bi-lateral agencies. International organizations like World's Wildlife Fund supports Tiger conservation projects in Sundarbans biosphere reserve, UNDP supported crocodile conservation project. UNDP along with selected NGO representatives implemented projects such as Protection of the Olive Ridley Sea Turtles Conservation of Ganges Dolphin project, People's Participatory Approach for the Conservation of Wildlife Corridors in Nilgiri Biosphere[29]. International donors such as JRS foundation, Critical Ecosystem Partnership Fund have also contributed to biodiversity projects in India. Charitable organizations such as the Tata Trusts have also contributed towards biodiversity conservation projects[30]. Global Environment Facility has also supported various biodiversity projects in India. Among the Externally Aided Projects (EAP), The National Coastal Zone Management Programme is a World Bank assisted Integrated Coastal Zone Management Project which is implemented in the coastal States and Union Territories to ensure livelihood security of coastal communities including fisher folks, for conserving and protecting the coastal stretches to promote sustainable development[31]. Wildlife Conservation Society – India scaled wildlife tracking through collaborative efforts between scientists, lawyers, forest department officials, helped in relocation of families in Karnataka and Kerala, developed first photographic database in Kaziranga National Park[32].

Forests

[25] Wildlife conservation through Corporate Social Responsibility initiatives in India, August 2019, Anuj Baroth and V.B. Mathur, accessed on 18 October 2019

26 Wildlife conservation through Corporate Social Responsibility initiatives in India, August 2019, Anuj Baroth and V.B. Mathur, accessed on 18 October 2019

[27] Excel industries Ltc Annual report 2017-18, Excel Industries Ltd, accessed on 19 October 2019

28 Business Responsibility Report, 2018-19, DCB Bank, accessed on 19 October 2019

29 Biodiversity conservation projects in India, Development Alternatives website, accessed on 17 October 2019

[30] Donors, India Biodiversity Portal, accessed on 18 October 2019

[31] Union budget - MoEFCC, MoEFCC, accessed on 17 October 2019

[32] Milestones, WCS India website, accessed on 21 October 2019

Some other stakeholders that have played an active role in in the forest sector are bilateral agencies, non-profit organizations, local communities, international non-government organization. State government have also sponsored forestry schemes such as the Social forestry scheme and Green Belt development scheme launched by Uttar Pradesh government. The Japan International Cooperation Agency has supported and funded various forest projects in India. Sadhna Forests, a Tamil Nadu based non-profit organization initiated various afforestation projects. In India villages and local communities have led initiatives and actively participated in various afforestation and forest conservation programmes such as the Arabari Project in West Bengal, Aravalli Project etc[33]. We Forest, an international NGO has carried out several tree plantation projects in India. UN- REDD Programme has also implemented projects in India for supporting Reducing Emissions from Deforestation and forest Degradation (REDD+) processes and promoting involvement of all stakeholders, including indigenous peoples and other forest-dependent communities.

It is observed that the private sector, bilateral and multilateral organizations, international donors have played an active role in terms of funding and implementing conservation programmes. It appears that corporate sector has contributed towards and participated in wildlife conservation and tree plantation projects compared to biodiversity projects. The private sector involvement through CSR is estimated to be only 2-3% towards biodiversity related activities[34].

Government Funding

The following table provides MoEFCC budgets for various projects and plans in the wildlife, biodiversity and forest sector during 2015–16 to 2018–19:

Table 4: Budgets for schemes in the wildlife, biodiversity and forest sector

Type of policy/project/authority	2015-16	2016-17	2017-18	2018-19
Central Sector scheme/projects (Rs. in crores)				
Forestry Training and Capacity Building	NA	NA	15.50	15
Other Central Sector expenditure				
National Tiger Conservation Authority	NA	5	10	9
National Biodiversity Authority	NA	18	20.40	20
Animal Welfare Board	11.5	11.04	3.75	10
Central Zoo Authority	5.88		11.50	14.30
Wildlife Institute of India	23.23	26.50	33	30
Indian Council of Forestry Research and Education	125	151.20	195	210
Indian Institute of Forest Management	14.85	20.10	22	25
Wildlife Crime Control Bureau	5.32	10.04	10.40	14
Externally Aided Projects (Rs. in crores)				

[33] Information Dissemination on Community Forestry Projects In India, FAO, accessed on 18 October 2019
34 Public finance mainstay, Biofin website, accessed on 19 October 2019

Green India Mission- National Afforestation Programme (EAP Component)	NA	0.01	0.5	1
Development of Wildlife Habitats (EAP Component)	NA		10	10
Biodiversity Conservation (EAP Component)	NA	2	14	-
NRCP (EAP)	NA	25	33	50
Forestry Training and Capacity Building (EAP)	26.70	NA	10	9
National Coastal Zone Management Programme (EAP)	100	NA	152	150
CSS schemes (including EAP) (Rs. in crores)	1446.60	2000	2634.72	2675.42

It is observed from above table that government budget in various projects, authorities and institutions have cumulatively increased over the last four years. The Indian Council of Forestry Research and Education has received comparatively higher budget allocations in the Central sector expenditure. Green Indian Mission (EAP) has been provided lowest allocation compared to other EAPs. The highest budget has been provided towards CSS schemes among all the components in the table which has further increased over the last four years. According to the National Biodiversity Action Plan, higher budget is allocated towards forestry and wildlife. For example, Project Tiger was allocated a budget of INR 350 crore which was the highest compared to other CSS schemes in 2018-19. Biodiversity conservation (Biosphere reserves) received the lowest budget of INR14.50 crores in 2018-19[35].

Potential for ecotourism

According to Mr. VK Bahuguna, former Director General of Indian Council of Forestry Research & Education, a well-organized ecotourism structure and policies help economy at local, state and national level. If planned properly, ecotourism and further forest conservation and add about 4-5% addition in the GDP allied activities in the country by providing resources for the States. The involvement of the local people can generate income and improve their livelihood. For example, small eco-tourism park in Dhanolti near Mussoorie in Uttarakhand has provided livelihood to more than 300 people, as in Satpura National Park in State of Madhya Pradesh. Globally ecotourism has helped countries to generate more revenue from forests through ecotourism compared to commercial purposes. For example, European countries have been able to generate more than 75% of the revenue from forests through eco-tourism.

A study which evaluated potential for wildlife tourism in India, suggested that growth in wildlife tourism is both and opportunity and challenge. The survey results showed that the primary reason for visitors to visit the national parks under was to enjoy nature and sight tigers. Majority of the tourists were optimistic about local people benefitting from park tourism but expressed an expectation to sight charismatic animals to encourage future visits. The study highlighted that tourists were interested to understand local cultures apart from visiting the parks to explore nature and sightseeing wildlife but also suggested better training for guides. Therefore, it was concluded that there is an opportunity to grow ecotourism, which would help increase awareness and educate tourists on conservation challenges to broaden their understanding of the ecosystem.

[35] Union budget - MoEFCC, MoEFCC, accessed on 22 October 2019

1.2.2 Performance

Presently, the Protected Areas (PAs) that have been recognized by the Government of India are biosphere reserves (18), national parks (104), wildlife sanctuaries (551), conservation reserves (88), community reserves (127) and marine protected areas (131). The protected area network has increased from 574 in 2000 to 870 (5.02% of total geographical area) in 2018[36].

The Status of Tigers in India, 2018 provided a survey of tiger census which estimated the current population of Tiger to be 2,967 as compared to 2,226 in 2014[37]. This increase was observed in every surveyed zone namely, Shivalik Hills and Gangetic Plains Landscape, Central Indian Landscape and Easter Ghats, Western Ghats Landscape, North East Hills and Brahmaputra Plains Landscape, and Sundarbans. However, 141 cases of tiger poaching, and 84 seizures have been recorded between 2012 and 2018 as per National Tiger Conservation Authority (NTCA) but 9,253 poachers have also been arrested for poaching during 2012-2018 as per Wildlife Crime Control Board (WCCB)[38]. The increase in population of Great One Horned Rhino ("Indian Rhino") by Indian authorities has been one of the successful conservation efforts applauded by WWF. There are approximately 3,333 Indian Rhino today as compared to fewer than 200 in 20th century[39]. However, poaching remains the biggest threat for the Indian Rhino apart from habitat loss. According to WWF, Snow Leopard population remains threatened in India due to illegal poaching and trading of animal parts. The Indian Bir Conservation Network was developed to monitor and safeguard Important Bird Areas (IBAs) in the country. Several states launched bird conservation projects for example, Rajasthan initiated the Project Great Indian Bustard to protect the endangered bird from extinction, Uttarayan Save Birds festival has also helped rescue birds and generate awareness on impact of kite flying bird lives. Bird Count India is group of organizations (Indian Bird Conservation Network, Wildlife Institute of India, state bird conservation groups etc.) that work together to increase knowledge on bird population in India. It was reported that over 2,300 people in India were killed by elephants while tigers claimed over 200 lives during 2014–19[40] and around 29 Leopards were killed due to attack by villagers in 2018 in India[41] due to human-wildlife conflict issues.

India submitted the Sixth National Report to the Convention of Biological Diversity report in 2018 (CBD report). According to this report, India has been working towards targets it has drafted under the National Biodiversity Action Plan in line with Aichi Biodiversity targets. Some states have drafted their own Biodiversity Action Plans to integrate biodiversity values at state level development programmes for example Uttarakhand, Maharashtra, Kerala, Punjab. There has been an increase in the number of Biodiversity Management Committees (74,063), Peoples Biodiversity Registers (6,096) in 2017 to increase local community involvement including women to achieve the NBT of sustainable development of local and vulnerable communities along with biodiversity conservation. For example, Women's Hargilla Army in Assam helped save the Great Adjutant Stork (red listed bird under IUCN) from disappearance. There

[36] Protected areas of India, ENVIS Centre on Wildlife & Protected Areas, accessed on 16 October 2019
[37] Status of Tigers in India, 2018, accessed on 19 October 2019
38 Around 9000 Wildlife Poachers Apprehended Between 2012 and 2018 in India, 2019, Ranthambore National Park website, accessed on 19 October 2019
39 Indian Rhino Vision 2020, 2015, Ellis.S et al, accessed on 19 October 2019
[40] Elephants killed over 2,300 people in last five years:Wildlife Protection Society of India website, June 2016, Wildlife protection society of India, accessed on 19 October 2019
[41] Figuring Out the Enigma of Leopard Deaths in India: A Complete Analysis, February 2019, Rathmore National Park, accessed on 19 October 2019.

has also been an increase in Environmental Education at school and college level to achieve NBT of raising awareness among youth in the country.

Botanical Survey of India and Zoological Survey of India helped discover new species which has increased India's floral and faunal species to 48,655 and 1,00,693 respectively. The differential increase is 3,655 in floral and 1,693 in faunal species from the previous figures. The number and area of protected areas increased from 690 PAs covering 16,685 km^2 in 2014 to 770 protected areas covering 1,62,098.57 km^2 in 2017. Wildlife Institute of India (WII) identified 106 more sites for prioritized conservation as Important Coastal and Marine Areas. Twelve Biodiversity Heritage sites covering 941.44 km^2 have were notified under the Biodiversity Act, 2002. Ecologically sensitive zones (ESZ) comprising of 30349.63 km^2 was notified around 283 protected areas for protection as buffer zones. Nearly 110 Medicinal Plant Conservation Areas (MPCAs) inside protected forests secure in situ conservation in natural habitats. The wetland area increased by 2,647 km^2 during 2005-2015 which is attributed conservation and biodiversity related works taken up under Mahatma Gandhi Rural Employment Guarantee Act. Conservation of wetlands outside Protected Areas is being strengthened through Wetland (Conservation and Management) Rules, 2017.which has further encouraged constitution of 'State Wetland Authority' for conservation and integrated management of wetlands in many states. For example, Uttar Pradesh government has been actively working towards notification of all wetlands outside protected areas exceeding 2.24 ha under the Rules, 2017. As on date only one wetland i.e Suhkna has been notified under the Wetlands (Conservation and Management) Rules, 2017. Further, funding plays a crucial role in implementation and achievement of national goals. The CBD report acknowledged that expenditure towards biodiversity increased by 82.4 % in 2016-2017 compared to 2012-13 which augmented NBSAP implementations.

The six bureaus of Ministry of Agriculture namely, National Bureau of Animal Genetic Resources, National Bureau of Plant Genetic Resources, National Bureau of Fish Genetic Resources, National Bureau of Agriculturally Important Microbes, National Bureau of Agricultural Insect Resources and National Bureau of Soil Survey and Land use Planning conducted explorations to identify and conserve genetic diversity. As a result of this, approximately, 437,000 accessions of plant germplasm of major crops were registered and preserved in the National Gene Bank during 2014 to 2018[42].

In 2010, National Mission for Sustaining Himalayan Ecosystem was drafted by Ministry of Science and Technology under the National Action Plan on Climate Change to develop sustainable national capacity in a time bound manner to continuously assess the health status of the Himalayan Ecosystem Himalayan ecosystem which includes glaciers, biodiversity, wildlife through research and scientific assessment, knowledge sharing, creating awareness, studying traditional knowledge systems etc[43]. This indicates that there was a cross sectoral initiative to protect Himalayan biodiversity by encouraging collaborative research porogrammes and knowledge sharing through various institutions.

According to the Forest Cover report by Forest Survey of India, the present forest cover is 21.54% of the geographic area of the country which has increased over the years but is still below the target of 33% forest cover. The states with the largest forest cover in the country are Madhya Pradesh (77,414 sq. km),

[42] 42India's sixth report for convention on biodiversity diversity, 2018, MoEFCC, accessed on 19 October 2019
[43] National Mission for Sustaining Himalayan Eco system, 2010, Ministry of science and Technology, accessed on 21 October 2019

Arunachal Pradesh, Chhattisgarh, Odisha and Maharashtra There was an increase in forest cover between 2015 and 2017 by 6,778 sq. km. Andhra Pradesh, Karnataka and Kerala contributed to a total increase of 4285 sq. km forest cover since 2015 which can be attributed to plantation, conservation and better technology for mapping the forest area. However, forest reduction of 1171 sq. km was recorded in some states such as Mizoram, Nagaland and Arunachal Pradesh[44]. The CBD report also highlighted an increase in forest area by 16,246 sq. km, very dense forest by 12,254 sq. km, mangroves by 181 sq. km, growing stock by 5768 sq. km, carbon stock by 7044 sq. km[45].

The wetlands in India have not recorded a significant progress on conservation and use because only selected number of wetlands receive significant attention under the wetland conservation programmes (like NWCP and NLCP) while others get neglected[46].There has been a significant concern raised over the conservation of wetlands and lakes in several states such as Maharashtra, West Bengal, Uttar Pradesh, Karnataka due to developmental projects, dumping of construction debris, sewage dumping in the small water bodies[47]. Some of the results of CAG performance audit on water pollution reported that inventorization of lakes and key species was not recorded, identification of pollutants and contaminants was not carried out, water quality goals were not developed, programmes that aim to control water pollution in lakes were also not efficiently implemented by several states[48]. The pollution in wetlands and lakes have been majorly due to pesticide release from agricultural activities, discharge of untreated sewage water, developmental activities, limited analysis of climate change impact, land use changes etc.[49] MoEFCC in collaboration with ISRO has prepared a national and state wetland inventory in the form of National Wetland Atlas (state wise) (Space Application Centre) in 2011.

Recently, PARIVESH was launched in 2018 as a single window hub for environment, forest, wildlife and CRZ clearances to expedite bureaucracy in these areas[50].

Currently there is a growing demand for timber in India. The current annual consumption of timber in the country is 68.9 million cubic meters and the availability is 70.9 million cubic meters. The demand is being largely met from 44.34 million cubic meters trees outside forests (TOF) sand 18.01 million cubic meters of imports. This is because policies such as Forest conservation Act,1980 and National Forest Policy,1988 limited the supply of timber from forest areas . It has been predicted that India will face shortage of supply of timber by 2020. Imports of timber have increased from 2001 to 2015 and can reach to 22.51 million cubic meters by 2020 if the imports increase at the same rate . Therefore, there is a need to increase self-sufficiency in Timber. One of recommended pathways is to promote agroforestry which is also included in TOF.

It can be observed that increase in faunal and floral diversity, increase in number of endangered species, increase in forest cover, new initiatives to conserve ecosystems, building inventories and database indicate that governments at national and state level are working towards the objectives of policies.

44 Forest Cover, 2017, Forest Survey of India, accessed on 19 October 2019
45 Forest Cover, 2017, Forest Survey of India, accessed on 19 October 2019
46 Status of Wetlands in India, November 2014, Nitin Bassi et al, accessed on 19 October 2019
47 India's Wetlands 2016: Encroached and Polluted, 2017, SANDRP, accessed on 19 October 2019
48 Performance audit of Water Pollution, 2011-12, CAG, accessed on 21 October 2019
49 Status of Wetlands in India, November 2014, Nitin Bassi et al, accessed on 19 October 2019
50 Strategy for Newx India @75, November 2018, Niti Aayog, accessed on 22 October 2019

However, scheme implementation should be improved in several areas such as health of aquatic ecosystems, protection of various species covered under the endangered list of species of India, effective engagement of local communities in conservation policies by states etc.

The Ecotourism Certification Standard is currently being developed by Network for Certification and Conservation of Forests (NCCF). India has developed guidelines and policy for ecotourism on a national level. Currently, only some states have their own ecotourism policies administered through state ecotourism boards or forest departments. In India, Madhya Pradesh Ecotourism Development Board has also commenced development of Arnia Ecopark under PPP model. Further, multi-stakeholder collaboration which comprises partnership with public and private sector (PPP) along with other stakeholders' augments accomplishment of ecotourism projects. For instance, development of infrastructure requires large investment and expertise which triggers the need for private sector participation, the government acts as a facilitator through creation of suitable policies, forest departments help in providing relevant permissions, other stakeholders such as tourists and locals support conservation by cooperating and respecting the environment and culture of the protected areas[51].

1.2.3 Issues and challenges

Issues and Challenges

Wildlife conservation has faced challenges such as habitat loss due to developmental activities which has led to human-wildlife conflicts. These conflicts can be a result of non-communication of warning signals, lack of awareness on mitigation measures. Further ineffective implementation of compensatory schemes due to loss of life or livelihood has further added to the difficulties of local communities.

Tiger and elephant conservation have been given higher weightage as compared to other animals which has limited the data collection for other animals. The budget allocation under CSS scheme also gives more weightage to Project Tiger. This makes an uneven budget allocation among the CSS schemes which may impact performance of schemes. The main issue indicated in the CAG performance audit was inefficient planning, implementation and monitoring to control pollution on central and state level.

Unavailability of a comprehensive wildlife census data of various species other than tiger, its co-predators and prey species, Indian Rhinos, elephants makes the impact assessment of wildlife conservation schemes difficult. This further indicates that only handful of species have been focused on under conservation schemes and rest have been comparatively neglected. Poaching has prevailed as major threat and increased in case of tigers, elephants, leopards, Indian Rhino. The elephant population status has not been clearly reported by the government due to inadequate information from states. There is no government led project primarily dedicated to bird conservation in India for endangered birds in India like house sparrows.

Several government bodies reports such as National Biodiversity Authority Annual Reports, MoEFCC annual reports only highlight various discussions, committee meetings, number of newly identified protected areas etc. under achievements of conservation efforts but do not record impact and achievements accomplished under the schemes and policies.

51 Role of PPP in Eco-Tourism Sector, Shodhganga

The evidence of reduction in forest cover in certain areas indicates the efforts need to be strengthened to achieve target of zero forest cover loss. This forest reduction is a result of developmental activities, regeneration of other plantations such as Bamboo, shifting cultivation[52]. According to the MoEFCC budgets, forestry capacity building does not receive adequate funding as compared to forestry research.

Despite the enactment of legislations and unlimited potential for ecotourism, there are very few examples from India where revenues earned are routed back to conservation or for local communities from community based or community run ecotourism enterprises or private sector partnerships. A research highlighted that 'greenwashing' in ecotourism is prominent in India across many protected areas, since most principles of ecotourism are not imbibed. This is due to unregulated development of relatively undisturbed areas, misuse of eco-labels etc. This has been primarily due to the absence of any certification policy.

Agroforestry has a huge potential in India yet the adoption rates are still low because there are several challenges that reap the benefits of agroforestry like shortage of superior planting material, insufficient research, lack of market infrastructure, cumbersome legislations, wood transportation, processing etc. However, the National Agroforestry Policy aims to reduce the challenges and further encourage adaptation of agroforestry. A research which studied some gaps in the National Agroforestry Policy, recommended preparation of regional models of agroforestry for small, marginal and large farmers is not covered by the policy, uniformity of guidelines for exemption of agroforestry tree species in all states are required, more emphasis should be given on hi-tech forestry, structured guidelines for insurance and credit access should be formulated, the grassroots level mechanism for convergence of schemes and programmes is yet to be implemented. The policy has majorly generalized suggestions to improve agroforestry but has not mandated a detailed structure to be followed.

National Agroforestry Policy, 2014 aims to increase timber production in India. The policy mentions challenges such as lack of processing technologies for fast growing timber species, limited knowledge and facilities in timber industry, limited research in agroforestry for multipurpose species that have nitrogen-fixing ability, meet local needs of timber, fodder, fuel and improve soil health. Therefore, the implementation of policy objective to increase domestic production of timber can be strengthened to address these gaps.

Studies on status of wetlands in India have reported that management of wetlands has received inadequate attention. Many wetlands have degraded due to anthropogenic pressures, including land use changes in the catchment area, pollution from industry and households, encroachments leading to habitat destruction of fishes and birds, tourism, agricultural run-off carrying pesticides and fertilizers. Further, majority of research on wetland management has focused on limnological aspects of wetland management, whereas, hydrological and land use changes in the catchment area, socio-economic processes leading to limnological changes have not be adequately studied. Unplanned development, absence of management structure, and lack of awareness importance of these ecosystems have contributed to their degradation. Other reasons such as deforestation of mangroves, overuse of water in agriculture has also caused poor state of wetlands. Infestation of invasive weeds have also been one of

[52] Forest Cover, 2017, Forest Survey of India, accessed on 19 October 2019

the biggest challenges in conservation of wetlands. According to CAG performance audit on water pollution, it was reported that inventorization of lakes and key species was not recorded, identification of pollutants and contaminants was not carried out, water quality goals were not developed, programmes that aim to control water pollution in lakes were also not efficiently implemented by several states. However, MoEFCC in collaboration with ISRO has prepared a national and state wetland inventory in the form of National Wetland Atlas (state wise) (Space Application Centre) in 2011 and is further strengthening the inventory of state wetlands.

1.3 Pollution abatement

1.3.1 Air pollution

1.3.1.1 Background

Rapid urbanisation and industrialisation have added elements/compounds to the pure air that result into or increase pollution. Urban and rural India have been increasingly witnessing degradation in air quality, either due to vehicular and industrial emissions or air pollution resulting from using firewood or other biomass from cooking. Over two-thirds of rural Indians are caught in the 'chulha trap' using biomass fuels such as wood, dung or coal to meet their cooking and heating needs, resulting in smoke-filled homes and extremely high levels of exposure especially to women and children[53]. Various sources of air pollution could be broadly categorized into following categories: Vehicle, Dust and construction, Biomass burning, Industries, Diesel gensets and Domestic. According to TERI's inventory below are the major sources of air pollutants and their contribution to air pollution[54].

PM2.5

Urban	Rural
36%- Industrial 39%- Residential combustion 4%- Transport 4%- Power plants 11%- Other sectors	7%- Open burning of agricultural residue
NOx	**SOx**
35%- Transport sector 22%- Power plants 15%- DG and agricultural pump sets	49%- Industry 43%- Power sector

As per the WHO Urban Ambient Air Quality Database, as many as 10 of the top 20 most polluted cities in the world are in India with the highest annual average levels of PM2.5[55],with nearly all in Northern and North-Western India[56]. Thus, air pollution has been a serious problem in most of India and has reached

[53] Air Pollution and Health in India: A review of the current evidence and opportunities for the future, 2017, Centre for Environmental Health, accessed on 18 October 2019
[54] Air pollutant emissions scenario for India,
[55] WHO Global Urban Ambient Air Pollution Database (Update 2016), World Health Organization, accessed on 18 October 2019.
[56] India Three Year Action Agenda- 2017-18 to 2019-20, NITI Aayog, 2017, accessed on 18 October 2019

crisis levels in Northern India. Air pollution has significant negative health impacts on the population[57], contributing significantly to the country's burden of disease. In 2016, a World Bank study revealed that air pollution cost India approximately 8% of its GDP in 2013, as a result of lost productivity due to premature mortality and morbidity[58]. Thus, the impacts of air pollution are not limited to direct ones on health, but also are extended to indirect ones on economy.

The Central Pollution Control Board (CPCB) has developed Minimal National Standards (MINAS) for 113 sectors. Under NAMP, four air pollutants viz. SO2, NO2, suspended particulate matter (PM10), and fine particulate matter (PM2.5) have been identified for regular monitoring at all the locations.

The objectives of NAMP are:

- to determine the status and trends of ambient air quality
- to ascertain whether the prescribed ambient air quality standards are violated;
- to identify non-attainment cities; (iv) to obtain the knowledge and understanding necessary for developing preventive and corrective measures; and
- to understand the natural cleansing process undergoing in the environment through pollution dilution, dispersion, wind-based movement, dry deposition, precipitation, and chemical transformation of the pollutants generated

India has committed to combat air pollution with a solutions-oriented approach under the National Clean Air Programme (NCAP). Developed in 2019, NCAP is a comprehensive strategy with actions to prevent, control and reduce air pollution and improve air quality monitoring across the country. Learning from global experiences, action plans are city specific rather than country oriented. The programme has proposed tentative national level target of 20-30% reduction of PM2.5 and PM10 concentration by 2024, keeping 2017 as the base year for the comparison of concentration[59].

1. To ensure stringent implementation of mitigation measures for prevention, control and abatement of air pollution
2. To augment and evolve effective and proficient ambient air quality monitoring network across the country for ensuring a comprehensive and reliable database
3. To augment public awareness and capacity-building measures encompassing data dissemination and public outreach programmes for inclusive public participation and for ensuring trained manpower and infrastructure on air pollution

Various CS and CSS schemes have been implemented by the government to tackle the challenge of air pollution.

Table 5: CS and CSS schemes related to air pollution

Scheme	Objectives

[57] Ibid.
[58] Cost of Air Pollution: Strengthening the economic case for action, 2016, World Bank and Institute for Health Metrics and Evaluation, accessed on 18 October 2019.
[59] Ibid.

National Clean Air Programme (NCAP)	• To ensure stringent implementation of mitigation measures for prevention, control and abatement of air pollution • To augment and evolve effective and proficient ambient air quality monitoring network across the country for ensuring a comprehensive and reliable database • To augment public awareness and capacity-building measures encompassing data dissemination and public outreach programmes for inclusive public participation and for ensuring trained manpower and infrastructure on air pollution
National Air Quality Monitoring Programme (NAMP)	The Central Pollution Control Board (CPCB), in association with State Pollution Control Boards (SPCBs) / Pollution Control Committees (PCCs), monitor air quality across the country under NAMP. Under this scheme grants are being provided to SPCBs, Environment Departments, Central/State Research Institutions, and other government agencies/ organizations with the aim of strengthening their technical capabilities to achieve the objective of management and control of pollution[60]. Four air pollutants- SO_2, NO_2, suspended particulate matter (PM10), and fine particulate matter (PM2.5) are regularly monitored over 240 cities of the country[61].
National Mission for Electricity Mobility (NMEM)	Enhance penetration of efficient and environmentally friendly hybrid and electric vehicles
Smart Cities Mission	• Applying Smart Solutions to infrastructure and services in area-based development in order to make them better. • Promoting a variety of transport options - Transit Oriented Development (TOD), public transport and last mile para-transport connectivity • Creating walkable localities – reduce congestion, air pollution and resource depletion
Pradhan Mantri Ujjwala Yojana	To safeguard the health of women & children by providing them with a clean cooking fuel – LPG, so that they don't have to compromise their health in smoky kitchens or wander in unsafe areas collecting firewood.

Regulations and standards have played an important role in the sector for a long time. The Air (Prevention and Control of Pollution) Act was enacted in 1981 to prevent, control and abate air pollution. The National Ambient Air Quality Standards (NAAQS) have also been developed as a policy guideline that regulates the effect of human activity upon the environment so that pollutant emission into the air can be regulated. Major objectives of NAAQS are:

[60] Ibid.

[61] National Air Quality Index (AQI) launched by the Environment Minister AQI is a huge initiative under 'Swachh Bharat, 2014, Press Information Bureau, accessed on 18 October 2019.

i. to indicate necessary air quality levels and appropriate margins required to ensure the protection of vegetation, health, and property,
ii. to provide a uniform yardstick for the assessment of air quality at the national level and,
iii. to indicate the extent and need of the monitoring programme[62]

NAAQS defines standards for Sulphur Dioxide (SO2), Nitrogen Dioxide (NO2), PM10, PM2.5, Ozone (O3), Lead (Pb), Carbon Monoxide (CO), Ammonia (NH3), Benzene, Benzo(a)Pyrene (BaP)- particulate phase only, Arsenic (As), Nickle (Ni).

Many international, multi-lateral organizations have developed knowledge base, and knowledge and data sharing platforms that that its members contribute to and keep developing. India has formally joined the Climate & Clean Air Coalition (CCAC), a voluntary partnership of governments, intergovernmental organizations, businesses, scientific institutions and civil society organizations committed to improving air quality and protecting the climate through actions to reduce short-lived climate pollutants. 67 state partners, 75 non-state partners, 18 intergovernmental organizations, 57 non-governmental organisations and numerous private sector entities are its members[63]. Another such initiative is the Clean Air Initiative announced in 2019 by United Nations, the World Health Organization (WHO), the United Nations Environment Programme (UN Environment), and Climate and Clean Air Coalition. The initiative calls on national and subnational governments to commit to achieving air quality that is safe for citizens, and to align their climate change and air pollution policies by 2030[64].

Moving beyond command and control policies, a cap-and-trade plan is being piloted in Surat, an industrial cluster in Gujarat to reduce particulate air pollution. In June 2019, Gujarat Pollution Control Board announced plans to pilot the world's first market-based scheme to reduce particulate air pollution. The pilot involves nearly 370 companies operating in Surat, one of the main industrial cities of the state. Under the scheme, individual industries will be allocated credits to emit a certain amount of particulate matter and is they are able to emit lesser than the credits available, they would have the option to trade unused credits to others who need to emit more. The mechanism has been used successfully in other countries such as the United States to reduce acid rain. If successful, it could set an example for other states and cities across the country and encourage private sector investment for pollution abatement measures at lower costs.

Livelihood, job creation in the sector

Approach and measures to bring reductions in air pollution require innovating and scaling up the alternatives to sources of energy such as coal and biomass fuels. Innovations to harness renewable energy would help generate new business opportunities, thereby generating new sources of employment. For instance, Pradhan Mantri Ujjwala Yojana (PMUY) is likely to result in an additional employment of around 1 Lakh and provide business opportunity of at least Rs. 10,000 Cr. over the next 3 Years to the Indian

[62] National Clean Air Programme, 2019, Ministry of Environment, Forest and Climate Change, accessed on 18 October 2019.
[63] United Nations Environmental Programme, accessed on 18 October 2019
[64] United Nations announces 2019 Climate Action Summit 'Clean Air Initiative', calls on governments at all levels to join, 2019, accessed on 18 October 2019.

industry. Launch of this scheme will also provide a great boost to the 'Make in India' campaign because all the manufacturers of cylinders, gas stoves, regulators, and gas hose are domestic[65].

Effect on tribal communities, other vulnerable communities

Studies have shown that people of a lower socio-economic status (the unemployed, those on low incomes or with lower levels of education) are particularly vulnerable to air pollution exposure[66]. There are various reasons for this including occupation, housing, cooking fuel use, the common link between being poverty. According to a study conducted in 2013, as Neighborhood Socioeconomic Status (NSES) reduces, concentrations of air pollutants increased[67].

1.3.1.2 Performance

Reduction of air pollution has been captured in several SDG goals and targets

Target 3.9	By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination
Target 7.1	By 2030, ensure universal access to affordable, reliable and modern energy services India's targets: • Percentage of households to be electrified by 2030 - 100% • Percentage of households using Clean Cooking Fuel by 2030 - 100%
Target 7.2	By 2030, increase substantially the share of renewable energy in the global energy mix India's targets: Renewable share of installed generating capacity (%) by 2030 - 40%

Monitoring of air pollutants in India has sound coverage and frequency due to real-time air quality data recorded through numerous monitoring stations.

Continuous Ambient Air Quality Monitoring Stations: There are 134 real-time Continuous Ambient Air Quality Monitoring stations (CAAQMS) in 71 cities across 17 states, monitoring 08 pollutants viz. PM10, PM2.5, SO2, NOx, ammonia (NH3), CO, ozone (O3), and benzene.

As of 2019, 703 monitoring stations have been installed in 307 cities under NCAP[68], of which 102 non-attainable cities have been identified based on ambient air quality data for the period 2011 – 2015 and WHO report 2014/2018[69].

Government policy/prgramme interventions

Below are the measures which re taken by the government for improvements in energy efficiency and air pollution control in India.

[65] PMUjjwala Yojana, accessed on 18 October 2019

[66] Unequal exposure and unequal impacts: social vulnerability to air pollution, noise and extreme temperatures in Europe, 2018, European Environment Agency, accessed on 18 October 2019.

[67] Air Pollution and Individual and Neighborhood Socioeconomic Status: Evidence from the Multi-Ethnic Study of Atherosclerosis (MESA), 2013, Anjum Hajat, Ana V. Diez-Roux, Sara D. Adar et. al., accessed on 18 October 2019. Available from: https://ehp.niehs.nih.gov/doi/10.1289/ehp.1206337

[68] National Clean Air Programme, 2019, MoEF&CC

[69] Rajya Sabha starred question 12, 2019.

- Advanced vehicle emission and fuel quality standards– BSIV from 2017 and BS-VI from 2020
- Ujjawala scheme to accelerate the LPG penetration programme for cooking in households
- Notifying new stringent standards for diesel generator sets for standby power generation.

Pollution control measures in industry

- Various measures are taken in the industry to reduce particulate matter pollution, including cyclonic separators, fabric filter collectors, wet scrubbers, and electrostatic precipitators.
- Reduction in nitrogen oxide pollution is done during combustion through staged combustion and Fluidised Bed Combustion (FBC). NOx pollution after combustion is removed through measures such as Selective Catalytic Reduction, Selective Non-Catalytic Reduction and Activated Carbon Process
- Reduction in nitrogen oxide pollution is done during combustion through Fluidized Bed Combustion (FBC) and Integrated Gasification Combined Cycle System. As well as after combustion by Flue Gas Desulphurisation (FGD) that uses Limestone system, Spray Dry System or Seawater Scrubbing System[70].

India is third most polluted in the world for its PM2.5 concentration[71]. The estimated average PM2.5 concentration (µg/m³) in India is 72.5. While comparing the world's regional capital cities by their average yearly PM2.5 concentration (µg/m³), Delhi ranks first- the highest polluted in the world[72].

To reduce its increasing air pollution, India has also focused on harnessing renewable energy and scaling those solutions. Successful solar, wind and hydro power plants have been installed and those solutions have been deployed through various schemes. India has set timebound goals to increase its capacity to harness renewable energy which keeps momentum on.

1.3.1.3 Issues and challenges

India has stringent pollution control standards, but the enforcement is not ensured, which renders them futile. Implementation of pollution control laws despite an overwhelming number of motorized transports on the streets is another challenge to ensure safe air quality. Hence, stronger mechanisms for compliance with air pollution standards is the need of the hour.

Furthermore, failure of the public transport system to cope with the rapid pace of urbanization and economic activity has aggravated the burden of air pollution related diseases. Setting time bound targets is crucial for aggressive approach towards air pollution reduction. This should be done through collaboration among various divisions/agencies to ensure a holistic approach.

In the rural areas, lack of universal access to clean household energy presents a major challenge to improving health and protecting the environment. While adoption of clean fuels such as LPG through Pradhan Mantri Ujjwala Yojana is being undertaken, there is a need to develop and deploy low-cost innovative solutions for mitigating health impacts of air pollution.

Apart from government funding, efforts to leverage private sector funding also needs to be explored. While the private sector is required to invest in pollution abatement measures through stringent emission

[70] Industrial emission controls: Sulphur Dioxide
[71] 2018 World Air Quality report. Region & City PM2.5 Ranking, accessed on 18 October 2019
[72] Ibid.

rules and regulations, other mechanisms can also be explored such as encouraging investments through mandatory Corporate Social Responsibility initiatives and market mechanisms such as the cap and trade scheme being piloted in Surat[73].

Enforcement of existing regulation is a challenge. A key indicator of whether the regulations have been successful at reducing pollution is the degree to which industries comply with them. There is evidence that highlights serious problems with the enforcement of existing regulations across India[74]. Lack of funding for the Central Pollution Control Board is a concern[75]. the total annual budget of the Central Pollution Control Board (CPCB) in India was just INR 74.3 crores (USD 11 million) in 2017[76], which is inadequate for conducting new research, policy guidance to states and enforcement activities among others.

Data driven and empirical approach is crucial not only for bringing improvement in environmental health. It also facilitates identification of problems, tracking trends, consequentially allowing to highlight policy success and failures. Such an approach ensures optimization of the gains from investments in environmental protection. Evidence highlights serious problems with the enforcement of existing regulations across India.

Strengthening monitoring of industrial emissions would generate reliable information on what the plants emit on a day to day basis, which would not only reflect the level of compliance or the lack thereof, but would also provide insights necessary to formulate strategies where mere technology mandates fail to solve the pollution problem[77].

1.3.2 Marine pollution

1.3.2.1 Background

Over three billion people across the world depend on marine and coastal ecosystems for their livelihood. Sustainable use of oceans is indispensable for habitation on earth, given the fact that oceans cover three quarters of the earth's surface, contain 97 percent of the earth's water, and represent 99 percent of the living space on the planet by volume[78]. Marine ecosystems play a significant role in maintaining healthy life-cycles on land. Oceans absorb about 30 percent of the carbon dioxide produced by humans. However, reckless exploitation of ocean resources and irresponsible human activities have caused almost 40 percent of world's oceans to be heavily affected, including depleted fisheries, ocean acidification, and loss of coastal habitats and beaches that have been littered recklessly.[79] In India, the quantity of litter on the beaches has been found to vary[80] with plastics being the major pollutants[81].

[73] https://gpcb.gujarat.gov.in/uploads/ETS_Cap_and_Trade_Plan_for_Air_Particles.pdf
[74] The solvable challenge of air pollution in India, 2017, National Council for Applied Economic Research.
[75] Ibid.
[76] Rajya Sabha Report- 313, 2019.
[77] The solvable challenge of air pollution in India, 2017, National Council for Applied Economic Research.
[78] United Nations in India, 2018
[79] http://niti.gov.in/writereaddata/files/SDX_Index_India_21.12.2018.pdf
[80] CMFRI Annual Reports in Eprints.cmfri.org.in
[81] https://www.unenvironment.org/news-and-stories/press-release/india-sets-pace-global-race-beat-plastic pollution

India has taken various steps to protect and enhance the coastal and marine ecosystem. Maritime sector in India has been the backbone of the country's trade. To utlize India's 7,500 km long coastline, 14,500 km of potentially navigable waterways and strategic location on key international maritime trade routes, the Government of India is emphasising promotion of Blue Economy through ambitious projects like the Sagarmala, which aim to promote port-led development of coastal communities through skill development and livelihood generation activities, fisheries development, coastal tourism, etc.

India has 25 Marine Protected Areas in the peninsular region and 106 in islands, collectively covering approximately 10,000 square km of the country's geographical areas. Four major coral reefs have also been identified in the country for intensive conservation and management. Various national and sub-national legislation are in place for the management and protection of the coastal and marine environment. India has also ratified numerous international conventions related to the use of oceans and their resources, including the United Nations Convention on the Law of the Sea. In addition, the revised National Oil Spill Disaster Contingency Plan, 2015 reflects the important national regulations as well as the current international norms[82].

Monitoring of the levels of marine pollution has been initiated through the Coastal Ocean Monitoring and Prediction System. India is also setting up a Marine Observation System along the Coast to gain a better understanding of coastal processes and monitor water quality. It is estimated that 80 per cent of pollutants in the marine environment originate from land. Some of the hazardous substances, such as toxic heavy metals, persistent organic compounds such as pesticides and industrial chemicals, hydrocarbons and radioactive substances released from industrial, agricultural, municipal and mining activities ultimately enter the marine environment through surface water and groundwater[83]. The contaminants in the coastal water may accumulate in marine organisms through which they enter the food chain adversely impacting human health.

The Society of Integrated Coastal Management (SICOM) has been established with a vision for vibrant, healthy and resilient Coastal and Marine Environment for continuous and enhanced outflow of benefits to the Country and the Coastal Community. Its objectives and functions include:

- To Support implementation of the Integrated Coastal Zone Management (ICZM) activities in India.
- To promote Research & Development (R&D) and stakeholder participation in management of the Coastal areas in India.
- To support to check violations to CRZ through improved technology-enabled enforcement, strengthened institutions, and regulatory and legal reform.

Integrated Coastal Zone Management Project (ICZM) Project has been initiated to protect and conserve the coastal and marine ecosystems and its environment. The project will be implemented through a holistic coastal management and will implement the National Environment Policy 2006 and various other notifications and recommendations with public participation. The provisions of the project are to:

- Achieve sustainable development of the coastal and marine area.

[82] SDG India Index, Baseline Report- 2018, NITI Aayog
[83] Coastal and marine pollution, International Atomic Energy Agency

- Reduce vulnerability to natural hazards which have major implication on the coastal areas and coastal communities especially with respect to Sea Level Rise (SLR) and increased frequency of cyclones and storm surges.
- To conserve and protect the fragile coastal ecosystems such as the mangroves, brackish water wetlands and coral reefs, including addressing the pollution of coastal waters and livelihood improvement of local communities.
- Strengthen institutional and governance capacity for Integrated and sustainable Coastal Management as per the National Environmental Policy 2006.
- Capture and disseminate lessons in best practice, both locally and globally.

India has also joined forces with various international initiatives and campaigns to tackle the challenge of marine pollution.

- **Clean Seas Campaign**

India has committed to join UN Environment's Clean Seas campaign, which seeks to turn the tide on marine litter. As part of this commitment, the government will establish a national and regional marine litter action campaign as well as a program to measure the total marine plastic footprint in India's coastal waters.[84]

- **National Marine Litter Policy**

To stop plastic waste from entering the ocean, the Union Ministry of Earth Sciences will assess the extent and source of marine litter along India's coastline[85].

- **India-Norway Marine Pollution Initiative**

To support local governments in implementing sustainable waste management practices, develop systems for collecting and analyzing information about sources and scope of marine pollution and improve private sector investment through a range of implementing partners[86].

- **Scheme on "Development of Marine Fisheries, Infrastructure and Post-Harvest Operation"**
    - Introduction of Intermediate Craft of improved design.
    - Resource specific Deep-Sea Fishing Vessels (including VMS).
    - Motorization of Traditional Craft.
    - Safety of Fishermen at Sea
    - Fishermen Development Rebate on HSD
    - Establishment of Fishing Harbours and Fish Landing Centres.
    - Strengthening of Post-Harvest Infrastructure
- **Neel Kranti Mission (Blue Revolution)** – Marine fisheries and aquaculture-related components; Integrated Development and Management of Fisheries

[84] https://www.unenvironment.org/news-and-stories/press-release/india-sets-pace-global-race-beat-plastic-pollution
[85] https://swachhindia.ndtv.com/national-marine-litter-policy-government-begins-work-action-plan-check-plastic-waste-flowing-oceans-21330/
[86] India and Norway launch initiative to combat Marine Pollution, 2019

- **Global Partnership on Marine Litter**- The partnership seeks to protect human health and the global environment by the reduction and management of marine litter as its main goal, through several specific objectives.

Reduction of marine pollution has been captured in SDG 14 through various targets.

Target 14.1	By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution
Target 14.2	By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans
Target 14.5	By 2020, conserve at least 10 percent of coastal and marine areas, consistent with national and international law and based on the best available scientific information

Though India has not defined any specific targets for marine pollution, coastal communities that depend on ocean for their livelihood and food are particularly vulnerable to marine pollution.

1.3.2.2 Issues and challenges

Marine debris is a significant issue affecting coastal pollution. Since the major source of marine debris is solid waste on land, an evaluation of the solid waste generated on land and the effectiveness of waste management can indicate the threat to the coastal ecosystem of the specific area[87]. A multi-agency partnership and collaboration is essential to tackle marine and coastal pollution.

Projects such as Sagarmala Project/Blue Revolution should be strengthened as they adopt a holistic approach towards improving state of India's ports and coastlines. According to India's Fifth National Report to the Convention of Biological Diversity 2014, India has a long coastline of about 7,517 km in length which sustains and provides a source of livelihood to over 250 million people. India is the second largest producer of fish in the world. The Indian government's Sagarmala Project, also known as the Blue Revolution, is working to improve the state of India's ports and coastlines[88].

Managing waste on land is crucial to ensure that it does not end up in the ocean as marine debris. Oil spills, fertilizer runoff, garbage, sewage and other chemicals enter the sea from land-based activities. Hence it becomes essential to adopt an integrated approach for protection of coastal areas and for treatment of waste streams that are being generated from the domestic and industrial sources.

1.3.3 Noise pollution

1.3.3.1 Background

Environmental noise pollution is becoming a major problem in India that can have serious health effects. The World Health Organization (WHO) recognized noise as one of the major pollutants affecting the health of the human population[89]. Noise pollution can result in hearing loss or impairedness,

[87] A national marine debris management strategy to conserve marine ecosystems, 2016.
[88] http://sagarmala.gov.in/projects/projects-under-sagarmala
[89] World Health Organization (WHO), Burden of disease from environmental noise, Quantification by healthy life years lost in Europe, WHO Regional Office for Europe, Denmark, 2011.

increasing stress levels, behavioural and mental problems, insomnia, heart ailments, hypertension among others. Some of the major sources of noise pollution are: road traffic, rail, construction noise, honking noise from vehicles, noise emitted from household appliances, loudspeakers, community processions, etc. Road traffic noise has been observed to be the major source of noise pollution in most of these studies carried out in different parts of the world[90].

The problem of environmental noise pollution requires a coherent strategy of long-term and medium- to short-term measures aimed at reducing exposure. Long-term measures are generally those that are aimed at reducing noise levels on a broader scale while medium- to short-term measures tend to be focused on mitigation of more specific and localized noise conflicts. While the increasing ambient noise levels in public places from various sources, industrial activity, construction activity, fire crackers, sound producing instruments, generator sets, loud speakers, public address systems, music systems, vehicular horns and other mechanical devices have deleterious effects on human health and the psychological wellbeing of the people; it is considered necessary to regulate and control noise producing and generating sources with the objective of maintaining the ambient air quality standards in respect of noise.[91]

With an objective of collecting real-time data, a National Ambient Noise Monitoring Network (NANMN) has been established in India. The CPCB has initiated the NANMN project in 2011 for collecting noise monitoring data from major cities of India. The network provides ambient noise level data which can be helpful in identification of noisy spots and adoption of suitable measures of abatement for noise pollution control. Phase I of NANMN covers 35 locations in seven metro cities of India. Among these, 14 locations lie in commercial zones, 5 in industrial, 7 in residential and 9 in silence zones. The numbers of monitoring stations increased to 70 in 2014, with each city having ten noise monitoring stations[92].

1.3.3.2 Performance

The regulation of noise pollution in the country has primarily been driven through rules and regulations. For better regulation for noise pollution, the Noise Pollution (Regulation and Control) Rules, 2000 have been notified under The Environment (Protection) Act, 1986. These include ambient standards with respect to noise for different categories of areas (residential, commercial, industrial) and silence zones. Noise limits have been prescribed for automobiles, domestic appliances and construction equipment at the manufacturing stage. Regulatory agencies have been directed to enforce the standards for control and regulate noise pollution[93].

Ambient air quality standards with respect to noise in different area types are set to be as below[94]:

Table 6: Ambient air quality standards with respect to noise

Category of Area	Limits in dB(A) Leq	
	Day time	Night time
Industrial area	75	70

[90] Vijay, R., Sharma, A., Chakrabarti, T. and Gupta, R., Assessment of honking impact on traffic noise in urban traffic environment of Nagpur, India. J. Environ. Health Sci. Eng., 2015, 13(10), 1–9. 3.
[91] https://cpcb.nic.in/displaypdf.php?id=Tm9pc2UtU3RhbmRhcmRzL25vaXNlX3J1bGVzXzIwMDAucGRm
[92] Noise Pollution (Regulation and Control) Amendment rules, 2010; http://envfor.nic.in/legis/noise.htm.
[93] http://chenvis.nic.in/index2.aspx?slid=30&sublinkid=17&langid=1&mid=-1
[94] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3968587/

Commercial area	65	55
Residential area	55	45
Silence zones	50	40

Other central legislations that deal with control of noise pollution include:

- Aircraft Act, 1934
- Noise Control under Railway Act, 1890
- The Police Act, 1861
- Air (Prevention and Control of Pollution) Act, 1981
- The Environment (Protection) Act, 1986 and the Environment (Protection) Rules, 1986

Responding to the challenges of noise pollution, some of the other measures that have been taken up in the country include[95]:

- Ambient noise standards were notified in 1989, which formed the basis for State Pollution Control Boards to initiate action against violating sources.
- The vehicular noise standards, notified in 1990, are being implemented by Ministry of Science and Technology, to reduce traffic noise.
- Noise standards for petrol and kerosene generator sets were notified in September 2000 and will be effective from September 2002. The sale of these gensets will be prohibited if not certified by the testing agencies, identified for the purpose.
- Central Pollution Control Board has taken up a study on aircraft noise monitoring in Indira Gandhi International Airport, Delhi.

1.3.3.3 Issues and challenges

Raising awareness is a crucial aspect of noise abatement. The reason being that public awareness of noise as an environmental problem is crucial for public acceptance, political will and subsequent implementation of the majority of other measures[96]. There is also a general lack of awareness about health consequences of noise pollution.

Lack of adequate laws and their enforcement by regulatory agencies has been challenging. Noise pollution (Regulation and Control) Rules, 2000 have been enacted to regulate the level of noise pollution in urban areas, including metropolitan cities, from various sources of noise pollution. However, these Rules have been found to be inadequate or insufficient to control noise pollution. For instance, they only cover the noise of loudspeakers and amplifiers within the area of operation. Further, the penalties imposed under the Rules are not adequate as compared to the health effect[97]s. Establishment of a suitable supporting infrastructure and maintenance would continue to play a key role in noise control in the years to come.

[95] http://chenvis.nic.in/index2.aspx?slid=28&sublinkid=15&langid=1&mid=-1
[96] https://www.sciencedirect.com/topics/earth-and-planetary-sciences/noise-pollution
[97] http://www.ijrhss.org/pdf/v3-i4/5.pdf

1.3.4 Water pollution

1.3.4.1 Background

Water pollution occurs from sources that can largely be assigned to three categories of waste: industrial, agricultural and domestic[98]. Water quality in rivers is deteriorating due to depleting water flow, which is further worsened due to discharge of pollutants from treated and untreated/partially treated domestic sewage, industrial effluents and run-off from agriculture. Most of the surface water bodies in India are contaminated to varying degrees by organic and bacteriological contaminants[99].

The infrastructure for sewage treatment falls short of the generated sewage in urban areas. As of 2017, 30,042.14 million litres of sewage were generated per day against the installed treatment capacity of 16,846.488 million litres per day (MLD), leaving a gap of about 13,196 MLD[5]. It is implausible to install the capital-intensive infrastructure in small towns. This makes it harder to treat sewage in those areas and address the gap between the amount of sewage generated and the capacity of Sewage Treatment Plants (STPs) along the rivers.

The discharge of untreated industrial wastewater through open drains is another major cause of water pollution- for surface water bodies and groundwater, in India and the identified polluted river stretches. One of the main challenges in controlling wastewater pollution from industries is non-compliance to discharge standards; the reasons for such non-compliance may be attributed to the following reasons:

- Inadequate capacity of ETPs
- Improper selection of treatment technologies
- Poor operation and maintenance of ETP
- ETP considered as financial liability
- Failure of regulators to identify the short-comings
- Exploitation of resource limitation of regulators
- Lack of environmental consciousness or self-regulation by industry[100]

Polluted water gives rise to numerous diseases including water-borne diseases such as diarrhoea, cholera, typhoid and viral hepatitis. India registered 149,92,793 and 162,88,959 cases of water borne diseases in the year 2015 and 2016 respectively[101]. According to NITI Aayog, 'currently 600 million Indians face high to extreme water stress and about two lakh people die every year due to inadequate access to safe water. By 2030, the country's water demand is projected to be twice the available supply, implying severe water scarcity for hundreds of millions of people and an eventual 6% loss in the country's GDP'[102]. Thus, water pollution has direct impact on population health and indirect impact on India's performance in economic sphere.

[98] Water Pollution: Impact of pollutants and new promising techniques in purification process, 2012, Ramandeep Singh Gambhir, Vinod Kapoor, Ashutosh Nirola, Raman Sohi, and Vikram Bansal. Journal of Human Ecology, 37(2): 103-109 (2012).
[99] Restoration of polluted river stretches- concept and plan- 2017, Central Pollution Control Board, accessed on 18 October 2019.
[100] Ibid.
[101] Water-Borne Diseases, Ministry of Drinking Water and Sanitation, accessed on 18 October 2019.
[102] socio-economic impact of commercial exploitation of water by industries, 2018, Ministry of Water Resources, River Development & Ganga Rejuvenation, accessed on 18 October 2019

Various legislations have been enacted for the regulation of water pollution in the country. The Water (Prevention and Control of Pollution) Act, 1974 has been established for prevention and control of water pollution and the maintaining or restoring of wholesomeness of water[103]. The Water (Prevention and Control of Pollution) Cess Act, 1977 provides "for the levy and collection of a cess on water consumed by persons carrying on certain industries and by local authorities, with a view to augment the resources of the Central Board and the State Boards for the prevention and control of water pollution constituted under the Water (Prevention and Control of Pollution) Act, 1974"[104].

CPCB has prescribed extensive, well-defined, general as well as industry specific standards that need to be complied with for effluent disposal from municipal water treatment plants and industrial effluent treatment plants[105].

Various CS and CSS schemes have been implemented by the government to tackle the challenge of water pollution.

Table 7: CS and CSS schemes related to water pollution

Scheme	Objectives
Scheme of Assistance for Abatement of Pollution	To strengthen the Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCBs) / State Pollution Control Committees (SPCCs) for enforcing statutory provisions of pollution abatement. The Scheme is now a part of a Centrally Sponsored Umbrella Scheme of 'Pollution Abatement'.
Swachh Bharat Mission- Rural (SBM)	The aim of Swachh Bharat Mission (Gramin) is to achieve a clean and Open Defecation Free (ODF) India. In Rural India, this would mean improving the levels of cleanliness through Solid and Liquid Waste Management activities and making villages Open Defecation Free (ODF), clean and sanitised.
Atal Mission for Rejuvenation and Urban Transformation	• Ensure that every household has access to a tap with the assured supply of water and a sewerage connection. • Increase the amenity value of cities by developing greenery and well-maintained open spaces (e.g. parks) • Reduce pollution by switching to public transport or constructing facilities for non-motorized transport (e.g. walking and cycling).
National River Conservation Plan	• Prevent the pollution of rivers through implementation of context-specific purposes such as construction of STP, riverfront development, low cost sanitation, afforestation etc. • Improve the water quality of polluted stretches of rivers by reduction in pollution load reaching the rivers by undertaking various pollution abatement works.

[103] The Water (Prevention and Control of Pollution) Act, 1974, accessed on 18 October 19, 2019
[104] The Water (Prevention and Control of Pollution) Cess Act, 1977, accessed on 18 October 2019
[105] General standards for discharge of environmental pollutants part-A: Effluents, 1986, accessed on 18 October 2019.

National Water Mission	To ensure integrated water resource management helping to conserve water, minimize wastage and ensure more equitable distribution both across and within states.
Scheme on Repair, Renovation and Restoration (RRR) of Water Bodies	• Comprehensive improvement and restoration of water bodies including increasing tank storage capacity • Groundwater Recharge • Increased availability of drinking water, Improvement of catchment areas of tank commands • Development of tourism and cultural activities • Improvement in agriculture/horticulture productivity • Improvement of catchment areas of tank commands • Environmental benefits through improved water use efficiency; by promotion of conjunctive use of surface and ground water, • Community participation and self-supporting system for sustainable management for each water body • Capacity Building of communities in better water management.
Environmental Protection, Management and Sustainable Development	The Umbrella Scheme supports development of clean technologies and also abatement of the pollution in industrial plants. The growing recognition of the threat of the Climate Change and its significance as an area of domestic policy making and planning is recognized under this umbrella scheme which funds support to programmes/projects on Pollution Abatement, Hazardous Substances Management, Climate Change Action Plan, National Adaptation Fund for Climate Change and National Mission of Himalayan Studies.
Development of Water Resources Information System	To collect the necessary data from various sources, conduct analysis of important data and developing a robust information system on water resources.

Funding for various schemes in the sector for the years 2017-18 and 2018-19 are as shown below:

Table 8: Funding for various schemes related to water pollution

Scheme	2017-18[106] (INR Cr)	2018-19[107] (INR Cr)
Swachh Bharat Mission- Rural	13948.27	15343.10
National River Conservation Programme	173.50	173.50
Pollution Abatement	21.20	20
Hazardous Substances Management	54.32	15
Shyama Prasad Mukherji RURBAN Mission	1000	1200

[106] Output Outcome Framework for Schemes 2017-18, Ministry of Finance, accessed on 18 October 2019
[107] Output Outcome Framework for Schemes 2018-19, Ministry of Finance, accessed on 18 October 2019

Swachh Bharat Mission- Urban	2300	2500
Atal Mission for Rejuvenation	5000	6000
PMKSY – Har Khet Ko Pani	1450 (+4020)	2600
National River Conservation Plan - National Ganga Plan	2500	Data absent
Development of Water Resources Information System	145.00	211.27
Human Resources Development and Capacity Building in NERIWALM, National Water Academy, RGI- Groundwater, MoWR and IEC	25	62.77
Development of Industrial Corridors	---	1100

Private sector has responded with CSR strategies through legislation and regulation by the governments. There is evidence from around the world that where governments have been most active in this field, the private sector has also responded with proactive attitude and strategic changes in its approaches[108]. Water is increasingly seen as a global and local issue, consequentially, becoming the CSR focus issue of various companies. However, this is happening slowly, and private sector is not engaged at the proportionate level of severity of the issue[109]. Companies like Jindal Steel & Power Limited (JSPL) have incorporated initiatives to manage water pollution through its corporate social responsibility. JSPL has carried out initiatives of watershed management programme and pollution control[110].

Public sector players have also been contributing toward achieving goals in water and sanitation sector. As per the guidelines on CSR, all profit making Central Public Sector Enterprises (CPSEs), including Maharatna CPSEs are required to select CSR activities and to undertake them in a project mode111. Through this, NTPC is to commence construction of 240 toilets in school. Likewise, POWERGRID and Coal India Limited will be constructing 90 and 400 toilets respectively[112].

1.3.4.2 Performance

India's water pollution reduction performance could be benchmarked against the United Nations Sustainable Development Goals targets under Goal 3 and Goal 6.

Target 3.3	By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases.
Target 3.9	By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

[108] Brief on Water and CSR, Union for the Mediterranean, accessed on 18 October 2019.
[109] Ibid.
[110] Empowering Community Annual report 2018, JSPL Foundation, accessed on 18 October 2019.
[111] Corporate Social Responsibility (CSR), ENVIS Centre on Hygiene, Sanitation, Sewage treatment Systems and Technology
[112] Ibid

Target 6.2	By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations
Target 6.3	By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally. India's target: Installed sewage treatment capacity as a proportion of sewage generated in urban areas by 2030- 68.79%[113]
Target 6.A	By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies
Target 6.B	Support and strengthen the participation of local communities in improving water and sanitation management

While national priorities align with global targets, there are significant gaps that need to be addressed to achieve them.

As per the assessment of the water quality data for the parameters BOD and Faecal Coliform (MPN/ 100ml) carried out during the year 2015 and comparison with the water quality criteria, it is observed that there are 317 polluted river stretches on 239 rivers and tributaries across 659 towns in the country.

Average installed sewage treatment capacity as a proportion of sewage created in urban areas in Indian states is 37.58%. The target is to install sewage treatment capacity of 68.79% of total generated sewage[114].

According to the World Bank, more than 520 million in India were defecating in the open – the highest number in the world. This has dramatically improved as government introduced several flagship programs, such as Swachh Bharat Abhiyan, National Rural Drinking Water Programme and Namami Gange which addresses the sanitation challenge in the nation as well as conservation of the River Ganga[115]. As of 2018, about 3.50 lakh villages, 371 districts and 13 states and 3 union territories declared themselves Open Defecation Free[116].

Due to water contamination by domestic effluent, water-borne diseases are not controlled yet. India registered 149,92,793 and 162,88,959 cases of water borne diseases in the year 2015 and 2016 respectively. In 2015-16, 63.3% of rural households and 19.7% of urban households were not using improved sanitation facilities[117].

1.3.4.3 Issues and challenges

The limitations in managing wastewater treatment in the country are attributed to[118]:

[113] SDG India Index. Baseline report-2018, 2018, NITI Aayog
[114] SDG India Index. Baseline report-2018, 2018, NITI Aayog
[115] Ibid.
[116] Strategy for new India @75, 2018, NITI Aayog, accessed on 18 October 2019
[117] SDG 6: Clean Water and Sanitation, United Nations in India, accessed on 18 October 2019.
[118] Restoration of polluted river stretches- concept and plan- 2017, Central Pollution Control Board, accessed on 18 October 2019.

- Lack of sewerage systems for collection and conveyance of sewage (open stormwater drains carry city sewage in many cities)
- Non-availability of STPs
- Limited capacity of STPs
- Capital intensive infrastructure
- Limitation of skilled manpower, technical know-how on operation
- Coordination across multiple agencies involved in implementation of regulation
- Compliance with effluent disposal standards
- Knowledge sharing among states that been performing well and the ones that are low-performing[119]

As of 2019, about 3.50 lakh villages, 371 districts and 13 states and 3 union territories have declared themselves Open Defecation Free[120], which reflects high water access. However, significant gaps exist in wastewater treatment. States have shown improvement in creation of wastewater treatment capacity, but utilization of this capacity remains low[121]. Improved knowledge-sharing amongst states can speed up innovation and scaling up solutions thereby further solidifying their water management practices.

- **Prohibitive costs of infrastructure:** Treatment of wastewater from municipal and industrial sources poses challenge in terms of installed capacity in the country and generated sewage. There is a clear lack of infrastructure required to treat all the generated sewage. The cost of the capital-intensive infrastructure of wastewater treatment is prohibitive and often does not justify the investment.

- **Lack of skilled manpower:** The operation and maintenance of Sewage Treatment Plants are dissatisfactory, not only because the power supply/ backup power supply is not ensured, but also because municipal authorities do not have the money for payment of electricity bills, and it lacks skilled manpower. This also results in underutilized plants due to lack of sewer lines[122].

- **Data driven approach:** In order to accurately assess the needs of various pollution control measures, a fact-based assessment of its current performance is crucial. This also ensures the maximum output from resource and financial investment. Thus, data is essential to improve India's water data practices. Establishing an integrated data-centre for water resources may potentially help states further utilize the platform to design targeted policies and programmes to manage its water resources better[123].

- **Underutilisation of budgeted funds:** due to several reasons[124] including non-receipt of competitive proposals that meet criteria under the scheme and non-receipt of utilization from state organizations and state boards. Overall this reflects on the lack of proactive approach from involved agencies regarding pollution abatement. Additionally, it also highlights the need of stronger coordination between agencies to implement the pollution prevention measures.

[119] Composite Water Management Index, 2019, NITI Aayog, accessed on 18 October 2019.
[120] Strategy for new India @75, 2018, NITI Aayog, accessed on 18 October 2019.
[121] Composite Water Management Index, 2019, NITI Aayog, accessed on 18 October 2019.
[122] Restoration of polluted river stretches- concept and plan- 2017, Central Pollution Control Board, accessed on 18 October 2019
[123] Composite Water Management Index, 2019, NITI Aayog, accessed on 18 October 2019.
[124] Three Hundred Twenty First Report, 2019, Rajya Sabha Secretariat, accessed on 18 October 2019

1.3.5 Waste management

1.3.5.1 Background

The increasing volume and complexity of waste associated with the modern economy is posing a serious risk to ecosystems and human health. Every year, an estimated 11.2 billion tonnes of solid waste is collected worldwide and decay of the organic proportion in the solid waste contributes to about 5% of global greenhouse gas emissions. Electrical and electronic equipment containing new and complex hazardous substances pose the fastest-growing challenge in both developed and developing countries.[125]

The effect of waste generation is unequally distributed. For instance, residents in developing countries, especially the urban poor, are more severely impacted by unsustainably managed waste as compared to those in developed nations. Over 90% of generated waste in low-income countries, is often disposed in unregulated scrapyards or openly burned. These practices create serious health and safety because poorly managed waste serves as a breeding ground for disease vectors. Further, it also has enormous environmental consequences due to methane generation which in turn contributes to climate change.

Proper waste management is essential for building liveable cities. This is especially true for developing countries, where it remains a major challenge due to rapid urbanization and population growth, and inefficient waste management practices. Effective waste management often requires 20%–50% of municipal budgets, and an institutional set-up to develop and operationalize integrated systems that are efficient, sustainable, and socially supported.[126]

Vulnerable communities are often unfairly impacted by poor waste management practices. Numerous studies in Europe and in the USA have documented that disadvantaged communities often suffer disproportionately from the impact of waste facilities. Public health professionals should identify and develop waste management policies that minimize health impacts and inequalities. A Health Impact Assessment (HIA) must be carried out before installation of any waste management facility[127].

As of 2016, waste generation rate in India was 0.57 kg/capita/day. India ranked fourth in the world in electric waste generation in the year 2016 by generating 2 million metric tonnes of electronic waste[128]. India also generated third most municipal solid waste worldwide in 2017- 168.4 metric tons[129]. In India, there are six categories of solid waste as per the CPCB:

- Hazardous waste
- Municipal Solid waste
- Biomedical waste
- Plastic waste
- Electronic waste
- Construction & Demolition waste

[125] https://www.unenvironment.org/explore-topics/resource-efficiency/what-we-do/cities/solid-waste-management
[126] https://www.worldbank.org/en/topic/urbandevelopment/brief/solid-waste-management
[127] Inequalities, inequities, environmental justice in waste management and health, 2010, European Journal of Public Health.
[128] Global E-waste Monitor 2017, International Telecommunication Union, 2017
[129] What a Waste- a Global Snapshot of Solid Waste Management to 2050, 2018, World Bank Group.

It makes economic sense to recycle and reuse in the economy. Considering the limited supply and ever-increasing demand of natural resources to meet the needs of constantly growing population in India, it makes economic sense to recycle waste wherever feasible. However, for recycling to be cost-effective, the waste management has to be sound so as to ensure that recyclable material is uncontaminated. Recyclables make up a substantial fraction of waste streams, ranging from 16 percent paper, cardboard, plastic, metal, and glass in low-income countries to about 50 percent in high-income countries[130].

Various CS and CSS schemes have been implemented by the government for waste management.

Table 9: CS and CSS schemes related to waste management

Scheme	Objectives
Swachh Bharat Mission	• Achieve a clean and Open Defecation Free (ODF) India. The objectives of Swachh Bharat include eliminating open defecation through the construction of household-owned and community-owned toilets and establishing an accountable mechanism of monitoring toilet use.
Atal Mission for Rejuvenation and Urban Transformation (AMRUT)	• Ensure that every household has access to a tap with the assured supply of water and a sewerage connection. • Increase the amenity value of cities by developing greenery and well-maintained open spaces (e.g. parks) • Reduce pollution by switching to public transport or constructing facilities for non-motorized transport (e.g. walking and cycling).
Hazardous Substance Management division	• Promote safe handling, management and use of hazardous substances, including hazardous chemicals and hazardous wastes, in order to prevent potential damage to health and environment.
National River Conservation Programme	• Prevent the pollution of rivers through implementation of context-specific purposes such as construction of STP, riverfront development, low cost sanitation, afforestation etc. • Improve the water quality of polluted stretches of rivers by reduction in pollution load reaching the rivers by undertaking various pollution abatement works.

The funding for these government schemes has been provided below:[131]

Table 10: Funding for various schemes on waste management

Scheme	2017-18 (INR Cr.)	2018-19 (INR Cr.)
City compost	15	10

[130] Ibid.

[131] Output Outcome Framework for Schemes 2017-18, Ministry of Finance, accessed on 18 October 2019

Non-Lapsable Central Pool of Resources (NLCPR)-State	695.5	702
Swachh Bharat Mission (Gramin)	13948.27	15343.10
Hazardous Substances Management	54.32	15
Urban and Industrial Waste to Power	13	
Urban/ Industrial Waste-to-Energy	22	
Biotechnology Research & Development	1250.58	1350
Promotion of Research & Development in Iron & Steel Sector	15	15
Swachh Bharat Mission (Urban)	2300	2500
Environmental Information System	23	24
Biopower (Scheme to support promotion of biomass power & Bagasse cogeneration in sugar mills and waste to Energy program)		25
Bio power		23

Various legislations have also been enacted for the regulation of waste management in the country.

Table 11: Various legislations enacted for the regulation of waste management

Type of waste	Applicable laws/rules/regulation
Hazardous waste	Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2016[132]
Municipal Solid Waste	Municipal Solid Waste (Management and Handling) Rules, 2016[133]
Bio-medical waste	Bio-medical Waste Management Rules, 2016 (Amended) - 10.05.2019[134]
Plastic waste	Plastic Waste Management Rules 2016[135]
Electronic waste	• E-waste rules 2016[136] • E-waste (Management) Amendment Rules, 2018
Construction and Demolition waste	Construction and Demolition Waste Management Rules, 2016[137]
Ozone depleting substances	The Ozone Depleting Substances (Regulation and Control) Rules, 2000[138]
Plastic	Plastic Waste Management Rules, 2016[139]

India has also joined forces with various international conventions for waste management.

[132] Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2016, Central Pollution Control Board
[133] Municipal Solid Waste (M & H) Rules, 2016
[134] Bio-medical Waste Management Rules, 2016 (Amended) - 10.05.2019
[135] Plastic Waste Management Rules 2016
[136] E-waste, Central Pollution Control Board
[137] Construction and Demolition Waste Management Rules, 2016
[138] Waste Regulation in India: An Overview, 2010
[139] Plastic Waste Management Rules, 2016

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal: The objective of the Convention is to protect human health and the environment against the adverse effects of hazardous wastes. Its scope of application covers a wide range of wastes defined as "hazardous wastes" based on their origin and/or composition and their characteristics.

Stockholm Convention on Persistent Organic Pollutants: a global treaty to protect human health and the environment from the adverse effects of mercury.

1.3.5.2 Performance

India's waste management practices could be benchmarked against the United Nations Sustainable Development Goals targets under Goal 6, 9, 11 and 12.

Target 6.3	By 2030, improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.
Target 9.4	By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.
Target 11.6	By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management. India's indicators for this target: - Percentage of wards with 100% door to door waste collection- 100%. Currently 73.58% wards have 100% door to door waste collection across India[140]. - Percentage of waste processed- 100%: Currently, average 24.8% of the total waste generated in India gets treated[141].
Target 12.5	By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse

Door to door waste collection: Sound waste management is an important criterion for sustainable cities. Five States and four UTs have achieved the target of 100 percent door to door waste collection. On an average, across India, 73.58 percent of the wards are collecting 100 percent of the waste from door to door[142].

Waste processed: The installed capacity of waste treatment in the country is disproportionately smaller than the amount of waste generated. Only 24.8 percent of the total waste generated gets treated. The best performer among the States is Chhattisgarh with 74 percent of its waste getting processed. Among the UTs, Delhi leads with processing 55 percent of its waste[143].

[140] SDG India Index. Baseline report-2018, 2018, NITI Aayog
[141] SDG India Index. Baseline report-2018, 2018, NITI Aayog
[142] SDG India Index. Baseline report-2018, 2018, NITI Aayog
[143] SDG India Index. Baseline report-2018, 2018, NITI Aayog

1.3.5.3 Issues and challenges

Waste segregation at source is a challenge due to lack of awareness. Hence, initiatives such as Swachh Bharat Mission that increase awareness about waste management at community level among citizens are to be encouraged. Along similar lines, recognizing businesses with responsible waste management incorporate in their business model and expanding the awareness in the business community can have significant benefits.

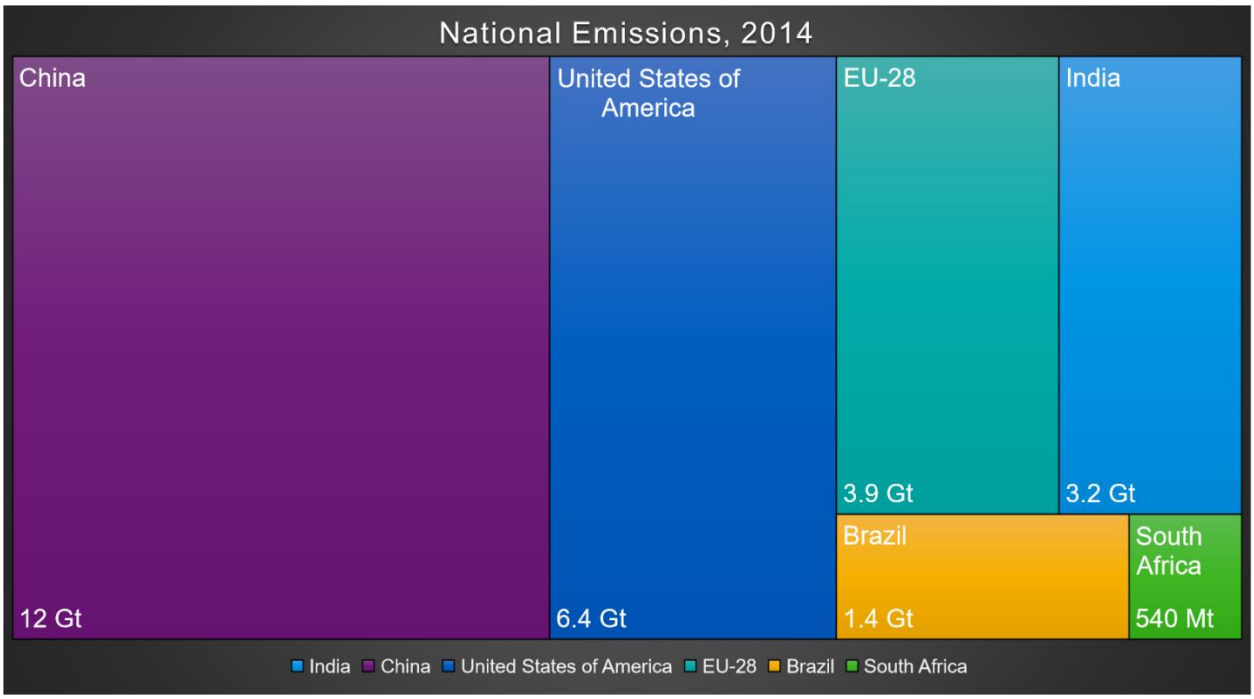
Investigating and addressing causes of the gap between good performance in waste collection and disproportionately smaller percent of processed waste is crucial. There is a large informal waste recycling sector in India that has done well in waste collection done for purposes of reuse and recycling. However, the sector is challenging to monitor and hence integration with formal sector would yield benefits to the economy as well as improve livelihoods for such workers in the sector.

There is a need to establish targets for waste reduction. Setting of time-bound and action-oriented goals in this direction can help formulate national policies that nudge cultural and attitudinal shift to encourage sustainable practices among industries and public at large.

1.4 Climate change

1.4.1 Background

India is the world's seventh largest country in terms of geographical area and is characterized by significantly diverse climatic conditions. It ranges from continental to coastal, extreme heat to extreme cold and negligible to torrential rainfall. Presence of the Himalayas, the Thar Desert and a significantly long coastline, about 7,500 km, contribute to this diversity. The rising concentration of greenhouse gases (GHGs) since the time of the Industrial Revolution because of human activity has been leading to increasing global temperatures. Science estimates that we must limit global temperature rise to less than 2 degrees Celsius to avoid the worst effects of climate change.



Emissions from different region around globe[144]

In 2014, India's net GHG emissions were 2.3 billion tCO_2e which is the third highest in the world, however per capita emissions were only 1.8 tCO_2e as against world average of 5 tCO_2e. While India's GHG emissions have risen from 1.2 billion tCO2e in 1994 to 2.3 billion tCO2e in 2014, the emission intensity of GDP has declined showcasing India's proactive and sustained actions on climate change mitigation. The emissions intensity of GDP has declined by 21% over the period 2005-2014 through focus on renewable energy installations, energy efficiency measures and sequestration through forests. Further, India's per capita emissions are significantly lower as compared to world average that is attributable in part to low levels of energy access in rural areas as well as climate friendly lifestyle practices[145].

GHG emissions in Gigagrams (tCO_2eq) from 1994 to 2014

Table 12: Greenhouse Gas emissions in India from 1994 to 2014 (tCO_2eq)

Sector	1994	2010	2014
Energy	7,43,820	15,10,120.76	19,09,765.74
IPPU	1,02,710	1,71,502.87	2,02,277.69
Agriculture	3,44,485	3,90,165.14	4,17,217.54
LULUCF	14,292	(2,52,531.78)	-3,01,192.69
Waste	23,233	65,052.47	78,227.15

[144] Climate Watch, CAIT https://www.climatewatchdata.org/countries last accessed on 29/11/2019
[145] India Second Biennial Update Report to the United Nations Framework Convention on Climate Change

Total National Emissions (with LULUCF)	12,28,540	18,84,309.46	23,06,295.43
Total National Emissions (with LULUCF)	12,28,540	18,84,309.46	23,06,295.43

While per capita emissions are low, India is one of the most vulnerable countries with regard to climate change. It has a very high population of poor people who rely on natural resources for their livelihood, with a high dependence on rainfall, and one of the highest densities of economic activity in the world. Increase in temperatures and changes in rainfall patterns could cost India 2.8 percent of GDP and depress the living standards of nearly half the country's population by 2050[146].

India's significantly diverse climate zones, topographies and ecosystems also mean that climate exposures and risks are distributed unevenly through the country. Even the ambitious 2°C rise the world is aiming to fall below would increase the unpredictability of summer monsoons in India significantly. In the scenario where 4°C warming occurs, an extreme monsoon season which currently has the odds of occurring once in a hundred years is projected to occur every ten years by the end of the century[147].

Agriculture, a vital part of India's economy, could witness 10-40% loss in crop production unless adaptation actions are undertaken. About 49% of the working population depends on agriculture as their principal means of livelihood, and 52% of agriculture is rainfed[148]. Agriculture, along with fisheries and forestry, is one of the largest contributors to the GDP. However, agricultural commodities even today are sensitive to variability in climate. Droughts, floods, tropical cyclones, heavy precipitation events, hot extremes and heat waves are known to negatively impact agricultural production and farmers' livelihood. It has been projected by an IPCC report and a few other global studies that unless we adapt, there is a probability of 10-40% loss in crop production in India by 2080-2100 due to global warming[149]. A few Indian studies on this theme also confirm a similar trend of agricultural production decline with climate change[150]. Projections indicate the possibility of loss of 4-5 million tonnes in wheat production with every rise of 1°C temperature throughout the growing period with current land use[151].

[146] Mani, Muthukumara; Bandyopadhyay, Sushenjit; Chonabayashi, Shun; Markandya, Anil; Mosier, Thomas. 2018. South Asia's Hotspots : Impacts of Temperature and Precipitation Changes on Living Standards. South Asia Development Matters;. Washington, DC: World Bank

[147] https://www.worldbank.org/en/news/feature/2013/06/19/india-climate-change-impacts

[148] Agricultural Statistics At A Glance 2016. Directorate of Economics and Statistics, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India

[149] Rosenzweig C and Parry M L, (1994). Potential impact of climate change on world food supply, Nature 367, 133-138; Parry M L, Rosenzweig C, Iglesias, Livermore A M and Fischer G, (2004). Effects of climate change on global food production under SRES emissions and socio-economic scenarios, Global Environmental Change 14: 53-67; and IPCC, (2007). Climate Change, 2007: The Physical Science Basis. Inter-governmental Panel for Climate Change, Cambridge University Press, Cambridge CB2 2RU, UK.

[150] Aggarwal P K and Sinha S K, (1993). Effect of probable increase in carbon dioxide and temperature on productivity of wheat in India, Journal of Agricultural Meteorology 48: 811-14; Rao G D and Sinha S K, (1994). Impact of climatic change on simulated wheat production in India, Implications of climate change for international agriculture: crop modelling study, [Rosenzweig C and Iglesias I (edts)]. EPA, USA. pp 1-10; Lal M, Singh K K, Rathore L S, Srinivasan G and Saseendran S A, (1998). Vulnerability of rice and wheat yields in NW - India to future changes in climate, Agriculture & Forest Meteorology 89: 101-14; Saseendran S A, Singh K K, Rathore L S, Singh S V and Sinha S K, (2000). Effects of climate change on rice production in the tropical humid climate of Kerala, India, Climatic Change 44: 495-14; Mall R K and Aggarwal P K, (2002). Climate change and rice yields in diverse agro-environments of India. I. Evaluation of impact assessment models. Climate Change 52: 315-30; Aggarwal P K (2003). Impact of climate change on Indian agriculture, Journal of Plant Biology 30: 189-98.

[151] Aggarwal P K (2008). Global climate change and Indian agriculture: impacts, adaptation and mitigation, Indian Journal of Agricultural Sciences 78 (11): 911-919.

Government response to climate change has been driven through the National Action Plan on Climate Change (NAPCC) and various State Action Plans on Climate Change (SAPCC). In 2008, the government prepared the National Action Plan on Climate Change which included eight missions as a multi-pronged, long-term and integrated approach to address climate change. Subsequently the states also prepared their respective State Action Plans on Climate Change (SAPCCs) that focused on adaptation interventions.

Table 13: Missions under the National Action Plan on Climate Change (NAPCC)

National Solar Mission	Development and deployment of solar energy technology in the country to achieve grid power tariff parity and establish India as the global leader in solar energy through the creation of policy conditions for its deployment across the country
National Mission for Enhanced Energy Efficiency	Promote the market for energy efficiency through fostering of innovative policies and market instruments
National Mission on Sustainable Habitat	Ensure that cities are made sustainable through improvements in energy efficiency in buildings, management of solid waste and shifting to modes of public transportation
National Water Mission	Conservation of water, minimizing wastage and ensuring its more equitable distribution both across and within states through integrated water resources development and management
National Mission for Sustaining the Himalayan Ecosystem	Addressing issues regarding Himalayan glaciers and their hydrological importance; protection and conservation of biodiversity; protection and conservation of wildlife; traditional knowledge societies and their livelihood; and planning for sustaining the Himalayan Ecosystem
National Mission for Green India	Protecting, restoring and enhancing India's (diminishing) forest cover and responding to the issue of climate change through a combination of adaptation and mitigation activities
National Mission for Sustainable Agriculture	Promoting sustainable agriculture through adaptation measures which focus on ten key areas which are essential to Indian agriculture
National Mission on Strategic Knowledge for Climate Change	Build a dynamic and vibrant knowledge system that informs and supports national policy and action for responding effectively to climate change challenges, while not compromising on the nation's growth goals

India's principle stance when it comes to climate action is that of equity-based action. According to the NAPCC, "we are convinced that the principle of equity that must underlie the global approach must allow each inhabitant of the earth an equal entitlement to the global atmospheric resource". Even the Brundtland Commission report of 1987 claims that the mark of sustainability is ensuring inter as well as intra-generational equity, which requires fair access to resources to all and shifts the burden of action to countries who have had (often more than) their fair share of the global common good that is carbon space.

India, therefore has explicitly stated its intent to ensure that its per capita greenhouse gas emissions at no point exceed that of developed countries while determining its development pathway.

India is also a party to the Kyoto Protocol, an international agreement linked to climate change. Under the agreement, industrialised nations and some central European economies in transition, agreed to commit to legally binding GHG emission reductions on an average of 6 to 8 percent below 1990 levels between 2008 and 2012. The key element of the Protocol was the principle of Common but Differentiated Responsibilities, which allowed for the differences in developmental trajectories that countries have been put on to be the central basis of determining the commitments expected out of them. India, being at a developmental stage participated extensively through the Clean Development Mechanism (CDM) by hosting projects that supplied carbon credits called Certified Emission Reductions (CERs) to developed countries to meet their GHG reduction commitment.

During COP 21, India put forth its commitment to the global community in the form of Nationally Determined Contribution (NDCs). As a part of the global effort on post-2020 climate actions, India submitted its NDCs according to which India has committed to reducing the emissions intensity of its GDP by 33-35% by 2030 from 2005 levels. It also includes ambitious goals on achieving 40 percent cumulative electric power installed capacity from non-fossil fuel based energy resources and creating an additional carbon sink of 2.5 to 3 billion tonnes of CO_2e through additional forest and tree cover by 2030.

MoEFCC has adopted two central sector schemes that address climate change. The Climate Change Action Plan (CCAP) was launched during the 12th Five Year Plan with an outlay of Rs.290 crore to build capacity and support implementation of relevant climate change related actions at the national and State level. Another scheme, the National Adaptation Fund for Climate Change (NAFCC), was established in August 2015, with the aim of meeting the cost of climate change adaptation for states and union territories in India which are vulnerable to the impacts of climate change. As of December 2018, 27 projects, including one regional project, have been approved at a total cost of INR 673.63 crore and INR 369 crore have been sanctioned. The Fund priorities the need to build climate resilience in areas identified by the SAPCC and the Missions of the NAPCC. This includes identifying project ideas and concepts from State Action Plan for Climate Change, formulating projects, appraisals, disbursing funds, monitoring and evaluation and capacity building of various stakeholders.

To further raise domestic funding for clean energy technologies, the National Clean Energy Fund (NCEF) was setup through introduction of a coal cess. Based on the 'polluter pays' principle, its purpose was to finance and promote clean energy initiatives, fund research into clean energy and other similar projects. The scope of the Fund was eventually expanded to include clean environment initiatives as well and was renamed as National Clean Energy & Environment Fund (NCEEF). The schemes and projects are approved of by an Inter-Ministerial Group chaired by the Finance Secretary and include various climate change and environment conservation programs of MoEFCC, clean energy programs of Ministry of New and Renewable Energy (MNRE) and National Ganga Plan of the Ministry of Water Resources, River Development and Ganga Rejuvenation.

Multilateral agencies, bilateral agencies and multilateral development banks play a significant role in facilitating projects through climate finance. India has accessed support from various international funds such as:

- USD 87.87 million as indicative allocation under the climate change focal area of Global Environment Facility (GEF) sixth cycle
- USD 9,885,436 accessed through the Adaptation Fund for five projects across the country
- USD 177.8 million through the Green Climate Fund (GCF) for three projects
- USD 774.37 million from Climate Investment Fund (CIF) for five projects

India is also accessing support through the World Bank and bilateral programmes with Department for International Development (DFID) and Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ).

The International Solar alliance has been launched by India and France on the side-lines of CoP 21 to UNFCCC. The alliance is an effort to provide a dedicated platform for cooperation among solar resource rich countries that lie completely or partial between the Tropics of Capricorn & Cancer, the global stakeholders, including bilateral and multilateral organizations, corporates, and industry to make a positive contribution to assist and help achieve the common goals of increasing the use of solar energy in meeting energy needs of prospective ISA member countries in a safe, convenient, affordable, equitable and sustainable manner[152].

1.4.2 Performance

India took a voluntary pledge in 2010 to reduce its emission and has been on track thus far to achieve this goal. Under the Copenhagen Accord, India aimed for 20-25% reduction of emissions intensity of GDP (excluding the agriculture sector) below 2005 levels by 2020. As of 2014, 21% reduction has been achieved thus keeping the country on track to achieve its goal.

Under the NDC, India has further taken emissions intensity reduction goals for 2030 along with renewable energy and carbon sequestration goals. Projections from various studies indicate that with the current policy interventions, the country is on track to achieve the emissions intensity goal of 33-35% reduction over 2005 levels by 2030 and renewable energy goal of 40% installed capacity from non-fossil fuel based energy resources by 2030[153]. However, data from Biennial Update Reports show that emission removals from forest land have worsened from 200 million tCO_2e in 2010 to only 68 million tCO_2e in 2014[154]. This puts into question the ability to create an additional carbon sink of 2.5 to 3 billion tCO_2e through additional forest and tree cover by 2030 as committed in the NDCs.

India's National Forest Policy, 1988 outlined a national goal of having a minimum of one-third of the total land area of the country under forest or tree cover. According to most recent available India State of Forest Report for 2017, the total forest cover was 708,273 square km, which is 21.54 percent of the total area of the country. Under the Green India Mission, the target for ten years is to increase forest/tree cover on 5 million ha of forest/non-forest lands and improve quality of forest cover on another 5 million ha. With overall INR 2000 Crores from 12th plan outlay, the overall budget allocation for the Mission is Rs. 282.12 Crores only. The Rajya Sabha Department-related Parliamentary Standing Committee on Science

[152] https://pib.gov.in/newsite/PrintRelease.aspx?relid=183908
[153] Climate Action Tracker, https://climateactiontracker.org/countries/india/; CSTEP (2018), Roadmap for achieving India's NDC pledge; IEEFA Report, http://ieefa.org/ieefa-update-india-on-track-to-meet-majority-of-paris-goals/
[154] India First and Second Biennial Update Report to the United Nations Framework Convention on Climate Change

& Technology, Environment & Forests has noted in its 2019 report that a lot more needs to be done to increase the forest/tree cover as per the objectives of the Green India Mission[155].

India has substantially grown its renewable energy installation base through various policy interventions. In 2015, India set a goal to install 175 GW of renewable energy capacity by 2022, which would consist of 100 GW from solar, 60 GW from onshore wind, 10 GW from bioenergy, and 5 GW from small hydro. As of September 2019, the installed renewable energy capacity in the country has reached 83 GW[156] and further 60 GW is under various stages of bidding and construction. According to the IEA total renewable power investment has been exceeding fossil fuel-based power investment for three years in a row[157].

India played an active role in the Kyoto Protocol and took a lead in hosting climate change mitigation projects across sectors. The country hosted 21% of the CDM projects and 10% of the volume of CERs in Non-Annex I countries of the Kyoto Protocol, second only to China, showcasing strong intent in accessing the international carbon market[158]. Most of the investment for these projects came from the private sector as opposed to the traditional route of government financing environment-friendly projects.

1.4.3 Issues and challenges

India has harvested most of the low-hanging fruits by deploying its domestic resources and has achieved a reduction in emission intensity of GDP by 21% over the period 2005-2014. The country is on track to meet its Copenhagen commitments and even most of the 2030 NDC goals. However, NDC goals under the Paris Agreement need to be revised periodically and made more ambitious to achieve the goal of limiting warming to 1.5 to 2 degrees C above pre-industrial levels. This requires a strong policy focus in addition to new and additional financial, technological and capacity support.

According to NDC estimates, India would need around USD 206 billion between 2015 and 2030 for implementing adaptation actions. These estimates are for actions to be taken in agriculture, forestry, fisheries infrastructure, water resources, and ecosystems. Additional investments are also needed for strengthening climate resilience and disaster management. Financial requirements for undertaking mitigation actions are even more. Estimates by Planning Commission (now known as NITI Aayog) indicate that the mitigation activities for moderate low carbon development would cost around USD 834 billion till 2030 (at 2011 constant prices)[159]. An Asian Development Bank (ADB) study indicates that approximate adaptation cost for India in the energy sector alone would roughly be about USD 7.7 billion in the 2030s and the economic damage and losses from climate change are likely to be around 1.8% of its GDP annually by 2050[160]. International Finance Corporation (IFC) estimates a USD 3.1 trillion climate investment for India in key sectors between 2018 and 2030, to fully meet its NDCs[161].

Climate finance required in developing countries for climate change mitigation and adaptation has not been forthcoming. In 2009 at Copenhagen, a decision was made at the COP that developed countries

[155] https://rajyasabha.nic.in/rsnew/Committee_site/Committee_File/ReportFile/19/108/321_2019_6_10.pdf
[156] http://cea.nic.in/reports/monthly/installedcapacity/2019/installed_capacity-09.pdf
[157] World Energy Investment 2019
[158] http://www.cdmpipeline.org/
[159] Planning Commission. (2014). The Final Report of the Expert Group on Low Carbon Strategy for Inclusive Growth
[160] Ahmed, M.et al. (2014). Assessing the costs of climate change and adaptation in South Asia. Asian Development Bank
[161] IFC. (2017). Climate Investment Opportunity in South Asia: An IFC analysis International Finance Corporation

would commit and adhere to mobilise USD 100 billion each year by 2020 in order to ensure that the needs of developing countries are met. A significant portion of this was meant to be disbursed through the Green Climate Fund however only about USD 20 billion has been pledged to the fund so far since its initial resource mobilization in 2014[162]. As of 2019, only USD 177 million was channelled into India via the GCF, of which USD 77.8 million is grant based. Thus, the government needs to urgently explore alternative modes of accessing finance and ensure efficient utilisation of domestic resources for meeting climate objectives.

A comprehensive long-term strategy for the country is required that would decouple carbon emissions from economic growth. India had a per capita energy consumption of 24 Gigajoules and a Human Development Index (HDI) of 0.64 in 2017 i.e., medium human development. Economic Survey projections indicate this consumption India would have to be quadrupled to reach an HDI of 0.8 and enter the group of countries with high human development[163]. This would substantially increase carbon emissions unless a comprehensive strategy is prepared that allows for decoupling of emissions from economic growth. This policy needs to come from collaboration with various stakeholders, such as the academic community, civil society, communities from sectors facing significant vulnerabilities, etc. and needs to incorporate their inputs into the policy framework. The framework that exists for environmental conservation and along similar tangents needs to be re-examined and re-calibrated to incorporate the perspective of climate change.

Lack of a strong carbon pricing signal in the economy also poses a challenge. India does not have a clear signal on carbon pricing unlike a majority of the developed as well as some of the developing countries that have implemented a carbon tax or emission trading system. A coal cess was introduced in India in 2010 as de-facto 'carbon tax', proceeds of which were diverted to the NCEF. However, from 2017 onwards, after implementation of Goods and Services Tax (GST), the cess is being diverted to the GST Compensation Fund and the same would be utilized to compensate the States for five years to for potential losses on account of GST implementation. From its introduction in 2010-11 to 2017-18, the coal cess collected was is estimated at INR 86,440.21 crores whereas projects recommended for financing from the NCEEF amount to INR 34,811.19 crores[164]. While there are other market mechanisms in place such as Perform Achieve Trade (PAT) for encouraging energy efficiency in energy-intensive industries and Renewable Purchase Obligations (RPO) for distribution companies, Open Access consumers and Captive Power Plants, an overarching carbon pricing mechanism still does not exist in the economy.

[162] https://www.greenclimate.fund/news/countries-step-up-ambition-landmark-boost-to-coffers-of-the-world-s-largest-climate-fund
[163] https://www.indiabudget.gov.in/economicsurvey/doc/vol1chapter/echap09_vol1.pdf
[164] https://doe.gov.in/sites/default/files/NCEF%20Brief_post_BE_2017-18.pdf

1.5 Gap Analysis of Sectoral Issues

1.5.1 Interventions gaps at sectoral level

Objectives of the sector	Major issues	Central Sector	Centrally Sponsored Schemes	State schemes	Policy, legal, regulatory interventions	Other interventions (e.g. multilaterals, private, NGOs)
Ecological restoration of existing natural habitats and migratory routes	Change in quantity of forest cover	Compensatory Afforestation Fund Management and Planning Authority (CAMPA)	National Mission for a Green India	Uttar Pradesh: Social forestry scheme (General) Telengana: Telanganaku Haritha Haram Punjab: Panchvati Yojana	Forest Conservation Act 1980 National Forest Policy,1988	Satpuda Foundation Green Future Foundation-Conservation of Landscapes of India
	Change in quality of forest cover	Intensification of Forest Management	National Afforestation Programme	Uttar Pradesh: Nursery Management Scheme	Forest Conservation Act 1980 National Forest Policy,1988	ICFRE: Forest based research and also on global issues like climate change, conservation of biological diversity etc.
	Increase in developmental activities leading to encroachment on natural habitats	Integrated watershed management program	Environmental Protection, Management and Sustainable Development	Uttar Pradesh: Green belt development scheme Madhya Pradesh: Green Building programme	Biological Diversity Act, 2002 National Bio-Diversity Targets (NBTs)	Nilgiri Wildlife and Environment Association: conserve the natural resources of the Nilgiri and preserve wildlife and the habitat.

Objectives of the sector	Major issues	Central Sector	Centrally Sponsored Schemes	State schemes	Policy, legal, regulatory interventions	Other interventions (e.g. multilaterals, private, NGOs)
	Rise of pollution in lakes and wetlands	Pollution Abatement Water Resources Information System (WRIS)	Scheme on Repair, Renovation and Restoration (RRR) of Water Bodies Conservation of Natural Resources and Ecosystems	Maharashtra State Lake conservation scheme Uttarakhand Decentralized Watershed Development Project (UDWDP) Punjab Forestry and Watershed Development and Promotion of ICT and e-governance Goa Water supply scheme for small/remote pollution affected wadas	Water Prevention and Pollution Act 1974 Hazardous Wastes (Management and Handling) Rules 1989 Wetlands (Conservation and Management) Rules, 2017	Indian National Trust for Art and Cultural Heritage (INTACH): undertake water harvesting projects, studies on the restoration of the ecological balance of lakes and wetlands Rajasthan Environment Preservation Society: Promote social forestry and plantation and to clean the ponds, lakes and reservoirs
Mitigation of human-wildlife conflicts and community engagement	Degradation and fragmentation of existing natural habitats	-	Integrated Development of Wildlife Habitats	Chhattisgarh: Khet Ganga Jharkhand: Environmental Education Training Scheme	National Wildlife Action Plan (NWAP) Public Liability Insurance Act, 1991	VANARAI: Joint Forest Management, Making wasteland productive, Rural development
	Compensatory policies for conflict situations		Integrated Development of Wildlife Habitats	Odisha: Ama Jangala Yojana Other state compensation schemes	National Wildlife Action Plan (NWAP) Public Liability Insurance Act, 1991	Bilateral agencies such as GIZ on human-wildlife conflicts issues

Objectives of the sector	Major issues	Central Sector	Centrally Sponsored Schemes	State schemes	Policy, legal, regulatory interventions	Other interventions (e.g. multilaterals, private, NGOs)
Wildlife population stabilization and improvement	Comprehensive census data of wildlife species	-	Integrated Development of Wildlife Habitats	For species other than elephant and tiger, census is undertaken by the respective state / UT governments periodically	National Wildlife Action Plan (NWAP) Public Liability Insurance Act, 1991 Wildlife (Protection) Amendment Act, 2013	World Wide Fund (WWF-India): Research in areas of study like Biodiversity, Endangered Species, Wildlife Policy Wildlife Trust of India (WTI): Conserve wildlife and its habitat and to work for the welfare of individual wild animals.
Wildlife health	Poaching of wildlife and illegal trading of animal goods	-	Integrated Development of Wildlife Habitats	-	National Environment Policy 2006 Wildlife (Protection) Amendment Act, 2013	Wildlife Protection Society of India (WPSI)
Preparedness against disasters such as forest fires	Infrastructure for prevention and control of forest fires	-	Forest Fire Prevention & Management Scheme (FPM)	Odisha: Catchment Area Treatment Plan	Coastal Zone Regulation 2011	World Bank worked with MoEFCC on a study to strengthen forest fire management in India
Promoting eco-tourism for sustainable development	Revenue from eco-tourism in national parks and wildlife sanctuaries	Comprehensive Sustainable Tourism Criteria for India (STCI)	Integrated Development of Wildlife Habitats	State tourism departments	Ecotourism Certification Standard	Responsible Tourism Society of India: Non-profit to promote and ensure environmentally responsible and sustainable practices

Objectives of the sector	Major issues	Central Sector	Centrally Sponsored Schemes	State schemes	Policy, legal, regulatory interventions	Other interventions (e.g. multilaterals, private, NGOs)
						in the tourism industry
Climate Change Resilience	Impact of climate change on vulnerable sectors Availability of finance for undertaking adaptation interventions	Climate Change Action Plan and National Adaptation Fund on Climate Change that together have an allocation of INR 640 crores	-	State Action Plans on Climate Change have been developed for most Indian states, however there are no schemes have been implemented specifically for them	National Action Plan on Climate Change has been developed in 2008 with 8 missions on climate change mitigation and adaptation	International funding from Global Environment Facility (GEF), Green Climate Fund (GCF), Climate Investment Fund (CIF), Clean Development Mechanism (CDM), World Bank and bilateral support from DFID and GIZ has been received
Intra-generational Equity: Livelihood Security for the Poor	Improvement in livelihood for forest-dependent communities	National Bamboo Mission (NBM) Village Entrepreneurship Start-up Programme	Mahatma Gandhi National Rural Employment Guarantee Scheme National Rural Livelihood Mission (NRLM)	Madhya Pradesh: Eco-friendly / Green Public Procurement Uttarakhand: Integrated Livelihood Support Project (EAP)	Environment Impact Assessments consider livelihood for local communities	Ladakh Ecological Development Group (LEDeG)- Environmental and cultural issues
Inter-generational Equity	Decline in country's natural capital	Schemes on capacity building, environmental education etc.	All CSS schemes have a component of improving country's natural capital	States have various environment schemes such as Chhattisgarh: Indira Gaon Ganga Yojna	Biological Diversity Rules, 2004.	Various multilaterals and NGOs work on specific aspects of natural capital
Integration of Environmental Concerns in	Diversion of forest land for	Green Skill Development Programme (GSDP)	Umbrella Programme for Development of	States have various schemes Uttarakhand:	Environment Impact Assessment Notification 2006	Indian Environmental Society (IES)

Objectives of the sector	Major issues	Central Sector	Centrally Sponsored Schemes	State schemes	Policy, legal, regulatory interventions	Other interventions (e.g. multilaterals, private, NGOs)
Economic and Social Development	development purposes	Multi-Sectoral Development Programme (MSDP)	Scheduled Castes and Other Vulnerable Groups	Mukhya Mantri Sanrchhit Udyan Vikash Yojana		
Efficiency in Environmental Resource Use	Increase in air pollution leading to environmental degradation	National Air Quality Monitoring Programme (NAMP) National Clean Air Program (NCAP) National Mission for Electricity Mobility (NMEM)	Industrial Infrastructure Upgradation Scheme	-	Air (Prevention and Control of Pollution) Act	Some support is provided by multilaterals and NGOs, however the issue is largely concerned with private sector operators
	Insufficient waste management and processing infrastructure	Hazardous Substances Management (HSM) Swachh Bharat Mission	Nirmal Bharat Abiyan (NBA) Smart Cities Mission	Delhi- Integrated Waste Management	Solid Waste Management Rules, 2016 Hazardous Wastes (Management and Handling) Rules 1989 Biomedical Waste Management Rules, 2018 Plastic Waste Management Rules, 2018	Some support is provided by multilaterals and NGOs for adoption of waste management and treatment technologies
Environmental Governance	Consultation with local communities in management and regulation of use of	Environment Impact Assessments have component on	All CSS schemes have a component of consultation with local communities	Typically, state schemes have a component of	Environment Impact Assessments have component on	Typically, multilaterals and NGOs have extensive stakeholder

Objectives of the sector	Major issues	Central Sector	Centrally Sponsored Schemes	State schemes	Policy, legal, regulatory interventions	Other interventions (e.g. multilaterals, private, NGOs)
	environmental resources	consultation with local communities		consultation with local communities	consultation with local communities	consultations in their programs
Enhancement of Resources for Environmental Conservation	Availability of finance for undertaking conservation measures	The allocation for Environment, Forestry and Wildlife CS schemes is INR 1017 crore for 2020-21	All CSS schemes have the objective of mobilizing resources for undertaking conservation measures. The allocation for Environment, Forestry and Wildlife CSS at INR 926 crore for 2020-21.	States have various environment schemes such as Himachal Pradesh: Mukhya Mantri Green Technology Transfer Scheme and Uttarakhand: Indira Mahila Samekit Vikas Yojana	-	Several development agencies, NGOs and private sector companies through CSR are contributing to conservation efforts. Various public and private sector agencies are also involved in R&D initiatives.
	Multi-stakeholder partnerships with research and development agencies	R&D for Conservation and Development Centres of Excellence Environment Information Systems (ENVIS)				

1.5.2 Gap Map Synthesis of Sector and CSS Schemes

Objectives of the sector	Major issues	Schemes addressing the issue	Scheme components intended to address the issue	Component performance	Way forward recommendations
Ecological restoration of existing natural habitats and migratory routes	Change in quantity of forest cover	Green India Mission National Afforestation Programme	Increase the forest/tree cover to the extent of 5 million hectares	Forest and tree cover have increased from 79.4 million hectares in 2015 to 80.7 million hectares in 2019	Forest and tree cover have largely hovered from 21-25% and is short of the National Forest Policy, 1988 goal of 33%. Green India Mission estimates a funding requirement of INR 46,000 crore over 10 years. However, in FY 2018-19 about INR 210 crore was budgeted for the scheme. Convergence with schemes such as CAMPA, MGNREGS needs to be captured effectively.
	Change in quality of forest cover	Green India Mission National Afforestation Programme	Improve quality of forest/tree cover of 5 million hectares of forest/non forest lands	Between 2015 and 2019, Very Dense Forest has increased from 8.6 to 9.9 million hectares, Moderate Dense Forest has decreased from 31.5 to 30.8 million hectares and Open Forest has marginally increased	
	Increase in developmental activities leading to encroachment on natural habitats	National Plan for Conservation of Aquatic Ecosystems	Wetland boundary delineation and demarcation	As per discussion with stakeholders, work on boundary delineation for wetlands has taken up under the scheme and use of technology is also being taken up for this	The National Wetland Atlas was prepared in 2013. Periodic mapping of wetlands should be taken up through scientific bodies such as ISRO to ensure developmental activities are kept in check.
	Rise of pollution in lakes and wetlands	National Plan for Conservation of Aquatic Ecosystems	Boundary delineation, catchment conservation, construction of Sewage Treatment Plants (STP)	While boundary delineation and catchment conservation works are being carried out, STP construction has not formed a substantial part of scheme implementation	Creation of STPs and sanitation works are under purview of Ministry of Housing and Urban Affairs and Ministry of Drinking Water and Sanitation, hence greater synergy with their schemes

Objectives of the sector	Major issues	Schemes addressing the issue	Scheme components intended to address the issue	Component performance	Way forward recommendations
					should be explored so that scheme's limited funding can focus on wetland conservation, biodiversity management, sustainable resource development and livelihood improvement
Mitigation of human-wildlife conflicts and community engagement	Degradation and fragmentation of existing natural habitats	Integrated Development of Wildlife Habitat	Strengthening of infrastructure, habitat improvement and water development	The Management Effectiveness Evaluation (MEE) of National Parks and Wildlife Sanctuaries conducted in 2015-17 and 2017-18, assessed habitat restoration at 60% (average)	The current structuring of the schemes is such that they do not allow for a high degree of inter-connectedness or convergence. There is a need to move towards a landscape-based approach where biological, socio-economic and cultural modules of conservation can be integrated to deliver sustainable development.
	Compensatory policies for conflict situations	Integrated Development of Wildlife Habitat	Compensation for human deaths due to wild animals, livestock depredation by carnivores, crop depredation	MEE of National Parks and Wildlife Sanctuaries conducted showed a decline in performance on human-wildlife conflict mitigation from 70% (good) in 2015-17 to 59% (average) in 2017-18	There has been a significant decline in performance on human-wildlife conflict mitigation. As per discussions with stakeholders, there is a need for ensuring timely disbursement of compensation through a more efficient mechanism. This will be further examined through household surveys.

Objectives of the sector	Major issues	Schemes addressing the issue	Scheme components intended to address the issue	Component performance	Way forward recommendations
Wildlife population stabilization and improvement	Comprehensive census data of wildlife species	Integrated Development of Wildlife Habitat	Census of tiger and elephant is undertaken once every four and five years respectively at national level. For other species it is undertaken by the respective state/UT governments periodically.	MEE of National Parks and Wildlife Sanctuaries showed a further decline in performance on population trends of endangered species from 51% (low) in 2015-17 to 49% (low) in 2017-18	While regular census of tigers and elephants are being carried out, there is a need for enhancing focus on other endangered species.
Wildlife health	Poaching of wildlife and illegal trading of animal goods	Integrated Development of Wildlife Habitat	Anti-poaching measures and infrastructure development Special Tiger Protection Force component Captive Elephant Management and Welfare	MEE of National Parks and Wildlife Sanctuaries conducted showed a decline in performance on effective protection strategy from 74% (good) in 2015-17 to 69% (good) in 2017-18 but it continues to be managed effectively.	Based on interactions with stakeholders, anti-poaching measures working effectively and because of cultural significance of nature and wildlife, the issue is not as a significant challenge as compared to other countries.
Preparedness against disasters such as forest fires	Infrastructure for prevention and control of forest fires	Forest Fire Prevention & Management Scheme	Creation and maintenance of fire lines, procurement of firefighting equipment, training and capacity building	Forest fire alert system of FSI has undergone improvements in recent years. The user base has grown from 2,000 in 2017 to 66,000 in 2019.	Based on the interactions with stakeholders, a need for greater involvement of local communities was noted along with provision of modern firefighting equipment to field staff.
Promoting eco-tourism for sustainable development	Revenue from eco-tourism in national parks and wildlife sanctuaries	Integrated Development of Wildlife Habitat	Fostering eco-tourism, eco-development, awareness generation and community-oriented activities	As per stakeholder discussions, there has been some funding allocation for this component but revenue	Eco-tourism has significant potential for improving sustainability of forest and wildlife schemes. There needs to be concerted efforts

Objectives of the sector	Major issues	Schemes addressing the issue	Scheme components intended to address the issue	Component performance	Way forward recommendations
				generation for example from sources such as gate fees has been low	between various departments such as forest, tourism and rural development to enhance opportunities for eco-tourism around national parks and wildlife sanctuaries.
Climate Change Resilience	Impact of climate change on vulnerable sectors	Central sector scheme - Climate Change Action Plan	Create and strengthen the scientific and analytical capacity for assessment of climate change in the country, putting in place an appropriate institutional framework for scientific and policy initiatives, and implementation of climate change related actions	Three demonstration projects have been approved on enhancing adaptive capacity through conservation of traditional water supply sources, coastal habitat rehabilitation, improving ecosystem services and fisher livelihood and technological adaptation for paddy straw	Forest and wildlife conservation plans need to incorporate mitigation and adaptation actions for the near future (5-10 yrs) and long term (20-30 yrs) risks due to climate change.
	Availability of finance for undertaking adaptation interventions	Central sector scheme - National Adaptation Fund on Climate Change	Fund adaptation actions which are not otherwise covered under the ongoing schemes/ programs	About 27 projects worth INR 673 crore have been approved in various states	India needs around USD 206 billion between 2015 and 2030 for implementing adaptation actions, hence enhancing resources for undertaking adaptation interventions needs to be explored through domestic and international sources such as Green Climate Fund
Intra-generational Equity: Livelihood	Improvement in livelihood for	Green India Mission	All CSS schemes have a component of improving	As per interaction with state and district	While forest-based industries can be further encouraged,

Objectives of the sector	Major issues	Schemes addressing the issue	Scheme components intended to address the issue	Component performance	Way forward recommendations
Security for the Poor	forest-dependent communities	Integrated Development of Wildlife Habitat Conservation of Natural Resources and Ecosystems	livelihood for forest-dependent local communities	stakeholders, while the schemes encourage livelihood for forest-dependent local communities through training and capacity building, further improvement in their socio-economic conditions is required.	other recommendations will be proposed based on findings from household surveys and further district level interviews.
Inter-generational Equity	Decline in country's natural capital	Green India Mission Integrated Development of Wildlife Habitat Conservation of Natural Resources and Ecosystems	All CSS schemes have a component of improving country's natural capital such as forests, lakes, wetlands wildlife and biodiversity	MoSPI report reveals that while the average GDP during 2005-15 for almost all the states was around 7-8 per cent, 11 states registered a decline in their natural capital, 13 states showed a marginal growth in the range 0-5 per cent and just four states saw their natural capital increase by more than 5 per cent.	The allocation for Environment, Forestry and Wildlife CSS at INR 926 crore for 2020-21 is among the lowest of the 30 CSS schemes currently operational. There is a need to improve the efficiency of schemes and explore opportunities of support from bilateral and multilateral agencies along with private sector investment.
Integration of Environmental Concerns in Economic and Social Development	Diversion of forest land for development purposes	Regulations around Environment Impact Assessment address these concerns	-	About 20,314 ha of forest land has been diverted between 2015-18 under Forest (Conservation) Act for development projects such as irrigation, mining, power projects, road and railway projects etc.	While diversion of certain forest land is required for development purposes, the benefits of such development need to be suitably ploughed back into conservation efforts through efficient implementation of schemes.

Objectives of the sector	Major issues	Schemes addressing the issue	Scheme components intended to address the issue	Component performance	Way forward recommendations
Efficiency in Environmental Resource Use	Increase in air pollution leading to environmental degradation	Regulations around Environment (Protection) Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act and MSW Rules address these concerns	-	As per the WHO Urban Ambient Air Quality Database, 10 of the top 20 most polluted cities in the world are in India, nearly all in Northern and North-Western India.	There is a need to adopt better performance indicators at a sectoral level so that protection and conservation efforts can be effectively planned and implemented. Refer Annexure 4. Independent monitoring and evaluation of schemes also needs to be taken up at a reasonable frequency so as to take suitable corrective action in a timely manner.
	Insufficient waste management and processing infrastructure Increase in quarrying and other mining activities		-	62 million tonnes of waste (mixed waste containing both recyclable and non-recyclable waste) every year, of which less than 60% is collected and around 15% processed.	
Environmental Governance	Consultation with local communities in management and regulation of use of environmental resources	Green India Mission Integrated Development of Wildlife Habitat Conservation of Natural Resources and Ecosystems	All CSS schemes have a component of consultation with local communities	As per consultation with state level stakeholders, regular consultations are conducted with local communities, however this needs to be confirmed through household surveys.	To be proposed based on findings from household surveys and further district level interviews.
Enhancement of Resources for Environmental Conservation	Availability of finance for undertaking	Green India Mission	All CSS schemes have the objective of mobilizing resources for undertaking conservation measures	The allocation for Environment, Forestry and Wildlife CSS at INR 926 crore for 2020-21 is among	There is a need to improve the efficiency of schemes through convergence with others to achieve greater impact within

Objectives of the sector	Major issues	Schemes addressing the issue	Scheme components intended to address the issue	Component performance	Way forward recommendations
	conservation measures	Integrated Development of Wildlife Habitat Conservation of Natural Resources and Ecosystems		the lowest of the 30 CSS schemes currently operational.	the limited resources made available.
	Multi-stakeholder partnerships with research and development agencies			Several development agencies, NGOs and private sector companies through CSR are contributing to conservation efforts.	There is a need to actively explore alternate sources of funding from international development agencies, NGOs and private sector CSR funds to augment the resources made available through government budgets.

1.6 Recommendations at sectoral level

There is a need to move towards a landscape-based approach where biological, socio-economic and cultural modules of conservation can be integrated to deliver sustainable development. The current structuring of the schemes is such that they have specific objectives and implementation methods that do not allow for a high degree of inter-connectedness, thus creating conservation islands which restricts natural migration of wild animals as their numbers grow. Since the 1990s, conservation actions have started evolving from a primarily reserve-based approach to consider landscape-scale processes because climate change and increased habitat fragmentation have led to increasingly dynamic patterns of colonization and extinction[165]. Landscape-based approach for conservation of wildlife has been recognized in the National Wildlife Action Plan 2017-31 as well as in consultation with experts as it allows for achieving conservation goals at the largest spatial scale possible in practical terms as against the existing approach of territorial forest divisions. Further, adaptation to climate change, which is expected to have a significant impact on biodiversity, can also be addressed when approaching it through a landscape approach. To operationalize the landscape-based approach, various biosphere reserve units would need to be identified. The 18 notified biosphere reserves in India could be the starting point for this purpose. Currently, Green India Mission, Project Elephant and Conservation of Biosphere Reserves have adopted a landscape-based approach. More details on the possible model of landscape-based conservation have been provided in Annexure 9.

Convergence of schemes needs to be explored as multiple schemes are operating with limited budgets with their own focus areas. With limited availability of funding for various schemes, there is need to explore greater convergence. For example, areas such as Nilgiris and Sundarbans have multiple schemes operating with their own focus areas such as Project Tiger, Green India Mission and Conservation of Biosphere Reserve. Pooling together the resources of different schemes in such an area will help achieve a stronger impact in the region. Currently, in practice some level of convergence does take place at the level of state and forest reserve officials. However, there is no mechanism to ensure this takes place in all landscapes. Some schemes such as Project Tiger have more funding available which if converged with other schemes of lower funding being implemented in the same region could have a greater conservation impact. Hence the earlier recommendation of adopting a landscape-based approach would have scheme convergence benefits as well. Regional biosphere authorities could be setup with the mandate of preparing landscape-based conservation plans and allocation of funds from various CSS schemes being implemented in the region.

Budgets for preservation, conservation and protection of the environment need to be enhanced through alternative sources. The allocation for Environment, Forestry and Wildlife CSS at INR 926 crore for 2020-21 is among the lowest of the 30 CSS schemes currently operational. Apart from encouraging convergence in various domestic schemes to achieve cost efficiency, alternative sources of funding should also be actively explored such as through support from bilateral and multilateral agencies and international funds. Opportunities of bringing in private sector investment e.g. Public-Private Partnerships

[165] https://link.springer.com/article/10.1007/s10531-016-1257-9

and CSR funds under Companies Act should be encouraged. These could be included within the scheme's objectives and targets for regular monitoring.

Eco-tourism has significant potential for improving sustainability of forest and wildlife schemes. Certain Wildlife Sanctuaries in India generate significant revenue from tourism. There needs to be concerted efforts between various departments such as forest, tourism and rural development to enhance opportunities for eco-tourism around national parks and wildlife sanctuaries. Apart from generating jobs in the area, revenue from such activities needs to be allowed to be used for management of the area and development of neighbouring communities. Countries such as Botswana and South Africa (e.g. Kruger National Park) have benefited significantly from eco-tourism, however care needs to be taken that such initiatives are managed well in order to avoid over-exploitation of natural resources.

Annual process for sanction, release and utilisation of funds under CSS schemes could be tracked through an online platform and dashboard with scheme implementation status. Currently the scheme implementation process involves preparation of Annual Plan of Operations (APOs) by each state, usually at the beginning of the financial year, which are collated and then reviewed by the Divisional Heads at MoEFCC. Based on budget availability for the year and any liabilities of states from previous year, funds are sanctioned and released to the consolidated fund of the states. Matching grant is then sanctioned by the state government upon which funds are released to the implementing agency. Any subsequent sanction of funds is contingent on submission of utilisation certificates by the state governments which becomes a challenge in case of some remote areas where due to weather conditions or access constraints, such certificates are not issued in a timely manner impacting subsequent fund releases. For schemes such as Green India Mission, where due to seasonality of afforestation activities (plantation season is usually June-July before onset of monsoon), it is essential to have well-defined fund sanction and release timeline that need to be defined in a process flowchart. These activities can then be tracked in an online platform that allows for submission of proposals from states, sanction of APOs, release of funds, submission of utilisation certificates and tracking of physical and financial progress of schemes. Online submission of documents would save time and help in identifying delays in a timely manner for which suitable correction action can be taken. An example is the proposal submission platform being used in the Swachh Bharat Mission (SBM) for implementation of waste management projects.

Revolving fund mechanism should be taken up because of challenges in matching of funding from states that results in implementation delays. India has various international targets and obligations under international treaties such as creating an additional carbon sink through additional forest and tree cover under the Paris Agreement, Aichi Biodiversity Targets under the Convention on Biological Diversity as well as for wetlands under Ramsar convention. Hence it becomes a matter of international prestige to ensure achievement of these targets. However, it has been observed that some states do not adequately budget for matching funding within the required financial year timeline that results in implementation delays e.g. afforestation activities that should be done in plantation season (usually June-July) and lake conservation works taken up before onset of monsoon get delayed beyond the optimal period which reduces their impact. Setting up of a revolving fund mechanism for implementing such critical programmes can address this issue of delay in fund flow by making funds available to implementing agencies immediately after approval of APOs as an advance without waiting for fund release at state level. Eventual fund release by

state government could be used for replenishing the revolving fund. Further, as a safeguard, any subsequent withdrawal by a state from the revolving fund could be subject to submission of required utilization certificates and confirmation of nil / minimal outstanding balance from the revolving fund. Union Ministry of Finance would also need to be consulted to issue the necessary amendments required in the General Financial Rules (GFR) for the implementation of this arrangement. For setting up of the fund, domestic resources such as those from CAMPA or government budgets could be used or funds from institutional donors or CSR organizations can also be explored.

Climate change is expected to make major impacts on global biodiversity through changes in fire frequencies, insect and pathogen attacks and shifts in species distribution. For this purpose, climate change-specific research needs to be encouraged and the management plans for Protected Areas and Tiger Reserves need to be revised to integrate climate change adaptation measures. The National Mission on Strategic Knowledge on Climate Change has been formulated by the Department of Science and Technology under the National Action Plan on Climate Change for building a vibrant and dynamic knowledge system that would inform and support national action for responding effectively to the objective of ecologically sustainable development. Collaboration with this mission can be considered to build the required knowledge base. As per the NDC estimates, India needs around USD 206 billion between 2015 and 2030 for implementing adaptation actions, hence enhancing resources for undertaking adaptation interventions needs to be explored through domestic sources such as carbon taxes and international sources such as Green Climate Fund, Global Environment Facility (GEF) and Climate Investment Fund (CIF).

Wildlife census for endangered species should be taken up at a regular frequency. As per the Management Effectiveness Evaluation (MEE) of National Parks and Wildlife Sanctuaries, the performance on population trends of endangered species has been low - 51% and 49% in 2015-17 and 2017-18 respectively. Currently census of tiger and elephant is undertaken at the national level once every four and five years respectively. Census of other major species is delegated to be taken up by the respective State / Union Territory governments periodically. A census provides essential information on the status of a species, its distribution and reproductive behaviour which is vital in the designing of conservation strategies. Therefore, a frequency for wildlife census exercises for each endangered species needs to be defined and a schedule developed for implementation by the respective state and UT governments. This frequency and scheduling can be done by the Standing Committee of the National Board for Wildlife (NBWL).

There is a need to adopt better indicators to track performance at a sectoral level. Using right kind of indicators for tracking of outcomes and impacts is required so that protection and conservation efforts can be effectively planned and implemented. Considering various international and national targets, strategies, action plans as well as indicators used by global environmental indices, a set of indicators have been proposed for the aspects of climate change, air quality, waste generation, biodiversity, water and forest resources. These have been provided in Annexure 4 for reference.

Independent monitoring and evaluation of schemes needs to be taken up at a reasonable frequency. Currently monitoring of scheme progress is done by state implementing agencies themselves which becomes a conflict of interest. There is a need to have an independent agency such as local universities,

research agencies, separate division / regional offices of MoEFCC to take up this activity. This will help in understanding progress being achieved and allow for suitable course correction to take place in scheme implementation. As an example, the National Afforestation & Eco-Development Board (NAEB) used to undertake concurrent evaluation of projects under National Afforestation Programme, findings of which were discussed in workshops organized by the Regional Centres of NAEB.

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Commentary, Narration and Analysis

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