15
Sustainable Management and Use of Terrestrial Ecosystem

Introduction

In the first year of the present millennium, with the main aim of eradicating poverty and fostering development, 189 countries agreed on the Millennium Development Goals (MDGs) consisting of eight goals, 21 related targets, measured by 60 official indicators.[1]

Rio+20 called for developing a set of inclusive Sustainable Development Goals (SDGs) drawing from the experiences of MDGs and integrating social, economic and environmental aspects.[2] Development cannot be sustainable without considering its environmental dimensions and poverty eradication cannot be achieved if ecosystem services and natural capital are degraded.[3] The UN General Assembly's Open Working Group (OWG) on Sustainable Development Goals brought out a proposal incorporating 17 goals, 126 level 1 targets and 43 level 2 targets to be achieved by the year 2030.[4] The post-2015 development agenda of India in the context of SDG 15 should build on all relevant existing international commitments, as MDGs, the Strategic Plan for Biodiversity 2011-2020 and Aichi Biodiversity Targets of Convention on Biological Diversity (CBD).

The MDG 7 had limited coverage of environmental sustainability issues, as desertification and land degradation and did not address mountain ecosystem, inland waters, grasslands, nor concentrated on drivers of biodiversity loss. A broad perspective of multiple synergies and trade-offs with other goal/targets is necessary. This paper presents an analysis of the progress in achieving the relevant MDG 7 "Ensure Environmental Sustainability" and an outline of the governance challenges and opportunities for implementing SDG 15 in India.

India's Progress and Gaps in Realising MDGs

Environmental objectives in the MDGs are reflected in MDG 7 and four subsidiary targets of which Targets 7a and 7b are relevant in the context of SDG 15.

Target 7a: *Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources.*

Target 7b: *Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss.*

Indicator 7.1 : Proportion of Land Area Covered by Forest

India has added around 3 million hectares (mha) of forest and tree cover over the last decade.[5] The forest cover of the country increased from 6,90,899 sq km (21.02 per cent of the geographical area) in 2007 to 6,97, 898 sq km (21.23 per cent) in 2013.[6] In comparison to 2011 there is a total increase of 5,871 sq km of forest cover. The tree cover is estimated to be 91,266 sq km (2.78 per cent of geographical area) and an increase of 278 million tonnes of carbon stock of country was recorded with respect to 2011. The Indian Forest Survey 2013 has attempted to demarcate forest cover within green wash area (corresponding to recorded forest area) and outside green wash area. Out of the total increase in 5,871sq km, 132 sq km is observed within green wash area and 5,739 sq km outside green wash area.[7]

Indicator 7.6: Ratio of Area Protected to Maintain Biological Diversity to Surface Area

The country has been on track in increasing the protected area network for maintaining ecological balance. From a Protected Area (PA) network of 54 national parks covering 21,003 sq km and 373

sanctuaries covering 88,649 sq km (total 1,09,652 sq km or 3.34 per cent of the country's geographical area) in 1988, the network has increased to 103 national parks, 531 wildlife sanctuaries, 66 conservation reserves and 26 community reserves in 2015 thus totalling to 1,60,499.31 sq km (4.88 per cent of geographical area).[8] In addition 9 biosphere reserves and 465 Important Bird Areas (IBAs) have been identified in India. 40 per cent of these IBAs fall outside the PA network and contain a range of habitats. Currently, there are 19 species recognised by the Alliance for Zero Extinction (AZE) in India, affirming India's commitment to zero extinction as outlined in Aichi Biodiversity Target 12. A total of 141 community conservation areas covering an area of 1,57,046 hectares (ha) have been identified for conservation measures and 110 Medicinal Plants Conservation areas, each of an average size of 200 ha, have been set up across 13 States of India.[9] In addition the managed forests under the State Forest Departments are also contributing towards biodiversity conservation. Thus, India has over 20 per cent of the total geographical area under effective biodiversity conservation, thereby exceeding the 17 per cent figure envisaged in Aichi Target 11.[10]

Indicator 7.7: Proportion of Species Threatened with Extinction

The Red List Index, used to measure progress towards the Aichi Target 12 and the MDGs show that globally a substantial proportion of species are declining overall in population and distribution. Terrestrial species declined by 39 per cent between 1970 and 2010. The Living Planet Index for freshwater species shows an average decline of 76 per cent.[11]

India is known to have over 6.7 per cent of animal species that the world holds and 3.7 per cent of the world's threatened vascular plants are in India. In India, 7.7 per cent of vascular plant species are under threat, while at global level, 13.8 per cent vascular plants are in a similar position.[13] Species-specific projects (Project Tiger, Project Elephant and Project Snow Leopard) are under implementation across the PAs as well as in areas outside the PA network. Species recovery plans for 16 terrestrial and 7 marine species (Dugong, four species of Sea turtle, Irrawaddy dolphin and Whale shark) are being prepared. Periodic assessment and updating of species protected under Wildlife Conservation Act of India is necessary (Table 1).

Table 1: Indian Fauna under IUCN Threat Categories[12]

IUCN Red List Category	Number of species (n = 4681)
Extinct	1
Critically endangered	73
Endangered	198
Vulnerable	375
Near Threatened	322

Source: ENVIS Centre on Wildlife and Protected Areas

Integration of Sustainable Development into Country Policies and Programmes

India has been part of several international agreements such as the Ramsar Convention on Wetlands, Convention on International Trade in Endangered Species of Fauna and Flora (CITES), CBD, etc. India has put in place various statutory provisions for conservation of the country's natural resources. These include:

- The Indian Forest Act 1927
- The Wildlife Protection Act 1972
- The Water (Prevention and Control of Pollution) Act 1974
- The Forest (Conservation) Act 1980
- The Environment (Protection) Act 1986
- The Biological Diversity Act 2002
- The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006

Green India Mission aims to increase forest and tree cover in 5 mha and improve quality of forest cover in another 5 million hectares (mha) on a landscape based approach.14 The National Afforestation Programme (NAP) is a flagship scheme of India. India has also established six National Bureaus dealing with genetic resources of plants, animals, insects, microorganisms, fish and soil sciences. The twelfth five year plan (2012-2017) mooted a four-pronged strategy of 'growth, inclusion, carbon mitigation and local environment benefits.[15]

Sustainable Development Goals: An Overview and Interlinkages

SDGs 12 through 15 focus on strategies for reversing the negative impacts of economic development on

ecosystems and the services they provide. SDG 12 (Targets 12.2, 12.8) focusses on reducing the pressure on resources through promotion of sustainable consumption and production pattern. SDG 15 is linked to SDG 2 on food security (Targets 2.3, 2.4, 2.5), SDG 6 (Targets 6.3, 6.4,6.5,6.6) on water and sanitation, SDG 11 (Targets 11.4, 11.6, 11.7) on sustainable cities and SDG 13 (13.1) on Climate Change. SDG 15 shows clear linkages with other UN environmental agreements and incorporates 9 level 1 targets and 3 level two targets.

SDG 15 and National Context

Land Degradation

At the Rio+20 Conference, world leaders recognised that desertification, land degradation and drought, were challenges affecting sustainable development. In the last two centuries, humans have converted 70 per cent of the grassland, 50 per cent of the savannah, 45 per cent of the temperate deciduous forest, and 27 per cent of the tropical forest biome to agricultural land.[16] While the world's drylands continue to be the most vulnerable and threatened by desertification, land degradation and drought (DLDD), 78 per cent of the total degraded land is located in terrestrial ecosystems other than drylands.[17] Globally the percentage of total land area that is already degraded or being degraded has increased from 15 per cent in 1991 to 24 per cent in 2008.[18]

India has a total geographical area (TGA) of 328.2 mha with drylands covering 228.3 mha (69.6 per cent of the total land area). Land is a natural capital vital for food security, regulating hydrological regimes, nutrient recycling and storing carbon, and other ecosystem services. The total area of India undergoing the process of land degradation is 105.4 mha that is about 32 per cent of the total land. The major process of land degradation is soil erosion (due to water and wind erosion), contributing to over 71 per cent of the land degradation in the country. Water erosion, the most widespread form of degradation, occurs widely in all agroclimatic zones. It has caused up to 33.56 mha (10.21 per cent of TGA) of land degradation. Wind erosion dominant in the western region, leading to loss of topsoil and shifting of sand dunes, has caused upto 17.56 mha of degradation (5.34 per cent of TGA).[19]

Fragmentation

A considerable area of forests is under low fragmentation i.e 49.63 per cent of TGA, 21.89 per cent under medium while 5.16 per cent is under high fragmentation.[20] Although India has improved its aggregate forest cover, India's forests have changed from multi-product and multi-layer to timber oriented, affecting livelihood of forest-dependent communities.[21]

Inland Fresh Water Ecosystems

India has about 7,57,060 wetlands with a total wetland area of 15.3 mha, accounting for nearly 4.7 per cent of the TGA of the country. Out of this, area under inland wetlands accounts for 69 per cent, coastal wetlands 27 per cent, and other wetlands (smaller than 2.25 ha) 4 per cent.[22] The Millennium Ecosystem Assessment evaluates that the beneficial expansion of public water supply for households and industry may result in a large increase in wastewater loadings to freshwater ecosystems in many developing regions during the 21st century.[23] A holistic approach considering interlinkages between the SDGs dealing with water resources (Targets 15.1 and 6.6) has to be followed to achieve sustainability.

Desertification

In India degradation occurs in arid, semi-arid and dry sub-humid areas where productivity is constrained by water availability, leading to desertification. About 81.45 mha is being subjected to desertification, i.e. 25 per cent of the TGA of India is affected by desertification.[24] About 69 per cent of the country's lands are drylands and degradation of these lands has severe implications for the livelihood and food security of millions. Desertification causes deterioration of the productivity of the fragile ecosystems, and increases poverty. In this context India's problem is not only sustainable land management but also reversing declines in productivity by restoring and regenerating land that is already degraded.

Mountain Ecosystem

The Rio conference, 1992 recognised the crucial role played by mountain ecosystems by highlighting that the livelihood of about 10 per cent of the world's population depended directly on mountain resources such as water, forests and agricultural products and

minerals. In India mountain ecosystems cover 18 per cent of the geographical area and are inhabited by 51 million people. Mountain areas are vulnerable to environmental degradation pressures placed by increasing population growth, tourism, infrastructure development, mining, etc. The working group on Indian Mountain ecosystem has recommended the following:

(a) Soil Conservation and managing the water resources for optimal utilisation and development of horticulture, floriculture and other agricultural usages.

(b) Strategy for disaster management in the States of mountain region.

(c) Nature conservation, involvement of community for management of forests, medicinal and aromatic plants, promotion of organic farming.

(d) Governance and Institutional framework for Spatial Planning and Sustainable Development.

Fair and Equitable Sharing of Benefits

The three pillars of CBD- conservation, sustainable use, fair and equitable sharing of the benefits arising from the utilisation of genetic resources form principal building blocks toward poverty eradication and sustainable development. In India Biodiversity Act 2002 and Rules 2004 address the issues relating to conservation of genetic resources and equitable sharing of benefits arising out of it through a decentralised three tier system. During 2014-15 National Biodiversity Authority (NBA) granted approvals to 19 applications from foreign nationals seeking access to Bioresources for research and commercial purposes and 14 applications for intellectual property rights (IPRs). The first internationally recognised certificate of compliance was issued by NBA on 1 October 2015, following a permit made available to the Access and Benefit-Sharing (ABS) Clearing House by India. The certificate serves as evidence of the decision by India to grant access to ethno-medicinal knowledge of the Siddi community from Gujarat to a researcher affiliated with the University of Kent in the United Kingdom.

Invasive Species

India has an estimated 18,000 plants, 30 mammals, 4 birds, 300 freshwater fishes and 1100 arthropods that are invasive which is one of the major drivers of biodiversity loss.

National and Local Level Planning and Poverty Reduction Strategies

At the local level, strengthening democratic institutions is necessary for sustained management of natural resources. Women's participation in local institutions governing natural resources is critical for sustainable forest and water management. Biodiversity Act 2002 promotes conservation and sustainable utilisation of bioresources by a three tier system comprising National Biodiversity Authority, State Biodiversity Boards and Biodiversity Management Committees (BMC) at local level. The role of natural resources in local livelihoods should be recognised as 200 million people are dependent on forests for their livelihood in India.

Consistency with Existing Agreements and Implementation of SDGs

The success of SDGs implementation framework depends on aligning targets with existing international agreements and SDGs can draw from what is agreed by CBD. Over the last year several proposals for a monitoring framework have been proposed which can be taken into consideration by India in addition to the National Biodiversity Targets (NBTs). This section analyses some of the complimentary targets and indicators.

SDG Targets and Aichi Targets

The Strategic Plan for Biodiversity 2011-2020 and its 20 Aichi Targets25 provide an agreed overarching framework for action on biodiversity and a foundation for sustainable development. Among the Aichi Biodiversity Targets, the following measurable targets are particularly pertinent for SDG 15:

Target 5: By 2020, at least halving deforestation and the loss of other natural habitats.

Target 7: Sustainably managed areas under agriculture, aquaculture and forestry.

Target 11: Protecting at least 17 per cent of land and 10 per cent of oceans through protected areas.

Target 15: Restoring at least 15 per cent of degraded lands.

The UN Convention to Combat Desertification (UNCCD)

UNCCD is a legally binding international agreement linking environment and development to sustainable land management, Parties adopted a 10-year strategic plan for 2008-2018 with 4 main strategic objectives[26] and indicators, which are:

1) To improve the living condition of the people affected
   - Proportion of people living below poverty line
   - Decrease in number of people negatively impacted by process of desertification/land degradation/drought
   - Land cover status
2) To improve the condition of affected ecosystem
   - Reduction in total area affected by desertification/ land degradation/drought
   - Increase in net primary productivity in affected areas
3) To generate global benefits through effective implementation of UNCCFD
   - Increase in carbon stock in affected areas
   - Areas of forest, agriculture, aquaculture ecosystem under sustainable management
4) To mobilise resources to support implementation of convention
   - Increase in level and diversity of funding for combating desertification/land degradation/ drought
   - Development of policies and legal measures to address desertification/land degradation/ drought

Sustainable Development and National Twelfth Plan

Sustainable development is a key agenda in National Twelfth Plan[27] which has identified deliverables consistent with SDG 15:

- Assess and remediate 12 identified contaminated sites with potential for groundwater contamination by 2017.
- Clean 80 per cent of critically polluted stretches in rivers by 2017 and 100 per cent by 2020.
- Greening 5 mha under Green India Mission including 1.5 million ha of degraded lands, afforestation and eco-restoration of 0.9 mha of ecologically sensitive areas.
- Technology-based monitoring of forest cover, biodiversity and growing stock including change-monitoring on periodical basis through dedicated satellite by 2017 and establishment of open web-based National Forestry and Environmental Information system for research and public accessibility by 2015.
- Engagement of Village Green Guards/Community Foresters for every Joint Forest Management (JFM) village by 2016.
- Establish forestry seed bank in forest circles and Model Nursery in every district with information on public portal by 2014.
- 20 per cent of veterinary professionals in the country will be trained in treating wildlife.
- Integrated Ecotourism District Plans covering 10 per cent of all potential Protected Areas (PAs) by 2017.
- Restore 0.1 mha of wetlands/inland lakes/water bodies by 2017.
- Mapping and preparation of biodiversity management plans for deserts (both cold and arid), coastal areas, important coral zones, wetlands, mangroves and so on to be completed by 2017.

SDGs and National Biodiversity Targets and Indicators

India has put in place an enabling legal mechanism under National Biodiversity Authority and a monitoring framework, National Biodiversity Targets[28] with indicators for each of the targets. Synchronisation of NBTs with SDG targets will contribute to development of a monitoring framework post 2015. India's National Biodiversity Targets (NBTs) 2, 3, 4, 5, 6, 8, 9, 10, 12 and Aichi Targets 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 17, 19, 20 are concomitant with SDG 15. This section attempts to draw the inter-linkages between the SDG targets, Aichi Targets and NBTs and corresponding indicators. Annex 1 depicts the national position.

An analysis of the National Biodiversity Targets and indicators in the perspective of SDG 15 reveals that two of the SDG targets namely 15.4 and 15.7 and one of the level two targets 15.c are not specifically addressed. Promoting integrated watershed development and alternative livelihood opportunities, generating and strengthening knowledge about the ecology and sustainable development of mountain ecosystems require a holistic approach. A composite indicator for conservation of mountain ecosystem and trends in poaching and illegal trade of protected species can be incorporated.

Challenges and Opportunities

India's major challenges include pollution of its inland rivers and waters; depleting fresh water sources and groundwater; land degradation, desertification, fragmentation and biodiversity loss and unsustainable utilisation of natural resources. Although India is reporting a marginal increase in forest cover this increase can be attributed to the fact that there is no distinction made between natural forests (usually mixed biodiverse) and plantations (often monoculture).[29] A periodic assessment of the loss of non-forest ecosystems of biodiversity outside the PAs as also inviolate forest areas is necessary.

India with about 2.4 per cent of world's geographic area, supports 17 per cent of world's population and 18 per cent of global livestock population, faces severe pressure on land. India had a poverty ratio of 29.5 per cent during 2011-2012[30] and 200 million people are dependent on forests for livelihood. Forests also meet 30 per cent of fodder needs of the cattle population and 40 per cent of domestic fuel wood needs of the people. Achieving food security is a crucial pillar of human development but can have severe negative impacts on biodiversity through land-clearing, the introduction of non-native species, excessive water use, habitat conversion, excessive use of chemical fertilisers and pesticides, chemical run-off and soil and water contamination and declining soil fertility associated with unsustainable production. Large scale ecological losses occur due to soil erosion, soil alkalinity and salinity, micronutrient deficiency, water logging and fast depletion and contamination of ground water, principle cause being irrigation. With a global population projected to reach 9 billion by 2050, ensuring food, water and energy security will be the challenge before all governments.[31] India is still home to a quarter of all the undernourished population in the world.[32] In India at the current nutritional level, about 100 million tonne of additional food grains are needed by year 2020 to achieve food security which will aggravate pressure on dry land ecosystems leading to over exploitation of land and water resources. The total contribution of irrigated agriculture to food grain production in terms of area expansion and yield improvement is likely to be around 64 million tonnes by 2020 leaving a shortfall of 36 million tonnes necessitating added productivity from dry lands.[33] The 2014 Global Harvest Initiative Report estimates that India's domestic production will only meet 59 per cent of the country's food demand by 2030 at the current growth rate of Total Factor Productivity Growth.

In India 60.6 per cent of total land area is agricultural land , 35 per cent of the area is sown under irrigation.[34] Although agricultural land is constant for the past several years, 60 per cent of the total area under cultivation is substantially degraded. Most of this damage is in the form of loss of topsoil and gradual deterioration of soil health and thus long-term productivity. While agriculture expansion can contribute to terrestrial ecosytem decline, integrated land use planning, agroecological methods and maintaining genetic diversity of cultivated plants and their wild relatives can form part of the solution.

Linkage of goals with specific and measurable indicators is a prerequisite for monitoring and evaluation. Since the SDG 15 has inter-linkages with targets in several other goals, fragmentation of issues at multi-departmental level is inevitable which may lead to lack of coordination and wastage of resources. The complexity of a system with a multitude of institutions and stakeholders with diverse aims and competences has to be taken into account while formulating the SDG framework for a diverse nation as India.

Free and open access to biodiversity data and interoperability mechanism between scientific and research institutions and science policy interface has to be developed. *National Biodiversity Information Outlook* (2012)[35] advocated a national information grid for biodiversity, to facilitate monitoring and management of natural resources.

A key factor to ensure compliance is effective governance regimes at national and local levels. Efforts to improve governance through strengthening Panchayati Raj Institutions (PRIs) and developing interlinkages between complementary institutions as BMC, JFM, etc., is indispensable.

Emerging demands for integrating information on environmental sustainability and human well-being needs an understanding of what ecosystems provide in terms of both market and non-market goods and services. UN Statistical Commission has developed a system for environmental-economic accounting which

Table 2: Funding for Biodiversity Conservation, 2013-2014

Nature of funding	Amount (in Rs. crores)
MoEF	
Core	1564.34
Forestry and Wildlife	1195.83
Research and development	153.51
Conservation of natural resources	90.00
National coastal management programme	125.00
Non-core	259.80
Total	**1824.14**
States	**5025.57**
Peripheral funding (Biodiversity related programmes of 23 departments under 77 schemes)	2354.74
Total	**9204.45 crores**

Source: India's Fifth National Report to Convention on Biological Diversity, 2014.

can be used as a framework for studying the impacts of the economy on the environment and the contribution of the environment to the economy.

It is estimated that a REDD+ (Reducing Emissions from Deforestation and Forest Degradation) programme for India could capture more than 1 billion tonnes of additional CO2 over the next 30 years and provide more than US$ 3 billion as carbon service incentives under REDD+. A national REDD+ strategy needs to be implemented along with relevant Aichi Biodiversity Targets (5, 7, 11, 14, and 15) and National Biodiversity Targets (3, 5,6,14).

Financing Biodiversity

During COP12 it was reaffirmed to double total biodiversity-related international financial resource flows to developing countries using average annual biodiversity funding for the years 2006-2010 as a baseline. Governments also agreed to increase domestic financing for biodiversity and identified a set of actions to allow the increased mobilisation of financial resources from all sources.

The total budget allocated for Ministry of Environment, Forest and Climate Change (MoEF) for the year 2013-2014 was Rs. 2430 crores out of which the core funding for schemes relevant to biodiversity conservation was Rs. 1564.34 crores. Compared to 2010-2011 core funding has increased by 45 per cent. Allocation of funds by MoEF for forestry and wildlife has increased by 50.7 per cent, research and development by 46.6 per cent, conservation of natural resources has tripled and national coastal management programmes have been reduced by 17.2 per cent when compared with 2010-2011 levels (figures of 2013-14 is presented in table 2). Government of India through 23 Ministries/Departments and 77 schemes is implementing schemes relevant to biodiversity conservation

The highest allocation of funds is for NBT 6, NBT 1 and NBT 3 which are complimentary to SDG 15 and specifically address rate of degradation, fragmentation and loss of natural habitats. Of the combined allocations of all related ministries including MoEF maximum funds are allocated towards NBT 3, and least for NBT 7, safeguarding genetic diversity of cultivated plants and their wild relatives and NBT 4 management and identification of pathways of invasive alien species. In this context, NBT 7 needs special attention as maintaining genetic diversity within agricultural systems and adopting biodiversity friendly farming practices can provide solution to the problem of balancing food security and biodiversity conservation.

Conclusions

Experts are warning that the country may shortly reach a threshold where the combination of poverty, poor resource management and climate change will contribute to a significant, if not irreversible, increase in fragility. Healthy and productive soils/lands, forests,

oceans and fresh water ecosystems, and the services they provide are critical for meeting this challenge. Protection of terrestrial ecosystems can be achieved only by sustainable forest management, conservation of inland waters, ecosystems, restoration of degraded lands, biodiversity conservation, and sustainable use of natural resources which is envisaged in SDG 15. India has attained much progress since and has achieved the MDG in some sectors, but achieving sustainable development of its 1.27 billion people requires well defined targets and indicators. Protection and sustainable use of terrestrial ecosystem can be achieved only as part of an integrated agenda of land use, food security, biodiversity conservation, that also provides for access to drinking water, sanitation and renewable energy while mitigating climate change. People are at the centre of sustainable development and ultimately the effectiveness of implementing SDGs depends on how well they are integrated into a decentralised governance framework.

Endnotes

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26 *ibid 21.*

27 *ibid 15.*

28 *ibid 9.*

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Inter-linkages between the SDG Targets, Aichi Targets and NBTs and Corresponding Indicators

SDG 15, Target	National Biodiversity Target	Aichi Target	Composite Indicator	Indicator	Frequency of monitoring
15.9	2. By 2020, values of biodiversity are integrated in National and State planning processes, development programmes and poverty alleviation strategies.	2	Trends in incorporating natural resource/biodiversity/ ecosystem service values in national and state planning processes and development programmes	1) Trends in biodiversity and ecosystem services valuation studies 2) Trends in number and coverage of studies- The Economics of Ecosystems and Biodiversity (TEEB), Net Present Value (NPV) relating to biodiversity 3) Trends in number and effectiveness of measures developed in the Mahatma Gandhi National Rural Employment Guarantee Act programme (MGNREGA) and Integrated Watershed Management Programme (IWMP) for protection and enhancement of ecosystem services and biodiversity 4) Trends in biodiversity inclusive climate change adaptation and mitigation measures formulated/ implemented 5) Trends in area covered by catchment area treatment under irrigation projects	3 years
			Trends in integration of biodiversity and ecosystem service values into sectoral and development policies and programmes	1) Trends in studies on economic valuation of selected ecosystem services 2) Trends in reflection of biodiversity and ecosystem services in policy decisions, planning and reporting processes	3 years
			Trends in policies considering biodiversity and ecosystem services in environmental impact assessment andstrategic environmental assessment	1) Trends in numbers of studies on biodiversity inclusive environment impact assessment, Cumulative Environment Impact Assessment (CEIA) and strategic environment assessment (SEA) 2) Trends in identification, assessment, establishment and strengthening of incentives that reward positive contributions to biodiversity and ecosystem services	3 years
15.1 15.2 15.3 15.5	3. Strategies for reducing rate of degradation, fragmentation and loss of all natural habitats are finalised and actions put in place by 2020 for environmental amelioration and human well-being	5, 15	1) Trends in forest cover	Changes in proportions of forest cover in different forest categories i.e., Very Dense Forest (VDF), Moderately Dense Forest (MDF), Open Forest (OF) and Scrub)	2 years
			Trends in aquatic ecosystems	Changes in areas in riverine ecosystems and wetlands (terrestrial and coastal) Number of wetlands under integrated management plans	3 years *Continued...*

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			Trends in mangrove cover and coastal area management	• Change in mangrove cover over the years • Trends in area covered by integrated coastal area management	2 years
			Trends in river water quality	Changes in water quality (by interception, diversion and treatment of domestic sewage and preventing agricultural runoff, toxic wastes, industrial effluents, chemical wastes and unburnt bodies from entering water bodies)	2 years
			Trends in afforestation and restoration	• Monitoring canopy cover, grasslands and traditional grazing lands • Monitoring carbon stock • Assisted natural regeneration • Rehabilitation of mined-out areas	2 years
			Combating Desertification	• Trends in land degradation • Status of and trends in area of deserts, water levels in wells/groundwater table	2 years
			Species restoration after forest and water body restoration	Status of selected indicator species	3 years
			Trends in maintenance of fertility in agricultural lands using natural methods and means	• Soil health records • Organic carbon and humus build up • Trends in maintaining the health of near-pristine soils, being awarded titles under FRA in forest areas	3 years
15.8	4. By 2020, invasive alien species and pathways are identified and strategies to manage them developed so that populations of prioritised invasive alien species are managed.	9	Trends in invasive alien species Management	• Number and coverage of management plans developed for prioritised invasive species and integration with PA -management plans and wetland management plans. • Changes in area affected by invasive species	3 years
15.2	5. By 2020, measures are adopted for sustainable management of agriculture, forestry and fisheries.	6, 7, 8	Trends in sustainable forestry	• Trends in area of degraded forests • Trends in area of restored forests • Trends in proportion of products derived from sustainable sources	3 years
			Trends in stock sizes of target and bycatch fish species (freshwater and marine)	Trends in catch per unit	3 years

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			Trends in intensity of destructive fishing practices	• Trends in sale of large scale or destructive fishing • Gear (e.g. purse-seine, bottom trawlers) • Trends in area covered by trawlers • Trends in frequency of Trawling	3 years
			Trends in sustainable fishing practices	Trends in certification of fish produce	Annual
15.1 15.5	6. Ecologically representative areas on land and in inland waters, as well as coastal and marine zones, especially those of particular importance for species, biodiversity and ecosystem services, are conserved effectively and equitably, on the basis of PA designation and management and other area-based conservation measures and are integrated into the wider landscapes and seascapes, covering over 20 per cent of the geographic area of the country, by 2020	10, 11,12	Trends in PA coverage under four legal categories (National Park, Wildlife Sanctuary, Community Reserve and Conservation Reserve)	Change in no./area/percentage of PA over time	3 years
			Trends in other area-based conservation measures	Area/no.of initiatives	3 years
			Trends in coverage under Biodiversity Heritage Sites (BHS) under the Biological Diversity Act 2002	Change in number/area/percentage of BHSs over time	3 years
			Trends in wetlands brought under integrated management	• Changes in area and ecological status of wetlands through implementation of integrated management plans • Changes in abundance and diversity of waterbird species in wetlands over time • Trends in coverage of sites of international importance for migratory species under CMS	3 years
			Trends in Important Bird Areas (IBAs)	Changes in number/area of IBAs over time	3 years
			Status and population trends of 16 IDWH terrestrial species and habitats	Population trends of selected species	5 years
			Trends in forest cover in four designated categories	Changes in proportions of forest cover in differentforest categories (VDF, MDF, OF, Scrub	2 years

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			Trends in status of Indian plant and animal species included in International Union for Conservation of Nature (IUCN) Red Data Book	Conservation status of species, subspecies and varieties and even selected subpopulations at a national scale highlighting taxa threatened with extinction and therefore promoting their conservation	4 years
			Status of ecosystem services of selected ecosystems	Status of ecological services of selected ecosystems including agricultural landscapes	5 years
15.1	8. By 2020, ecosystem services, especially those relating to water, human health, livelihoods and wellbeing, are enumerated and measures to safeguard them are identified, taking into account the needs of women and local communities, particularly the poor and vulnerable sections.	14	Level of toxic contaminants in wetlands/rivers/aquatic fauna	• Trends in pollution status of wetlands of international (Ramsar sites) and national identified by state governments) importance • Levels of toxic contaminants in rivers that provide freshwater for human use • Levels of toxic contaminants in aquatic/terrestrial fauna	2 years
			Extent of restored forest cover in India	• Trends in area of forests under restoration • Trends in area under plantations in rural/urban areas • Trends in very dense forest/moderately dense forest in PAs	2 years
			Trends in wetlands significant for delivering freshwater being brought under integrated management	Area of wetlands such as lakes and ponds under integrated management	3 years
15.6	9. By 2015, Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their utilisation as per the Nagoya Protocol are operational, consistent with national legislation.	16	Trends in access to genetic resources and equitable sharing of benefits	• Trends in number of proposals for intellectual property rights • Trends in number of cases seeking third party transfer for accession of biological resources and associated Traditional Knowledge (TK) • Trends in number of cases seeking prior approval of NBA for transferring the results of research to • foreign nations, companies and NRIs for commercial purposes • Trends in number of cases seeking approval of use of bio-resources and associated TK for commercial utilisation	3 years
15.9	10. By 2020, an effective, participatory and updated national biodiversity action plan is made operational at different levels of governance.	3 , 4, 17	Progress in implementing NBAP	• Trends in preparation of State Biodiversity Action Plans (SBAPs) • Trends in implementing the activities envisaged under SBAPs	3 years
15.a 15.b	12. By 2020 opportunities to increase availability of financial resources for effective implementation of Startegic Plan for Biodiversity 2011-2020	19, 20	Trends in financial resources available for implementing Aichi Targets		3 years

Source: Compiled by Authors.

Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss: Targets and Indicators	
15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	15.1.1 Forest area as a proportion of total land area 15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type
15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	15.2.1 Progress towards sustainable forest management
15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world	15.3.1 Proportion of land that is degraded over total land area
15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development	15.4.1 Coverage by protected areas of important sites for mountain biodiversity 15.4.2 Mountain Green Cover Index
15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	15.5.1 Red List Index
15.6 Promote fair and equitable sharing of the benefits arising from the utilisation of genetic resources and promote appropriate access to such resources, as internationally agreed	15.6.1 Number of countries that have adopted legislative, administrative and policy frameworks to ensure fair and equitable sharing of benefits
15.7 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	15.7.1 Proportion of traded wildlife that was poached or illicitly trafficked
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	15.8.1 Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species
15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts	15.9.1 Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011-2020
15.a Mobilise and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems	15.a.1 Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems
15.b Mobilise significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation	15.b.1 Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems
15.c Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities	15.c.1 Proportion of traded wildlife that was poached or illicitly trafficked