



SUPREME AUDIT INSTITUTION OF INDIA
लोकहितार्थं सत्यमिष्टा
Dedicated to Truth in Public Interest



International Centre for Environment Audit and Sustainable Development (iCED)

GREEN FILES VOLUME- 55

Progress Towards SDGs - an Audit Perspective



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Foreword

As a Global Training Facility of the INTOSAI WGEA and WGEI, iCED has remained at the forefront of this transformation by not only strengthening the capacity of Supreme Audit Institutions across the world but also building domestic expertise to respond to India's environmental challenges.



The Sustainable Development Goals (SDGs) represent a global commitment to achieving inclusive growth, environmental sustainability, and resilient governance by 2030. For governments, translating these goals into measurable outcomes requires not only robust policies and adequate financing, but also strong systems of accountability, transparency, and performance monitoring. In this context, public audit assumes a critical role in assessing whether SDG commitments are being effectively planned, implemented, and sustained.

Audits of SDG implementation go beyond compliance with rules or financial propriety. They examine governance frameworks, institutional coordination, data systems, utilisation of public funds, and outcomes achieved on the ground. Supreme Audit Institutions, through independent and evidence-based assessments, contribute to strengthening public sector accountability and improving policy effectiveness across sectors that are central to the SDG agenda.

Green Files Volume 55 is particularly relevant in this regard. This edition brings together analytical articles that examine progress under key environment-related SDGs—namely water and sanitation (SDG 6), clean energy (SDG 7), climate action (SDG 13), life below water (SDG 14), and life on land (SDG 15)—through the lens of governance and audit. The focus on audit perspectives highlights how policy intent, financial allocations, institutional arrangements, and monitoring mechanisms translate into outcomes, and where systemic gaps persist.

The articles in this volume demonstrate how audit findings, performance reviews, and use of emerging technologies such as GIS, remote sensing, and AI-based tools can support more informed decision-making and course correction. By linking SDG indicators with audit evidence, this edition reinforces the importance of credible data, effective utilisation of resources, and inter-sectoral coordination in achieving sustainable development outcomes.

I am confident that Green Files Volume 55 will serve as a valuable knowledge resource for auditors, policymakers, researchers, and practitioners engaged in SDG implementation and oversight. I commend the contributors and the editorial team for their thoughtful analyses and continued commitment to strengthening environmental governance through audit.

We look forward to your suggestions to make Green Files as informative and user friendly as possible. Your contributions within the broad scope of this quarterly journal will be highly appreciated, including any feedback you may like to share on the featured articles.

(Dr. Abhishek Gupta)
Additional Dy. Comptroller and Auditor General
and Director General,
iCED, Jaipur

Message from the Director (Training & Research)

Dear Readers,



It gives me great pleasure to present **Green Files Volume 55**, the quarterly journal of iCED for the period July to September 2025, centred on the theme “**Progress towards SDGs – An Audit Perspective.**” This edition brings together a diverse and insightful collection of articles that examine how governance systems and audit interventions contribute to the achievement of the Sustainable Development Goals.

The volume features in-depth articles on auditing biodiversity conservation (SDG 15), water governance and sanitation systems (SDG 6), life below water (SDG 14), climate action and institutional readiness (SDG 13), and India’s energy transition (SDG 7). Together, these contributions highlight how audit can assess policy effectiveness, institutional preparedness, utilisation of funds, and achievement of intended outcomes across critical sectors.

Articles in this edition has tried to explore the role of audits in evaluating regulatory frameworks, coordination among institutions, data reliability, and monitoring mechanisms, while also drawing on findings from audit reports and national indicator frameworks.

A key feature of this edition is inclusion of articles from IA&AS officers on emerging policies and programs such as National Green Hydrogen Mission and Island Coastal zone regulation and Integrated Island Management Plan. These contributions from our national training program participants showcases impacts of our capacity building programs in developing professional excellence among IA&AD fraternity.

In addition, this volume provides perspectives on national and state-level progress on SDGs and SDG specific suggestive audit frameworks. These articles collectively demonstrate how audits can add value by identifying

systemic risks, promoting transparency, and supporting evidence-based governance.

I hope that Green Files Volume 55 will inform and inspire readers, encourage informed dialogue, and support auditors and stakeholders in strengthening SDG-linked governance and accountability. I sincerely thank all contributors and the editorial team for their dedication in bringing out this meaningful edition.

(Meena Bisht)
Director (Training & Research)
iCED, Jaipur

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iCED in its Role

The International Centre for Environment Audit and Sustainable Development (iCED), Jaipur, sustained its efforts to enhance audit competencies and foster sustainability-oriented knowledge exchange through a diverse range of training programmes and workshops during the third quarter of 2025. These initiatives were designed for officers of the Indian Audit and Accounts Department (IA&AD), officials from other government organisations underscoring iCED's expanding international engagement and its commitment to high standards of professional capacity building.

Trainings at iCED

1. NTP on "Audit of Air Pollution and Environmental issues associated with Transport and Energy sectors" from 07 July 2025 to 11 July 2025.



Figure 1: NTP on "Audit of Air Pollution and Environmental issues associated with Transport and Energy sectors"

The Training Programme focused on issues such as environmental issues associated with Transportation System in India, Decarbonizing Transportation: The Role of Electric Vehicles, Promoting Low Carbon Transport in India - Case Study of Metro Rails in Indian Cities, Air Pollution in India: Assessment and Audit Approaches.

Domain subject experts from MNIT, Jaipur; Council on Energy Environment and Water, New Delhi; IIT Delhi; and IIT Kharagpur deliberated on issues of Air Pollution and related Transport and Energy Sectors.

2. NTP on "Audit of Water Pollution and Sustainable use of Water" from 14 July 2025 to 18 July 2025.



Figure 2: NTP on "Audit of Water Pollution and Sustainable use of Water"

The Training Programme focused on issues such as The Role of Environmental Impact Assessment in Waste Water Management, Water Quality Analysis and Remedial Measures, Sewage Management and its Audit, Performance Audit on Degradation of Kshipra River: Experience Sharing, Geospatial Technologies & Remote Sensing for Water Quality Monitoring.



Figure 3: Field Visit of NTP on "Audit of Water Pollution and Sustainable use of Water"

The NTP hosted insightful sessions by experts from National Law School of India University, Bengaluru; CEEW, New Delhi; and MNIT Jaipur and IA&AD. As part of its experiential learning approach, iCED organised focused field study visits during the third quarter of 2025 to complement classroom sessions with practical exposure. Under the National Training Programme on “Audit of Water Pollution and Sustainable Use of Water” (14–18 July 2025), a study trip was organised to Tarun Bharat Sangh (TBS) at Village Bheekampura–Kishori, Block Thanagazi, District Alwar, where participants gained first-hand insights into community-led water conservation, watershed management and revival of traditional water harvesting systems.

3. Training Programme on Appreciation of CAG Audit for IAF officers from 21 July 2025 to 25 July 2025

The training was an effort to strengthen the



Figure 4: Training Programme on Appreciation of CAG Audit for IAF officers from 21 July 2025 to 25 July 2025

auditor-auditee relationship in defence audits. The programme designed for Indian Air Force officials focused on enhancing participants’ understanding of defence audit under the framework of the Comptroller and Auditor General of India. It covered key areas such as the mandate of C&AG, defence audit structure and processes, procurement challenges, performance and compliance audits, environmental audit in the defence sector, and post-audit follow-up, with

practical insights provided through case studies and group discussions.

The programme was supported by expert faculty drawn from the iCED, Jaipur; Offices of the Director General of Audit (Air Force and Central); the Principal Controller of Defence Accounts (Army); the Office of the Controller General of Defence Accounts (CGDA); and the National Academy of Audit and Accounts (NAAA), Shimla, who shared their professional experience and expertise.

4. NTP on “Ethics and Governance” from 28 July 2025 to 01 August 2025.



Figure 5: NTP on “Ethics and Governance”

This Training Programme focused on issues of Ethics in Public Administration: Need & Importance, Ethics in the Digital Age: Data Privacy, AI and Organizational Responsibilities, Use of Technology in IA&AD for Enhancing Transparency and Good Governance in Public Sector, Importance of Ethical Integrity in IA&AD.

Expert faculties from Jindal Global Business School, Sonapat; Rajasthan State Institute of Public Administration, Jaipur; Department of Philosophy & Centre for Advanced Studie; and University of Rajasthan, Jaipur deliberated on various related issues. IA & AD officials also presented sessions on issues of Ethics and Governance.

5. Workshop on "Urban Development and Governance" in collaboration with NIUA, New Delhi from 04 August 2025 to 06 August 2025



Figure 6: Workshop on "Urban Development and Governance" in collaboration with NIUA, New Delhi from 04 August 2025 to 06 August 2025

The workshop was designed to discuss the critical issues in field on Urban Development and Governance framework including Current legal framework for Urban Governance, Financing cities, Envisioning sustainable cities.

Domain subject experts from Institute of Chartered Accountants, IIT Roorkee, former Director of National Institute of Urban Affairs (NIUA) deliberated on issues of Urban Development and Governance.

6. NTP on "Audit of Renewable Energy with focus on Solar and Wind Energy" from 18 August 2025 to 22 August 2025.



Figure 7: NTP on "Audit of Renewable Energy with focus on Solar and Wind Energy"

The training Programme highlighted critical aspects of Energy Sector (Wind and Solar), Policy & Regulatory Framework, Climate Change, Driving Sustainable Energy Scenario in India, Green Energy Technologies with special reference to Green

Hydrogen, Development of Solar Energy, Wind Energy and Offshore Wind Energy: Issues and Challenges.

Domain subject experts from National Institute of Solar Energy, Faridabad; AMITY University, Jaipur; Department of Environmental Studies, Central University of Haryana; and officials from Ministry of New & Renewable Energy, New Delhi deliberated on issues related to Renewable Energy.

7. NTP on "Renewable Energy Strategies with Focus on Electric Vehicles and Other Emerging Green Energy Technologies" From 25 August 2025 to 29 August 2025



Figure 8: NTP on "Renewable Energy Strategies with Focus on Electric Vehicles and Other Emerging Green Energy Technologies" From 25th to 28th August 2025

The training programme focused on sustainable energy and low-carbon transportation, with emphasis on renewable energy, energy efficiency, green mobility, and decarbonisation initiatives such as SDG-07, Indian Railways' Mission Net Zero 2030, FAME, and green hydrogen. The programme aimed to strengthen audit perspectives through expert sessions and group work.

The faculty comprised experts from leading institutions including TERI, New Delhi; Railway Board, Ministry of Railways; MNIT Jaipur; WRI India; and IIT Delhi, along with senior officers from the Office of the Comptroller and Auditor General of India,

who provided practical insights and guided group presentations.



Figure 9: Study tour ant North Western Railway, Jaipur

As part of the programme, a study tour was organised to the North Western Railway, Jaipur, to demonstrate the practical aspects of railway electrification. The visit provided participants with first-hand exposure to implementation processes and operational challenges associated with railway electrification projects in Indian Railways.

8. NTP on "Audit of Conservation and Management of wetlands and Coastal ecosystems" from 25 August 2025 to 29 August 2025.



Figure 10: NTP on "Audit of Conservation and Management of wetlands and Coastal

This training Programme focused on issues of impact of Climate Change on Coastal Ecosystem, Legal and Policy Framework in India (Including Wetland Rules 2017, CRZ Notifications, Biodiversity Act, Ramsar Convention, etc.), Economic Valuation of Wetlands, and also a Case Study on Audit of Conservation and Management of Dal Lake.

Experts from the Wetland International South Asia; Coastal Ecology and Marine Resources Centre; TERI, Goa; National Centre for Coastal Research, Chennai; Rajasthan Wetland Authority; and Indian Institute of Science, Bengaluru deliberated on critical aspects of the subject area highlighting key risk areas, challenges and way forward.

9. Webinar on “Audit of Municipal Solid Waste Management” held on 19.08.2025 for SCO members



Figure 11: webinar on “Audit of Municipal Solid Waste Management” held on 19.08.2025 for SCO members

The webinar on “Audit of Municipal Solid Waste Management,” organized by iCED, Jaipur on 19 August 2025, witnessed participation from five countries, including India, Kyrgyzstan, Pakistan, Tajikistan, and representation from the SCO Secretariat. Participants from SAI Uzbekistan and SAI Belarus also joined the webinar informally.

The webinar was conducted in two virtual sessions. The first session provided an overview of municipal solid waste management, covering key challenges, global best practices, and future strategies. The second session focused on experience-sharing by SAI India, presenting audit case studies, good practices, and lessons learned in the audit of municipal solid waste management.

10. NTP on Training on “Environment Audit & related issues” for IA&AS Officers Trainees (OTs) of 2024 Batch from 01 September 2025 to 05 September 2025.



Figure 12: NTP on Training on “Environment Audit & related issues” for IA&AS Officers Trainees (OTs) of 2024 Batch from 01 September 2025 to 05 September 2025

The training Programme focused on issues related to Environment Impact Assessment in India and the World. It included a brief Interaction on new approach to Audit in the Era of Emerging Technology (i.e. AI/ML on VLC data sets), and experiencing Sharing on Audit of Blue Economy: Leveraging GIS and Remote Sensing for Enhanced Audit Outcomes.

Domain subject experts from Department of Financial Service New Delhi, Conservator of Forest (North) Udaipur and IA & AD officials deliberated on issues Environment Audit & related issues.



Figure 13: Field visit at Sajjangarh Biological Park

A field visit was also conducted during the training programme to Sajjangarh Biological Park and Menar Wetland near Udaipur, Rajasthan. Sajjangarh Biological Park, established in 2015 at the foothills of the Sajjangarh (Monsoon) Palace, functions as a modern conservation and recreation facility.

Menar Wetland, popularly known as the “Bird Village of Rajasthan,” provided participants with exposure to a successful model of community-led wetland conservation and biodiversity protection.

11. NTP on AI Champions and AI Enablers from 15 September 2025 to 18 September 2025.



Figure 14: NTP on AI Champions and AI Enablers from 15.09.2025 to 18.09.2025

The training Programme deliberated on Ethics in AI & best practices with a focus on Accounting, Audit and Corporate Governance, Drone technology for Audits, identification of right places for check dams, tree counting in forest, amount of minerals extracted, etc

Faculties from the Wadhvani Center for Government Digital Transformation, AEREO Bengaluru, Lakshimpat University Jaipur and officials from IA & AD deliberated on critical areas of digital transformation.

12. International Webinar on “Nexus Area: Climate and Biodiversity” on 24th September 2025

The International Webinar on “Nexus Area: Climate and Biodiversity,” organized by iCED, Jaipur in association with INTOSAI (WGEA) on 24 September 2025, witnessed participation of 116 participants from 22

Supreme Audit Institutions (SAIs) across the globe.

The webinar was structured into multiple virtual sessions, including project presentations, country case studies, breakout discussions, and a wrap-up session. The sessions covered audit frameworks and question banks, followed by case studies from SAI Canada and SAI Maldives on auditing climate and biodiversity. A key feature of the webinar was the use of virtual breakout rooms, enabling interactive discussions among participants, which were followed by expert insights and concluding key messages from the INTOSAI WGEA Secretariat.



Figure 15: International Webinar on “Nexus Area: Climate and Biodiversity” on 24th September 2025

National and International Events in field of Environment

By: Shri Manoj Kumar, SAO and Shri Ravi Kumar Sr. Auditor

High Seas Treaty Ratification

A landmark UN treaty to safeguard marine biodiversity on the high seas has now met the required 60 ratifications for entry into force, clearing the way for it to take effect in January 2026.

In a historic milestone, enough countries ratified the UN High Seas Treaty in September 2025 to bring it into force, clearing the way for 30% of international waters to become Marine Protected Areas. Morocco and Sierra Leone joined the list of States ratifying the treaty, becoming the 60th and 61st parties to the pact.

The treaty, formally known as the Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction (BBNJ agreement), was adopted by UN Member States in June 2023 after nearly two decades of negotiations. The BBNJ agreement builds on the UN Convention on the Law of the Sea, regarded as the “constitution for the oceans.”

Once the high seas treaty enters into force on 17 January 2026, it will provide a global framework to help achieve international biodiversity targets, including the pledge to protect 30 per cent of land and sea areas by 2030 under the Kunming-Montreal Global Biodiversity Framework.¹

The Agreement addresses four main issues:

- Marine genetic resources, including the fair and equitable sharing of benefits;
- Measures such as area-based management tools, including marine protected areas;
- Environmental impact assessments; and
- Capacity-building and the transfer of marine technology.

The Agreement also addresses a number of “cross-cutting issues”, establishes a funding mechanism and sets up institutional arrangements, including a Conference of the Parties and various subsidiary bodies, a Clearing-House Mechanism and a secretariat.²

UN Climate Summit 2025

The UN Climate Summit 2025 was convened on 24th September 2025 on the margins of the 80th session of the UN General Assembly.

Leaders and ministers representing 46 Parties made new announcements on their 2035 NDC targets. A further 29 Parties spoke about their plans to implement the targets in their already submitted new NDCs. All other leaders and participants emphasized that they are close to completing their domestic processes, with 54 Parties committing to bring their NDCs forward by COP 30. By the conclusion of the

¹ [United Nations News](#)

² [United Nations BBNJ Agreement](#)

Summit, 125 Parties had either submitted or made announcements related to their new NDCs, covering 79% of global greenhouse gas emissions and 67% of the global population.

Of the 125 submitted/announced NDCs, 62 featured absolute emissions reductions targets, 73 reflected economy-wide emissions reductions targets, and 52 covered all greenhouse gases – many for the first time. 86 announcements and submissions outlined targets and measures for renewable energy, 72 committed energy efficiency targets, and 64 included references to reduce fossil fuel demand. 65 Parties also referenced efforts to halt and reverse deforestation, with 37 setting quantified targets, whilst 21 Parties included targets and measures to reduce methane emissions from the energy sector.³

High-Level Political Forum 2025

The High-level Political Forum on Sustainable Development (HLPF) was convened from Monday, 14 July, to Wednesday, 23 July 2025, under the auspices of the Economic and Social Council. This included a three-day ministerial segment of the forum from Monday, 21 July, to Wednesday, 23 July 2025, as part of the High-level Segment of ECOSOC.

The theme of the HLPF was “Advancing sustainable, inclusive, science- and evidence-based solutions for the 2030 Agenda for Sustainable Development and its Sustainable Development Goals for leaving no one behind”.

The 2025 HLPF with full appreciation for the integrated, indivisible and interlinked nature of the Sustainable Development Goals,

conducted in-depth reviews of: SDG 3. Ensure healthy lives and promote well-being for all at all ages; SDG 5. Achieve gender equality and empower all women and girls; SDG 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all; SDG 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development; and SDG 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development.

The 2025 HLPF brought together over 100 ministerial and high-level representatives of governments, as well as a wide range of expertise and stakeholders, including heads of UN entities, academics and other experts, and over 800 representatives of major groups and other stakeholders and non-government organizations with ECOSOC status, including 300 youth.⁴

National Designated Authority for the Implementation of Article 6 of the Paris Agreement (NDAIAPA)

Article 6 of the Paris Agreement, defines the contours under which such an emissions trading regime, or a market, can take shape. One of the long-standing bones of contention among countries, Article 6, was finally passed by countries at the 29th edition of the climate COP in Baku, Azerbaijan, in November 2024.

In exercise of the powers conferred by section 3 of the Environment (Protection) Act, 1986, (29 of 1986) the Central Government has proposed to issue a notification to constitute an authority to be known as the National

³ [UN Climate Summit 2025](#)

⁴ [UN: High-Level Political Forum 2025](#)

Designated Authority for the Implementation of article 6 of Paris Agreement.

The creation of an NDA is a mandatory requirement under Article 6. A notification from the Ministry of Environment, Forest and Climate Change (MoEFCC) on August 22 lays out the composition of the NDA, which is a 21-member committee headed by the Secretary of the Environment Ministry. Representatives include officials from the Ministry of External Affairs, Ministry of Renewable Energy, NITI Aayog and Steel Ministry among others.⁵

In addition to this, the Ministry of Environment, Forest and Climate Change has issued a revised list of activities under bilateral/ cooperative approaches in India under Article 6.2 mechanism of Paris Agreement. These activities will be considered for trading of carbon credits under bilateral/ cooperative approaches under Article 6.2 mechanism. These activities will facilitate adoption/transfer of emerging technologies. The list of identified activities will initially be for first 03 years, and it may be updated/revised by NADAIPPA.⁶

The list includes the following:

I. GHG Mitigation Activities:

1. Renewable energy with storage (only stored component)
2. Solar thermal power plant
3. Off- shore wind
4. Green Hydrogen
5. Compressed bio-gas
6. Emerging mobility solutions like fuel cells
7. High end technology for energy efficiency
8. Sustainable Aviation Fuel
9. Best available technologies for process improvement in hard to abate sectors
10. Tidal energy, Ocean Thermal Energy, Ocean Salt Gradient Energy, Ocean Wave Energy and Ocean Current Energy
11. High Voltage Direct Current Transmission in conjunction with the renewable energy projects

II. Alternate Materials:

12. Green Ammonia

III. Removal Activities:

13. Carbon Capture, Utilization and Storage

⁵ [notification from the Ministry of Environment](#)

⁶ [Revised List of activities to be considered under bilateral/cooperative approaches in India under Article 6.2 Mechanism](#)

Auditing Biodiversity Conservation: Evaluating Policy Effectiveness for SDG 15

By: Shri Ajay Babu Meena, AAO

Introduction

Biodiversity is the living fabric of our planet, essential for human survival and economic resilience. Sustainable Development Goal 15 (SDG 15)- "Life on Land", mandates the global community to protect, restore, and promote the sustainable use of terrestrial ecosystems. For India, a megadiverse nation, occupying just 2.4% of the global land area yet supporting nearly 8% of the world's flora and 7.5% of its fauna, including 28% endemic plants and over 30% endemic animals,¹ achieving this goal of SDG-15 "Life on Land" is a balancing act between rapid development and ecological preservation².



Source: *Goal 15 | Department of Economic and Social Affairs*

In October 2024, India reaffirmed its commitment by submitting the updated National Biodiversity Strategy and Action Plan (NBSAP) 2024-2030 during the Convention on Biological Diversity Conference of Parties (CBD-COP) -16. This roadmap aligns with the Kunming-Montreal Global Biodiversity Framework (KM-GBF), setting 23 ambitious targets focusing on reducing threats to biodiversity, ensuring sustainable use of resources, and enhancing tools for implementation³. However, policy intent is only as good as its implementation.

Quantitative Progress

SDG India Index Data from NITI Aayog presents a trajectory of steady improvement, characterized by rising indices and expanding green cover.⁴

SDG India Index 2023-24⁵

The NITI Aayog SDG India Index 2023-24 indicates significant progress. The national score for SDG 15 improved to 75, up from 66 in 2020-21.

Front Runners: The number of States and Union Territories (UTs) classified as "Front Runners" (score 65–99) in SDG 15 nearly doubled from 17 in 2020-21 to 32 in 2023-24.

New Entrants: States like Bihar, Maharashtra, Gujarat, Tamil Nadu, Manipur,

¹ [Press information bureau 09 October 2025](#)

² [United Nations SDG 15 India's Fourth National Report to the Convention on Biological Diversity MOEF](#)

³ [UNEP: THE CONVENTION ON BIOLOGICAL DIVERSITY](#)

⁴ [SDG India Index 2023-24 NITI Aayog](#)

⁵ [Press Information Bureau 12 July 2024](#)

Uttar Pradesh, Uttarakhand, and West Bengal moved into the Front Runner category, indicating broad-based improvements across diverse geographical regions.

Drivers: The improvement is attributed to percentage increase in forest cover, tree cover, area covered under afforestation schemes to the total geographical area, and percentage change in carbon stock in forest cover.⁶

India State of Forest Report (ISFR) 2023⁷

The Forest Survey of India (FSI) provides the baseline data for these indices. The ISFR 2023 reported:

Total Cover: The Forest and Tree cover of the country is 8,27,357 sq km which is 25.17 percent of the geographical area of the country, consisting of 7,15,343 sq km (21.76%) as forest cover and 1,12,014 sq km (3.41%) as tree cover.

Net Increase: As compared to assessment of 2021, there is an increase of 1445 sq km in the forest and tree cover of the country which includes 156 sq km increase in the forest cover and 1289 sq km increase in tree cover.

The total growing stock of India's forest and trees outside forests is estimated as 6430 million cum, of which 4479 million cum is inside the forests and 1951 million cum outside the forest area. There is an increase of 262 million cum of total growing stock as compared to the previous assessment which includes an increase of 91 million cum inside

the forest and 171 million cum outside the forest area.

While these figures suggest robust health, the definition of "forest cover"—which captures all lands with over 10% canopy density⁸—regardless of land use mask the distinction between biodiversity-rich natural forests and commercial monoculture plantations.

CAG Audit Reports

Subject Specific Compliance Audit of Zoological Survey of India (Report No. 29 of 2025)⁹

India's faunal diversity is critical for biodiversity conservation under SDG 15 and the Convention on Biological Diversity. The CAG's compliance audit (2018-2023) on ZSI activities exposed fundamental institutional and operational weaknesses.

Failure to achieve delivery of primary objectives: ZSI failed to deliver on primary objectives of faunal exploration, taxonomic studies, monitoring, and publication as per its Strategic Plan and Vision 2020, due to chronic manpower shortages (42-52% vacancies), huge backlogs (23% taxonomic identification of 24.35 lakh specimens), persistent delays in surveys/publications (1-14 years).

Effectiveness of Extended Scientific Activities under Secondary Objectives: ZSI failed to effectively maintain National Zoological Collections or implement secondary objectives like digitisation, barcoding, and GIS/RS labs, with no physical verification after 10 years, no disposal policy,

⁶ [SDG India Index 2023-24 NITI Aayog](#)

⁷ [Press Information Bureau 21 December 2024](#)

⁸ [MoEF&CC: India State of Forest Report 2023](#)

⁹ [Union Government Scientific and Environmental Ministries/Departments Report No. 29 of 2025 \(Compliance Audit\)](#)

slow digitisation (0.06 percent of General Specimens and 30 percent of type specimens complete), and outdated infrastructure despite Vision 2020 targets.

Forest Finance: The CAMPA Paradox (Report No. 5 of 2024)¹⁰

The Compensatory Afforestation Fund Management and Planning Authority (CAMPA) manages funds collected from industries diverting forest land. The audit (Uttarakhand, Report 5 of 2024) highlighted gross financial inefficiency.

Diversion of Forest land: Out of 2,144 cases (15,083.76 ha) of diversion of forest land submitted for developmental works during the period 2014-22, final clearance was granted in 679 cases (3,947.43 ha), in-principle approval was granted in 782 cases (2,025.97 ha) and rest of the 683 cases (9,110.36 ha) are pending/under process at various stages.

Diversion of Funds: Instead of regenerating ecosystems, funds were diverted for "inadmissible purposes" such as renovating office buildings, purchasing vehicles for administrative use, and buying laptops, violating the core "polluter pays" principle.

Planning Failures: Systemic deficiencies were found in the process of preparation of the Annual Plan of Operations (APOs). The planning was found deficient as there were cases of delay in preparation of APOs, poor planning and defective APOs. The State was shifting its burden of specified forest activities to the CA funds.

¹⁰ [Government of Uttarakhand Report No. 5 of 2024 \(Performance Audit- Civil\)](#)

Tiger Conservation: Habitat vs. Statistics (Maharashtra Report No. 2 of 2019)¹¹

While tiger numbers are rising, the management of their habitats faces critical challenges.

Planning Void: The audit observed that The Tiger Conservation plans, which play a significant role in formulating the management strategy for 10 years were non-existent in two Tiger Reserves while in remaining four Tiger Reserves, the Tiger Conservation Plans were formulated with delays ranging from 2.5 to seven years.

Corridor Fragmentation: The Department did not show the resolve to secure inviolate space available for tiger habitats and these were being curtailed due to encroachment by human settlements and tourist facilities. These were further fragmented and criss-crossed by highways and railway lines. This led to tiger deaths due to electrocution and road accidents.

Tourism Pressure: In reserves like Tadoba-Andhari, tourism exceeded carrying capacity, and Local Advisory Committees (LACs) failed to meet regularly to regulate this pressure.

Recommendations by CAG of India for Policy Effectiveness

ZSI Performance Improvement Recommendations: The Zoological Survey of India (ZSI) should review its performance against the Strategic Plan, complete surveys and publications within time-bound plans, and prioritize studies on invasive fauna in line

¹¹ [GOVERNMENT OF MAHARASHTRA Report No. 2 of the year 2019](#)

with the Vision Document. The Ministry of Environment, Forest and Climate Change (MoEF&CC) must closely monitor ZSI's functioning to ensure accountability. ZSI should also develop baseline data for coral reef monitoring with regular surveys, establish a structured capacity-building framework by creating a pool of taxonomic experts from academia and retired specialists, and focus on achieving targets related to threatened and endemic species through periodic reviews. Additionally, ZSI should ensure disaster preparedness for its collections and museums while strengthening overall institutional capacity.¹²

Strengthening Forest Land Diversion and CAMPA Planning: Ensure timely compliance with in-principle forest diversion and funding conditions, create and regularly update a land bank database for suitable CA lands, enforce prompt recovery of NPV balances from user agencies, and adopt need-based Annual Plans of Operation (APOs) supported by a robust multi-level appraisal mechanism.¹³

Strengthening Tiger Conservation and Habitat Management: A focused strategy should ensure safe wildlife corridors, adequate eco-sensitive zones, and timely preparation of

Tiger Conservation Plans (TCPs). Human settlements and tourist facilities in core areas should be phased out, and high-tension lines insulated to prevent electrocution. Tiger reserves should function under unified control with adequate infrastructure, rehabilitation of affected people expedited, and tourism regulated through GPS-enabled monitoring. Stronger internal control and monitoring mechanisms are also essential.¹⁴

Conclusion

India's biodiversity governance is at a pivotal juncture. The updated National Biodiversity Strategy and Action Plan (NBSAP) 2024-2030 provides a visionary framework, and the Sustainable Development Goals (SDG) India Index reflects a strong political will to succeed. However, the CAG findings serve as a critical conscience, reminding us that true conservation lies not in the allocation of funds or the notification of rules, but in the rigorous, day-to-day enforcement of protections on the ground. For SDG 15 to be truly realized, India must close the gap between its high-level ambition and its field-level implementation.

¹²[Union Government Scientific and Environmental Ministries/Departments Report No.29 of 2025 \(Compliance Audit\)](#)

¹³ [Government of Uttarakhand Report No. 5 of 2024 \(Performance Audit – Civil\)](#)

¹⁴[GOVERNMENT OF MAHARASHTRA Report No. 2 of the year 2019](#)

Auditing Water Governance: Assessing Progress Towards SDG 6

Ensure availability and sustainable management of water and sanitation for all

By: Shri Rohan Sharma, AAO



Figure 1 Source: *Sustainable Development Goals National Indicator Framework*

Introduction

Water is at the core of sustainable development, essential not only for human health and well-being but also for economic growth, environmental protection, climate resilience, and social stability. Sustainable Development Goal 6 (SDG 6) - “*Ensure availability and sustainable management of water and sanitation for all*” - sets an ambitious global agenda to address water scarcity, ensure safe drinking water, expand sanitation systems, restore ecosystems, and improve integrated water resource management (IWRM).

Given the accelerating challenges of climate variability, declining groundwater, pollution of water bodies, and inequities in service delivery, **strong water governance** has

become more critical than ever. Audits of water governance provide an independent lens on policy effectiveness, institutional coordination, data integrity, compliance, financial management, and environmental outcomes.

This article examines how SAIs can assess progress toward SDG 6 through a governance-focused audit approach, integrating accountability with sustainable resource management.

2. Why Audit Water Governance?

Auditing water governance goes beyond verifying physical infrastructure or financial compliance. It evaluates **how well institutional arrangements enable**

sustainable, equitable, and efficient water management.

Key reasons include:

2.1 Increasing Water Stress

- Nearly **half the world's population** experiences severe water scarcity for at least part of the year¹.
- Groundwater depletion is accelerating, particularly in agrarian economies.
- Climate change is altering rainfall patterns, increasing drought and flood frequency.

2.2 Fragmented Institutional Structures

Multiple ministries, utilities, regulators, and local bodies often operate without coordination. SAIs can highlight overlapping mandates, unclear roles, and lack of accountability.

2.3 Data Reliability Issues

SDG 6 depends heavily on accurate, timely water data - yet monitoring networks are often outdated, fragmented, or inconsistent. Audits can examine data systems, measurement standards, and reporting reliability.

2.4 High Public Investments

Water supply, sanitation, irrigation, and watershed development involve substantial public funds. Governance audits help ensure value for money, reduce leakages, and enhance efficiency.

2.5 Human Rights and Equity

SDG 6 directly links to the human right to water and sanitation. Audits can assess

whether vulnerable communities such as women, rural populations, urban poor are receiving equitable services.



Figure 3 Performance of States/UTs on SDG 6 (Source *SDG India Index 2023-24 NITI Aayog*)

3. Understanding SDG 6 Through a Governance Lens ²

SDG 6 comprises 8 targets aimed at ensuring the availability and sustainable management of water and sanitation for all. At the national level, a total of 13 indicators have been identified to measure and monitor the progress of these targets, with data available for all indicators. For audit purposes, the following are especially relevant:



Figure 2 Source *SDG India Index 2023-24 NITI Aayog*

¹[UN World Water Development Report](#)

² [SDG India Index 2023-24 NITI Aayog](#)

6.1 Safe and affordable drinking water

Governance questions include:

- Are service delivery institutions accountable to users?
- Are quality standards enforced?



Figure 4 Source: *SDG India Index 2023-24 NITI Aayog*

6.2 Sanitation and hygiene

- How effective are systems for wastewater treatment and sludge management?

6.3 Water quality and pollution

- Are regulatory bodies enforcing pollution norms?
- Is monitoring adequate?



Figure 5 Source: *SDG India Index 2023-24 NITI Aayog*

6.4 Water-use efficiency and scarcity

- Do irrigation programs promote efficiency?
- Are groundwater extraction regulations enforced?

6.5 Integrated Water Resources Management (IWRM)

- Are river basin organisations functional?
- Is cross-sector coordination effective?

6.6 Protection of water-related ecosystems

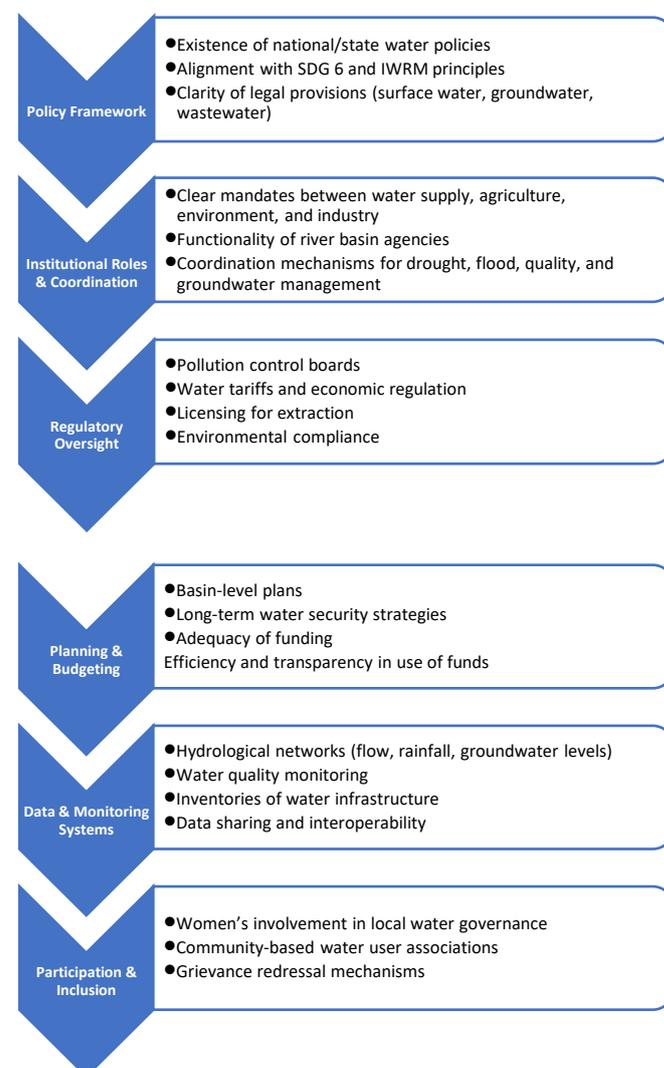
- Are wetlands, rivers, aquifers, and catchments protected and restored?

6.A & 6.B International cooperation and community participation

- Are local bodies empowered and funded?
- Are communities engaged in planning and monitoring?

Key Dimensions for Audit

A governance audit must look at the overall system rather than isolated schemes.



5. Audit Approach for Assessing SDG 6 Progress

SAIs can adopt a **hybrid audit approach** combining **performance, compliance, environmental, and financial audits.**



5.1 Audit Objectives

Possible objectives include:

- Assess whether government institutions are effectively implementing SDG 6 targets.
- Evaluate adequacy of regulatory, monitoring, and governance frameworks.
- Examine efficiency, equity, and sustainability of water resource management.
- Assess whether data systems support evidence-based decision-making.
- Identify capacity-building needs and institutional weaknesses.

5.2 Audit Criteria Sources

- National water policies and legislation

- SDG 6 indicators (UN Water)
- International guidelines such as Dublin Principles, IWRM
- Environmental norms, pollution standards
- Public finance rules and sectoral guidelines
- River basin and watershed management protocols

5.3 Audit Evidence

- Policy documents
- Ministry and department records
- Water quality datasets
- Utility data on supply, leakage, NRW
- Groundwater monitoring reports
- Budget and expenditure analytics
- Site inspections
- GIS/remote sensing analysis of rivers, wetlands, reservoirs
- Stakeholder interviews

6. Using GIS & Remote Sensing in Water Governance Audits

Modern water audits increasingly rely on geospatial technologies.

Applications

- Mapping wetland loss
- Detecting encroachment of floodplains
- Analysing river course shifts
- Monitoring reservoir sedimentation
- Assessing water quality using satellite data (Sentinel-2, Landsat)
- Identifying illegal sand mining hotspots
- Monitoring groundwater-dependent ecosystems

GIS integration strengthens audit evidence, enables visual reporting, and enhances credibility of audit findings.

Conclusion

SDG 6 offers a comprehensive roadmap for ensuring water security, ecosystem health, and equitable development. However, achieving its targets requires more than infrastructure, it demands robust governance systems capable of planning, regulating, monitoring, and adapting to changing water realities.

Supreme Audit Institutions are uniquely placed to assess whether governments are meeting these responsibilities. By focusing on governance rather than just compliance, SAIs can help strengthen institutions, enhance accountability, and accelerate progress toward SDG 6. Ultimately, audits of water governance contribute to building resilient societies where water is managed sustainably, equitably, and efficiently for present and future generations.



A **Carbon Sink** is a natural or artificial system, such as forests, oceans, or soils—that absorbs more carbon dioxide from the atmosphere than it releases.



DID YOU KNOW?

Auditing Marine and Coastal Ecosystems: Evaluating Governance for SDG 14

By: Shri Rohit Kirodiwal, AAO

The Earth is majorly covered with water with oceans covering more than 70 *per cent* area which gave earth its other name - the Blue Planet. Marine and coastal ecosystems contribute significantly to food security, climate regulation, disaster risk reduction, trade and transport, and livelihoods for millions. For India, with its extensive 11,098.81 km coastline¹, 12 major ports, 200 minor ports, and an Exclusive Economic Zone (EEZ) of 2.02 million sq. km².

The marine and coastal environment is integral to national development and ecological stability. However, these ecosystems face increasing pressures from coastal degradation, climate change, pollution, unsustainable fishing, coastal infrastructure expansion, and inadequate governance. Recognizing these threats, the global community incorporated the conservation and sustainable use of oceans into the United Nations Sustainable Development Goal 14 (SDG 14): “Conserve and sustainably use the oceans, seas and marine resources for sustainable development”.

India’s National Indicator Framework for SDG 14

To monitor India’s progress on SDG 14 targets, the Government of India has identified 10 national indicators under the National Indicator Framework (NIF). These indicators track key dimensions such as coastal water quality, extent of coastal and

marine ecosystems (mangroves, coral reefs), marine protected area coverage, sustainable fish stock status, capacity for ocean science and research and implementation of regulatory frameworks.

Government of India has identified 10 targets³ under SDG 14. Achieving SDG 14 requires integrating environmental conservation with sustainable coastal development, marine resource management, and community livelihoods. This is where governance and audit systems become crucial.

The 10 targets under SDG 14 to promote the sustainable development of coastal ecosystem are as follows:

- **SDG 14.1:** Reduce marine pollution, especially land-based pollution including plastics and nutrient runoff.
- **SDG 14.2:** Sustainably manage and protect marine and coastal ecosystems to avoid adverse impacts, strengthen resilience, and undertake restoration activities.
- **SDG 14.3:** Minimize and address the impacts of ocean acidification
- **SDG 14.4:** Regulate fishing, end overfishing, and illegal, unreported, and unregulated (IUU) fishing.



¹ [MoPSW Coastline of India](#)

² [Ministry of Earth Sciences](#)

³ [National Indicator Framework 2025](#)

- **SDG 14.5:** Conserve at least 10% of coastal and marine areas, consistent with national and international law.
- **SDG 14.7:** Increase economic benefits from sustainable use of marine resources, including fisheries and tourism.
- **SDG 14.a:** Increase scientific knowledge and marine research capacity; promote technology transfer.
- **SDG 14.b:** provide access for small-scale artisanal fishers to marine resources and markets
- **SDG 14.c:** Enhance implementation of international law as reflected in the United Nations Convention on the Law of the Sea (UNCLOS).

Together, these indicators enable systematic measurement of government interventions and provide a structured basis for assessing conservation effectiveness, ecosystem resilience, and sustainable use of marine resources across India's coastline.

India's progress towards achieving targets of SDG 14

The progress monitored through these indicators is as follows:

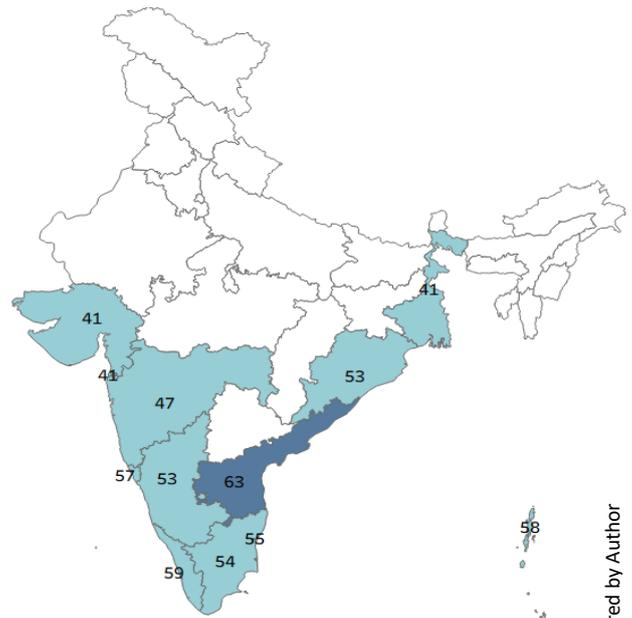
Coastal Water Quality Monitoring

To assess the impact of various anthropogenic activities and natural processes on the coastal ecosystem, Government of India started monitoring coastal waters through Coastal Water Quality Index⁴. Only Andhra Pradesh is in Good category among 9 coastal states⁵ and 4 UTs⁶ with slightly higher score from Kerala.

⁴ [Very Poor \(0-20\), Poor \(21-40\), Moderate \(41-60\), Good \(61-80\) and Very Good \(81-100\).](#)

⁵ Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Odisha, West Bengal

Chart 1: CWQI level for 2024-25
(Source: [SDG 14 Index MoSPI](#))



Source: [SDG 14 Index MoSPI](#)

Prepared by Author

Approval of Updated Coastal Plans

Under the 2019 Notification of Government of India, all 9 coastal States and 4 Union Territories are required to update their Coastal Zone Management Plans (CZMPs), Island Coastal Regulation Zone Plans (ICRZPs), or Integrated Island Management Plans (IIMPs) and submit them to the Ministry for approval. To date, updated CZMPs for Odisha, Karnataka, Maharashtra, and Kerala, as well as ICRZPs for Great Nicobar and Little Andaman, have been approved⁷.

Expansion of Mangrove Cover

India has made notable progress in mangrove conservation through strong regulatory measures and focused restoration initiatives. According to the India State of Forest Report 2023, the country's mangrove cover stands at 4,991.68 sq. km, accounting for 0.15% of its

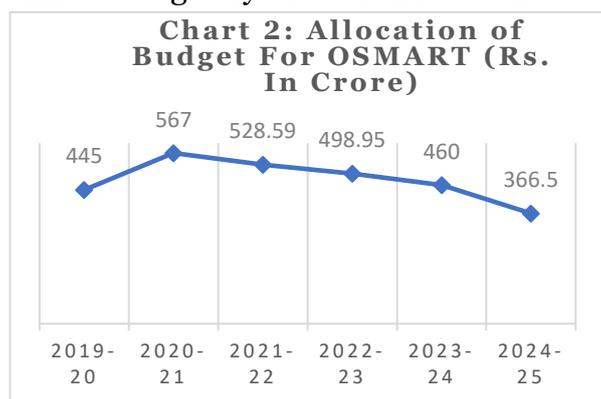
⁶ Andaman and Nicobar Island, Daman and Diu, Puducherry, and Lakshadweep

⁷ [MoEF&CC Lok Sabha Answer 18 August 2025](#)

geographical area. This reflects a net increase of 363.68 sq. km (7.86%) in mangrove cover between 2013 and 2023⁸.

Ocean Science and Research

For increasing scientific knowledge, develop research capacity, Ocean Services, Modelling, Applications, Resources and Technology (OSMART) scheme was identified. The annual budgetary allocation is as follows:



Parliamentary Standing Committee on Science and Technology, Environment, Forests and Climate Change in its 379th report on Demands for Grants (2023-2024) of the Ministry of Earth Sciences noted that the sharp reduction in Revised Estimates was primarily attributable to delays in procurement processes, administrative bottlenecks, slow progress in construction works, and delays in land acquisition, which adversely affected timely utilisation of allocated funds⁹.

Welfare Programme

Under SDG 14, India implements several welfare-oriented schemes for the fisheries sector aimed at protecting marine resources while securing livelihoods of fishers. The Pradhan Mantri Matsya Sampada Yojana (PMMSY) is the flagship scheme providing

financial assistance for fishing vessels, gear, safety equipment, insurance, and post-harvest infrastructure, with a focus on small-scale and artisanal fishers. Income and social security support is extended through measures such as Savings-cum-Relief and Group Accident Insurance during fishing ban periods. Programmes like deep-sea fishing assistance and vessel tracking systems promote safety and sustainable fishing practices. Together, these schemes enhance access to marine resources and markets, improve income security, and support conservation objectives under SDG 14.

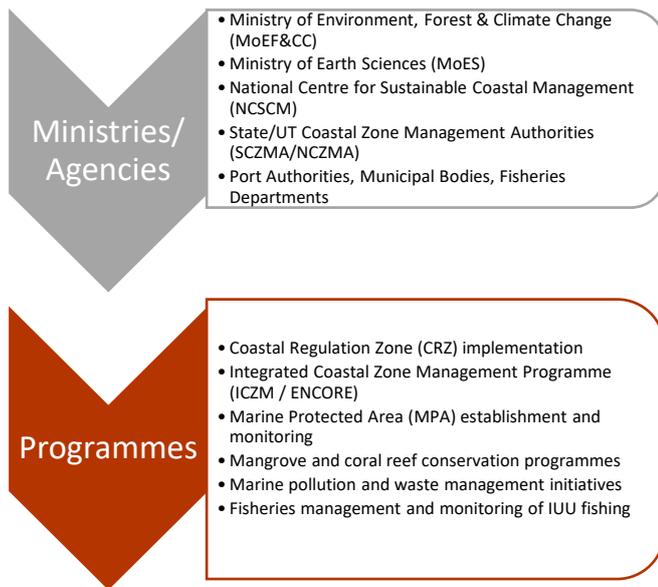
Governance Framework

India has made notable progress toward SDG 14 through expanded coastal regulation, restoration of mangroves and coral reefs, establishment of Marine Protected Areas, and implementation of the ICZM/ENCORE programmes. However, challenges remain in marine pollution control, enforcement of CRZ norms, and scientific monitoring capacity, which continue to affect the overall pace of achieving SDG 14 targets. Strengthening governance, data systems, and inter-agency coordination is essential for accelerating future progress.



⁸ [PIB: Mangroves as Guardians of Life and Livelihoods](#)

⁹ [379th report on Demands for Grants \(2023-2024\) of Parliamentary Standing Committee on Science and Technology, Environment, Forests and Climate Change](#)



Need of Audit

SDG 14 is critical for safeguarding India's marine and coastal ecosystems, which support biodiversity, fisheries, livelihoods, and climate resilience. Audit is essential to assess the effectiveness of government actions. Audit helps evaluate compliance with CRZ norms, adequacy of monitoring systems, utilisation of funds, and progress against national and international commitments. Through evidence-based analysis, audit strengthens governance, transparency, and long-term sustainability of coastal and marine resources.

Some probable audit objectives are as follows:

- To Assess the adequacy of institutional frameworks, planning processes, and coordination mechanisms for SDG 14 implementation.
- To Examine the effectiveness of marine pollution control measures, including sewage, industrial effluents, and plastic waste management.

- To Evaluate the protection and sustainable management of key coastal and marine ecosystems, such as mangroves, coral reefs, wetlands, and MPAs.
- To Review compliance with CRZ/ICRZ/IIMP regulations and the effectiveness of project clearance monitoring.
- To Assess efficiency in resource utilisation, scientific monitoring systems, and data quality supporting SDG 14 indicators.
- To Determine the effectiveness of livelihood-linked initiatives and community participation in supporting sustainable marine resource use.

Use of technology for Audit of SDG 14

GIS and remote sensing tools play a critical role in auditing SDG 14 by enabling objective, spatially accurate assessment of coastal and marine ecosystems. GIS and remote sensing can be used for audit in following areas:

- Coastal erosion and shoreline changes
- Illegal constructions or encroachments in CRZ areas
- Mangrove loss or gain
- Degradation of coral reef patches

Auditable domains related to marine and coastal governance under SDG 14:

1. Regulatory and Institutional Framework

- Presence and effectiveness of CZMP / ICRZP / IIMP approvals
- Functionality and capacity of regulatory agencies (e.g. SCZMAs, NCZMA, coastal authorities)

- Coordination among central, state, and local coastal governance bodies

2. Coastal and Marine Ecosystem Conservation

- Protection/restoration of mangroves, wetlands, coral reefs, and marine habitats
- Management and effectiveness of Marine Protected Areas (MPAs)
- Habitat mapping and ecological zoning

3. Pollution Control and Waste Management

- Sewage treatment, industrial effluent control, waste disposal near coastal zones
- Compliance with pollution norms, monitoring of coastal water quality, plastic/marine litter control

4. Coastal Development and Project Clearances

- Compliance with CRZ/ICRZ regulations for coastal projects (ports, tourism, industry, infrastructure)
- Proper environmental impact assessment (EIA), Environmental Management Plan (EMP), and post-clearance monitoring

5. Scientific Monitoring, Data & Information Systems

- Use of GIS, remote sensing, and periodic ecological surveys
- Data integrity, consistency, and coverage of marine/coastal monitoring networks
- Reporting against SDG 14 indicators (e.g. water quality, habitat area, biodiversity indices)

6. Community Livelihood & Stakeholder Participation

- Inclusion of fishing, coastal communities, indigenous populations in planning and conservation
- Grievance redressal mechanism for impacts on local livelihoods due to coastal development
- Sustainable livelihood support, eco-tourism norms, and benefit-sharing mechanisms

7. Disaster Risk and Climate Resilience

- Coastal hazard mapping (erosion, sea-level rise, cyclones)
- Early warning systems, adaptation and mitigation plans
- Restoration or conservation of natural buffers (mangroves, wetlands)

The conservation and sustainable use of India's marine and coastal ecosystems are essential for ecological resilience, fisheries livelihoods, disaster risk reduction, and long-term sustainability. While India has made meaningful progress in mangrove expansion, coastal planning, and marine research, challenges persist in pollution control, enforcement, monitoring, and ecosystem conservation.

Environmental auditing provides a powerful tool to evaluate government actions, identify systemic gaps, and strengthen accountability. By integrating scientific evidence, GIS-based assessments, and community perspectives, audits can significantly enhance the effectiveness of marine governance and accelerate India's progress toward **SDG 14: Life Below Water**.

Auditing Climate Action: Evaluating Institutional readiness and resilience for SDG 13

“In climate governance, the credibility of targets rests on the strength of systems that assess, measure, and verify progress. Target-setting and progress assessment must advance in tandem. Without strong MRV (Monitoring–Reporting–Verification), climate targets are at risk of becoming symbolic rather than transformative.”

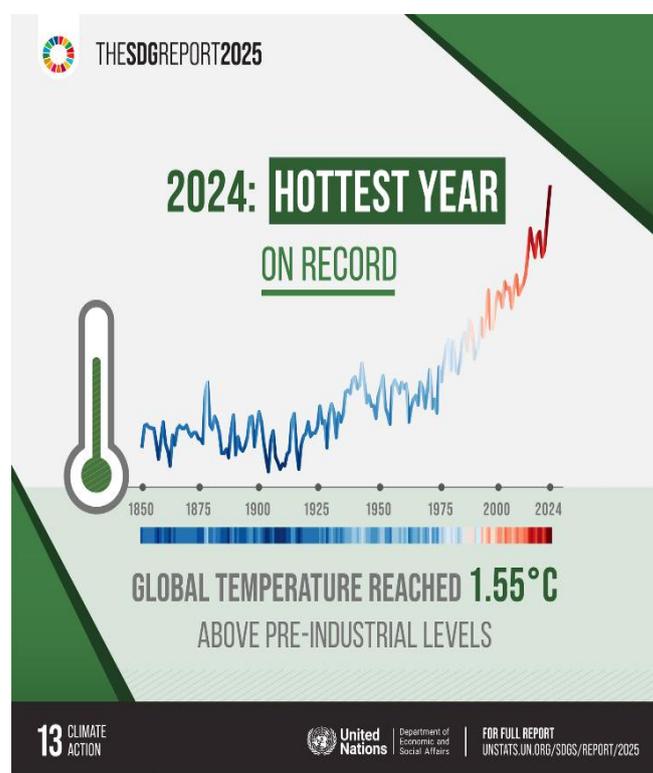
By: Shri Rahul Yadav, AAO

Governments across the Globe, at UN Climate Change conference **COP21** Paris (2015), agreed that mobilizing stronger and more ambitious climate action is urgently required to achieve the goals of the Paris Agreement. The Paris Agreement formally acknowledged the urgent need to scale up our global response to climate change, which supports even greater ambition from governments¹.

Climate change has become the defining governance challenge of the 21st century. **SDG 13: Climate Action**, calls upon nations to strengthen resilience, build adaptive capacity, and integrate climate considerations into policies and development planning. While countries are progressively adopting climate targets, their real effectiveness depends on the systems that track, enforce, and steer progress.

The World Meteorological Organization (WMO) confirmed a global average of **1.55°C** above pre-industrial levels in 2024. It was the hottest year in 175 years, capping a decade of record-breaking temperatures (2015–2024). The WMO also estimates an 80 per cent chance that at least one of the next five years will surpass 2024 as the hottest on record.

Every fraction of a degree of additional warming drives more frequent and more



Source: Goal 13 | Department of Economic and Social Affairs

intense extreme weather².

In 2023, atmospheric concentrations of CO₂ levels remained at their highest in more than 2 million years and were 151 per cent above pre-industrial levels. The number of people affected by disasters surged by more than two thirds, from 1,158 per 100,000 population in

¹ [United Nations Climate Changes](#)

² [The Sustainable Development Goals Report 2025 United Nations](#)

the period 2005–2014 to 2,028 in the period 2014–2023, with an average of 124 million

audit; it is an audit of governance, finance, risk management, and public sector resilience.

Supreme Audit Institutions (SAIs), the independent national auditors, have a unique mandate to evaluate government performance and finances. An audit of SDG implementation is an ISSAI-compliant performance audit to examine the implementation of the SDGs at the national level using a whole-of-government approach⁴.

According to the INTOSAI Global Trends Report,

“SAIs faces reputational risks if they fail to warn policymakers of the increasing risks posed by climate change and environmental degradation to public budgets and the value and availability of natural resources”.

In recent years INTOSAI (the global SAI body) and UN bodies have explicitly recognized SAIs as key actors in climate action. For instance, in 2024 the 26th UN/INTOSAI Symposium highlighted that SAIs “have a critical role in implementing SDG 13” by promoting accountability, transparency, and the efficient use of funds. In 2024, the UN General Assembly adopted Resolution 79/231, recognizing the crucial role of SAIs in climate change efforts. The resolution emphasizes SAIs' importance in evaluating national climate policies and calls for capacity-building to ensure their effectiveness. This marks a significant step in integrating rigorous oversight into global climate action⁵.

What Does Institutional Readiness Mean for SDG 13?

Institutional readiness refers to the capability of government systems to plan, coordinate, finance, implement, and monitor climate

Goal 13. Take urgent action to combat climate change and its impacts

Target 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

Target 13.2 Integrate climate change measures into national policies, strategies and planning

Target 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

Target 13.a Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly \$100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible

Target 13.b Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities

people affected every year over the past decade³.

These stark figures underscore SDG-13’s call for “urgent action to combat climate change and its impacts”, emphasizing both mitigation and, crucially, adaptation and resilience. In this context, Supreme Audit Institutions (SAIs) play a pivotal role. Through independent scrutiny, SAIs evaluates whether governments are institutionally prepared, equipped, and accountable in their approach to climate risks and commitments. Auditing climate action is not merely an environmental

³ [Goal 13 | Department of Economic and Social Affairs United Nations](#)

⁴ [IDI's SDGs Audit Model \(ISAM\) 2024](#)

⁵ [INTOSAI Sustainable Development: Role of SAIs](#)

action across sectors and administrative levels. It includes:

- **Policy Readiness:** Existence of climate policies, NDC-aligned strategies, and sectoral roadmaps.
- **Governance and Coordination:** Defined responsibilities across ministries, departments, and state agencies.
- **Financial Readiness:** Ability to mobilise, allocate, tag, and track climate-related expenditures.
- **Data & Technical Readiness:** Systems for climate data, GHG inventories, vulnerability assessments,

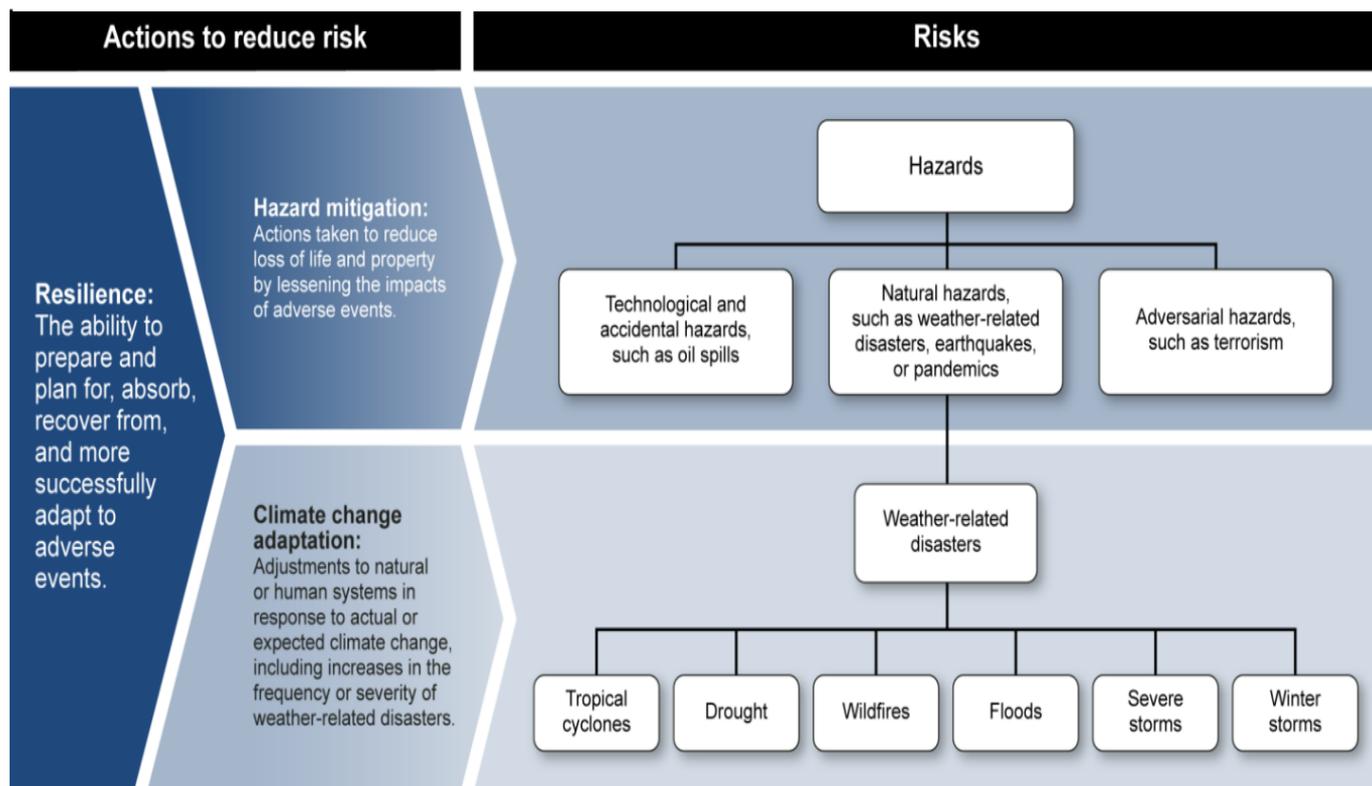
(Monitoring–Reporting–Verification), and risk-based decision-making.

Institutional readiness determines whether climate ambitions can translate into credible, measurable outcomes.

What Is Climate Resilience in the Public Governance Context?

Resilience under SDG 13 means the capability of institutions and communities to withstand, absorb, adapt to, and recover from climate-related shocks. Resilience is what happens as a result of adaptation to climate change. Thus, it is the ability of not to get killed or your property destroyed by climate disaster. Resilience is about staying alive in a climate

Figure 1: Relationship among Risks, Resilience, Hazard Mitigation, and Climate Change Adaptation (Source: [INTOSAI WGEA Work Plan 2017-2019 Project 2.1 \(e\)](#))



Source: GAO analysis of Presidential Policy Directive 8, previous GAO work, and National Oceanic and Atmospheric Administration data. | GAO-16-454

and early warning.

- **Human Resource Capacity:** Skills in climate modelling, planning, MRV

emergency⁶.

For public governance systems, resilience includes:

- Anticipatory risk assessment

⁶ 21st INTOSAI WGEA Assembly summary

- Disaster preparedness and response
- Resilient infrastructure, urban planning, and critical systems
- Adaptive capacity in agriculture, water, health, and energy sectors
- Social protection mechanisms for vulnerable populations

Resilience is not static; it demands continuous learning, capacity building, and data-driven decision-making.

Why Audit Climate Action? The Role of SAIs

Audit functions add value to climate action in four critical ways:

- Enhancing Accountability:** Audits verify whether commitments made under NDCs, national policies, and SDG 13 targets are translated into action.
- Strengthening Transparency:** Reviewing data systems, GHG inventories, and reporting processes improves the credibility of climate information.
- Improving Efficiency and Resource Use:** Climate-related schemes often involve large public investments. Audits ensure that funds are properly targeted, monitored, and evaluated.
- Supporting Better Governance:** Audit insights help ministries and departments strengthen institutional coordination, risk management, and policy coherence.
- Facilitating International Obligations:** Under the Paris Agreement, countries must demonstrate progress through transparency

frameworks—audits reinforce these systems.

A growing body of audit work by Supreme Audit Institutions (SAIs) across the world demonstrates how climate action is increasingly being scrutinized as a governance and resilience issue rather than a narrow environmental concern.

- The European Court of Auditors has assessed the EU’s climate adaptation framework and how a selection of EU adaptation projects addressed the impacts of climate change.⁷
- The UK National Audit Office has assessed cross-government readiness for net-zero delivery and climate adaptation, identifying coordination weaknesses and risks to long-term implementation.⁸
- The U.S. Government Accountability Office has evaluated federal climate risk management and the adequacy of institutional responses to climate-related financial threats.⁹
- The Auditor-General of Australia has reviewed governance arrangements underpinning national climate commitments, emphasizing accountability structures and performance measurement.¹⁰

Collectively, these audits show that institutional readiness for SDG 13 depends not only on policy ambition but on measurable governance capacity, financial transparency, and sustained accountability mechanisms. They reinforce a global trend: climate action is now a core domain of public sector auditing, linking environmental stewardship directly

⁷ [Special report 15/2024: Climate adaptation in the EU – Action not keeping up with ambition](#)

⁸ [UK NAO Report – Value for money](#)

⁹ [GAO-24-106937](#)

¹⁰ [Governance of Climate Change Commitments](#)

with fiscal responsibility and institutional resilience.

Effective climate action requires more than ambitious commitments. It relies on institutional readiness, strong governance, climate-informed budgeting, reliable data systems, and resilient development pathways. Supreme Audit Institutions, through objective scrutiny, ensure that climate ambitions

translate into action, and that action generates measurable progress toward SDG 13.

As climate risks intensify, auditing becomes an essential accountability and governance tool, ensuring countries are not only setting the right targets but are systematically assessing progress, building resilience, and strengthening institutional capacity. In this way, public audits become catalysts for climate-responsive, future-ready governance.



Natural Capital refers to the stock of natural resources—such as forests, water, soil, and biodiversity—that provide ecosystem services essential for human well-being and economic activity.



DID YOU KNOW?

Greening India's Energy Transition: Audit Insights into SDG 7

Dr. Mahesh Kumar Saini
Research Associate I

Introduction:

Sustainable Development Goals (SDGs) are a set of 17 global goals adopted by all United Nations¹ member countries in 2015 as part of the 2030 Agenda for Sustainable Development. These goals aim to end poverty, protect the planet, and ensure peace and prosperity for all by 2030².

The Sustainable Development Goals (SDGs) are important because they aim to improve living standards for poor and vulnerable people while protecting the environment through climate action, clean water, renewable energy, and biodiversity conservation. By promoting gender equality, quality education, reduced inequalities, decent work, innovation, and sustainable economic growth, the SDGs help build fairer and more prosperous societies. They also

focus on ensuring good health and well-being, strengthening peace, justice, and transparent institutions, and guiding nations to balance development with environmental protection so that future generations can thrive³.

What is Goal 7?

“Ensuring access to clean and affordable energy, which is key to the development of agriculture, business, communications, education, healthcare, and transportation”.

World and SDG 7:

Progress towards clean and sustainable energy is continuing, but it is still too slow to meet global goals. If the current trend continues, around 645 million people will remain without electricity and about 1.8 billion people will still use dirty fuels and technologies for cooking by 2030 (UN, 2025).

In 2022, renewable energy provided about 30% of the electricity we use, but transport is still heavily dependent on fossil fuels. Overall, the share of renewables in total energy use rose from 15.6% in 2015 to 17.9% in 2022. To give everyone access to energy by 2030, countries need to move faster on electrification, invest more in renewables, use energy more efficiently, and make strong policies and rules to support these changes. Access to electricity has improved from 84% of the world's population in 2010 to 92% in 2023, and 45 countries have reached full

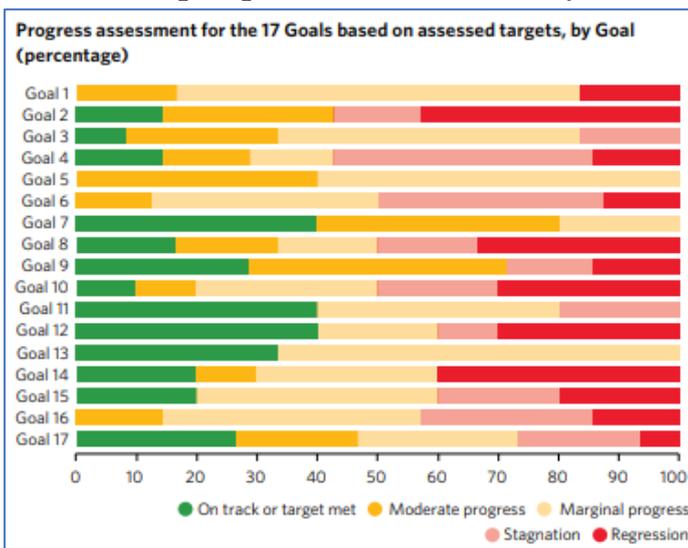


Figure 1: Progress Assessment for the 17 Goals based on assessed targets, by Goal (percentage)

¹ The United Nations is an international organization founded in 1945. Currently made up of 193 Member States stayed the one place on Earth where nations can gather together, discuss common problems, and find shared solutions that benefit all of humanity.

² [United Nations Peace, dignity and equality on a healthy planet](#)

³ [Worldtop20. \(2025\)](#)

access, but about 8% of people worldwide (mainly in least developed countries and sub-Saharan Africa) still live without electricity. About 2.1 billion people still cook with dirty and unsafe fuels. Access to clean cooking increased from 64% in 2015 to 74% in 2023, but sub-Saharan Africa is far behind because population growth is faster than progress. Financial support from richer countries for clean energy in developing countries reached 21.6 billion dollars in 2023, 27% more than in 2022, but this is still below the 2016 peak of 28.4 billion dollars. Everyday life depends on energy that is both reliable and affordable, but energy use is also the main driver of climate change, responsible for about two-thirds of global greenhouse gas emissions. On a positive note, access to electricity has improved: between 2010 and 2023, the share of the world's population with electricity rose from 84 per cent to 92 per cent⁴.

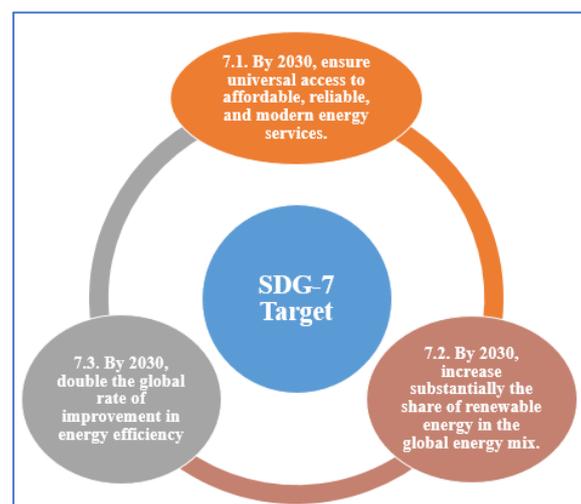
India and SDG 7:

India is expected to account for about one-fourth of the increase in the world's energy use in the coming years. Between 2013 and 2014, the country's total electricity-generation capacity grew quickly, at about 7% per year. Yet in 2015, around 237 million people in India still did not have electricity. To change this, the government is pushing renewable energy through the National Solar Mission and is expanding rural electrification and very large power projects, so that everyone can eventually get modern energy services.

Targets for SDG 7 (UNADAP, 2025):

- By 2030, ensure universal access to affordable, reliable and modern energy services.

- By 2030, increase substantially the share of renewable energy in the global energy mix.
- By 2030, double the global rate of improvement in energy efficiency.
- By 2030, enhance international co-operation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.
- By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing states and land-locked developing countries, in accordance with their respective programmes of support.



Key Actions against SDG 7 in India

India's SDG-7 commitments aim to ensure universal energy access, expand renewable energy to 450 GW by 2030, promote clean fuels such as LPG, biogas, ethanol and green hydrogen, strengthen domestic renewable manufacturing, and improve energy efficiency

⁴ [The Sustainable Development Goals Report 2025 United Nations](#)

through schemes like PAT, LED adoption, building codes, and supportive policy,

financial, and regulatory measures shown in the below Table 1.

Table 1: SDG 7 Schemes' Targets and Achievements in India¹

Schemes	Targets and Achievements
PM Surya Ghar (rooftop solar),	Launched in February 2024 with a budget of Rs 75,021 crore, PM Surya Ghar Muft Bijli Yojana aims to install rooftop solar in 1 crore households by March 2027, generating 30 GW capacity. Milestones include 10 lakh systems by March 2025, 20 lakh by October 2025, and 40 lakh by March 2026. It offers up to 300 units of free electricity monthly through 40% subsidies and net metering. Long-term goals include 1,000 billion clean units, a 720 million tonne reduction in CO ₂ over 25 years, and 17 lakh jobs. By December 2025, 19.46 lakh systems has been installed, benefiting 24.35 lakh households ^{2,3} .
Pradhan Mantri Ujjwala Yojana (PMUY),	Launched in May 2016, the initiative has been installed, benefiting 24.35 lakh households with posit-free LPG connections to replace traditional fuels like firewood and cow dung. PMUY 1.0 targeted 8 crore connections by March 2020 but achieved it in September 2019, raising LPG coverage from 62% to 99.8% by April 2021. PMUY 2.0 added 1 crore connections by December 2022. The FY 2023-26 extension delivered 75 lakh more by July 2024, reaching 10.35 crore total. In September 2025, 25 lakh additional connections were approved for FY 2025-26, targeting 10.6 crore overall, with 10.33 crore released by November 2025 ^{4,5} .
Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY)	Launched in December 2014 with ₹75,631 crore investment, strengthened rural power infrastructure. Key targets included electrifying all villages, separating agricultural and non-agricultural feeders, metering distribution transformers/feeders/consumers, and upgrading sub-transmission networks. A major achievement was electrifying all 18,452 unelectrified villages (per Census 2011) by April 28, 2018—987 days ahead of the 1,000-day target ⁶ . While the scheme dashboard claimed 100% achievement by March 2019, the CAG found that only 151.60 lakh households had actually been electrified by that date. By March 2022, this number increased to 174.36 lakh households, still representing only 66.34% of the estimated target ⁷ .
PM-KUSUM (solar pumps for farmers)	PM-KUSUM is implemented through three components with defined targets and progress. Component A aims to install 10,000 MW of decentralised grid-connected solar plants on barren land, against which about 667 MW has been installed (~6.7%). Component B targets 14 lakh standalone solar pumps in off-grid areas, with around 9.42 lakh pumps installed (~67%). Component C focuses on solarising 35 lakh grid-connected pumps , achieving about 10.99 lakh pumps (~31%). Overall, against a total capacity target of 34,800 MW , approximately 10,203 MW (~29%) has been achieved up to November, 2025 ^{8,9} .
UJALA (LEDs)	Launched on 5 January 2015 , the PM-UJALA scheme aims to promote energy efficiency by providing affordable LED bulbs, tube lights, and fans , replacing

¹ [SDG7 Energy Compact of the Government of India](#)

² [Press Information Bureau 16 December 2025](#)

³ [PM Surya Ghar Yojana Indian Brand Equity Foundation](#)

⁴ [Pradhan Mantri Ujjwala Yojana](#)

⁵ [Press Information Bureau 04 December 2025](#)

⁶ [Press Information Bureau 07 February 2023](#)

⁷ [CAG Audit Report on Deen Dayal Upadhyaya Gram Jyoti Yojana](#)

⁸ [Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyaan \(PM KUSUM\)](#)

⁹ [Press Information Bureau 23 December 2025](#)

	inefficient lighting, reducing electricity consumption and peak demand, cutting carbon emissions, and lowering household energy costs. It also seeks to transform the lighting market and expand LED adoption nationwide. By December 2025 , over 36.87 crore LED bulbs were distributed, saving 47,883 million kWh/year , avoiding 9,586 MW peak demand, reducing ~3.88 crore tonnes CO₂ , and saving consumers around ₹19,153 crore annually , while making LEDs widely affordable ¹⁰ .
National Hydrogen Energy Mission (NHEM)	The National Green Hydrogen Mission aims to produce at least 5 million metric tonnes (MMT) of green hydrogen per year by 2030 , with the potential to scale up to 10 MMT if export demand increases. Key targets include strengthening domestic electrolyser manufacturing to reduce import dependence, replacing ammonia-based fertiliser imports with green ammonia by 2034–35, and capturing about 10% of the global green hydrogen and ammonia export market . The mission also focuses on substituting grey hydrogen in refineries and fertilisers, blending hydrogen in city gas, and piloting applications in steel, mobility, and shipping. At least two Green Hydrogen Hubs will be developed initially, supported by a total financial outlay of ₹19,744 crore ¹¹ . Currently, India is developing three Green Hydrogen Hubs, such as Deendayal (Gujarat), V.O. Chidambaranar (Tamil Nadu), and Paradip (Odisha) for production and export, alongside large-scale projects like the massive Pudimadaka hub in Andhra Pradesh by NTPC for green chemicals and ammonia, all under the National Green Hydrogen Mission (NGHM) to boost clean energy and achieve net-zero goals ¹² .
SATAT (Sustainable Alternative Towards Affordable Transportation)	The SATAT (Sustainable Alternative Towards Affordable Transportation) initiative aims to promote clean and affordable transport fuel by encouraging entrepreneurs to set up 5,000 Compressed Bio-Gas (CBG) plants across India, with a production target of 15 million metric tonnes per year ¹³ . The initiative seeks to reduce fossil fuel imports, improve waste management by utilizing agricultural and organic waste, generate bio-manure, and create around 75,000 direct rural jobs . By December 2025 , steady progress has been made, with over 130 CBG plants commissioned and several more under construction. The introduction of a mandatory CBG Blending Obligation in the City Gas Distribution sector from FY 2025–26 , along with growing investor interest and issuance of Letters of Intent (LOIs) , reflects the expanding bio-CNG ecosystem in India ¹⁴ .
The EBP Programme	Under the EBP Programme (Ethanol Blended Petrol Programme), India targets 20% ethanol blending by ESY 2025–26 . Ethanol capacity rose from <200 crore litres in 2014 to 1,953 crore litres by Oct 2025 . Blending reached 19.24% in ESY 2024–25 , generating ₹1.29 lakh crore for sugar mills and improving farmer payments ¹⁵ .
National Mission for Enhanced Energy	The National Mission for Enhanced Energy Efficiency (NMEEE) , a key mission under the National Action Plan on Climate Change, Its targets include achieving annual fuel savings of about 23 million tonnes , avoiding nearly 19,600 MW of additional power capacity , and reducing around 98.55 million

¹⁰ [Govt of India's UJALA Scheme](#)

¹¹ [National Green Hydrogen Mission](#)

¹² [Press Information Bureau 10 October 2025](#)

¹³ [Press Information Bureau 08 December 2022](#)

¹⁴ [EV Charging Network and Biofuel Initiatives](#)

¹⁵ [Press Information Bureau 31 December 2025](#)

Efficiency (NMEEE)	tonnes of greenhouse gas emissions per year. By December 2025 , multiple PAT cycles have delivered significant reductions in industrial energy intensity, while initiatives such as UJALA have transformed lighting efficiency nationwide, creating strong market and financing mechanisms for sustained energy efficiency gains ¹⁶ .
Roadmap of Sustainable and Holistic Approach to National Energy Efficiency (ROSHANEE) ,	ROSHANEE, launched in 2019 as the revised framework of NMEEE and extended to 2031, aims to scale up energy efficiency across sectors to help India achieve a 45% reduction in emissions intensity by 2030 . Key targets include expanding the PAT scheme to more industries and MSMEs, achieving 42.71 million Tonne of Oil Equivalent (Mtoe) thermal and 500 billion kWh electricity savings , enforcing building energy codes, and delivering 557 Mt CO₂ reduction by 2030. By 2025 , PAT Cycle I achieved 23 Mtoe energy savings (102 Mt CO₂) , LED street lighting installed 12.18 million lights saving 8.18 billion kWh/year , the S&L programme covered 28 products reducing 55 Mt CO₂/year , and efficiency financing supported 630 firms with 12 Mtoe savings ^{17,18} .

Audits Report on SDG 7:

The Performance Audit on the Renewable Energy Sector in India (2015), conducted by the CAG of India, examined efforts to increase renewable energy's share in the national energy mix to support sustainable development and climate goals. The audit focused on improving electricity access in remote areas, promoting research, design, development, and demonstration (RDD&D), and strengthening institutional capacity and monitoring systems. It revealed major gaps in planning, governance, and implementation. Weak monitoring led to delays, incomplete projects, and poor evaluation. Overambitious RDD&D projects underperformed due to weak feasibility studies, limited skilled manpower, poor accountability, and inadequate data reporting. The audit recommended stronger monitoring, capacity building, performance-linked funding, and enhanced transparency¹⁹.

Conclusion:

India's progress on SDG 7 shows that clean, affordable and reliable energy can advance development while supporting climate goals. Through large-scale electrification, near-universal LPG access, rapid growth in renewable energy and green hydrogen, and strong pushes on efficiency, India is steadily greening its energy system. These efforts reduce emissions, improve health, create jobs and strengthen energy security, while supporting multiple SDGs beyond energy alone. However, the audit insights underline that timely implementation, adequate finance, robust monitoring and inclusive policies remain critical to close remaining gaps and ensure that the energy transition is just, resilient and sustainable for all by 2030.

¹⁶ [NATIONAL MISSION ON ENHANCED ENERGY EFFICIENCY](#)

¹⁷ [Roadmap of Sustainable and Holistic Approach to National Energy Efficiency \(ROSHANEE\)](#)

¹⁸ [Impact of Energy Efficiency Measures for the year 2021-22](#)

¹⁹ [Report No. 34 of 2015](#)

Use of AI/ML in Environment Audit

By: Shri Ajay Babu Meena, AAO

India, and indeed the world, stands at a precipice where environmental accountability is no longer a luxury but a necessity. As Supreme Audit Institutions (SAIs) and environmental auditors strive to ensure that governments and corporations adhere to sustainability commitments, the volume and complexity of data have exploded. Traditional audit methods, often reliant on sample-based testing and manual verification, are finding it increasingly difficult to keep pace with the scale of environmental degradation and the vast datasets generated by climate monitoring systems. Enter Artificial Intelligence (AI) and Machine Learning (ML). These technologies are not just buzzwords; they are transformative tools that are redefining how we approach environmental assurance. From predicting deforestation patterns to automatically extracting data from thousands of compliance reports, AI is empowering auditors to see the "bigger picture" with unprecedented clarity.

Artificial Intelligence in Auditing

Supervised, Unsupervised, and Reinforcement Learning

At the core of AI are three learning paradigms. *Supervised Learning* is like teaching a student with an answer key. In environmental audit, we feed the model historical data on industrial emissions labelled as "compliant" or "non-compliant." The model learns the patterns and can then classify new data with high accuracy. *Unsupervised Learning*, on the other hand, deals with the unknown. It explores data without labels to find hidden structures. For

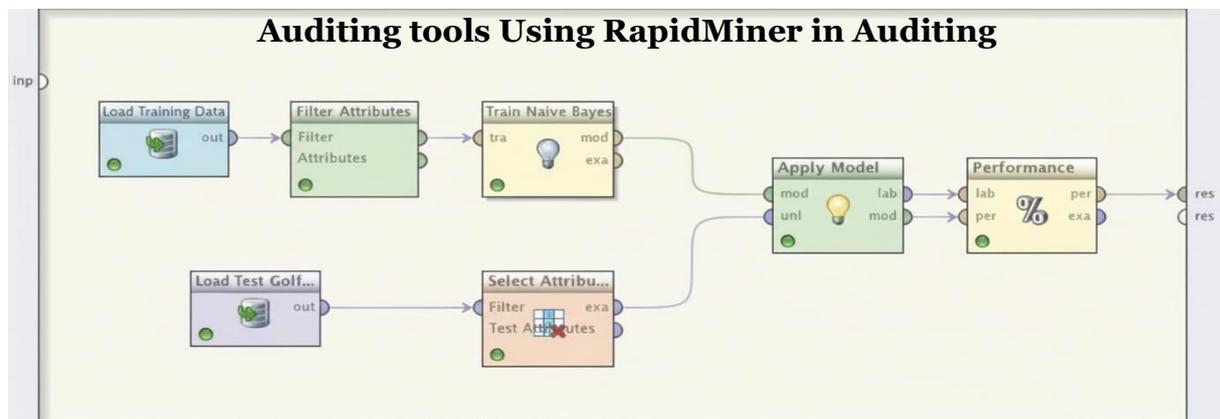
example, it could be used to cluster regional pollution data, potentially discovering a previously unknown hotspot of contamination that needs further investigation. *Reinforcement Learning* works on a reward-based system. Although, currently in experimental phase, it holds promise for optimizing resource allocation—teaching a system to "learn" the most efficient route for deploying physical inspection teams to high-risk environmental sites.¹

Generative, Predictive, and Prescriptive AI

Predictive AI is perhaps the most immediately useful for auditors. It forecasts future outcomes based on historical data. For example, predicting the likelihood of a specific region failing to meet its carbon reduction targets by a particular year allows auditors to raise red flags today, rather than waiting for the failure to occur. Prescriptive AI goes a step further by suggesting actions. If a Predictive model warns of a water shortage, a Prescriptive model will simulate various policy interventions to recommend the most effective conservation strategy. Generative AI creates new content. In auditing, it will help in drafting preliminary audit findings, summarizing vast technical reports, or generating code to analyze complex datasets, significantly reducing the administrative burden on human auditors.²

¹ [Machine Learning Application for SAIs](#)

² <https://www.gao.gov/products/gao-25-107172>



Source: AI Generated Rapid Miner Workflow Process

RapidMiner does data analytics by offering a visual, "no-code" or "low-code" platform. For auditing purposes, RapidMiner is invaluable for data preparation—cleaning, joining, and transforming messy data from multiple sources like satellite feeds, PDF reports, and Excel spreadsheets. Its drag-and-drop interface allows to build repeatable workflows. Once a model is created, it can be saved and reused in future audits, ensuring consistency. Furthermore, RapidMiner supports "audit readiness" by creating transparent documentation of how data was processed. This is crucial for auditing, as the audit process itself must be auditable. The platform's ability to handle large datasets allows for complete data testing rather than sampling, increasing the assurance level of the audit.¹

Using Anaconda in Auditing

Anaconda is an open-source distribution that simplifies package management and deployment. In environmental audit, security and governance of data is paramount. Random code libraries from the internet cannot be used to analyze government data. Anaconda provides a secure environment where one can access thousands of vetted data science packages. It enables the use of advanced libraries for geospatial analysis (like Geopandas) or time-series forecasting. By using Anaconda, audit teams can ensure

"reproducibility", i.e., one can run the exact same code in the same environment and get the same result.

Use of Natural Language Processing (NLP) for Sustainability Audit

Natural Language Processing (NLP) gives computers the ability to read and understand human language. In sustainability audits, vast amounts of unstructured data such as annual ESG (Environmental, Social, and Governance) reports, news articles, and board meeting minutes must be reviewed. NLP can automate this review. For instance, Audit can use NLP to scan thousands of corporate compliance reports to identify specific "risk words" or clauses related to environmental liability. A practical application involves analyzing regulatory documents. NLP tools can rapidly scan complex texts, such as environmental directives or Central/State pollution control laws, to extract key compliance requirements, deadlines, and penalties. This allows auditors to quickly build a checklist of what should be happening, against which the auditee can be measured.²

Use of LLMs for Data Extraction

Large Language Models (LLMs) have shown remarkable capability in "Information Extraction." A persistent challenge in auditing is that fiscal and environmental data is often

¹ [Artificial Intelligence Generative AI's Environmental and Human Effects](#)

² [Natural Language Processing \(NLP\)](#)

locked in PDF format, scanned images of tables that traditional software cannot read. LLMs can accurately extract structured data from these multi-page documents. LLMs could read complex, hierarchical tables in PDFs and convert them into research-ready databases. For example, an LLM could ingest a 500-page PDF report on river water quality and instantly extract every test result into a clean Excel sheet, flagging any value that exceeds the permissible limit. This reduces weeks of manual data entry into minutes of automated processing.³

Advanced Modelling Techniques

Regression and Classification Models

Regression models are used to predict a continuous value. For example, In an air pollution audit, a regression model might predict the expected level of particulate matter (PM2.5) in the air based on industrial activity levels and weather conditions. If the *actual* measured pollution is significantly higher than the *predicted* value, it suggests an anomaly—perhaps an illegal emission or a malfunctioning sensor, that may be investigated.

Classification models, largely similar with Supervised Learning, predict a category. A "Binary Classification" model answers yes/no questions such as, "Is this facility compliant?" A "Multi-class Classification" model might categorize satellite images of land cover into "Forest," "Urban," or "Water Body" to track urbanization encroaching on protected areas. By applying these models to the entire dataset rather than a sample, audit can identify exceptions with far greater precision.⁴

Audit Reports on AI and Environment

GAO Report on Generative AI: The U.S. Government Accountability Office (GAO) recently released a report (GAO-25-107172) highlighting the dual nature of AI. While AI aids in efficiency, the technology itself has an environmental cost. The report noted that Generative AI models consume significant energy and water for cooling data centers. The audit found that Companies are generally not reporting the details of these resource uses, creating a "black box" of environmental impact. The audit suggested improved data collection and reporting standards so that the environmental cost of using AI does not outweigh its benefits.⁵

Conclusion

The integration of AI and ML into environmental auditing represents a paradigm shift. Technologies like **RapidMiner** and **Anaconda** are making data science accessible and secure for auditors. **Natural Language Processing** and **Large Language Models** are unlocking the vast amount of information hidden in text documents, while **Regression** and **classification models** are allowing us to predict risks. However, we must remain vigilant as the tools we use to protect the environment must not themselves become a burden on it. For India, with its ambitious renewable energy goals and vast environmental diversity, the adoption of these technologies is not just an option—it is the way forward. By embracing these tools, audit can ensure that the "Green Future" we are building is based on data we can trust.

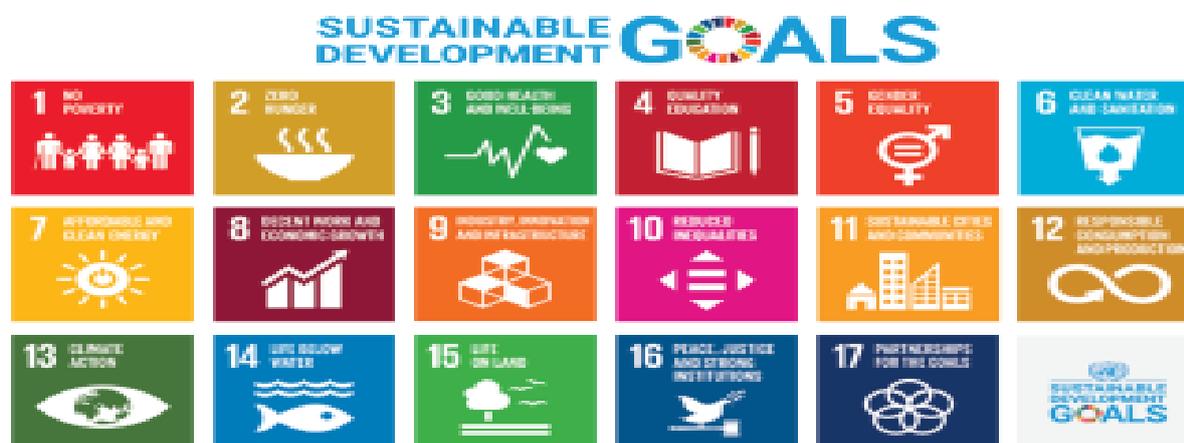
³ [Artificial Indulgence Strategy \(SAI Of India\)](#)

⁴ [Classification and regression overview](#)

⁵ [Artificial Intelligence: Generative AI's Environmental and Human Effects](#)

National Progress and State-Level Initiatives in the Field of SDGs: An Indian Perspective

By: Shri Rohan Sharma, AAO



Introduction

India's commitment to achieving the Sustainable Development Goals (SDGs) is reflected in a structured national framework led by the **NITI Aayog**, backed by flagship welfare missions and strengthened by state-level localisation efforts. With the launch of the **SDG India Index**, India has institutionalised continuous monitoring of progress across States and Union Territories. National flagship schemes—focused on water, sanitation, housing, clean energy, and poverty reduction—serve as major accelerators for achieving SDG targets¹.

The 2023–24 SDG Index highlights notable gains under **SDG 6 (Clean Water and Sanitation)** driven by the **Jal Jeevan Mission** and **Swachh Bharat Mission (Phase II)**, while **SDG 7 (Affordable and Clean Energy)** outcomes are reinforced through the **National Solar Mission**, **PM Ujjwala Yojana**, and energy efficiency

programmes under **NMEEE**. Urban sustainability outcomes under **SDG 11** have benefited from convergence between the **National Mission on Sustainable Habitat**, **PMAY (Urban)**, and **AMRUT**.

At the sub-national level, states such as **Kerala, Maharashtra, Rajasthan, and Uttar Pradesh** demonstrate varied but improving performance, underscoring the importance of SDG localisation, decentralised planning, and context-specific interventions.

Despite progress, the Index draws attention to persistent inter-State disparities, sustainability of infrastructure assets, and the need for granular district-level data. Strengthening convergence between SDGs and NAPCC missions, ensuring operation and maintenance of assets, and enhancing community ownership emerge as key priorities.

¹ [SDG India Index 2023-24](#)

National Progress on SDGs

Institutional Framework for SDG Monitoring

The **SDG India Index (2018–2024)** developed by NITI Aayog tracks progress on **113 indicators across 16 SDGs**, enabling evidence-based planning by States/UTs.

The **2023–24 edition** highlights continued national progress, with improvements recorded in areas such as poverty reduction, access to sanitation, drinking water, affordable housing, and clean energy².

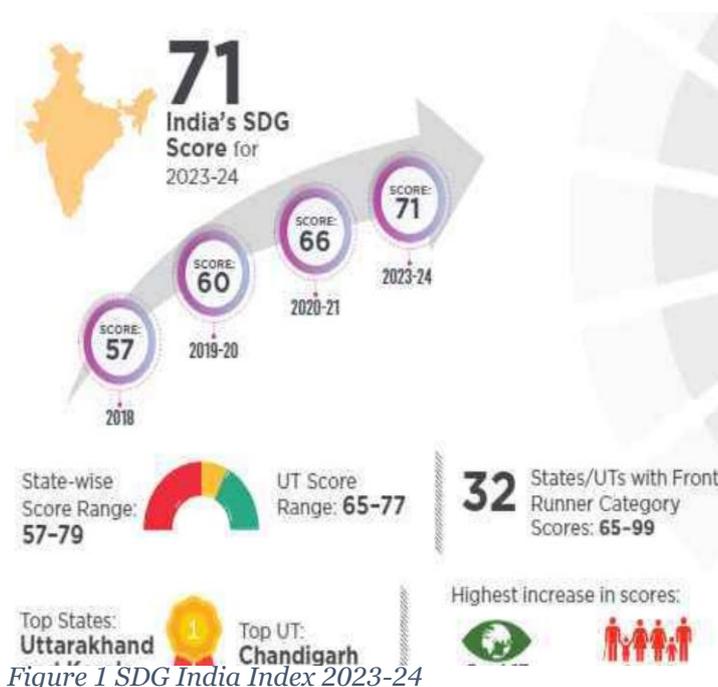


Figure 1 SDG India Index 2023-24

NAPCC Mission	Linked SDGs	Key Policies / Schemes
National Solar Mission	SDG 7, 13	Solar Parks, Rooftop Solar, PM-KUSUM
National Water Mission	SDG 6	Jal Jeevan Mission, Atal Bhujal Yojana
National Mission on Sustainable Habitat	SDG 11, 6	SBM (Urban), AMRUT, PMAY
National Mission for Sustainable Agriculture	SDG 2, 13	PMFBY, Soil Health Card, Micro-irrigation
National Mission for a Green India	SDG 15	CAMPA, Afforestation Programmes
National Mission on Enhanced Energy Efficiency (NMEEE)	SDG 7, 12	PAT Scheme, UJALA LEDs
National Mission for Sustaining the Himalayan Eco-system	SDG 13, 15	Climate adaptation & biodiversity projects
National Mission on Strategic Knowledge for Climate Change	SDG 17	Climate data systems & research

Source: [Climate Change Programme \(Ministry of Science and Technology\)](#)

² [SDG India Index 2023-24](#)



Figure 2 SDG Goal Wise Performance (Source: *SDG India Index 2023-24*)

State-Level Initiatives and SDG Localisation

India has consciously embedded the Sustainable Development Goals into its core development framework, treating them not as a parallel agenda but as an integral part of national planning. The Indian approach to SDG localisation rests on four pillars: **institutional ownership, competitive and cooperative federalism, capacity building, and a whole-of-society approach**. As primary responsibility for most SDG-related sectors lies with subnational governments—and given their significant share in public expenditure—the **States and Union Territories play a central role** in advancing the SDG agenda. This model highlights both achievements and challenges,

offering key insights for accelerating SDG implementation at the sub-national level¹.

Maharashtra – Water Conservation through Jalyukt Shivar Abhiyan



Figure 3 *Jalyukt Shivar Abhiyaan*

- The project adopts a watershed-based approach involving deepening and widening of streams, treatment of nullahs, construction of cement and earthen stop dams, and excavation of farm ponds, supported by a mobile application developed by the Maharashtra Remote Sensing Applications Centre (MRSAC) for mapping and monitoring intervention sites.

¹ <https://www.undp.org/india/publications/institutionalising-sdg-localization-multi-level-governance->

[settings-lessons-india#:~:text=March%202024,at%20the%20sub%20national%20level.](https://www.undp.org/india/publications/institutionalising-sdg-localization-multi-level-governance-#text=March%202024,at%20the%20sub%20national%20level.)

- These interventions enhance drought resilience and agricultural productivity in rural areas, with the initiative aiming to make around 5,000 villages water-scarcity free each year².

Kerala – SDG Localisation through Decentralised Governance & Social Development

Extreme Poverty Eradication Programme (EPEP)

(SDG 1, SDG 10)

- The programme identifies extremely poor households through a multi-dimensional deprivation framework and provides customised support including housing, health care, livelihood assistance, and access to government entitlements, implemented through Local Self-Government Institutions (LSGIs)³.
- The initiative strengthens social protection systems and has contributed to Kerala’s consistently high performance in poverty, inequality, health, and education indicators under the SDG India Index.

Integrated Local Governance Model

(SDG 3, SDG 4, SDG 6, SDG 11)

- Kerala integrates SDGs into local planning through empowered Panchayats and Urban Local Bodies, supported by capacity building from the Kerala Institute of Local Administration (KILA) and SDG dashboards for monitoring outcomes⁴.

- This decentralised, outcome-oriented governance model ensures high service coverage, sustainability of assets, and strong performance across multiple SDGs.

What can be done to strengthen India’s SDG Outcomes

a. Enhance Localisation of SDGs

Promote district-level monitoring dashboards, aligning with NITI Aayog’s localisation framework.

b. Strengthen Operation and Maintenance Financing

Especially in water supply, sanitation systems, and public housing.

c. Promote Cross-Sector Convergence

Integrate water, sanitation, housing, health, livelihood, and environmental interventions for holistic impact.

d. Prioritise Lagging States and Districts

Use SDG Index findings to channel resources and technical support strategically.

e. Build Community-Led Mechanisms

Involve Panchayati Raj Institutions, SHGs, youth groups, and CSOs for sustained behavioural change.

Conclusion

India’s progress towards the Sustainable Development Goals, as reflected in the SDG India Index 2023–24, demonstrates the effectiveness of a coordinated national

² [Jalyukt Shivar Abhiyaan](#)

³ [Extreme Poverty Alleviation Project \(EPEP\)](#)

⁴ [Localizing SDGs in Kerala](#)

framework complemented by strong State-level initiatives. National flagship schemes aligned with the National Action Plan on Climate Change have driven improvements in critical areas such as water, sanitation, clean energy, housing, and urban sustainability. At the State level, initiatives such as **Kerala's decentralised governance and Extreme Poverty Eradication Programme** illustrate how strong institutional capacity and SDG localisation can deliver sustained human development outcomes, while **Maharashtra's Jalyukt Shivar Abhiyan**

highlights the role of scientific planning and community participation in enhancing water security and climate resilience. Together, these examples underscore that achieving the SDGs in India requires not only national policy direction but also context-specific State innovations, effective convergence, and sustained focus on asset sustainability and community ownership as the country advances towards the 2030 Agenda.



A **Circular Economy** is a production and consumption model that minimises waste by reusing, recycling, and regenerating materials, thereby reducing pressure on natural resources.



DID YOU KNOW?

Sustainability Reporting

“Sustainability Reporting is not merely a corporate compliance exercise; it is a global accountability mechanism that makes every individual, producer, consumer, institution, and citizen, responsible for the sustainability of human life on Earth. From the producer who must disclose the environmental and social implications of their processes, and consumers consciously support sustainable practices. Sustainability reporting creates a shared chain of responsibility, it transforms sustainability from an abstract ideal into a measurable, reportable, and participatory duty of humanity.”

– **By: Shri Rahul Yadav, AAO**

The Evolution of Sustainability Reporting: From Forests to Financials¹

The intellectual foundations of Sustainability Reporting stretch across three centuries of human inquiry into its relationship with nature and how societies can thrive without exhausting the very systems that support them. In 1713, **Hans Carl von Carlowitz**, responding to a crisis of timber shortages in Saxony, wrote *Sylvicultura Oeconomica*, calling for the careful, regenerative use of forests. His work introduced the concept of “*Nachhaltigkeit*” (sustainability), the idea that natural resources must be used in a way that doesn’t compromise their availability for future generations. It linked economic activity with ecological stewardship, predating modern sustainability discourse by centuries.

Over the centuries, this seed grew through milestones such as **Rachel Carson’s Silent Spring** (1962), which awakened the world to environmental harm; the **Limits to Growth** report (1972), which challenged the illusion of infinite resources; and the **Brundtland**

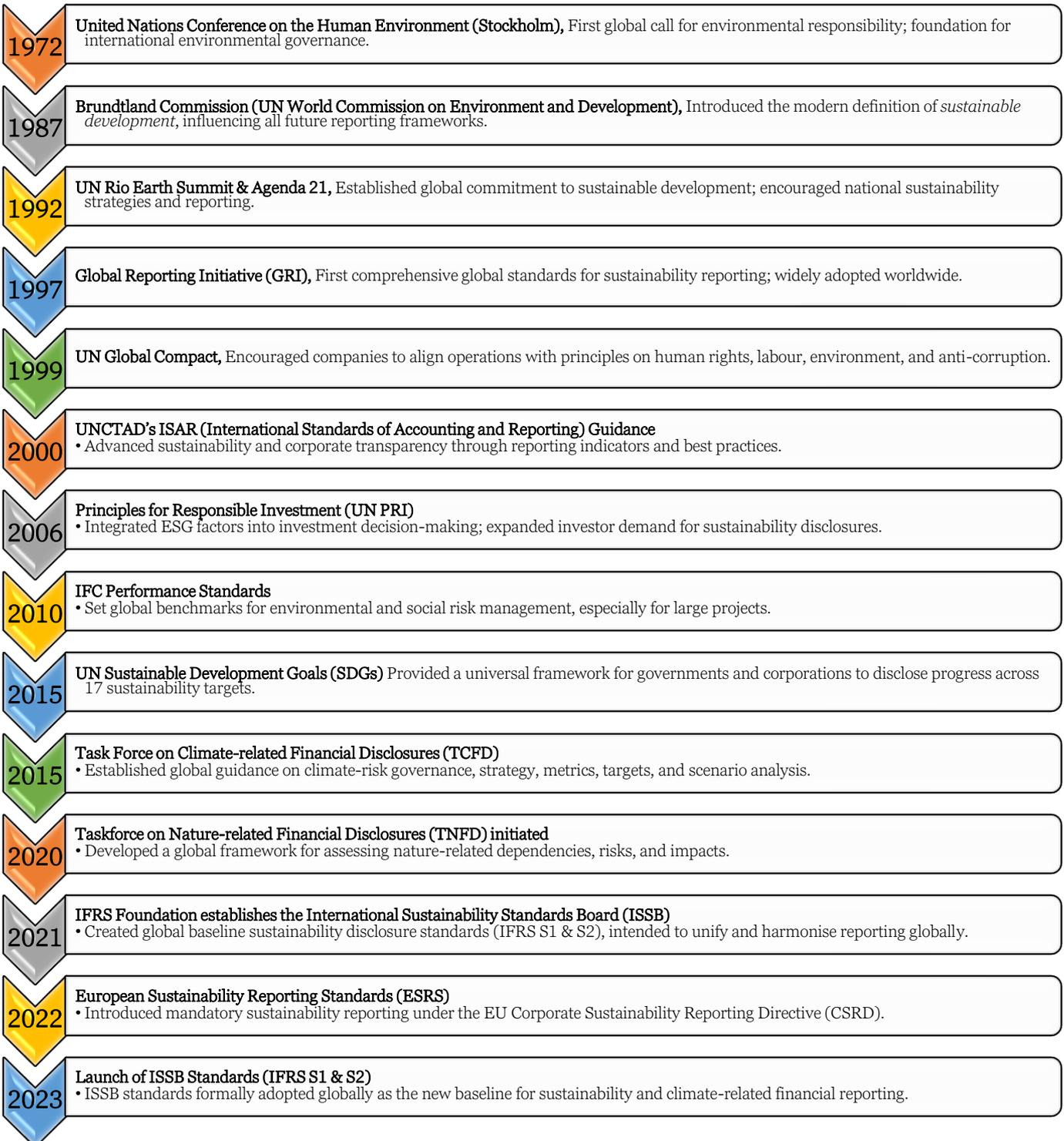
Commission report (1987), which offered the enduring definition of “sustainable development.”



¹ [Sylvicultura Oeconomica](#)

Over time, concerns once confined to scientists, ecologists, and policymakers have become central to everyday life. Climate change, pollution, inequality, and corporate responsibility now shape public debate and personal choices alike. It is in this evolving context that sustainability reporting has emerged: a structured, globally accepted way for institutions to disclose their

environmental, social, and governance performance with clarity and accountability. Far more than a compliance exercise, it invites citizens, investors, and governments to see how today's actions align with the long-term well-being of people and the planet, making sustainability not just a policy goal, but a shared societal journey.



Global Frameworks Shaping Sustainability Disclosure

Several international institutions have developed harmonized reporting frameworks:

- **¹GRI (1997):** Comprehensive ESG disclosure standards. 
- **²IFRS-ISSB (2021–23):** IFRS S1 (general sustainability) and S2 (climate disclosures), absorbing TCFD recommendations.
- **TCFD & TNFD:** Frameworks for climate and nature-related risk disclosures. 
- **UN Global Compact, ISAR, SDGs:** UN bodies defining principles and benchmarks. 
- **OECD, World Bank, IFC:** Sectoral and governance performance standards

The Global Reporting Initiative (GRI), established in 1997, created the first comprehensive global framework for environmental, social and governance disclosures. The United Nations, through initiatives such as the UN Global Compact, UNCTAD's ISAR, and the Sustainable Development Goals (SDGs), has provided normative guidance and performance benchmarks for responsible and transparent reporting. In the financial domain, bodies such as the IFRS Foundation's International Sustainability Standards Board (ISSB), the



Task Force on Climate-related Financial Disclosures (TCFD), and the Taskforce on Nature-related Financial Disclosures (TNFD) have developed globally recognised frameworks for climate and nature-related risk reporting.

Additionally, the OECD, World Bank Group, and International Finance Corporation (IFC) have contributed sectoral guidelines, governance principles, and ESG performance standards. Together, these institutions have established a harmonised ecosystem of sustainability reporting norms that guide governments, corporations and public institutions in disclosing their sustainability performance in a credible and comparable manner.

India's Sustainability Architecture: From Environment to Accountability

India's evolution in Sustainability Reporting and ESG disclosure reflects a gradual but deliberate shift from environmental regulation to an integrated model of sustainability governance. The trajectory begins with the Environment (Protection) Act of 1986, enacted in response to industrial risk and environmental vulnerability, which provided a comprehensive statutory foundation for environmental oversight. The subsequent EIA Notifications of 1994 and 2006 institutionalised systematic processes

¹ <https://www.globalreporting.org/>

² [IFRS](#)

for environmental appraisal, public participation, and post-clearance monitoring, thereby introducing early mechanisms for structured environmental documentation and accountability. These regulatory developments marked the emergence of formalised environmental reporting practices in India and laid the groundwork for more holistic sustainability frameworks.



A major conceptual broadening occurred in the following decade as India recognised that sustainability extends beyond ecological parameters to encompass social responsibility, ethical governance, and long-term economic resilience. The National Voluntary Guidelines (2011) articulated India’s first normative framework for responsible business conduct, signalling a policy shift toward integrated sustainability management. Drawing from these principles, SEBI introduced Business Responsibility Reporting (BRR) for top-listed entities, embedding ESG considerations into corporate transparency norms. This period also witnessed the transformative Companies Act, 2013, which mandated CSR spending and reporting, positioning India as a pioneer in legislated social responsibility and signalling an expansion of the sustainability agenda into corporate governance and socio-economic development³.

Year	Milestone	Description
1986	Environment Protection Act	Legal foundation for environmental regulation.
1994 & 2006	EIA Notifications	Structured public participation and environmental assessment.
2011	National Voluntary Guidelines (NVG)	First ESG principles for business.
2012	BRR by SEBI	ESG reporting for top listed firms.
2013	Companies Act	Mandated CSR spending and disclosure.
2021	BRSR	Comprehensive ESG performance report.
2023	BRSR Core with Assurance	Mandatory ESG assurance framework for top 150 firms.
2023	RBI ESG Governance Guidelines	Climate and ESG integration in financial institutions.
2022	Sovereign Green Bond Framework	Climate finance reporting in public debt instruments.

The decade since 2015 marks the consolidation of sustainability reporting into

³ [SEBI: May 10, 2021: Business responsibility and sustainability reporting by listed entities](#)

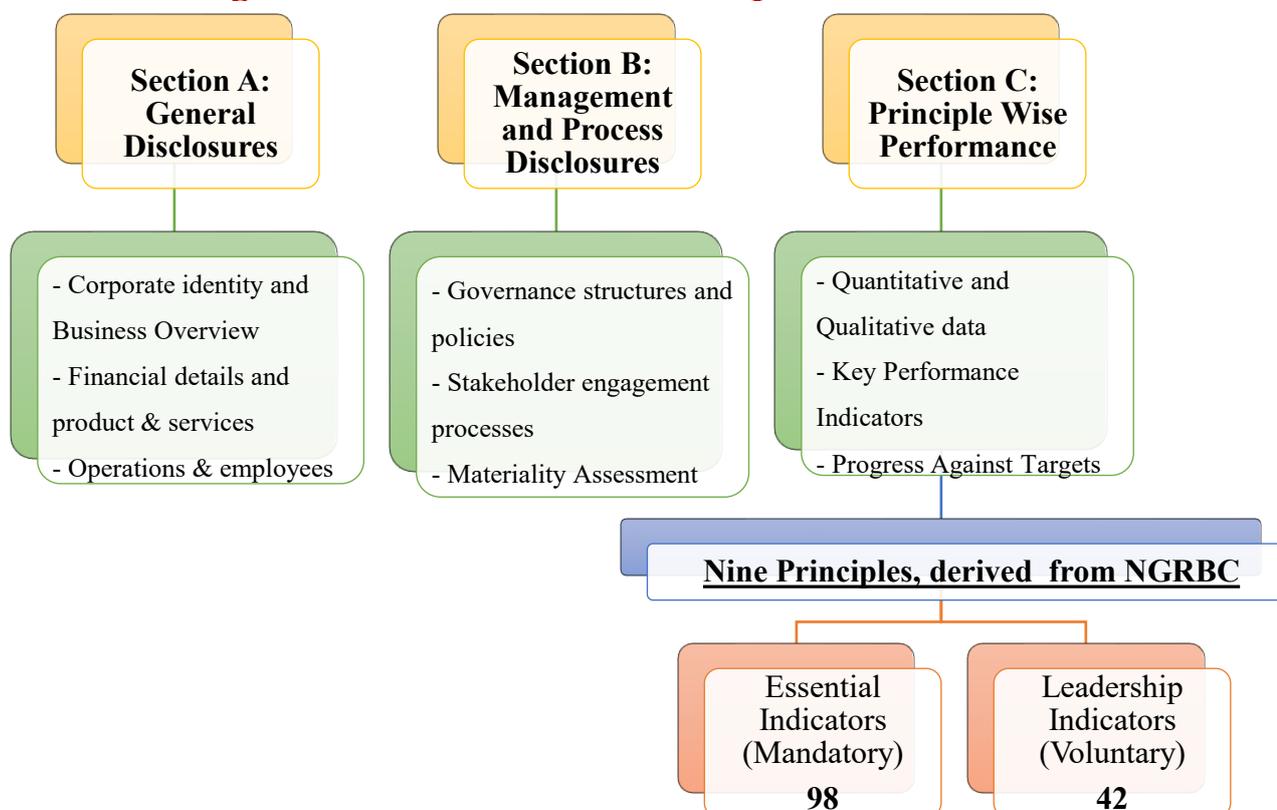
a coherent national architecture aligned with global norms. The introduction of the Business Responsibility and Sustainability Report (BRSR) in 2021, followed by the BRSR Core with mandatory assurance in 2023, elevated sustainability reporting from voluntary narrative disclosures to structured, measurable, and independently verifiable ESG performance indicators⁴.

Parallel developments, the Sovereign Green Bond Framework and the RBI's climate-risk and ESG governance guidelines, have mainstreamed sustainability considerations within public finance and the financial sector. With ongoing convergence toward ISSB's IFRS S1 and S2 standards, India's sustainability reporting regime now reflects a sophisticated, multi-dimensional gove

rnance framework that integrates environmental protection, social performance, corporate responsibility, and financial stability. This progression underscores India's transition from compliance-driven environmental management to a research-informed, globally relevant ESG disclosure ecosystem.

The CAG audit assessed India's preparedness to implement the 2030 Agenda and SDGs, noting institutional arrangements by NITI Aayog and MoSPI, development of SDG India Index/National Indicator Framework, but highlighted gaps in roadmap, resource planning, data availability, monitoring frameworks, and integration of SDGs into budgeting and governance⁵.

Figure: Structure & disclosure requirements in BRSR



⁴ [SEBI: July 12, 2023: BRSR Core – Framework for assurance and ESG disclosures for value chain](#)

⁵ [CAG Report No 8 of 2019: Preparedness for the implementation of SDGs](#)

To institutionalize sustainability governance:

- **SAIs** must develop audit protocols for ESG frameworks.
- **Public finance systems** must integrate climate tagging and expenditure tracking.
- **Data governance** must evolve with interoperable, disaggregated, verifiable MRV systems.
- **Capacity building**, including for line ministries, PSUs, and auditors, must align with SDG-linked planning.

Public audits, when systemically linked to SDG progress, become strategic instruments of adaptive governance and fiscal accountability in the Anthropocene.

Role of Civil Society in Sustainability Reporting, and Trust

Public participation governance aims to systematically include diverse stakeholders, including non-experts and civil society, in the decision-making processes of decentralized systems or corporate sustainability initiatives. This strategy seeks to broaden legitimacy,

ensure decisions reflect wider societal values, and prevent outcomes that disproportionately affect marginalized groups. The central goal is to democratize decision power and improve accountability

Civil society plays a critical role in strengthening the credibility and legitimacy of sustainability reporting. International frameworks such as the **Global Reporting Initiative (GRI)** recognise civil society as a key stakeholder in determining material environmental and social impacts. Through independent scrutiny, research, advocacy, and public engagement, civil society helps verify disclosures, counter greenwashing, and align reported commitments with ground realities.

The **Organisation for Economic Co-operation and Development (OECD)** and the **United Nations** emphasise participatory accountability as essential for trustworthy ESG governance. By amplifying community perspectives and reinforcing transparency, civil society enhances trust and ensures sustainability reporting serves broader sustainable development objectives.



ESG is a framework used to evaluate an organisation's performance on environmental protection, social responsibility, and quality of governance.



DID YOU KNOW?

Auditing the Implementation of Island Coastal Regulation Zone (ICRZ) Plan and Integrated Island Management (IIM) Plan: A Strategic Framework for Effective Environmental Audit

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Abstract

The Island Coastal Regulation Zone (ICRZ) Notification 2019 and Integrated Island Management (IIM) Plans embody India's strategy for harmonizing sustainable development with the conservation of delicate island ecosystems in territories such as Andaman & Nicobar and Lakshadweep. This research paper delineates a strategic audit framework crafted by the Comptroller and Auditor General of India (CAG) to scrutinize the implementation efficacy of these mechanisms. Leveraging CAG's institutional expertise, best practices from international Supreme Audit Institutions (SAIs), and cutting-edge geospatial audit techniques, the framework tackles the distinctive challenges of auditing island coastal ecosystems. It incorporates risk-based evaluations, participatory methodologies, and scientific analyses to align with Sustainable Development Goal 14 (Life Below Water). Updated with recent policy developments as of 2025, including amendments to ICRZ and the White Paper on Blue Economy (2024), the framework offers actionable insights for bolstering environmental governance, ensuring regulatory compliance, and fostering resilient island communities.

Introduction

India's island territories, encompassing the Andaman & Nicobar Islands and Lakshadweep, represent unique ecosystems of extraordinary biodiversity and strategic



importance. The Island Coastal Regulation Zone (ICRZ) **Notification** 2019, which superseded the Island Protection Zone 2011, established a comprehensive regulatory framework designed to conserve and protect these unique coastal environments while ensuring livelihood security for fisher communities and promoting sustainable development.

The notification mandates preparation of Island Coastal Regulation Zone Plans for larger islands and Integrated Island Management Plans for smaller islands, creating a tiered approach to coastal governance. This regulatory evolution reflects India's commitment to achieving Sustainable Development Goal 14 (Life Below Water) and aligning with global best practices in integrated coastal zone management.

As the Supreme Audit Institution of India, the CAG has a constitutional mandate to audit government programs and policies, including environmental governance frameworks. This paper presents a comprehensive audit approach developed to evaluate the

implementation effectiveness of ICRZ and IIM plans, building upon lessons learned from previous CAG environmental audits and international SAI experiences.

Background and Legal Framework

Evolution from IPZ 2011 to ICRZ 2019: Key Regulatory Changes

The transition from the Island Protection Zone (IPZ) Notification 2011 to the Island Coastal Regulation Zone (ICRZ) Notification 2019 marks a pivotal shift in India's approach to island ecosystem management. Drawing on eight years of implementation experience under IPZ 2011, the ICRZ 2019 introduces more flexible and development-oriented regulations while maintaining conservation priorities. A primary change is the substantial reduction in the No Development Zone (NDZ), from 200 meters from the High Tide Line (HTL) under IPZ to 20 meters under ICRZ, aligning island norms with mainland coastal regulations. This 90% reduction expands development opportunities but necessitates stronger monitoring to prevent ecological degradation. Recent scholarship has highlighted that while India's coastal regulations have become more flexible, governance capacity to monitor and enforce them remains uneven (Banerjee & Choudhury, 2022).

Furthermore, ICRZ 2019 adopts a tiered classification based on island size, unlike the uniform framework of IPZ 2011. Large islands exceeding 1,000 square kilometers and medium islands between 100 and 1,000 square kilometers require detailed ICRZ Plans, while small islands under 100 square kilometers mandate IIM Plans. Development permissions have been liberalized, permitting eco-tourism projects from 20 meters HTL in designated smaller islands and allowing road construction in eco-sensitive zones, which was

previously restricted to pipelines and transmission lines. The framework also integrates disaster management, emphasizing resilient infrastructure against tsunamis and cyclones, and includes provisions to protect tribal communities' traditional rights and cultural heritage.

Incorporating scientific projections for climate change, ICRZ 2019 establishes dynamic setback lines to address sea-level rise and erosion, moving beyond IPZ's static buffers. Streamlined clearance processes and clearer institutional roles address past implementation hurdles. Recent amendments, such as S.O. 5494(E) dated 24 November 2022, permit the temporary use of 2011 Coastal Zone Management Plans (CZMPs) until new ICRZ maps are finalized, mitigating delays in plan approval. Table below summarizes these changes.

Evolution: IPZ 2011 vs ICRZ 2019

Aspect	IPZ 2011	ICRZ 2019	Impact
No Development Zone	200m from HTL	20m from HTL	90% reduction - Higher risk, more development
Classification	Uniform approach	Tiered by island size	Customized governance
Development Permits	Highly restricted	Liberalized for tourism/roads	Economic boost with safeguards
Tribal Provisions	General protection	Specific livelihood safeguards	Enhanced equity and cultural rights
Climate Integration	Static buffers	Dynamic setbacks	Adaptive to climate change

Applicability Framework

The ICRZ framework applies to different island categories:

Andaman & Nicobar Islands:

- Group I (>1000 sq. km): North, Middle, South Andaman, Great Nicobar - ICRZ Plan required

- Group II (100-1000 sq. km): Havelock, Baratang, Little Andaman, Car Nicobar - ICRZ Plan required
- Small islands (<100 sq. km): Hundreds of minor islands - IIM Plan required

Lakshadweep Islands:

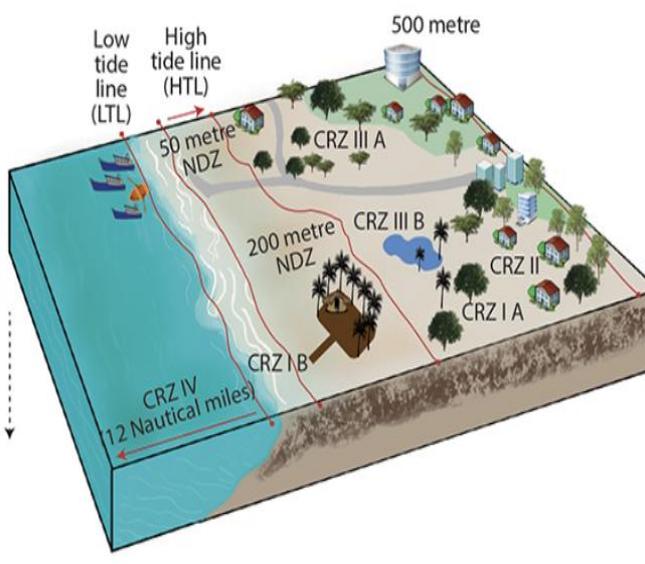
- All 36 islands are <100 sq. km - IIM Plan applies to each island

As of 2025, updates include approved ICRZ Plans for 9 Andaman islands, with ongoing revisions for others.



ICRZ Zoning System

The notification establishes four distinct zones as shown below.



ICRZ Zone Classification

ICRZ-I: Ecologically Sensitive Areas



IA: Mangroves, coral reefs, turtle nesting sites, biosphere reserves
IB: Area between Low Tide Line and High Tide Line
No development permitted - MoEF&CC oversight

ICRZ-II: Already Developed Areas



Areas with existing development along the coast and built-up areas
Regulated development permitted - State authority oversight

ICRZ-III: Relatively Undeveloped Areas



Rural and urban areas not substantially developed
20m NDZ from HTL (reduced from 200m in IPZ 2011)
Special relaxations for small islands - State authority oversight

ICRZ-IV: Water Areas (Andaman & Nicobar/Lakshadweep)



Up to 12 nautical miles including tidal water bodies
Regulated fishing, discharge, and dredging activities - MoEF&CC oversight

Literature Review: CAG Reports and International SAI Experiences

Previous CAG Environmental Audits

CAG's prior audits provide critical insights into coastal governance challenges. The Performance Audit on Conservation of Coastal Ecosystems (Report No. 4 of 2022) examined projects across states and found non-compliance in 18 cases, where proponents ignored clearance conditions and failed to submit compliance reports. The National Coastal Zone Management Authority (NCZMA) operates ad-hoc, affecting consistency, while several State Coastal Zone Management Authorities (SCZMAs) face delays or non-constitution. Environmental Impact Assessments (EIAs) were often inadequate, and monitoring of coastal

resources was insufficient due to manpower shortages. Large-scale violations were noted, highlighting enforcement gaps.

Subsequent audits, such as the Gujarat Performance Audit on Conservation and Management of Coastal Ecosystems (2023), reinforced these findings, identifying similar issues in project approvals and habitat protection. The Tamil Nadu audit (covering 2015-2022) revealed that 114 of 175 projects were approved despite lapses, underscoring the need for strengthened institutional mechanisms.

International SAI Best Practices

The INTOSAI Working Group on Environmental Auditing (WGEA) promotes integrated audits focusing on outcomes, stakeholder engagement, and technology use. SAIs in Pacific Island nations emphasize incorporating traditional knowledge and climate adaptation in coastal management. For example, the Philippines and Indonesia audits stress community-based monitoring. Specific models include the Pacific Ridge-to-Reef approach for watershed-marine integration, Maldives natural solutions like mangrove restoration with 30m NDZ, and Seychelles Blue Economy, which expanded marine protected areas by 30% while enhancing economic growth. Regional studies confirm that weak inter-agency coordination and insufficient community integration are systemic across South Asian coastal governance frameworks (Mukherjee & Shaw, 2021).

National Policy Framework and Guidelines

National policies serve as benchmarks for ICRZ audits. Approved IIM Plans provide measurable indicators for ecosystem health and community participation. The National

Coastal Mission Guidelines ensure procedural compliance and inter-agency coordination. The White Paper on Transforming India's Blue Economy (MoES, 2024) outlines a roadmap for sustainable ocean resource utilization, targeting sectors like fisheries and tourism, with projections for INR 5 lakh crore GDP contribution by 2035. The National Strategy for Sustainable Tourism (2022) emphasizes carrying capacity assessments for island ecotourism. Blue Economy 2.0, announced in the 2024-25 budget, boosts maritime infrastructure. NITI Aayog's "Transforming the Islands through Creativity & Innovation" (2022) advocates innovative governance, while the IPCC 6th Assessment Report (2021) offers climate benchmarks for vulnerability assessments.

Audit Framework and Methodology

Audit Objectives

The audit framework is structured around three primary objectives:

- 1. Implementation Effectiveness:** Evaluate the effectiveness of ICRZ and IIM Plan implementation in protecting island ecosystems while balancing development needs.
- 2. Institutional Mechanisms:** Assess whether institutional mechanisms established for monitoring and enforcement of ICRZ/IIM provisions are adequate, effective, and coordinated.
- 3. Regulatory Compliance:** Examine whether coastal and island management authorities have ensured compliance with ICRZ Notification 2019 provisions.

Innovative Audit Methodologies



1. **Geospatial Analysis:** Utilize advanced satellite imagery and Geographic Information Systems (GIS) mapping to assess changes in coastal land use patterns, verify accurate zone demarcation, and systematically identify unauthorized developments across island territories. This technology-enabled approach allows for comprehensive geographical coverage and provides objective, quantifiable evidence of implementation status over time. High-resolution satellite imagery can detect changes as small as individual structures, enabling precise monitoring of compliance with ICRZ setback requirements. Time-series analysis using multi-temporal satellite data helps track coastal erosion, mangrove cover changes, and development encroachment patterns, providing crucial evidence for audit findings.
2. **Participatory Audit:** Engage local communities, fishing cooperatives, tribal representatives, and civil society organizations through structured focus group discussions, community consultations, and participatory mapping exercises to gather authentic ground-level implementation insights. This methodology ensures audit findings reflect actual community experiences, incorporate traditional ecological knowledge systems, and capture social impacts often missed in conventional

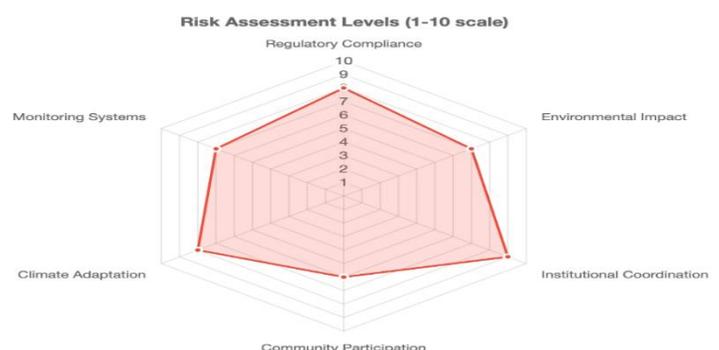
audits. Community scorecards and feedback mechanisms enable systematic documentation of stakeholder perceptions about ICRZ implementation effectiveness, enforcement quality, and livelihood impacts. Participatory approaches also help identify informal governance mechanisms and community-based conservation practices that complement formal regulatory frameworks.

3. **Environmental Impact Assessment and Scientific Analysis:** Conduct comprehensive scientific evaluation of ecological outcomes through systematic analysis of water quality parameters (pH, dissolved oxygen, turbidity, nutrient levels, pollutant concentrations), biodiversity indices (species richness, abundance, endemic species status), and coastal geomorphological changes (erosion rates, sediment deposition, shoreline changes). This scientific approach provides quantitative measures of plan effectiveness in achieving conservation objectives beyond mere regulatory compliance.

Key Risk Factors and Audit Questions

The audit approach integrates risk assessment with strategic questioning to identify areas of highest concern and develop targeted audit procedures. The following risk-based audit framework combines potential problem areas with specific audit questions designed to

Key Risk Assessment Areas



evaluate implementation effectiveness. The Risk score is derived from past audit reports and other research articles which highlighted lapses in implementation of plans.

Regulatory Compliance and Enforcement Risks

Risk Area: Inadequate demarcation and enforcement of ICRZ zone boundaries

Key Audit Questions:

- Have comprehensive ICRZ maps been prepared for all islands with proper scientific assessment using latest survey techniques and stakeholder consultation processes?
- Are ICRZ zone boundaries clearly demarcated on the ground with appropriate signage and community awareness programs?
- What mechanisms exist for regular monitoring and enforcement of zone boundaries, and how effective have they been in preventing violations?

Risk Area: Unauthorized constructions and development in no-development zones

Key Audit Questions:

- What unauthorized constructions have been identified in NDZ areas, and what enforcement actions have been taken against violators?
- Are institutional structures, monitoring systems, and enforcement mechanisms adequate and coordinated for effective ICRZ implementation?
- How do penalty mechanisms and violation response systems compare with the scale and frequency of infractions?

Risk Area: Weak institutional mechanisms and coordination gaps

Key Audit Questions:

- How effectively do NCZMA, SCZMA, and District Level Committees coordinate their roles and responsibilities in ICRZ implementation?
- Are there clear protocols for information sharing, joint monitoring, and coordinated enforcement among different agencies?
- What capacity building measures have been implemented for officials involved in ICRZ administration, and how adequate are current staffing levels?

Environmental Impact and Conservation Effectiveness Risks

Risk Area: Coral reef degradation from tourism and development activities

Key Audit Questions:

- Has implementation resulted in measurable improvements in coastal ecosystem health, particularly coral reef conservation and marine biodiversity protection?
- Are tourism activities and infrastructure development projects adhering to environmental carrying capacity assessments and impact mitigation measures?
- What monitoring systems track ecosystem health indicators, and how do current trends compare with conservation objectives?

Risk Area: Mangrove destruction and coastal habitat loss

Key Audit Questions:

- How effectively are ICRZ-I zones protecting critical habitats like mangroves, turtle nesting sites, and coral reefs from development pressures?

- What restoration and conservation programs have been implemented, and what measurable outcomes have been achieved?
- Are ecosystem services (coastal protection, carbon sequestration, fish nursery functions) being maintained or enhanced through ICRZ implementation?

Risk Area: Climate change adaptation inadequacy. As Singh & Ghosh (2023) demonstrate, India's coastal regulatory framework often underestimates future sea-level rise scenarios, underscoring the need for climate-sensitive audit criteria.

Key Audit Questions:

- Do the plans adequately address climate change vulnerabilities and disaster risks specific to island ecosystems, including sea-level rise projections and extreme weather scenarios?
- Are current setback distances and building restrictions adequate considering latest climate change projections and coastal vulnerability assessments?
- How well integrated are ICRZ provisions with disaster management planning and early warning systems?

Governance and Stakeholder Engagement Risks

Risk Area: Limited community participation and traditional knowledge integration

Key Audit Questions:

- How effectively have local communities, particularly tribal populations and traditional fishing communities, been engaged in ICRZ planning and implementation processes?
- Are traditional ecological knowledge systems and customary resource

management practices being incorporated into formal ICRZ frameworks?

- What livelihood support and alternative income generation programs have been provided to communities affected by ICRZ restrictions, and how successful have these been?

Risk Area: Inadequate monitoring and adaptive management

Key Audit Questions:

- What systematic monitoring and evaluation mechanisms track both environmental and socio-economic outcomes of ICRZ implementation?
- How are lessons learned from implementation experience being incorporated into plan revisions and policy refinements?
- Are there adequate financial resources allocated for long-term monitoring, enforcement, and adaptive management of ICRZ zones?

Challenges

Accessing reliable baseline data for environmental parameters

- **Inadequate baseline records:** In many coastal areas, systematic data on water quality, biodiversity, and shoreline dynamics prior to ICRZ implementation is either missing, fragmented across agencies, or inconsistent in methodology. Baseline ecological data, particularly on mangrove and coral cover, remain inconsistent — a gap already highlighted by Kathiresan & Rajendran (2020) in their assessment of Indian coastal ecosystems.
- **Temporal gaps:** Short-term studies may exist, but they often do not capture **seasonal variability** (e.g., monsoon-driven turbidity, spawning cycles, or storm

surges). This makes it difficult to distinguish natural fluctuations from management impacts.

- auditors must rely on **proxy indicators or reconstructed baselines (e.g., satellite imagery, oral histories)**.

Evaluating effectiveness of community participation mechanisms

- **Documentation gap:** While ICRZ regulations emphasize involving local communities, evidence of how far these mechanisms function effectively is often poorly documented. Records may highlight meetings or committees but rarely assess the quality of participation.
- **Capacity constraints:** Communities may lack the technical knowledge to meaningfully engage in decisions on biodiversity monitoring, pollution control, or shoreline management.

Measuring long-term impacts of conservation measures

- **Time lag:** Many ecological benefits (e.g., mangrove regrowth, coral recruitment, reduction in erosion after setback enforcement) manifest only over several years, often beyond the typical audit cycle.
- **Attribution problem:** Ecological outcomes are influenced by multiple drivers - climate change, sea-level rise, extreme events, coastal development pressures - making it difficult to isolate the effects of ICRZ measures alone.

Technical and Scientific Complexity

Auditing ecological and environmental aspects demands multidisciplinary expertise in marine science, coastal engineering, and climate studies. Assessing Environmental Impact Assessments, scientific methodologies, and evolving best practices is technically

demanding. Auditors must reconcile differing expert views and account for advances in scientific knowledge.

Conclusion

The audit of ICRZ and IIM plan implementation represents a critical opportunity to evaluate India's approach to sustainable island management. By combining CAG's institutional experience with international best practices and innovative audit methodologies, this framework provides a comprehensive approach to assessing the effectiveness of these important environmental governance mechanisms.

Three key insights emerge: (1) Institutional Reform — better coordination among agencies; (2) Scientific Rigor — reliable baselines and climate integration; (3) Community Engagement — incorporating traditional knowledge and livelihood support. International experiences from Seychelles, Maldives, and the Pacific show that balancing development with resilience requires inclusive and adaptive approaches. By embedding these lessons, India's audit framework can go beyond compliance checks to foster adaptive management and ensure the sustainability of fragile island ecosystems and dependent communities.

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Green Hydrogen is hydrogen produced by splitting water using electricity generated from renewable energy sources, resulting in zero carbon emissions during production.

DID YOU KNOW?

Auditing India's National Green Hydrogen Mission:

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Abstract

India's commitment to achieving net-zero emissions by 2070 has placed green hydrogen at the centre of its long-term energy transition strategy. The launch of the National Green Hydrogen Mission (NGHM) in January 2023 marks a significant policy intervention aimed at establishing India as a global hub for green hydrogen production, utilization, and export. Given the scale of public expenditure, technological uncertainty, and multi-agency implementation framework, the Mission presents a complex and high-risk audit environment. This article proposes a structured audit framework for NGHM, drawing upon international Supreme Audit Institution (SAI) practices and early policy developments in India. It outlines potential audit scope, risk areas, and methodological challenges, offering an anticipatory audit model that can guide future performance, compliance, and financial audits.

1. Introduction

Green hydrogen is increasingly viewed as a critical enabler of deep decarbonisation in hard-to-abate sectors such as steel, fertilizers, shipping, and heavy transport. Recognizing its strategic importance, the Government of India launched the **National Green Hydrogen Mission (NGHM)** in January 2023 with an approved outlay of **₹19,744 crore up to 2029-30**. The Mission targets **5 million metric tonnes (MMT) of annual green hydrogen production by 2030**, alongside

the development of hydrogen hubs, innovation clusters, and domestic electrolyze manufacturing capacity.

As NGHM moves from policy intent to early implementation, the role of public audit becomes critical—not merely as an ex-post accountability mechanism, but as an instrument for strengthening governance, risk management, and value for money. This article presents a **proposed audit approach** for NGHM, conceptualized before the commencement of a full-scale audit, with the objective of identifying key risk areas and suitable audit lenses.

2. Overview of the National Green Hydrogen Mission

The NGHM is implemented by the **Ministry of New and Renewable Energy (MNRE)** with support from multiple line ministries and agencies. Key components include:

- **Strategic Interventions for Green Hydrogen Transition (SIGHT)** for electrolyser manufacturing and hydrogen production incentives
- **Green hydrogen hubs and hydrogen valley innovation clusters**
- **Pilot projects** in sectors such as steel and shipping
- **Testing and certification infrastructure**
- **Research and Development (R&D) support**

	Risk	Impact	Likelihood	Priority for Audit
<p>Risk Matrix (Impact × Likelihood)</p> <p>Highest audit priority goes to subsidy use, project efficacy, certification, and GHG credentials.</p> <p>(Critical > Major > Significant > Moderate > Minor)</p>	Subsidy misuse/misallocation	Critical	Significant	HIGH
	Delays/project failure	Major	High	HIGH
	Certification non-compliance	Major	Moderate	HIGH
	Safety lapses/accidents	Major	Minor	MEDIUM
	Poor GHG mitigation	Major	Moderate	HIGH
	Local conflict/reputation loss	Significant	Moderate	MEDIUM
	Cost overruns	Moderate	Moderate	MEDIUM

A major governance instrument under the Mission is the **Green Hydrogen Certification Scheme of India (GHCI)**, which defines system boundaries, eligible production pathways, emissions thresholds (≤ 2 kg CO_{2e}/kg hydrogen), and verification mechanisms. The **Bureau of Energy Efficiency (BEE)** acts as the nodal authority for certification and issuance of guarantees of origin.

Recent policy developments during 2024–25 include revised guidelines for hydrogen hubs, identification of port-based hubs (such as Kandla, Paradip, and Tuticorin), and regulatory relaxations related to environmental clearances.

4. Lessons from Global SAI Experiences

International SAI reports provide valuable insights for designing an audit of hydrogen missions:

- **European Union (European Court of Auditors – Special Report 11/2024):** The EU set ambitious hydrogen targets (10 MMT by 2030) without adequate assessment of demand, infrastructure readiness, or regulatory clarity. Despite allocating €18.8 billion, actual production remains negligible. The audit highlighted weaknesses in planning, delayed

regulations, and ineffective subsidy deployment.

- **United Kingdom (National Audit Office):**

The NAO adopted a **blended audit approach**, combining financial, compliance, and performance audit elements. It observed that policy uncertainty and delayed clarity on long-term hydrogen pathways slowed adoption and potentially crowded out more cost-effective alternatives.

These experiences underscore the importance of auditing **effectiveness, timeliness, subsidy governance, and policy coherence**, rather than focusing solely on expenditure compliance.

5. Risk Analysis and Audit Priorities

A preliminary risk matrix (impact × likelihood) indicates **highest audit priority** in the following areas:

- **Subsidy utilization and value for money**
- **Project effectiveness and operational viability**
- **Integrity of green hydrogen certification and emissions claims**
- **GHG accounting and lifecycle assessment (LCA)**

Other significant risks include coordination failures across ministries, idle or delayed funds, and over-reliance on optimistic production assumptions.

6. Proposed Audit Scope for NGHM

The proposed audit framework envisages coverage of:

- **Schemes:** SIGHT incentives, pilot projects, hydrogen hubs, bunkering facilities, and certification systems
- **Timeframe:** From Mission approval (January 2023) to the latest available year,

with an interim review approach towards 2030 targets

- **Geographical Focus:** National-level planning and selected states/ports where hubs and pilots are operational

Key audit aspects include:

- Achievement of Mission targets (production capacity, utilization, off-take arrangements)
- Financial management and subsidy disbursement

Audit Objectives	Main LOEs	Audit Criteria	Audit Methodologies	Citizen Centricity/Ease of living
1. To assess whether NGHM targets (quantity, timeline, standards) are being delivered as per plan	<p>a. Are NGHM schemes cumulatively on a credible path to 5 MMT/yr by 2030 (capacity pipeline, commissioning, utilisation, off-take)? What are the bottlenecks?</p> <p>b. How do India's program controls and delivery pace compare to international lessons (ECA 2024, OAG Canada 2022)? What can be adopted/avoided?</p>	<ul style="list-style-type: none"> • NGHM Guidelines (2023) • MNRE Notifications & Progress Reports • International good practices (ECA Special Report 2024, OAG Canada 2022) • ISSAI 300 (Performance Audit Principles), ISSAI 3100 (Compliance with objectives and outcomes) 	<ul style="list-style-type: none"> • Document review of MNRE reports, PIB releases, progress trackers • Stakeholder interviews (MNRE, NITI Aayog, project developers) • Comparative analysis with global benchmarks • Data analytics of project pipelines and commissioning status 	<ul style="list-style-type: none"> • Faster rollout ensures access to clean fuels and reduces fossil import dependency. • Citizens benefit from cleaner air and improved energy security.
2. To examine whether financial resources are utilized for intended purposes, with clear documentation	a. Are SIGHT and pilot funds properly targeted, timely, and producing measurable outputs? Any diversion, delays, or idle assets?	<ul style="list-style-type: none"> • NGHM Financing & SIGHT Scheme Guidelines (2023) • GFR 2017, DFPR Rules • CAG's Auditing Standards & ISSAI 4000 (Compliance Audit) 	<ul style="list-style-type: none"> • Test check of financial records, sanctions, and fund flows • Beneficiary/project site verification • Cross-checking utilization 	<ul style="list-style-type: none"> • Transparent use of subsidies ensures value-for-money for taxpayers. • Better targeting creates more jobs in green hydrogen hubs and local
3. Verify whether compliance with safety, certification (GHCI), and environmental criteria is maintained	<p>a. Are producers complying with GHCI and meeting ≤2 kg CO₂e/kg H₂? Are MRV systems & ACV reports reliable and independently verifiable?</p> <p>b. Are Kandla/Paradip/VOC pilot and bunkering facilities on schedule, with adequate HSE, emergency response, and environmental safeguards?</p> <p>c. Are water sourcing, land acquisition, and local impacts assessed, mitigated, and monitored transparently?</p>	<ul style="list-style-type: none"> • Green Hydrogen Standard for India (MNRE 2023, ≤2 kg CO₂e/kg H₂) • GHCI, ISO 14040/44 (Life Cycle Assessment) • Environmental Protection Act 1986, Water Act 1974, Land Acquisition Act 2013 • International HSE norms (ILO, World Bank EHS Guidelines) • ISSAI 3000 (Performance Audit), ISSAI 5130 (Sustainable Development) 	<ul style="list-style-type: none"> • Verification of compliance reports & MRV systems • Review of ACV/LCA documentation • Field visits to hydrogen hubs (ports, bunkering sites) • Consultation with regulators (MoEFCC, PESO, State Pollution Control Boards) • Media & secondary literature scan (PIB, Times of India) 	<ul style="list-style-type: none"> • Ensures safety of workers and communities around hubs. • Prevents environmental harm (water stress, land conflicts). • Builds citizen trust in "green" credentials of hydrogen.

- Compliance with safety standards, GHCI certification, and environmental safeguards
- Infrastructure readiness (storage, transport, port facilities)
- Monitoring, reporting, and inter-agency coordination mechanisms

Private R&D initiatives outside the NGHM framework and downstream industrial adoption beyond MNRE's mandate are proposed to be excluded.

7. Key Audit Challenges

Auditing NGHM is likely to face several challenges:

- **Evolving policy and standards**, making audit benchmarks unstable
- **Limited and unreliable data**, particularly in early pilot phases
- **Complex verification of “green” claims**, requiring advanced MRV and LCA expertise
- **Inter-agency implementation**, obscuring accountability lines
- **Capacity constraints** within audit teams due to limited prior experience in hydrogen technologies

Addressing these challenges may require specialized training, technical collaboration, and phased audit planning.

8. Conclusion

The National Green Hydrogen Mission represents a transformative but high-risk public policy intervention. Given the scale of investment, technological uncertainty, and strategic importance, a well-designed audit approach can play a constructive role in improving governance, ensuring fiscal prudence, and strengthening environmental credibility.

This proposed audit model demonstrates how Supreme Audit Institutions can move beyond retrospective scrutiny and contribute proactively to national climate and energy transitions. As NGHM matures, such a framework can serve as a foundation for comprehensive performance and value-for-money audits, ensuring that India's green hydrogen ambitions translate into sustainable and accountable outcomes.

Biodiversity at iCED Campus

Shikra (*Tachyspiza badia*)

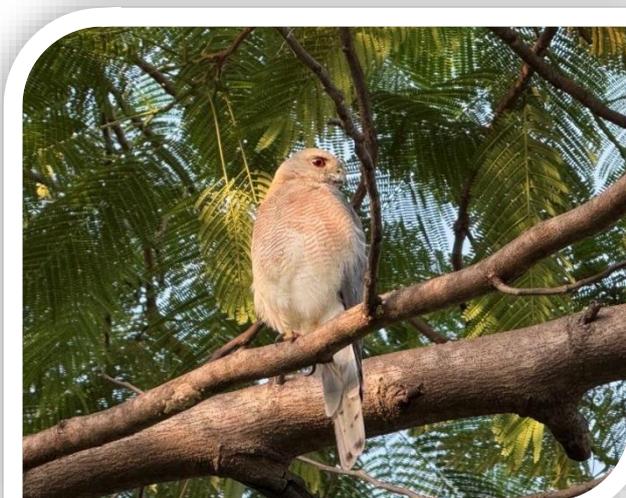


Image Source: Captured by Shri. Rahul Yadav, AAO

Its courage and intelligence once made the Shikra a preferred bird for falconry in pre-independence India, a practice now prohibited.

The Shikra (*Tachyspiza badia*) is a small raptor of the family Accipitridae, widely distributed across Asia and Africa, where it is also known as the little banded goshawk. It is among the commonest hawks in India. The name Shikra, derived from Urdu and linked to the Hindi word shikari (hunter), aptly reflects its predatory prowess.

Despite its small size (30–36 cm), the Shikra is a highly skilled hunter and functions as an apex avian predator in urban environments such as Delhi.

Adult males are ashy blue grey above with fine brownish-orange barring below and deep orange-red eyes. Females are larger and browner, with yellow to orange-yellow eyes, while juveniles have pale brown upperparts, dull yellow eyes, a banded tail, and a distinct black median throat stripe. Rounded wings and a long tail aid agility.

Norfolk Island Pine (*Araucaria heterophylla*)



Image Source: Captured by Shri. Rahul Yadav, AAO

Fertilize the plant every two to four weeks during the growing season with a balanced, water-soluble fertilizer formulated for houseplants.

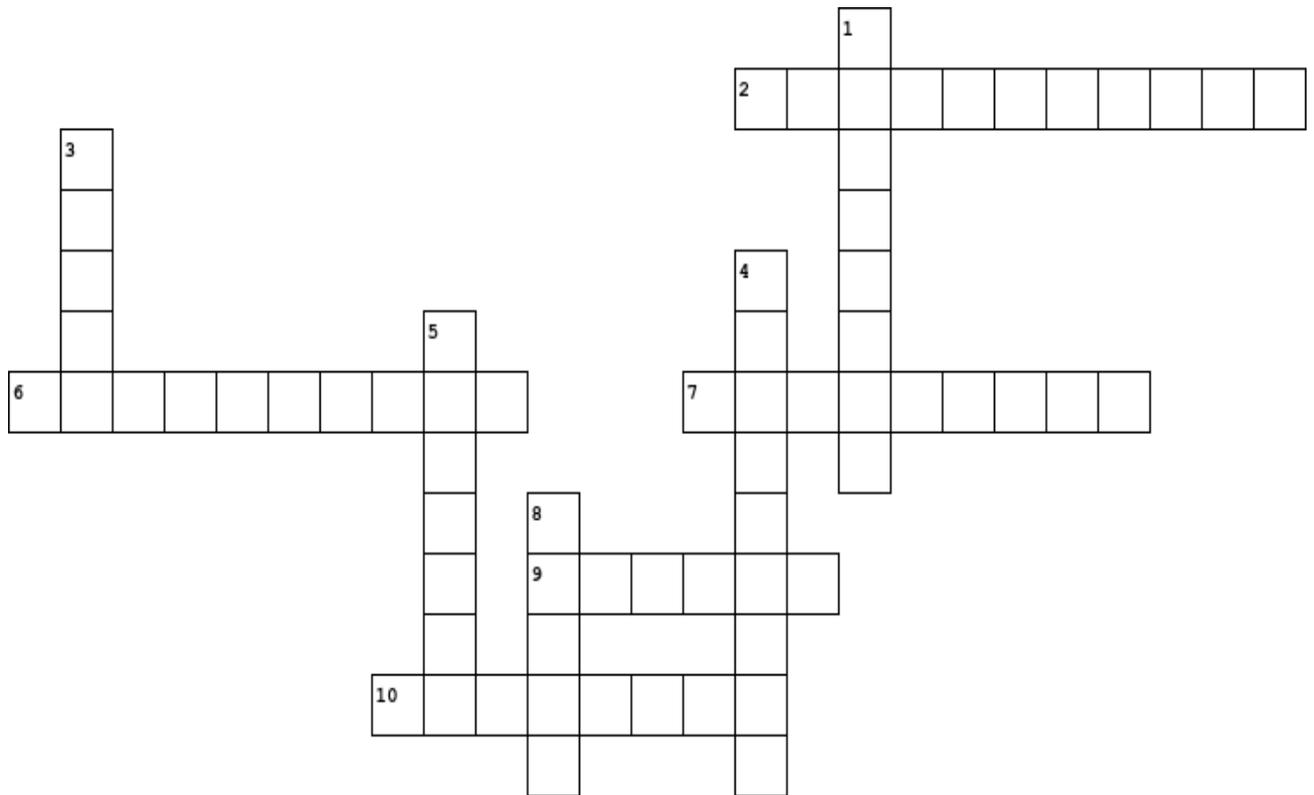
The Norfolk Island Pine, scientifically known as *Araucaria heterophylla*, is a member of the Araucariaceae family and is native to Norfolk Island in the South Pacific. It is a coniferous evergreen tree that, when grown indoors, maintains a compact and symmetrical form.

The Norfolk Island Pine features tiered branches that emerge in a spiral pattern around the trunk, giving it a distinctive pyramid shape. Its needle-like leaves are arranged in flattened sprays and are vibrant green, creating a lush and enchanting display.

Plant the Norfolk Island Pine in a well-draining potting mix that retains moisture without becoming waterlogged. A blend of peat moss, perlite, and sand works well. Dilute the fertilizer to half-strength to avoid overfeeding, which can lead to nutrient burn.

Crossword Puzzle

By: Ms Manju Godara, Auditor



Across

2. Layer of the atmosphere where weather occurs.
6. Science of mapping and exploring the seafloor.
7. Loss of marine species due to rising temperatures.
9. Gas released by plants during photosynthesis.
10. International pact ending mercury pollution from industrial processes.

Down

1. International agreement banning ozone-depleting substances.
3. Large-scale forest ecosystem in boreal regions of Earth.
4. India's national mission focused on household tap connections under SDG 6.
5. Oldest mountain range in India.
8. A hard red, pink or white substance that forms in the sea from the bones of very small sea animals

Answers of the crossword puzzle

<p>Across</p> <p>2.Troposphere 6.Bathymetry 7.Bleaching 9.Oxygen 10.Minamata</p>	<p>Down</p> <p>1.Montreal 3.Taiga 4.Jaljevan 5.Aravali 8.Coral</p>
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