Introduction

Environment statistics are a set of data and information that describe the natural environment, its quality, and its interaction with human activities. These statistics provide valuable insights into the state of the environment and the effectiveness of policies and measures to protect it. The scope of environment statistics encompasses all dimensions of the environment, be it Earth, Water or Air, the biotic and abiotic matter found within the natural environment, and various concerns arising out of impacts of human footprints on it. Geographic attribute of a country and its shape of economic development define the scope of Environment Statistics to a large extent. Environment statistics, therefore, describe (i) the quality and availability of natural resources (ii) human activities and natural events that affect the environment (iii) the impacts of these activities and events and (iv) social responses to these impacts.

2. The objective of environment statistics is to provide information about the environment, its changes over time and across locations, and the main factors that influence them. Ultimately, environment statistics aim at providing statistical information to improve knowledge of the environment, to support evidence-based policy and decision making, and to provide information for the general public, as well as for specific user groups. As a whole, environment statistics play a crucial role in understanding the state of the environment, assessing environmental risks and impacts, and promoting sustainable development.

Framework for Development of Environment Statistics

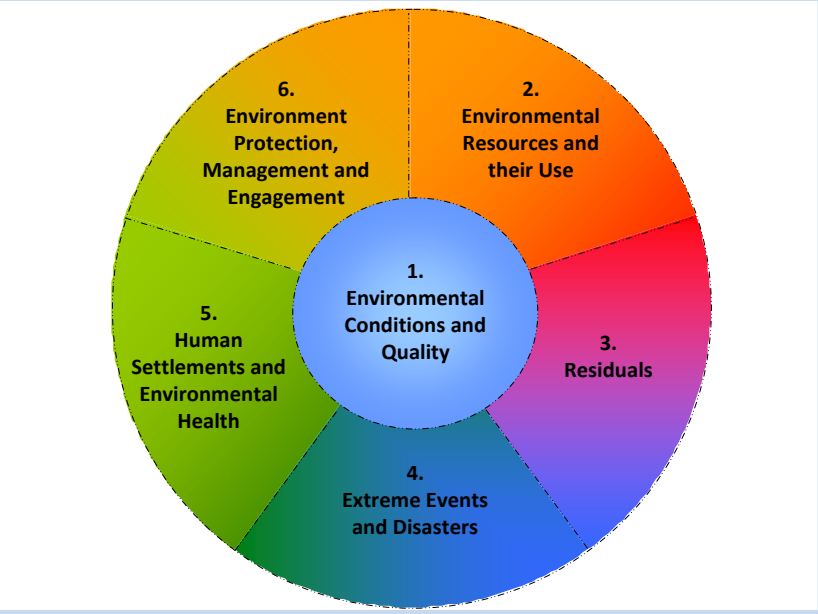
3. In order to standardize the environment statistics being compiled by different countries, the United National Statistical Division (UNSD) developed and published 'A Framework for the Development of Environment Statistics (FDES)' in 1984. The purpose of FDES is to provide a common approach and set of principles for the production of environment statistics, to ensure that data are comparable across countries and regions. FDES is based on the System of Environmental-Economic Accounting (SEEA), which is a statistical framework that integrates economic and environmental data to provide a comprehensive picture of the interactions between the economy and the environment.

4. FDES provides guidance on how to collect, compile, and disseminate environment statistics, including guidance on the development of environmental indicators and the integration of environmental data into national accounts. It also provides guidance on the use of new data sources, such as satellite data and remote sensing, to supplement traditional data sources. The contents of the FDES are "statistical topics", they are those aspects of environmental concerns that can be subjected to statistical description and analysis. It is a flexible framework for developing and organizing environmental and related socio-economic information. FDES is an important tool for improving the

quality and comparability of environment statistics around the world, and for promoting the sustainable use of natural resources.

5. The UNSD released an updated edition of the framework, known as FDES 2013, in June 2016. This version was endorsed by the UN Statistical Commission during its 44th Session in 2013 as the framework to enhance environmental statistics programs globally. The FDES 2013 is a multipurpose conceptual and statistical framework that is comprehensive and integrative in nature. The FDES 2013 organizes environment statistics into a structure consisting of components, subcomponents, statistical topics, and individual statistics using a multi-level approach. The first level of the structure consists of six fundamental components that follow the FDES conceptual framework. Chart 1 shows the six components of the FDES. The first component consolidates statistics concerning environmental conditions, their quality, and changes. The second component categorizes statistics related to availability and use of environmental resources (ecosystem provisioning services, land and subsoil resources). The third component encompasses statistics pertaining to the use of regulating services for the discharge of residuals from production and consumption processes into the environment. Statistics concerning extreme events and disasters (both natural and technological) and their impacts fall under the purview of the fourth component. The fifth component amalgamates statistics related to environmental conditions and impacts within human settlements. Lastly, the sixth component clusters statistics relevant to societal responses and economic measures aimed at protecting the environment and managing environmental resources.

Chart 1: Component of FDES 2013



6. Each of the six components is further broken down into its respective sub-components (second level) and statistical topics (third level). The FDES 2013 sets out a comprehensive (though not exhaustive) list of statistics (the Basic Set of Environment

Statistics) that can be used to measure the statistical topics related to environment and to develop national environment statistics programmes. This Basic Set of Environment Statistics is designed with enough flexibility to be adapted to individual countries' environmental concerns, priorities and resources and it follows a progression of three tiers:

(a) Tier 1 is the Core Set of Environment Statistics with 100 indicators, which are of high priority and relevance to most countries and have a sound methodological foundation.

(b) Tier 2 includes environment statistics that are of priority and relevance to most countries but need more investment in time, resources or methodological development.

(c) Tier 3 includes environment statistics which are either of less priority or require significant methodological development.

7. The Core Set of Environment Statistics (i.e., Tier 1) represents a broad consensus of opinion; as such, it is intended to foster collection, coordination and harmonization of environment statistics at the national, regional and global levels in the short-term. Consequently, depending on their priorities and resources, countries are encouraged- to consider producing Tier 2 and Tier 3 statistics in the medium- and in the long-term respectively.

Environment Statistics in India

8. India has a well-established system for collecting and disseminating environment statistics. The National Statistical Office has been releasing the publication, "EnviStats-India", in line with FDES 2013, from 2018 onwards. The tables presented in this publication have been sourced from various Departments/ Divisions/ Organisations of the Central/State Governments. In accordance with the FDES 2013, the tables of the publication 'EnviStats-India' has been categorized into six chapters, each corresponding to one of the components of FDES 2013. The tables related to the topics under the component have been put together, for the ease of comprehension and use.

9. India also participates in international efforts to develop and promote environment statistics. For example, India has adopted the System of Environmental-Economic Accounting (SEEA) framework and is working to develop environmental accounts based on this framework. India is also a member of the United Nations Environment Programme (UNEP) and participates in international forums on environmental statistics and sustainable development.

10. Environment statistics play a critical role in tracking progress towards achieving the Sustainable Development Goals (SDGs). The SDGs are a set of 17 global goals adopted by the United Nations in 2015, which aim to end poverty, protect the planet,

and ensure prosperity for all by 2030. Several of the SDGs specifically relate to the environment. To monitor progress towards these environmental goals, a range of environment statistics are needed. These might include data on greenhouse gas emissions, air and water quality, waste generation and management; land use and land cover change, biodiversity, and access to clean energy and water. Accurate and reliable environmental statistics are essential for assessing the effectiveness of policies and interventions aimed at achieving the SDGs, and for identifying areas where additional action is required. They also help to raise awareness and understanding of environmental issues among policymakers, businesses, and the public, and to inform decision-making at all levels.

COMPONENTS OF FDES

Component-1: Environmental Conditions and Quality

11. Statistics on environmental conditions and qualities help to measure the physical, biological and chemical characteristics of the environment. Just like the vital signs are used to measure the human body's basic functions, these measurements are taken to help assess the environmental health as well as to give clues to possible problems and show progress toward recovery after interventions. In respect of the policy makers, the government, these statistics help to judge the need for and efficacy of policies. Component 1 of FDES covers statistics on different aspects of the environmental conditions like its meteorological, hydrographical, geological and geographical conditions, soil characteristics, land cover, extent of ecosystems, biodiversity and environmental quality.

Component 2: Environmental Resources and their Uses

12. Earth is abundant with natural resources that develop on this planet using its surrounding environment. Few of them are used for our survival like land, water, air, rest of them like minerals, coal, gas and oil are used for satisfying our daily needs. From forests to wetlands, mountains to coastal shores and crops & livestock to minerals – each of these resources has its own importance.

13. Component 2 of FDES includes statistics on environmental resources and their use, with specific focus on their stocks and changes therein, and also their use for production and consumption so as to help policy formulation to ensure sustainable management of current and future use by the human sub-system.

Component 3: Residuals

14. Of all living things, humans have the most impact on their environment. The economic growth and technological advancement which have expanded the horizon of

possibilities for mankind, has also resulted in polluting the earth and is threatening to throw the natural environment off balance. Pollutants, whether they are released into the water, the air, or the ground, spread throughout the ecosystems. They not only affect human health, but the health of all species. Therefore, the planet's health and future depend solely on the ways and means to fight the causes of pollution.

15. Statistics on pollution are covered under two Components of FDES. While Component 1 of FDES focusses on "environmental quality" and organizes statistics on the concentration of pollutants, Component 3 of FDES focusses on generation and management of pollution. It contains statistics on the amount and characteristics of residuals generated by human production and consumption processes, their management, and their final release to the environment. Residuals are defined as flow of solid, liquid and gaseous materials, and energy that are discarded, discharged or emitted by establishments and households through processes of production, consumption or accumulation. Data on management of residuals- collection, treatment and recycling/reuse are included in this component. Generally, emissions are analysed by the type of receiving environment (air, water or soil) and type of substance.

Component 4: Extreme Events and Disasters

16. The anthropogenic climate change has now been proven to be the cause of increased extremes of heat and rainfall and the frequency and severity of the extreme events- heat waves, cold waves, floods and droughts- is likely to get worse. These natural extreme events cannot be neglected for the disturbances they cause and the effect they have on people, their incomes, their livelihoods and local business. This being the case, it is important for the policy makers to take mitigation and adaptation action for the extreme events. In this section, the details relating to some of the natural disasters are given. The datasets have been sourced from India Meteorological Department (IMD), National Crime Records Bureau (NCRB) etc..

Component 5: Human Settlements and Environment Health

17. The link between good planning and good health is unequivocal. The quality of environment – both the natural and the man-made environment- has a significant impact on health and wellbeing. While the natural environment comprises the environmental components of air, water, land and the biota therein, the man-made environment is represented by human settlements which consist of physical elements, namely, shelter and infrastructure and the basic services like those of safe water, sanitation, health and transport. Therefore, Component 5 of FDES 2013 encompasses the statistics related to two sub-components – human settlements and environmental health.

5.1 Human Settlements

18. The interaction of human settlements on the environment, at the most basic level, is that they extract non-renewable natural resources on the one hand and, on the other, produce waste products and pollution that has to be absorbed by the environment. The impact of human settlements on the natural environment increases as the population grows, urbanizes and consumes more. Urban and rural sprawl, housing demand, modes and character of transportation and basic service infrastructure, which have the most noticeable impact on the natural environment, are the focus for the creation of more sustainable human settlements with a reduced ecological footprint. These interactions and effects are described using information on human population, housing conditions, access to selected basic services (e.g., water, sanitation, waste removal, energy and transport) and environmental concerns, especially those specific to urban settlements.

5.2 Environmental Health

19. Environmental health focuses on how environmental factors and processes impact and change human health. It can be defined as an interdisciplinary field that focuses on analysing the relationship between public health and the environment. Common measures of health problems within human populations include statistics on morbidity (incidence and prevalence) and mortality associated with specific types of diseases and conditions that are heavily influenced by environmental factors. Climate change and the associated increase in extreme events are also said to be linked with the expanding risk areas for air, water and vector-borne diseases, putting more people at risk.

Component 6: Environment Protection, Management and Regulation

21. India has taken several measures for better management of environment in line with the international regulations and on account of the conditions in the country. Component 6 of FDES recognizes the importance of synchronization of regulations and instruments. This component organizes information on the following key aspects of environmental governance:

a. Expenditure on environmental protection and resource management to improve the environment and maintain ecosystem health;
b. Statistics on environmental governance, institutional strength, enforcement of regulations and extreme event preparedness; and
c. Programmes and activities undertaken to increase awareness about environment, to diminish environmental impacts and to improve the quality of local environments.

Component 1: Environmental Conditions and Quality

Component 1 is at the centre of the FDES structure. It includes statistics about the physical, biological and chemical characteristics of the environment and their changes over time. These fundamental background conditions are strongly interrelated and determine the types, extent, conditions and health of ecosystems.

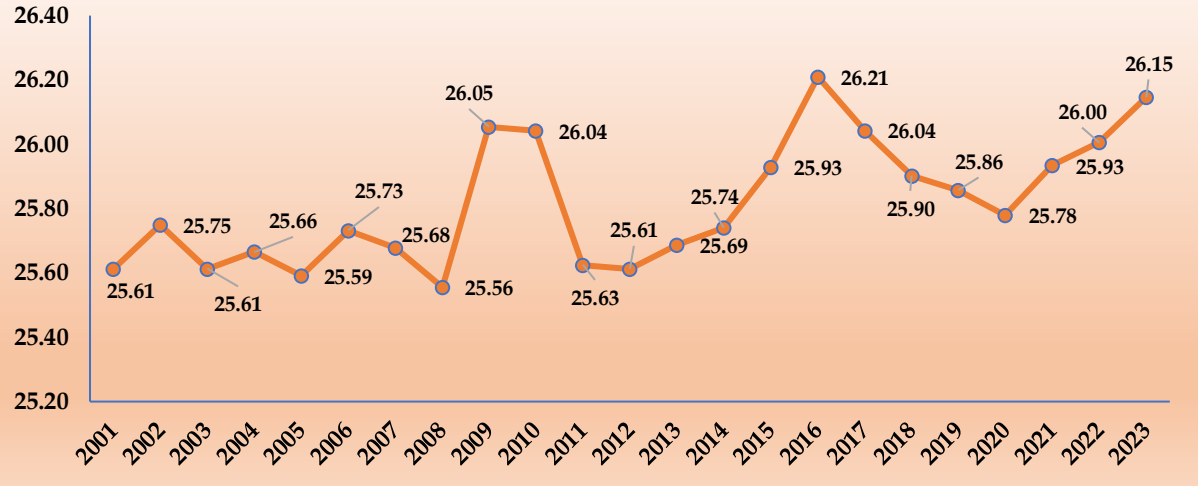
Component 1 contains three subcomponents:

i. Subcomponent 1.1: Physical Conditions;
ii. Subcomponent 1.2: Land Cover, Ecosystems and Biodiversity; and
iii. Subcomponent 1.3: Environmental Quality.

Thus, component 1 of FDES lays the groundwork for understanding the current state of the environment, which is essential for informed decision-making, policy formulation, and sustainable development planning. It serves as a basis for the other components of the framework, including policy formulation, data management, and dissemination.

1.2: It is observed from **Statement 1.01** that the annual and seasonal viz., January-February, March-May, June-September and October-December mean temperatures for the year 2023 are 26.15, 21.47, 27.68, 28.77 and 24.24^{0}C respectively. Figure 1.1 illustrates the trend of annual mean temperature from 2001 to 2023.

Fig. 1.1: Trend of Annual Mean Temparature (^{0}C): 2001-2023



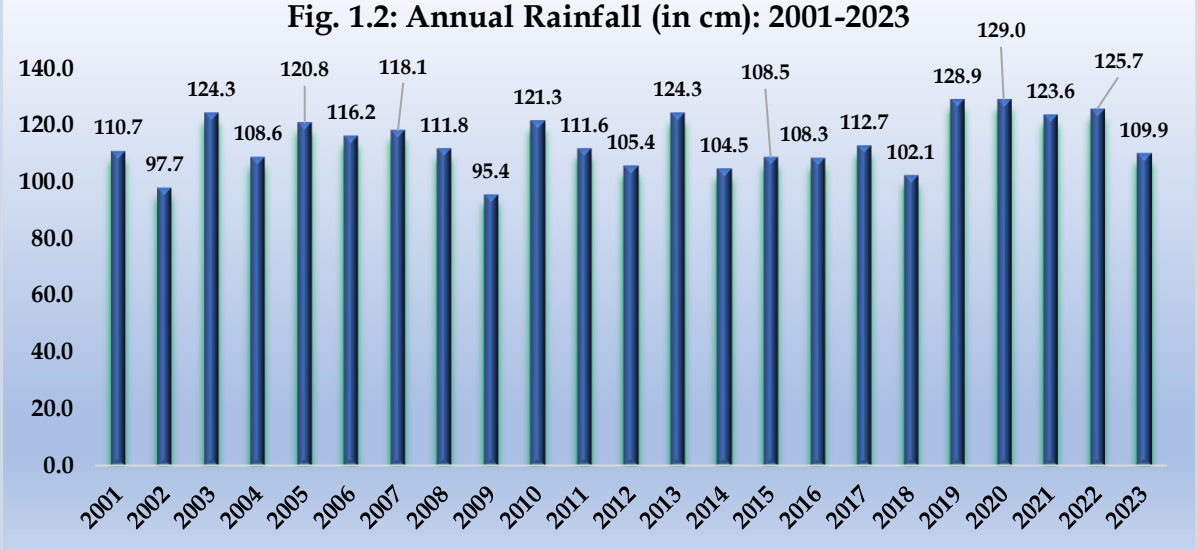
Source: India Meteorological Department, Ministry of Earth Sciences

Furthermore, the data regarding annual and seasonal mean temperatures indicates a notable rise over the last two decades, suggesting a steady warming trend.

1.3: The data from 2001 to 2023 shows significant variability in annual and monthly rainfall. In 2023, the annual rainfall measured in India was 109.9 cm compared to 2022 and 2021 when 125.7 cm and 123.6 cm of rainfall was recorded. However,

there was a higher amount of rainfall recorded in 2020, with 129 cm indicating a fluctuating trend in annual rainfall over the years. Trend of annual rainfall from 2001 to 2023 is depicted in Fig. 1.2. Overall, the data reflects high rainfall during the monsoon season (June to September) and low rainfall in the early and later months of the year, with significant year-to-year fluctuations **(Statement 1.03)**.

Fig. 1.2: Annual Rainfall (in cm): 2001-2023



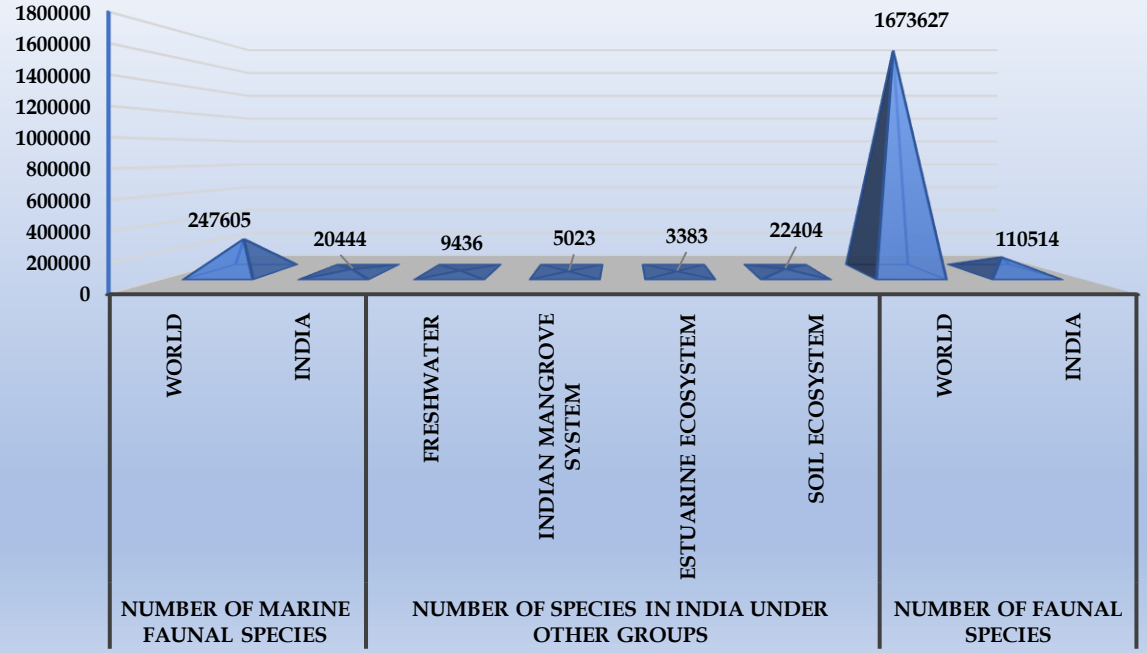
Source: India Meteorological Department, Ministry of Earth Sciences

1.4: Terrestrial protected areas refer to designated regions of land set aside for the conservation of biodiversity and natural resources. These areas include National Parks, Wildlife Sanctuaries, Conservation Reserves, and Community Reserves. Terrestrial protected areas play a crucial role in maintaining biodiversity, preserving habitats, and safeguarding endangered species. **Statement 1.12** provides the distribution of terrestrial protected areas across states and union territories of India, covering a total area of 3,287,263 km². There are 106 National Parks and 572 Wildlife Sanctuaries, which constitute 1.36% and 3.86% of the total area, respectively. Gujarat boasts the largest expanse of protected areas, spanning 17,098 km², equivalent to 8.72% of its state area. Additionally, Rajasthan, Ladakh, and Madhya Pradesh possess extensive networks of protected areas, each exceeding 10,000 km². In terms of the proportion of total state area, Sikkim, Chandigarh, Ladakh, and Goa lead, with over 20% of their territories designated as protected areas. This indicates abundant biodiversity and substantial investments in conservation initiatives within these regions. Conversely, Delhi, Punjab, and Lakshadweep exhibit minimal protected areas, with Delhi having only 1.32% of its land area as a Wildlife Sanctuary and Lakshadweep merely 0.03% protected. This data underscores regional disparities in conservation endeavours.

1.4: India is very rich in terms of biological diversity due to its unique biogeographic location, diversified climatic conditions and enormous eco-diversity and geodiversity. This country possesses diversified ecosystems from snow clad high mountain ranges to sea coasts of all categories (sandy, muddy,

rocky, shingle, coralline) including deserts and semi-arid regions, almost all "types"- of forests, grass lands, lakes, and rivers, estuaries, lagoons, islands and the ocean. The data presented in **statement 1.14** provides total number of faunal species spanning marine, freshwater, estuarine, mangrove, soil ecosystem categorized by phylum.

Fig. 1.3: Faunal Diversity in India and the World



Source: Zoological Survey of India, Ministry of Environment, Forest & Climate Change

As on December 2023 there are 2, 47,605 marine faunal species globally, while in India, there are 20,444 species have been documented. 9,436 species are from freshwater ecosystems, 3,383 species from estuarine, 5,023 species from mangroves, and 22,404 from soil ecosystems within India. The country's faunal diversity at present includes 1,10,514 faunal species in different phyla of Animalia and Protista, with a majority of species (77,776) belong to the phylum Arthopoda.

Component 2: Environmental Resources and their Use

Environmental resources are essential inputs for both production and consumption, playing a crucial role in providing shelter, food, healthcare, infrastructure, transportation, communication, defence, and other key aspects of human activity. Consequently, policymakers need reliable statistics on the availability and quality of these resources over time to make informed decisions.

2.2: Component 2 of the FDES contains six subcomponents that correspond to the main categories of Environmental resources:

i. **Mineral Resources** are crucial for modern society, providing raw materials for construction, manufacturing, energy production, and many other industries. Their extraction and processing also contribute significantly to the global economy.

ii. **Energy Resources** are sources of power used to generate electricity, heat, and fuel for various applications in both residential and industrial sectors. They are essential for the functioning of modern society and can be categorized into renewable and non-renewable resources.

iii. **Land Resources** refer to the natural features and materials available on the earth's surface, which are essential for various human activities, including agriculture, forestry, urban development, and conservation. These resources play a vital role in supporting ecosystems, providing habitat for wildlife, and offering recreational and aesthetic value.

iv. **Soil Resources** are a critical component of the natural environment and are vital for supporting life on Earth. They serve as a medium for plant growth, a habitat for many organisms, a filter for water, a carbon store, and a foundation for human infrastructure.

v. **Biological Resources** encompass the variety of life forms on Earth, including plants, animals, fungi, and microorganisms. These resources are essential for ecosystem functioning and provide a wide range of ecosystem services that support human well-being.

vi. **Water Resources** are essential for all forms of life and play a crucial role in various human activities. They include freshwater from rivers, lakes, groundwater, and glaciers, as well as saltwater from oceans and seas.

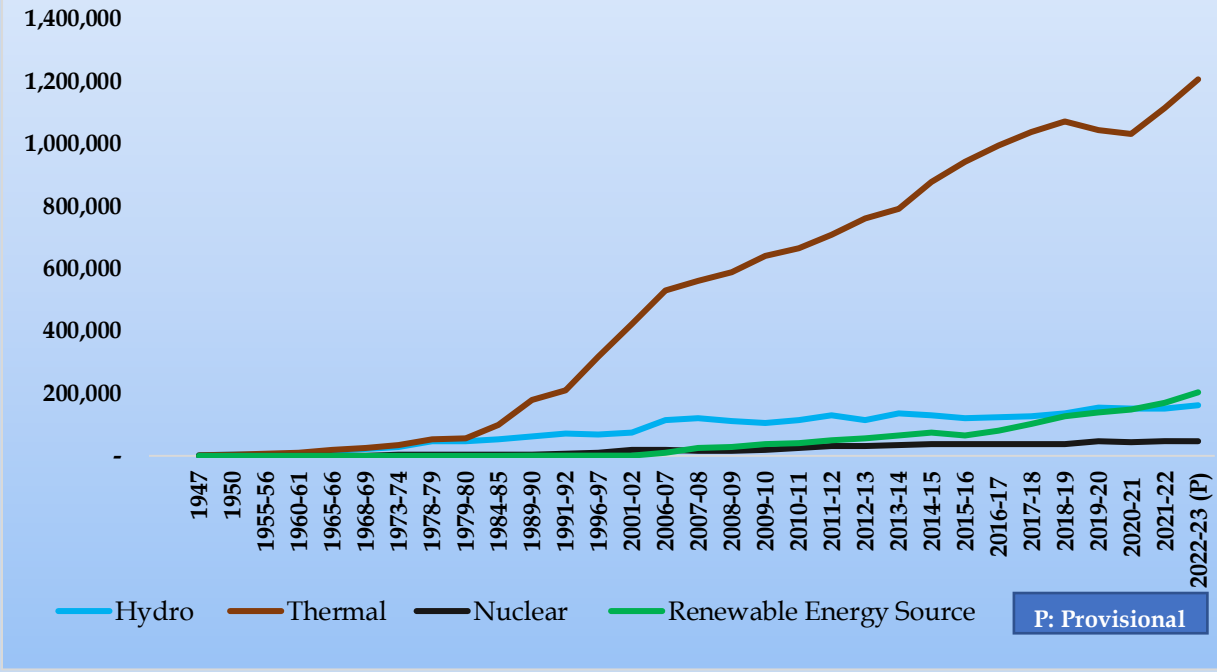
2.3: Data on the most critical human activities associated with the utilization of environmental resources is necessary to prevent shortages or usage restrictions, ensure resource availability for emerging applications, assess import dependency and other risks, and facilitate their continued use over time. Additionally, to ensure sustainable management of current and future environmental resource is being used by the human subsystem, data on their availability and usage is crucial.

2.4: Statement 2.01 reports the stock of 70 minerals where it can be seen that remaining stock of 35 minerals has increased in 2020 as compared to the year 2015. **(Statement (2.01)**

2.5: The total coal reserves for India shows a positive trend of increase over the years in all categories. Jharkhand has the highest total coal reserves among the listed states, with a significant amount in the 'Proved' category. Odisha also shows substantial coal reserves, especially in the 'Proved' and 'Indicated' categories. States like Bihar, Madhya Pradesh, and Chhattisgarh exhibit consistently increasing coal reserves across the years. Assam, Maharashtra, and West Bengal also have notable coal reserves, with variations in different categories over the years. **(Statement 2.06)**

2.6: Statement 2.10 indicates a consistent growth in electricity generation from various sources, with thermal power (especially coal/lignite) dominating the electricity mix, while renewable energy sources have also shown significant growth in recent years. Thermal power generation has risen from 1,877 GWh in 1947 to 12,06,390 GWh in 2022-23. Coal/lignite contributes the most to thermal power generation, reaching 12,06,390 GWh in 2022-23. Electricity generation from renewable energy sources has also seen a continuous increase, reaching 2,03,553 GWh in 2022-23. Hydro and nuclear power generation have also increased, but compared to other sources, their growth is relatively lower.

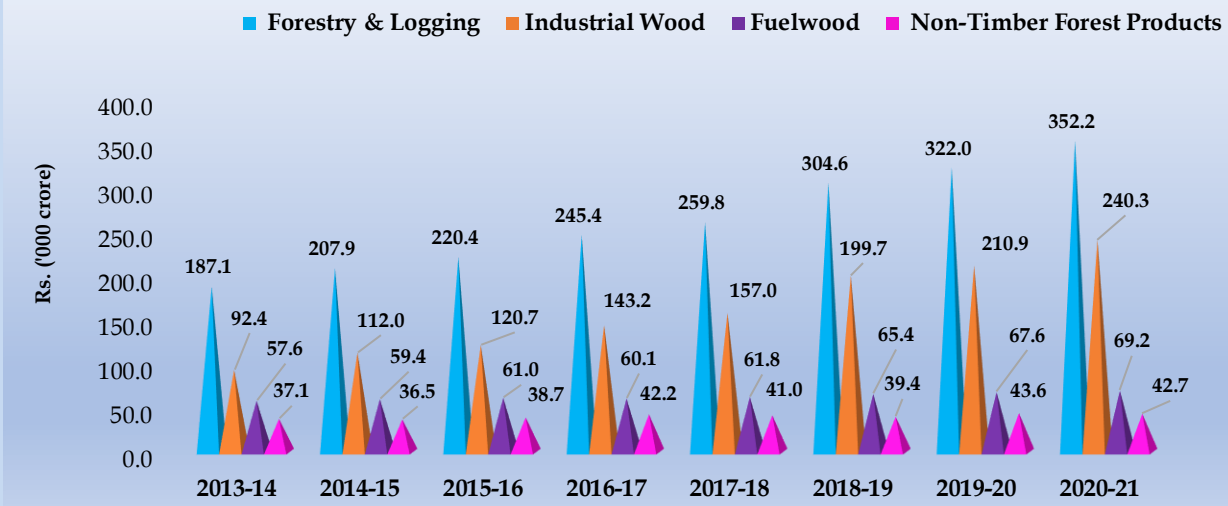
Fig. 2.1: Annual Gross Generation of Power by Source and Sector (in Gwh)



Source: Central Electricity Authority

2.7: According to **Statement 2.14 (a)-(d)**, it has been noted that the forestry and logging sector has displayed consistent growth over time, with an uptrend from 187.1 ('000 crore) in 2013-14 to 352.2 ('000 crore) in 2020-21, indicating sustained expansion in output. Similarly, there has been a positive trajectory in industrial wood production, with a significant rise from 92.4 ('000 crore) to 240.3 ('000 crore) during the same period, showcasing notable growth over the years. However, fuelwood output has experienced a moderate increase from 57.6 ('000 crore) to 69.2 ('000 crore) during 2013-14 to 2020-21. Non-timber forest products have exhibited some fluctuations but generally maintained a stable trend, with values shifting from 37.1 ('000 crore) in 2013-14 to 42.7 ('000 crore) in 2020-21.

Fig. 2.2 : Value of Output from Agriculture and Allied sectors (At Current Prices)



Source: State-wise and Item-wise Value of Output from Agriculture and allied sectors (2011-12 to 2020-21), NAD,NSO, MoS&PI.

2.8: The total food grains area in India has increased from 101.2 million hectares in 1950-51 to 132.2 million hectares in 2022-23, an increase of about 30%. The area remained relatively stable between 120-130 million hectares from 1990-91 to 2022-23, with some fluctuations year-on-year. The highest area of 132.2 million hectares was recorded in 2022-23, suggesting a consistent upward trend in recent years. However, the data for 2023-24 indicates a significant decline to 70.4 million hectares. This sharp drop is likely limited to the Kharif season, as the Rabi season data is not yet included. The overall trend demonstrates India's ability to gradually increase its total food grains area over the past seven decades, with some year-to-year variations. **(Statement 2.15 (a))**

Fig. 2.3 : Total Foodgrains Area (Thousand Hectares)

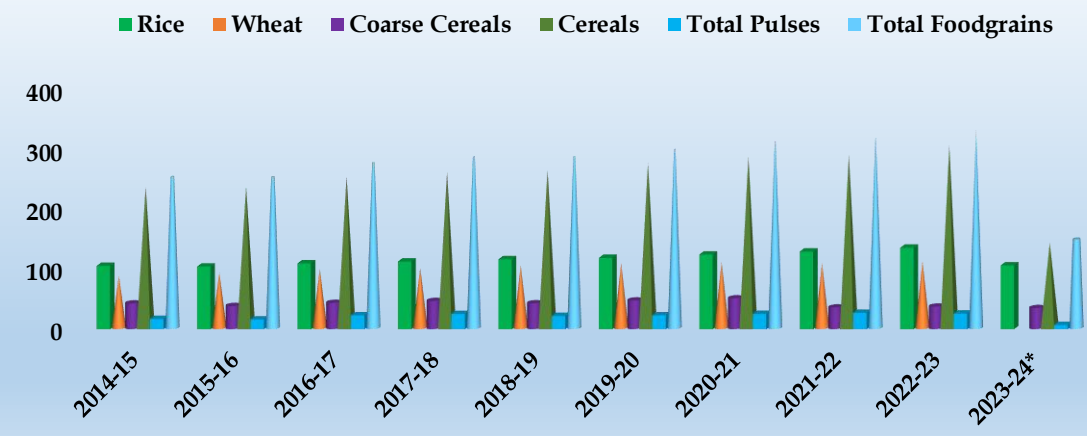
Source: Economics, Statistics & Evaluation Division, MoAFW

* As per 1st Advance Estimates (Kharif only)

2.9: India has made significant progress in increasing crop production over the years, with cereals and oilseeds showing the most substantial growth. Cereal production has steadily risen from 234.9 million tonnes in 2014-15 to 303.6 million tonnes in 2022-23, primarily driven by increases in rice and wheat output. Total food grains production, including cereals and pulses, has also grown from 252.0 million tonnes to 329.7 million tonnes during the same period.

Oilseeds production has experienced significant fluctuations, with soybean and rapeseed/mustard being the major contributors. Total oilseeds production reached 413.6 lakh tonnes in 2022-23. Cotton production has remained stable, ranging from 280-360 lakh bales, with a slight increase in recent years. However, sugarcane production has grown from 3623.3 lakh tonnes to 4905.3 lakh tonnes with a slight dip in 2019-20. **(Statement 2.15 (b))**

Fig. 2.4 : Production of Food Grains(in Million Tonnes)



Source: Economics, Statistics & Evaluation Division, MoAFW

* As per 1st Advance Estimates (Kharif only)

2.10: The livestock and marine products sectors play a crucial role in India's agricultural exports, contributing to the country's economic growth and foreign exchange earnings. The export value of livestock and livestock products has shown a steady increase over the years, indicating a growing demand for Indian products in the global market. While the import value of livestock and livestock products has remained relatively stable, suggesting that India is largely self-sufficient in meeting its domestic demand. The export value of marine products has shown a consistent and significant increase over the years, reflecting the growing importance of this sector in India's export basket. India's position as the second-largest fish producing and second-largest aquaculture nation in the world has contributed to this growth. **(Statement 2.23 b)**

2.11: Statement 2.24(a) indicates a positive growth trajectory in fish production in India, with a shift towards inland fisheries and aquaculture playing a significant role in meeting the rising demand for fish protein. The data shows a consistent growth in total fish production in India over the years, increasing from 7.52 lakh tonnes in 1950-51 to 175.45 lakh tonnes in 2022-23. There has been a notable shift in fish production from marine to inland fisheries. In 1950-51, marine fisheries dominated with 71% share, but by 2022-23, inland fisheries have taken the lead with a 75% share of total production. The significant growth in inland fish production can be attributed to the development of aquaculture practices and technologies, leading to increased productivity and efficiency in fish farming.

Component 3: Residuals

Component 3 is intricately linked with the SEEA-CF's physical flow accounts, which delineate the movement of materials from the economy to the environment. This component encompasses data concerning the volume and properties of residuals stemming from human activities in production and consumption, as well as their handling and eventual discharge into the environment.

3.2: Residuals, which include solid, liquid, and gaseous substances as well as energy, denote the materials and energy that are discarded, emitted, or released by establishments and households during various stages of production, consumption, or accumulation. These residuals can either directly enter the environment or undergo capture, collection, treatment, recycling, or reuse. Within this context, the component addresses primary categories of residuals, including emissions of substances into air, water, or soil, wastewater and waste, as well as the release of residuals resulting from the use of chemical substances (termed dissipative uses of products in the SEEA-CF).

Component 3 contains four subcomponents:

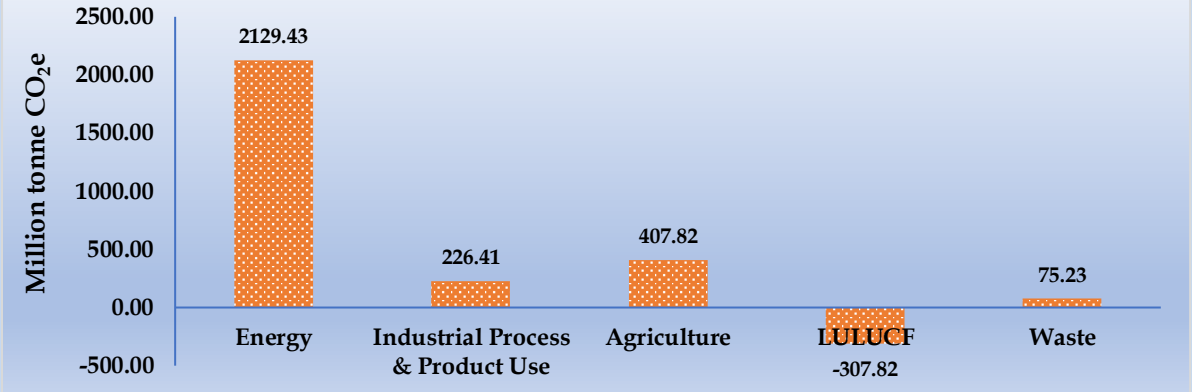
i. Subcomponent 3.1: Emissions to Air;

ii. Subcomponent 3.2: Generation and Management of Wastewater;
iii. Subcomponent 3.3: Generation and Management of Waste; and
iv. Subcomponent 3.4: Release of Chemical Substances.

3.3: Chemicals can produce emissions, wastewater, waste, and residuals, all of which can harm human and ecosystem health in different ways. The degree to which they are absorbed, persist, and accumulate varies based on factors like their properties, the size of their release, and local environmental conditions such as wind and water currents, as well as characteristics of the surrounding land, air, and water bodies. Sometimes, these substances are discharged or discarded without undergoing any form of treatment. Information regarding these occurrences offers valuable insights for policymakers, environmental advocates, and healthcare professionals. Such data aids in developing strategies to enhance environmental quality and foster a healthier society.

3.4: It is evident from **Statement 3.01** that India's total Greenhouse Gas (GHG) emissions, excluding Land Use Land-Use Change and forestry (LULUCF) in 2016 were amounted to 2838.89 million tonne CO_2 equivalent and 2531.07 million tonne CO_2 equivalent with the inclusion of LULUCF. The breakdown shows that energy sector contributed 75% (2129.43 million tonne), Industrial Process and Product Use 8% (226.41 million tonne), Agriculture sector 14% (407.82) and waste sector contributed 3% (75.23 million tonne) of total GHG emissions. LULUCF emerged as a crucial carbon sink, removing 330.77 million tonne, thereby reducing the overall emissions with LULUCF to 2531.07 million tonne. These figures underscores the importance of LULUCF in mitigating emissions and highlight the need for targeted measures to reduce emissions across the energy, industrial, agriculture, and waste sectors.

Fig. 3.1: GHG Emissions by sources, 2016



Source: India Third Biennial Update Report to the United Nations Framework Convention on Climate Change -2020 ,M/o EF& CC

3.5: Ozone depletion occurs when there is an imbalance between the natural production and destruction of stratospheric ozone, leading to a shift towards its destruction. Ozone serves as a protective layer shielding the Earth's surface from harmful UV-B and UV-C radiation. Depletion of ozone means more UV rays reach the Earth's surface, which can have adverse effects on human health and impact terrestrial and aquatic ecosystems' flora and fauna. Ozone Depleting Substances (ODS) include chlorofluorocarbons (CFCs) and halons, which were traditionally used in older refrigeration and fire-fighting systems, as well as in portable equipment. ODS were also utilized as blowing agents in some insulation foams. Hydro chlorofluorocarbons (HCFCs) were introduced as intermediate replacements for CFCs but are still considered ODS. To address this issue, there is a global effort under the Montreal Protocol to phase out the production and use of these substances worldwide.

According to **Statement 3.02,** which provides data on India's consumption of ODSs and HFCs from 2015 to 2022 indicates fluctuations and changes in the consumption of different ozone-depleting substances and related compounds over the years with a notable increase in total consumption in recent years particularly for HFCs. However, it is pertinent to mention that ODSs viz. CFC-11, CFC-12, and halons have consistently phased out demonstrating compliance with the Montreal Protocol. Consumption of HCFC-22 has also decreased significantly from 11,777.7 metric tons (MT) in 2015 to 6,220.553 MT in 2022.

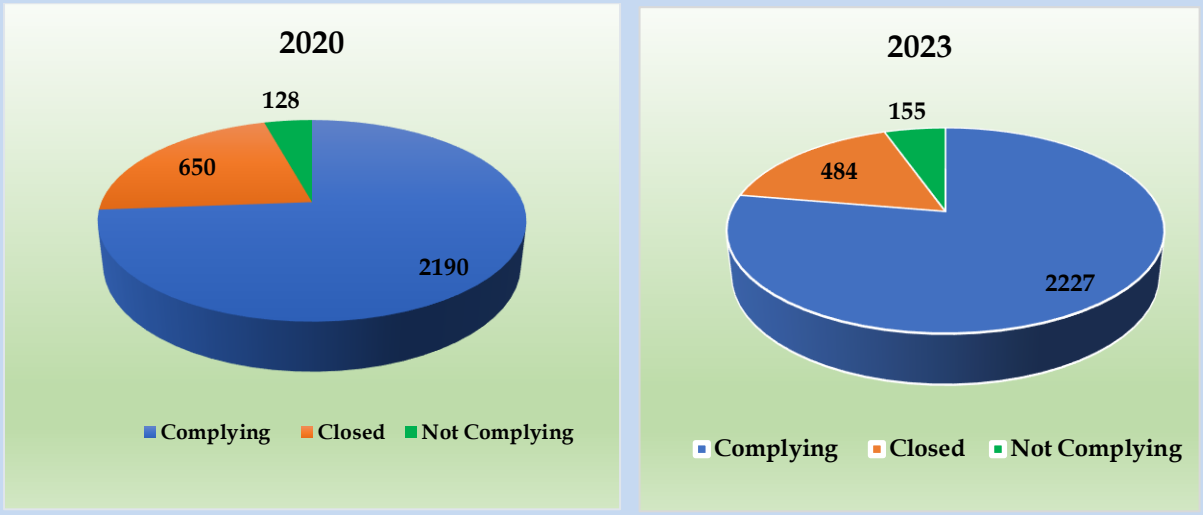
Fig. 3.2 : Consumption of ozone depleting substances (ODSs) and Hydrofluorocarbons (HFCs) in India

Source: Ozone Cell, Ministry of Environment, Forest and Climate Change

3.6: Statement 3.04 provides data on status of grossly polluting industries discharging their effluents into rivers and lakes offer insights into the enforcement of environmental laws and the state of environmental compliance across India. The data shows that during 2020 to 2023, there has been a slight increase in the number of industries complying with regulations rising from 2190 to 2227. This indicates some improvement in compliance levels over the three-year period. In contrast,

the number of non-compliant industries also increased from 128 to 155 during the same period, however the change is relatively small compared to complying industries. The statistics underscores the importance of robust regulatory frameworks and effective enforcement mechanisms in addressing pollution from industrial sources.

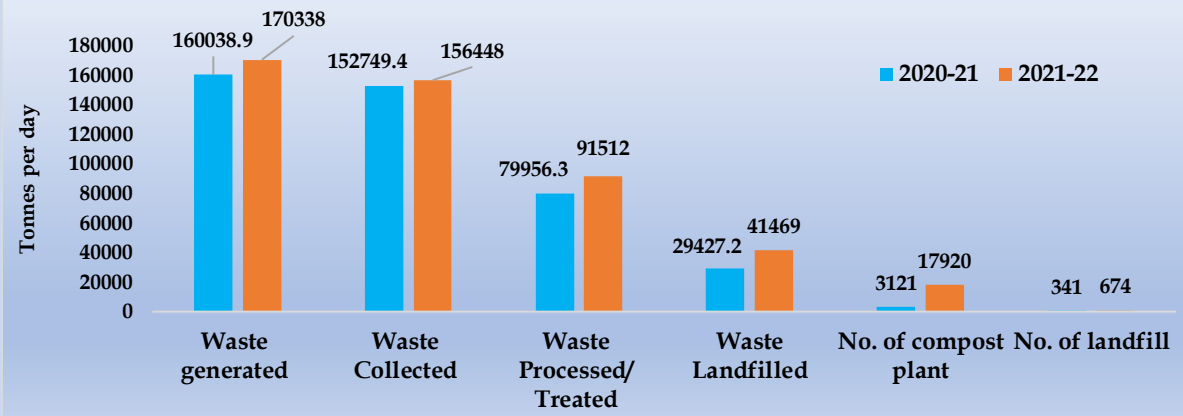
Fig.3.3: Grossly polluting industries discharging their effluents into rivers and lakes



Source: Central Pollution Control Board, Ministry of Environment, Forest & Climate Change

3.7: From Figure **3.4,** it is evident that there has been a notable increase in waste generation, collection, and treatment between 2020-21 and 2021-22. According to **Statement 3.05,** during 2021-22, the total solid waste generated in the country amounted to 170,339 tonnes per day (TPD), with 156,449 TPD collected. Out of the total waste generated, 91511 TPD (53.72%) of waste is treated and 41455 TPD (24.3%) is landfilled. A significant variation in waste management practices across different states and union territories in India. States like Maharashtra, Gujarat, Telangana, and Tamil Nadu are at the forefront of waste treatment efforts. However, West Bengal, despite its substantial waste generation, lacks sufficient treatment capacity, relying heavily on landfilling and thereby increasing environmental hazards. The information highlights the significance of dedicating resources to sustainable waste management infrastructure and enacting impactful policies to tackle environmental issues associated with waste generation and their disposal.

Fig. 3.4: Municipal solid waste generation in India



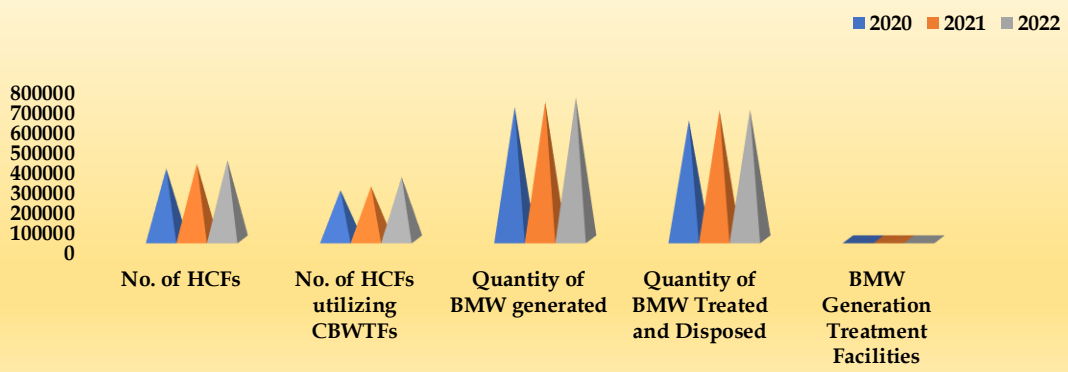
Source: Central Pollution Control Board, Ministry of Environment, Forest & Climate Change

3.8: The data on municipal solid waste generation in metro cities and state capitals from 1999-2000 to 2022-23 demonstrates a clear trend of escalating waste generation in many cities over the years. Cities like Delhi, Mumbai and Bengaluru consistently generate high amounts of waste compared to smaller cities. For instance, Delhi's waste generation surged from 400 tonnes per day (TPD) in 1999-2000 to 11,342 TPD in 2022-23, while Mumbai witnessed fluctuations but still produced 6,200 TPD in 2022-23. Similarly, Bengaluru has shown a consistent increase in waste generation from 200 TPD in 1999-2000 to 5,500 TPD in 2022-23. This trend suggests the need for robust waste management systems and and initiatives aimed at enhancing community awareness and involvement to mitigate environmental impacts. **(Statement 3.06)**

3.9: The data on biomedical waste generation and management shows a consistent increase in the number of healthcare facilities, indicating growth in healthcare infrastructure. For instance, the total number of healthcare facilities rose from 352,014 in 2020 to 393,939 in 2022. Additionally, the daily generation of biomedical waste increased from approximately 656 tonnes in 2020 to around 705 tonnes in 2022. While the amount of BMW treated and disposed of has also risen, it has done so at a slower rate than the waste generated, highlighting improvements in treatment and disposal capacity but also suggesting gaps in fully managing the generated waste. The number of BMW treatment facilities has grown gradually, but the pace has been slow, indicating the need for a more robust expansion plan to handle the waste effectively. COVID-19 pandemic (2020-2022) has further contributed to a spike in biomedical waste. Despite these challenges, many states have successfully expanded their waste treatment and disposal capabilities, underscoring progress in waste management infrastructure. However, certain

regions need further improvements to ensure efficient biomedical waste management to safeguard public health. **(Statement 3.10)**

Fig. 3.5: Status of Bio-Medical Waste (BMW) Generation and its management



Source: Central Pollution Control Board, Ministry of Environment, Forest & Climate Change

3.10: As per CPCB, only 10 States namely Andhra Pradesh, Bihar, Gujarat, J&K, Karnataka, Madhya Pradesh, Punjab, Rajasthan, Tamil Nadu and West Bengal are involved in import and export of hazardous wastes. It has been observed that about 5,74,170 metric tonnes (MT) of hazardous wastes was imported in the country and about 10 MT of hazardous waste exported during 2022-23.

In 2019-20, the imports stood at 424,223 MT, which then dropped sharply to 149,336.7 MT in 2020-21. However, the imports rebounded in the following years, reaching 327,742 MT in 2021-22 and further increasing to 574,170 MT in 2022-23. In contrast, the exports have been on a declining trend. For instance, 11,843 MT of hazardous waste were exported in 2019-20 and dropped to 2,635 MT in 2020-21 and further decreased to 982 metric tonnes in 2021-22. However, in 2022-23, the exports further decreased to 10 MT. **(Statement 3.11)**

3.11: The State-wise status of industrial wastewater treatment plants (CETPs) shows a significant variation across India. Gujarat leads with 37 CETPs and a total capacity of 817.7 MLD, followed by Tamil Nadu with 36 CETPs and Maharashtra with 26. States like Haryana (19), Rajasthan (16) and Delhi (13) also have a considerable number of CETPs with substantial capacity. On the other hand, several states and union territories, including Bihar, Arunachal Pradesh, Chhattisgarh and Goa have no CETPs, suggesting less industrial activity or limited infrastructure for effluent treatment. These variations indicate where industrial wastewater treatment is more prevalent and highlight where further development is needed. **(Statement 3.12)**

Component 4 : Disasters and Extreme Events

Component 4 of the Framework for the Development of Environment Statistics 2013 (FDES 2013) is consists of two sub components:

(i) **Natural Extreme Events and Disasters:** sudden and severe environmental events caused by natural forces, which result in significant damage to life, property, and the environment, for example Earthquakes, Floods, Hurricanes, Heatwaves, Wildfires, etc. These events can have devastating effects on communities and ecosystems. Natural extreme events and disasters are a natural part of Earth's processes, but their impacts can be exacerbated by human activities, such as urbanization, deforestation, and climate change. Mitigation and preparedness efforts, including early warning systems, land-use planning, and disaster response planning, are crucial for reducing the risks associated with these events.

(ii) **Technological Disasters**: events caused by the failure or malfunction of technological systems, leading to widespread damage, environmental harm, and loss of life. These disasters can result from industrial accidents, infrastructure failures, transportation incidents, or other technological failures. For example, Nuclear accidents, Industrial accidents, Explosions, Cybersecurity breaches, etc. Technological disasters can have far-reaching impacts on communities, economies, and the environment.

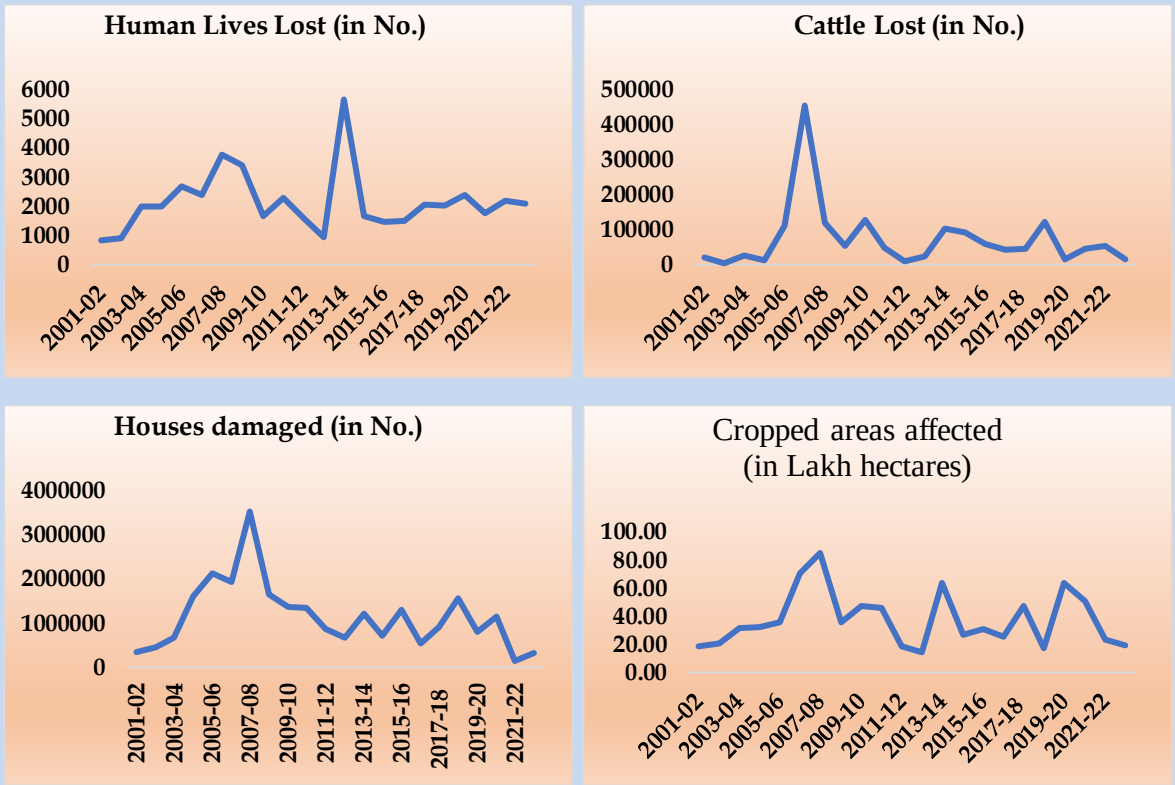
4.2: This component provides essential statistics related to natural disasters and extreme weather events. Understanding disasters and extreme events helps us to plan and prepare. It also helps government in making rules and decisions to keep everyone safe. This component helps in learning about disasters and extreme events through collecting data, understanding impact of disasters and preparing for future.

4.3: Analyzing the data on the average number of Heat Wave days reported during the summer season across various states and union territories reveals that States of Rajasthan, Bihar, and Punjab consistently reported a relatively high number of heatwave days. Some states like Assam, Himachal Pradesh, Mizoram, Kerala, Chandigarh, and Puducherry reported zero heatwave days throughout the observed period. Other states viz. Karnataka, Gujarat, Telangana, and West Bengal reported a relatively low number of heatwave days. Haryana, Odisha, Jharkhand, and Andhra Pradesh also reported a significant number of heatwave days, but with some fluctuations **(Statement 4.01).**

4.4: States of Haryana, Bihar, and Uttar Pradesh tend to experience a higher number of cold wave days during the winter season while Assam, Gujarat, Sikkim, Tamil Nadu, and Uttarakhand reported very few cold wave days or none at all. Madhya Pradesh, Telangana, and Chhattisgarh also experience a moderate number of cold wave days **(Statement 4.02).**

4.5: The data on damage due to natural extreme events in India reveals a fluctuating yet impactful trend over the years. While the number of human lives lost and cattle lost due to these events varies annually with 2104 humans and 14166 cattle loss during 2022-23. Concurrently, the number of houses damaged exhibits a mixed trend with a loss of 3.18 lakh houses in 2022-23, maximum being 35.27 lakh during 2007-08. Likewise, cropped areas affected by these events fluctuate, with impact on 19 lakh hectares of cropped area during 2022-23. This data underscores the substantial toll that natural disasters take on various aspects of life in India, emphasizing the imperative for robust disaster preparedness and mitigation strategies to mitigate future losses and safeguard communities and livelihoods **(Statement 4.06).**

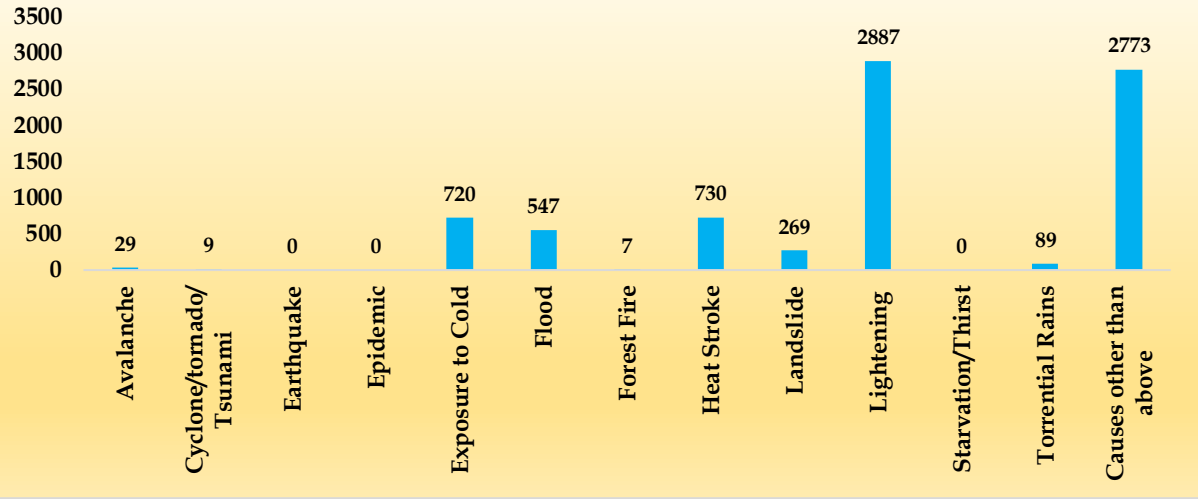
Fig. 4.1: Damage due to Natural Extreme Events in India



Source: Disaster Management Division, Ministry of Home Affairs

4.6: The data on deaths attributed to "forces of nature in India" offers insights into the fluctuating patterns of fatalities over the years and across various disaster types. While the total number of deaths exhibits fluctuations, there is not a discernible linear trend observed throughout the analyzed period. Notable peaks and troughs are evident in certain years, such as a decrease from 2018 to 2019 followed by an increase in subsequent years. During 2022, deaths due to lightning was the highest at 2887, while deaths from heat stroke stood at 730 followed by Exposure to cold (720), Flood (547) and Landslide (269). However, deaths from epidemics and starvation/thirst are minimal or absent. Overall, the data underscores the dynamic and multifaceted nature of natural disasters toll on human lives, highlighting the importance of robust disaster management and mitigation strategies to minimize casualties and enhance resilience in the face of unpredictable events **(Statement 4.08)**.

FIG. 4.2: NUMBER OF DEATHS DUE TO NATURAL DISASTERS - 2022



Source : National Crime Record Bureau, Ministry of Home Affairs

4.7: The analysis of government expenditure on natural calamities reveals fluctuating trends both year-wise and state-wise. While the total expenditure fluctuates over the years, there is not a consistent linear trend observed during the analyzed period. Some years witness significant increase, followed by fluctuations in subsequent years. State-wise, various regions show differing patterns of expenditure, with some experiencing notable peaks in certain years. For instance, states like Assam and Bihar demonstrate substantial fluctuations, while others like Gujarat and Uttar Pradesh show significant increase in specific years. Overall, the data underscores the dynamic nature of disaster response and mitigation efforts, highlighting the necessity for adaptable policies and resources allocation to address the evolving challenges posed by natural calamities **(Statement 4.09)**.

Component 5: Human Settlements and Environmental Health

Component 5 of the Framework for the Development of Environment Statistics 2013 (FDES 2013) focuses on two subcomponents:

(i) Human Settlements i.e the totality of the human community, whether people live in large cities, towns, or villages. They encompass the human population that resides in a settlement, the physical elements (e.g. shelter and infrastructure), services (e.g. water, sanitation, waste removal, energy, and transport), and the exposure of humans to potentially deleterious environmental conditions.

(ii) Environmental Health focuses on how environmental factors and processes impact and change human health. It can be defined as an interdisciplinary field that focuses on analysing the relationship between public health and the environment.

5.2: The data provided in Component 5 are crucial for pinpointing areas that need intervention to enhance both environmental conditions and health outcomes. Furthermore, this component underscores the interconnection between human settlements and the environment, stressing the importance of sustainable practices to uphold healthy living conditions. FDES 2013 Component 5 serves as a critical tool for policymakers, urban planners, and public health experts striving to enhance the environmental health of human settlements.

5.3: The component provides statistics concerning the environment in which people reside and operate, especially regarding their living conditions and environmental health. These statistics are crucial for managing and enhancing conditions related to human settlements, housing conditions, access to safe water, sanitation and health. This is particularly important given the backdrop of rapid urbanization, escalating pollution, environmental decline, disasters, extreme events, and climate change.

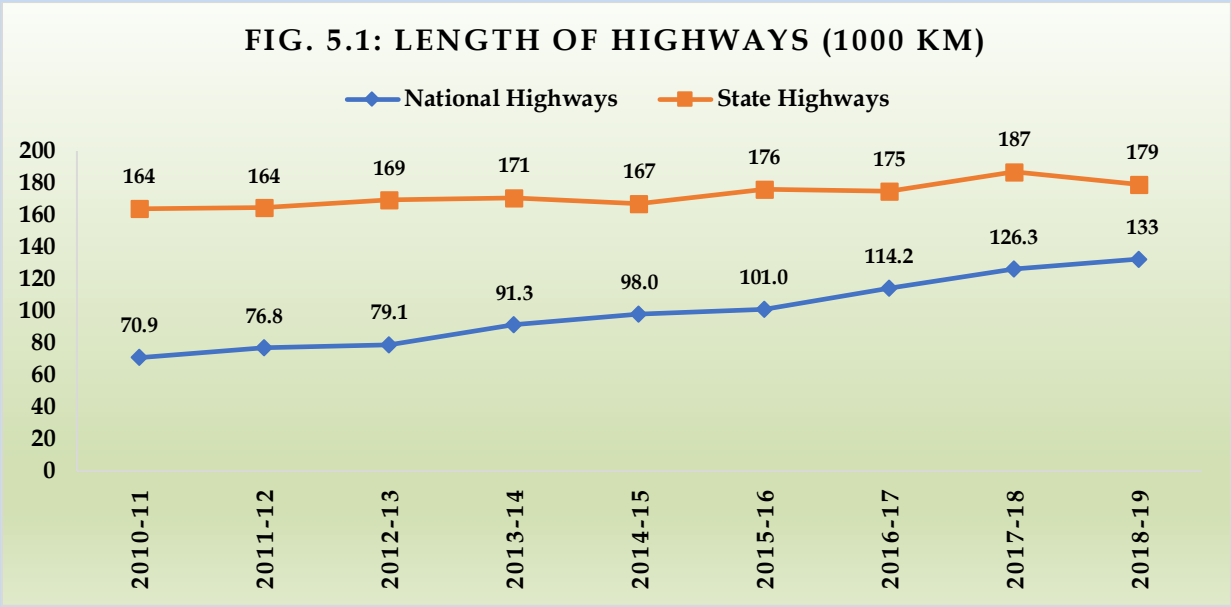
5.4: The statistics compiled in this component may provide indicators helpful to achieve the following Sustainable Development Goals (SDGs): SDG 3 – to ensure healthy lives and promote well-being for all at all ages, SDG 6 – to ensure access to water and sanitation for all, and SDG 11– to make all cities inclusive, safe, resilient, and sustainable. Component 5 also contains statistics related to SDG 7 – to ensure access to affordable, reliable, sustainable, and modern energy for all, and SDG 13 – to combat climate change and its impact.

5.5: As per 2016 data, the coastal length in India is 8162 Kms and fisherfolk population in India's fishing villages is 37,74,577. West Bengal has the highest fisherfolk population per Km of coastal length **(Statement 5.02).**

5.6: In human settlement, safe drinking water is of paramount importance for health, Nutrition, Hygiene, economic development, environmental sustainability, and the overall well-being of communities. As per Multiple Indicator Survey of NSS, MoSPI conducted during 2020-21, 95.7 percent of the population in India has access to improved source of drinking water which includes piped water, boreholes or tube wells, protected dug wells, protected springs, and rainwater collection **(Statement 5.04).**

5.7: Absence of basic sanitation facilities can result in an unhealthy environment contaminated by human waste. Without proper sanitation facilities, waste from infected individuals can contaminate a community's land and water, increasing the risk of infection for other individuals. As per Multiple Indicator Survey, 2020-21, 85.1 percent of households have access to improved latrine and hand washing facilities with water, soap/detergent within the household premises. About 73.3 percent of the persons in the rural areas and about 81.4 percent of the persons in the urban areas had exclusive access to improved latrine and hand washing facilities with water and soap/detergent within the household premises **(Statement 5.08).**

5.8: While improving access by having a good road infrastructure is important for economic development, at the same time air pollution, traffic noise and impact on wildlife habitat is also to be considered from the environment aspect. Hence, indicators on road length, number of vehicles etc are included in the FDES. As per the data maintained by the Ministry of Road Transport and Highways, the length of roads was 6322 thousand Kms in 2018-19, an increase of 35% from 2010-11 of which length of surfaced roads was 4096 thousand Kms. Number of registered vehicles increased from 142 million in 2010-11 to 336 million in 2021-22 with an increase percentage of 136 percent **(Statement 5.10).**



Source: Ministry of Road Transport & Highways

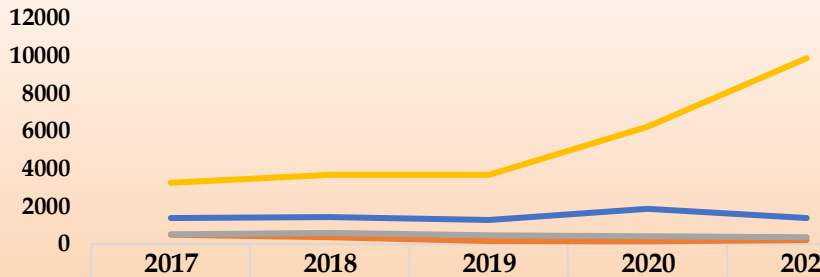
5.9: Sanitation and environmental factors plays a crucial role in preventing various diseases, particularly those that are transmitted through contaminated water, food, and contact with infected individuals. Here are some factual data on key diseases that are closely linked to inadequate sanitation and hazardous environment:

- Cholera is a severe diarrhoeal disease caused by the Vibrio cholerae bacterium. It is transmitted through the ingestion of contaminated food or water. According to the National Health Profile of 2022, West Bengal reported 603 cases of cholera out of a total of 836 cases in the country. Other states and territories still grappling with cholera cases include Delhi, Gujarat, Haryana, Jharkhand, Kerala, Meghalaya, Chandigarh, Ladakh, and Puducherry **(Statement 5.12).**
- Typhoid fever is transmitted through the ingestion of food or water contaminated with the feces of an infected person. Improving sanitation and access to clean water are important measures for preventing typhoid fever. In 2021, there were 1.38 million cases of typhoid reported nationwide, with 229 fatalities. Uttar Pradesh reported the highest number of typhoid cases, with 538,789 cases and 95 deaths. No state reported zero cases of the disease. **(Statement 5.14).**
- Acute respiratory infection (ARI) is another disease caused in absence of proper hygiene and sanitation. In 2021, 1.7 crores of such cases were reported in India. Rajasthan reported highest number of ARI cases (36.5 lakh) followed by West Bengal (22.1 lakh), Andhra Pradesh (18.9 lakh), Karnataka (14.7 lakh), Uttar Pradesh (12.1 lakh)

and Odisha (11.4 lakh). Kerala reported zero case of the disease **(Statement 5.16).**

- Inadequate sanitation is also responsible for dengue fever which can result in fatality if not treated in time. In 2023, 94198 cases of Dengue were reported in India out of which 91 deaths occurred. Maximum number of cases were reported in Kerala with 9770 cases and 37 deaths, Karnataka reported 9185 cases followed by Maharashtra (8496 cases), Odisha (6563 cases) and Uttar Pradesh (5742 cases) **(Statement 5.18).**

Fig. 5.2: Deaths due to Diseases



	2017	2018	2019	2020	2021
Acute Diarrhoeal Disease	1362	1412	1278	1870	1375
Enteric Fever (Typhoid)	496	345	147	144	229
Viral Hepatitis	537	589	456	420	361
Acute Respiratory Infection	3254	3698	3665	6229	9872

Source: Ministry of Health Family Welfare

Component 6: Environment Protection, Management and Engagement

Component 6 of the Framework for the Development of Environment Statistics (FDES) 2013 focuses on the societal response to environmental challenges. It compiles statistics aimed at environmental protection, resource management and public engagement. Primarily, this component covers:

- **Policy and Expenditure:** This sub-component gathers statistics on government spending and policy instruments aimed at environmental protection and resource management.
- **Environmental Legislation and Regulatory Instruments:** It tracks the development and implementation of laws and regulations designed to safeguard the environment.
- **Environmental Institutions and Management Practices:** This sub-component collects data on institutions responsible for environmental management and the practices they employ.
- **Public Awareness and Education:** It focuses on statistics related to environmental education programmes, public awareness campaigns, and access to environmental information.
- **Public Participation and Civil Society Engagement:** This sub-component tracks information on public involvement in environmental decision-making and the activities of civil society organizations on environmental issues.

By collating data on these various aspects, Component 6 helps to:

- Evaluate the effectiveness of environmental policies and programmes.
- Track progress towards environmental goals.
- Identify areas where further action is needed.
- Promote transparency and accountability in environmental management.

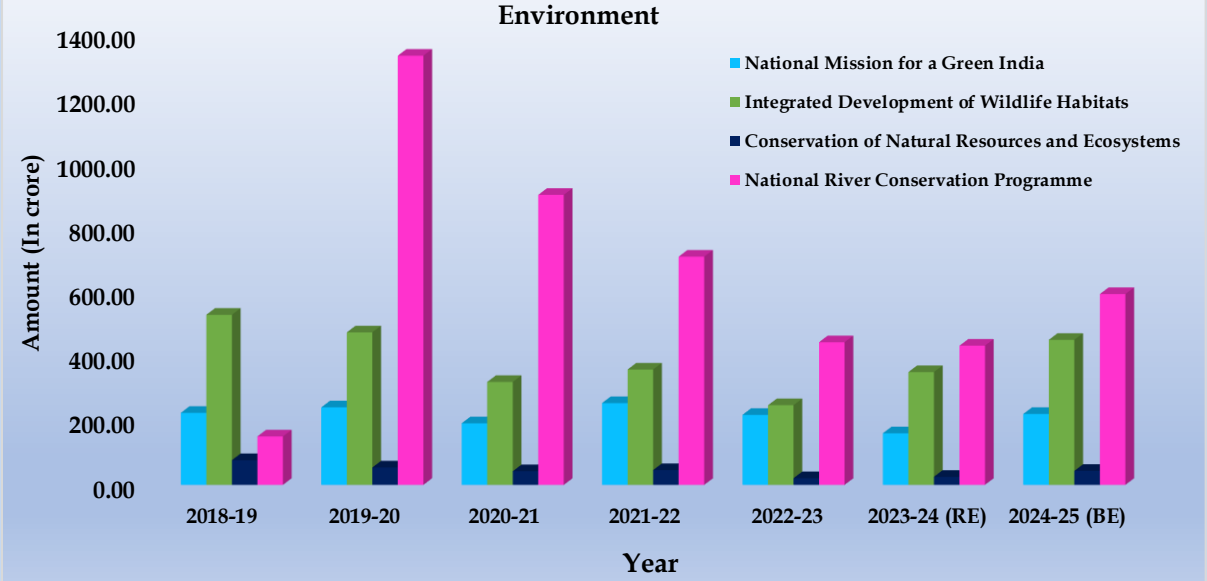
Therefore, Component 6 serves as a vital element in comprehending how society responds to environmental challenges and in shaping more efficient environmental policies.

6.2: As the frequency of extreme events rises and environmental degradation continues unabated, the significance of climate action and environmental protection is escalating. The impending climate crisis underscores the urgency of addressing these issues. Human activity has surpassed the Earth's biocapacity, leading to widespread biodiversity loss, shifts in land use, and adverse consequences such as disease outbreaks, fatalities, and displacement triggered by natural disasters, climate change, and environmental pressures. Expenditure on

environmental protection is not only a matter of ecological preservation but also essential for achieving sustainable development, improving public health, and enhancing the resilience of communities and ecosystems in the face of environmental challenges.

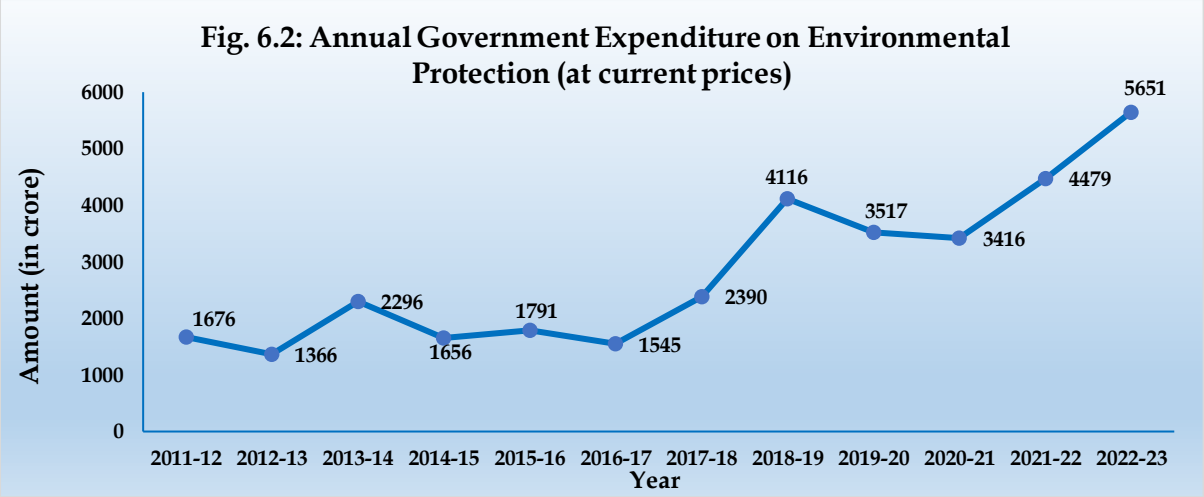
As per S**tatement 6.01**, it has been observed that the budgetary allocations for centrally sponsored schemes for environmental protection in India during 2018-19 to 2024-25 exhibit diverse trends. The National River Conservation Programme experiences significant increase in funding from 2018-19 to 2019-20, followed by fluctuations in subsequent years. In contrast, funding for the Conservation of Natural Resources and Ecosystems shows decline trend during 2018-19 to 2022-23; however, there is a slight uptick in allocation from the revised estimates of 2023-24 to the budget estimates of 2024-25. These trends offer insights into the government's priorities and resource allocations concerning environmental conservation and management initiatives over the specified period.

Fig. 6.1: Expenditure on Centrally Sponsored Schemes for Protection of Environment



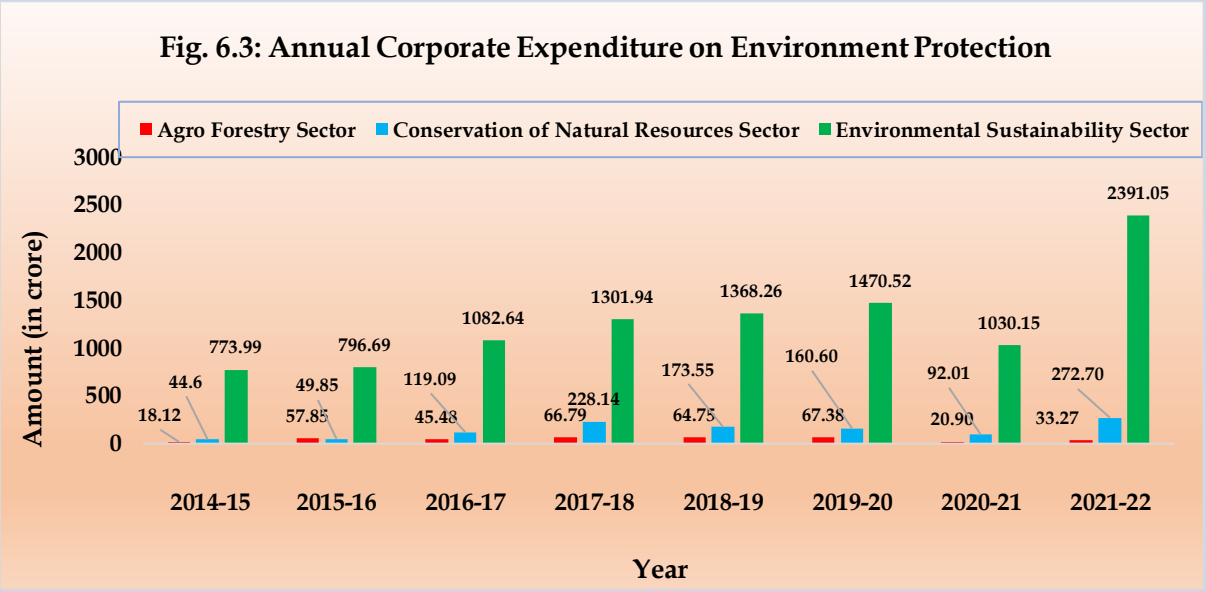
Source: Expenditure Profile, Union Budget, M/o Finance

6.3: There is a clear upward trend in government expenditure on environmental protection over the years, with fluctuations in some years. The expenditure has more than doubled from the initial year i.e. Rs. 1676 crore in 2011-12 to Rs. 5651 crore in 2022-23. Significant spikes in expenditure are also observed in the years 2020-21, 2021-22, and 2022-23 and the highest expenditure is recorded in 2022-23, indicating a heightened focus on environmental conservation and sustainability in recent years **(Statement 6.02).** Year-wise trend of expenditure on environmental protection from 2011-12 to 2022-23 is depicted in Fig. 6.2 below:



Source: National Accounts Statistics-2024, NSO, Ministry of Statistics & Programme Implementation

6.4: According to **Statement 6.03**, it has been observed that corporate expenditure on environmental protection through Corporate Social Responsibility (CSR) in India has shown a significant upward trend. This growth is driven primarily by the environmental sustainability sector, which has experienced a consistent increase, suggesting a stronger corporate focus on sustainability. However, expenditure patterns in the agroforestry and conservation of natural resources sectors exhibit greater variability. States like Bihar, Gujarat and Maharashtra contributing significantly to agroforestry, while Delhi, Maharashtra, Andhra Pradesh leading in conservation of Natural Resources sector. Despite the overall positive trend, some states, viz. Daman and Diu, Lakshadweep, Andaman and Nicobar Islands, Tripura and Sikkim have seen minimal CSR investment across all three sectors in environmental protection.



Source : Ministry of Corporate Affairs

6.5: According to the data on the number of students pursuing environment related various academic disciplines at the Ph.D., M.Phil., and Post Graduate levels during 2016-17 to 2021-22, it has been observed that across all disciplines, there is a general trend of increasing enrolment over the years, suggesting a growing interest in higher education and research in these fields. However, during this period, Ph.D. enrolment saw a steady increase, rising from 10,681 in 2016-17 to 15,011 in 2021-22. Post Graduate programmes witnessing an increase in student enrolment from 123,629 in 2016-17 to 192,677 in 2021-22 (**Statement 6.05**). This growth is particularly driven by popular fields such as Zoology, Botany, and Environmental Science. The data emphasizes a broader trend towards pursuing advanced degrees in environment-related disciplines.

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