SUPREME AUDIT INSTITUTION OF INDIA
लोकहितार्थ सत्यनिष्ठा
Dedicated to Truth in Public Interest

GREEN FILES

April to June 2023, Volume 46

Theme: Climate Change and Blue Economy

Foreword

Green Files is iCED's quarterly newsletter, featuring glimpses of recent environmental news, events, emerging trends, innovations, initiatives, and efforts, of different organisations in the field of environment and sustainable development, including the initiatives of the Supreme Audit Institution (SAI) of India. As in every issue, we attempt to highlight both the local, and the global, with a special emphasis on environmental issues of SAI India under the aegis of the Hon'ble Comptroller and Auditor General (C&AG) of India. This issue is a special issue focussed on the theme of "Climate Change and Blue Economy" in tandem with the global concerns relating to Climate Change and a focus on the audit of the Blue Economy under the SAI20, being promoted by the Hon'ble Chair, the C&AG of India in 2023. In keeping with the Hon'ble C&AG of India's vision of harnessing SAI India's decade long experience in conducting Environmental Audits, iCED is now evolving as a "Centre of Excellence" on Audit of the Blue Economy.

This edition of the Green Files sees various milestones in building vibrant knowledge and experience sharing frameworks. We strive to give a new commitment to iCED's scholastic standards by including diverse global as well as national voices, to establish Green Files as a key component of the SAI India's dedication to value-add to the international auditing fraternity. SAI of Brazil and SAI of Egypt have contributed articles to this volume of Green Files, which have greatly enriched the publication. The article on "Audit of Illegal Deforestation in the Amazon Rainforest" by the SAI-Brazil (Federal Court of Accounts – TCU) and an article on "The Role of Supreme Audit Institutions in auditing Sanitation and Industrial projects in accordance with Goal No. 6 of the SDGs with reference to the ASA's Experience" by the SAI Egypt (Accountability State Authority- Egypt) are of immense value. Sincere and deep appreciation to SAI Brazil and SAI Egypt for their extremely relevant contributions.

We are also very delighted to feature inputs from the renowned national think-tank on the Blue Economy, the National Maritime Foundation (NMF). An article titled "Impact of Climate Change on Coastal Cities: An 'Integrated Adaptation' Approach Part I" (29th November 2020), by Ms. Chime Youdon, Associate Fellow at the NMF, is reprinted with kind permission from the NMF. I hope this article's focus on the impact of Climate Change and sea-level rise in coastal cities and the most vulnerable and disadvantage sections of the population would give readers new insights into this important area.

This edition also initiates a section containing Book Reviews. The first Book Review titled "Global Climate Change and Environmental Policy: Agriculture Perspectives" analyses the multiple facets of Climate Change, aspects of governance, policies and their impacts on agricultural practices, socio-economic vulnerabilities in the Indian as well as international context and adaptive solutions to deal with the emergent problems. The second Book Review titled "BLUE ECONOMY: Global Best Practices Takeaways for India and Partner Nations, A Study by Core Group of Experts on Blue Economy" provides an analysis of the study conducted by a core group of experts in the field of the Blue Economy.

Recently, the SAI20 Summit of the SAI20 Engagement Group, under India's G20 Presidency, was held in Goa from 12-14 June. Shri Girish Chandra Murmu, Hon'ble Comptroller and Auditor General of India, as the Chair of the Supreme Audit Institutions-20 (SAI20) Engagement Group, led the deliberations. In this context, a comprehensive coverage on this stellar event is featured in an article on "The SAI20 Summit of the SAI20 Engagement Group under India's G20 Presidency in Goa from 12-14 June 2023". This article highlights the crucial role of the Supreme Audit Institutions in auditing sectors of the Blue Economy, to encourage their contribution to the national economy, while ensuring long-term sustainability. It features the release of the Communique of the SAI20

Engagement Group, compendiums on the Blue Economy and Artificial Intelligence, and the evolution of iCED as the "Centre of Excellence on the Blue Economy". The article also features the event proceedings and deliberations by participating members in the Blue Economy and Artificial Intelligence discourse.

This edition highlights multiple sectors and perspectives in auditing the Blue Economy in India. There are articles titled "Significance of High Seas Treaty" and "Maritime Transport and Shipping: Challenges and Opportunities" which emphasise the importance of protecting marine biodiversity in areas outside national jurisdictions and the criticality of Marine Transport and Shipping in the context of Blue Economy, respectively. We continue some of our earlier features such as a State-Centric article. The State of Chhattisgarh, which has been highlighted in this edition, provides important pointers for planning audits on environmental issues.

Snapshots of recent environmental news, key events and emerging trends are presented in this volume. It is hoped these will act as a corpus of information for Environment Audits. The newsletter further covers a gist of the trainings/workshops/other activities at iCED and recent happenings in SAI India and INTOSAI WGEA community during the period April-June 2023. To increase environmental awareness among readers, we have continued to feature a Crossword.

As has been the trend in previous editions, we have also showcased selected Audit Reports relating to Blue Economy sectors of both national and international nature. The audit report on "Audit Report of Republic of Slovenia Court of Audit: Intervention management system in the case of a sudden pollution of the Adriatic Sea" highlights important findings and conclusions on the assessment of the effectiveness of the Intervention Management system in case of sudden pollution of the Adriatic Sea.

The International Centre for Environment Audit and Sustainable Development (iCED), strives to be a knowledge repository on important environmental issues. In May 2022, iCED pioneered an "Occasional Research Paper Series" to cement its capacity building efforts with research-oriented outcomes. As a part of these efforts, iCED has published a Compendium Report 2023 (Volume-II), featuring research conducted by interns at iCED. The compendium is a cornucopia of diverse themes of environmental concern, namely,

'Sustainability Issues in Groundwater Usage and its Management in Rural Areas', 'Municipal Solid Waste Management in Three Selected Cities in India (Indore, Surat, and Jaipur)', and 'Pollution Caused by Road Dust: A Case Study in Delhi and Mumbai'. Now, in the latest addition to its 'Occasional Research Paper Series', iCED proactively engages with the critical issue of Gender Equity and its linkages to sustainable livelihoods within the contours of the Blue Economy. The paper 'Sustainable Livelihood and Gender Equity in the Development of the Blue Economy with a Special Focus on Marine Fisheries' offers valuable insights for planning gender audits especially in the area of marine fisheries.

In doing so, iCED re-centres research excellence with dynamism which is at the heart of SAI India's contribution to the global auditing fraternity, with a contemporary theme which formed a major area of interest during India's G20 Presidentship in 2023.

We look forward to your feedback as well as any further contributions.

Ms. Sayantani Jafa

Addl. Dy. C&AG and Director General, iCED, Jaipur

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The SAI20 Summit of the SAI20 Engagement Group under India's G20 Presidency in Goa (12th-14th June 2023)

By: Manoj Kumar, AAO

With the G20 summit theme of "One Earth, One Family, One Future", India has set the tone and perspective for commitment to green development, circular economy and lifestyle behaviour changes as an actionable plan for achieving the 2030 Sustainable Development Goals. A slew of events were held across the country to focus on solutions to a wide range of issues from climate finance and technology sharing to financial inclusion and digital public infrastructure (Hon'ble C&AG of India, Shri Girish Chandra Murmu, 2023).

SAI20 Summit
Image Source: SAI20 Organisation, 2023

The SAI20 Summit of the SAI20 Engagement Group under India's G20 Presidency was held in Goa from 12th-14th June 2023. The SAI20 Summit was inaugurated by the Hon'ble Governor of Goa Shri P. S. Sreedharan Pillai. Shri Amitabh Kant, G20 Sherpa also graced the occasion.

The SAI20 Summit saw the participation of about 85 National and International delegates from G20 member SAIs, viz. Australia, Brazil, Korea, Indonesia, India, Russia, Saudi Arabia, and Turkiye; Guest SAIs, viz. Bangladesh, Egypt, Mauritius, Nigeria, Oman, Spain, and UAE; Invited SAIs, viz. Morocco and Poland; International Organisations, viz. United States Agency for International Development (USAID) and World Bank; and Engagement Groups

SAI20 Summit
Image Source: SAI20 Organisation, 2023

viz. Think20 and Youth20 (Supreme Audit Institution of India, 2023). The SAI20 Summit aimed to collaborate and strengthen SAIs' role and responsibilities in promoting efficiency, accountability, effectiveness, and transparency in the delivery of public services. As Chair of SAI20, the Comptroller and Auditor General of India aims to help create a framework for G20 nations to ensure inter-generational equity and mitigate Climate Change while developing ocean resources.

Shri Girish Chandra Murmu, C&AG of India delivering the opening address.

Image Source: SAI20 Organisation,2023

In his opening address, Shri Girish Chandra Murmu, The Comptroller and Auditor General of India highlighted that the Supreme Audit Institutions have a crucial role to play in the audit of Blue Economy and Responsible Artificial Intelligence (AI) to ensure good governance, transparency, and accountability and to optimise their positive impact on humankind. Shri Murmu, stated that the Supreme Audit Institutions (SAIs) should develop new techniques and capabilities to audit marine life or the Blue Economy to ensure sustainable development. In order to fulfil their commitment towards sustainability goals in consonance with SDG 14 – Life below Water, the governments are reorienting policies

"As the Blue Economy gains primacy, so will its audit. In order to keep ahead of the curve, the SAI20 community must prioritise collaborations in arriving at new techniques, skills, capabilities and methods and that SAIs must proactively formalise channels and platforms that would facilitate these collaborations". (Supreme Audit Institution of India, 2023)

Shri Girish Chandra Murmu
The Comptroller and Auditor General of India

and regulatory structures to conserve and sustainably use the oceans, seas, and marine resources for sustainable development. The SAIs are aligning themselves with national priorities and efforts, through their audit by tracking progress, monitoring implementation, and identifying opportunities

for improvement" (Financial Express, 2023). In the same framework, the SAI20 member countries are being engaged in a collaborative exercise to evolve globally relevant audit toolkits along with a Compendium of case studies and challenges in the broader framework of auditing coastal spaces, which, inter-alia, include legal and institutional frameworks, compliance to coastal regulation, biodiversity conservation, capacity building and compliance to SDGs (Hon'ble C&AG of India, Shri Girish Chandra Murmu, 2023).

Image Source: (SAI20 Organisation, 2023.)

In his inaugural address of the SAI20 Summit, the Hon'ble Governor of the State of Goa, Shri P. S. Sreedharan Pillai, emphasised that the SAI20 Group under the aegis of G20 is expected to play a central role in strengthening governance and in delivery of a positive impact on the lives of citizens. While emphasising the role of SAIs, Hon'ble Governor stated that SAIs in their respective countries are a key pillar of accountability, effectiveness and ensuring integrity in governance (Supreme Audit Institution of India, 2023).

Shri Amitabh Kant, G20 Sherpa, in his address, expressed that establishment of SAI20 is a very positive step as it has led to the creation of a network between the SAIs and the governments to coordinate and articulate strategies and provide opportunity to the SAIs to deliver as partners in governance and help in creating greater transparency and accountability. He was also appreciative of the proposal mooted by SAI India to have

SAI20 as a separate Accountability Institutional Track, in addition to existing Finance and Sherpa Tracks so as to propel the group's independent stature, in playing a profound role in realisation of the G20 agenda (Supreme Audit Institution of India, 2023).

Through the SAI20 Engagement Group Communique, the SAI 20 members agreed that SAIs will continue, where it is within the SAIs mandates, to:
a. *Support the need for a comprehensive policy for promoting inclusive and sustainable growth in Blue Economy.*
b. Support the need for social and gender inclusive investment towards safety and livelihood of coastal communities.
c. Support research, collection and collation of accounting data, sustainable utilization data and social data from sources such as non-governmental and civil society organizations, as well as statistics agencies on Blue Economy that aid evidence-based policy making.

In the SAI20 Engagement Group Communique, SAI20 members acknowledged that Artificial Intelligence (AI) systems hold vast potential to unlock economic value and help mitigate social challenges.
AI can positively impact the delivery of all 17 goals and 169 targets recognized in the 2030 Agenda for Sustainable Development. We also acknowledge that rapid adoption of AI systems presents risks which need to be managed.

During the Summit, SAI India released a Communique of the SAI20 Engagement Group. The Communique highlighted the pressing need for the SAIs to invest in targeted professional development and encourage mutual exchange of subject matter experts across SAIs to audit the areas related to the Blue Economy and Artificial Intelligence (AI). It emphasised the need to cooperate and collaborate in knowledge-sharing endeavours involving the exchange of innovative ideas and best practices to build public trust and impact the policy and decision-makers (The Comptroller and Auditor General of India, n.d.).

"Our vision is to create a Centre of excellence that not only fosters research but also acts as a catalyst for knowledge sharing and capacity building amongst SAIs in this important field". **(Supreme Audit Institution of India, 2023)**

Shri Girish Chandra Murmu
The Comptroller and Auditor General of India

iCED as the "Centre of Excellence on the Blue Economy"

With the aim to formulate consensual and widely applicable standards or guidelines that shall enable SAIs to evaluate and guide, within their respective mandates, the development and effective implementation of policies and programmes which balance sustainability on the one hand with

economic progress and welfare on the other, the Comptroller and Auditor General of India announced to establish iCED as the "Centre of Excellence on the Blue Economy".

iCED Jaipur

Through this iCED will develop into a body of research, best-practice compilations, toolkits, or audit guidelines, as well as foster possible modalities for closer collaboration between SAIs as also with other stakeholder communities.

iCED had set the ball rolling by conducting an international webinar on "Audit of Blue Economy Issues" in April 2023. The webinar was attended by 32 participants from seven SAIs across the globe.

The Comptroller and Auditor General of India released the compendiums on Blue Economy and Responsible AI. The Compendium on Blue Economy aims to serve as a medium for sharing the audit experiences of SAIs on diverse areas of Blue Economy and foster its commitment under Goal 3 of International

Release of the Compendiums on Blue Economy and Responsible Artificial Intelligence
Image Source: SAI20 Organisation, 2023

Organisation of Supreme Audit Institutions (INTOSAI) of encouraging SAI cooperation, collaboration, and continuous improvement through knowledge development, knowledge sharing, and knowledge services. The Compendium on Responsible AI showcases case studies that range from the use of AI to automate traditional audit procedures to developing new approaches to risk assessment and fraud detection. These Compendiums will act as a dictionary of valuable insight, experiences, and good practices for the Auditors (The Comptroller and Auditor General of India, n.d.).

Delegations from SAI20 member SAI's sharing their views
Image Source: SAI20 Organisation, 2023

The Heads of the delegations from the SAI20 member SAIs, Guest SAIs, Invited SAIs, International Organisations and Engagement Groups shared their views on the SAI20 Summit and its priority areas of Blue Economy and Responsible AI through their general statements (Supreme Audit Institution of India, 2023).

The participating SAIs concluded on a unanimous note that SAI20 is an action-oriented forum providing a platform for all SAIs to collaborate on sharing of best practices, capacity building, and development of appropriate auditing guidelines and actionable toolkits for auditing national priorities (Supreme Audit Institution of India, 2023).

The SAI20 Summit concluded with a social cultural programme for the international and national delegates who participated in the event. The delegates visited historical and cultural places in the State of Goa. The delegates expressed their gratitude for the warm hospitality extended by the SAI India (Supreme Audit Institution of India, 2023).

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SAI India/iCED News

By: Kailash Chand Bajya, AAO

SAI India's Engagements/Activities/MOUs during April to June, 2023

1. Shri. Girish Chandra Murmu, Comptroller & Auditor General (C&AG) of India has been re-elected (Comptroller and Auditor General of India, 2023) as an External Auditor of World Health Organisation (WHO) for the period from 2024 to 2027. The election was held on 29th May 2023 at the 76th World Health Assembly in Geneva. Shri G. C. Murmu, in his address to the World Health Assembly, outlined his vision as an external auditor for WHO emphasising process improvement for better outcomes, transparency and a professional approach.

Shri Girish Chandra Murmu, Comptroller and Auditor General of India

Image Source: All India Radio 2023

2. A Bilateral meeting between Shri Girish Chandra Murmu, C&AG of India with Excellency, Humaid Obaid Khalifa Obaid Abushibs, President, Supreme Audit Institution, United Arab Emirates (UAE) was held on 23rd May 2023 at C&AG office, New Delhi (C&AG of India, 2023).

The aim of the meeting was to collaborate in the field of audit and invigorate capacity development initiatives and exchange knowledge and information, to learn from best practices (C&AG of India, 2023). Both SAIs also explored the possibility to sign an MOU in near future. The possibility of other collaborations was also discussed during the meeting. A 10-member delegation from SAI UAE also visited the C&AG office on 22nd May 2023 to familiarise about SAI India's Auditing methodology and training strategy and to exchange knowledge and expertise in the field of IT Audit. Presentations from both of the SAIs were also made during this occasion.

Bilateral meeting between Shri Girish Chandra Murmu, Comptroller and Auditor General of India with Excellency, Humaid Obaid Khalifa Obaid Abushibs, President, Supreme Audit Institution, UAE

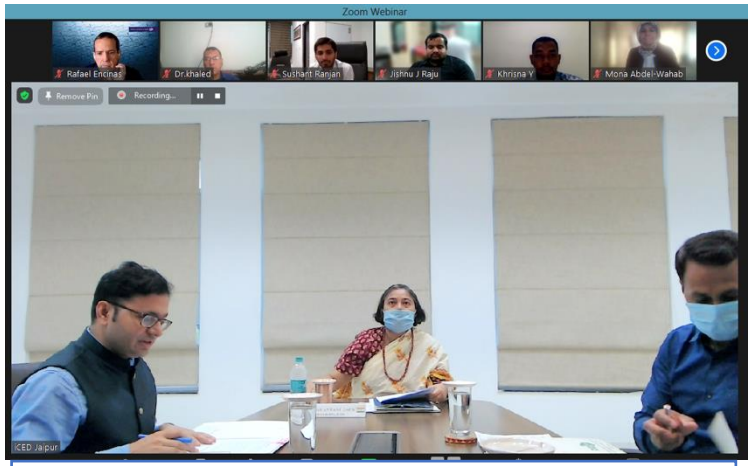
Image Source: C&AG of India

3. Overview of Capacity Development Programmes at iCED, Jaipur

During the period April-June 2023, iCED conducted one International Webinar on "Experience Sharing on Audit of Blue Economy related issues", iCED's 14th Foundation Day and one National Training Programme on "Audit of Climate Change, Mitigation and Adaptation Strategies". Details of the Training Programmes/Webinars conducted during the period from April-June 2023 are summarised below:

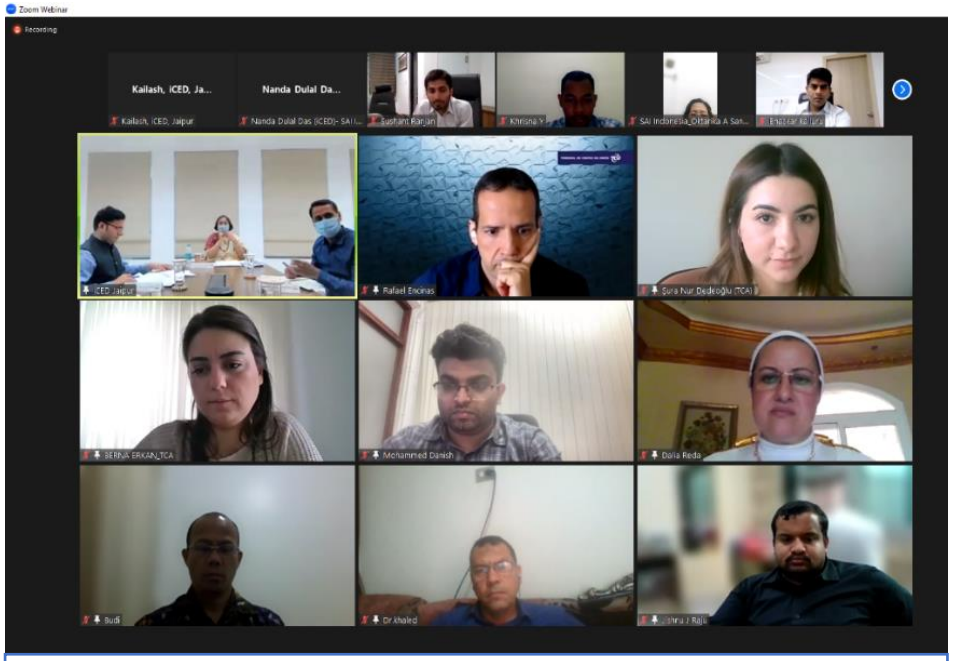
3.1 International Webinar on "Experience Sharing on Audit of Blue Economy related issues"

International Centre for Environment Audit and Sustainable Development (iCED), organised an International Webinar on "Experience Sharing on Audit of Blue Economy related issues" on 27th April 2023. A total of 32 participants representing seven SAIs (including SAI India) attended this webinar through virtual mode.

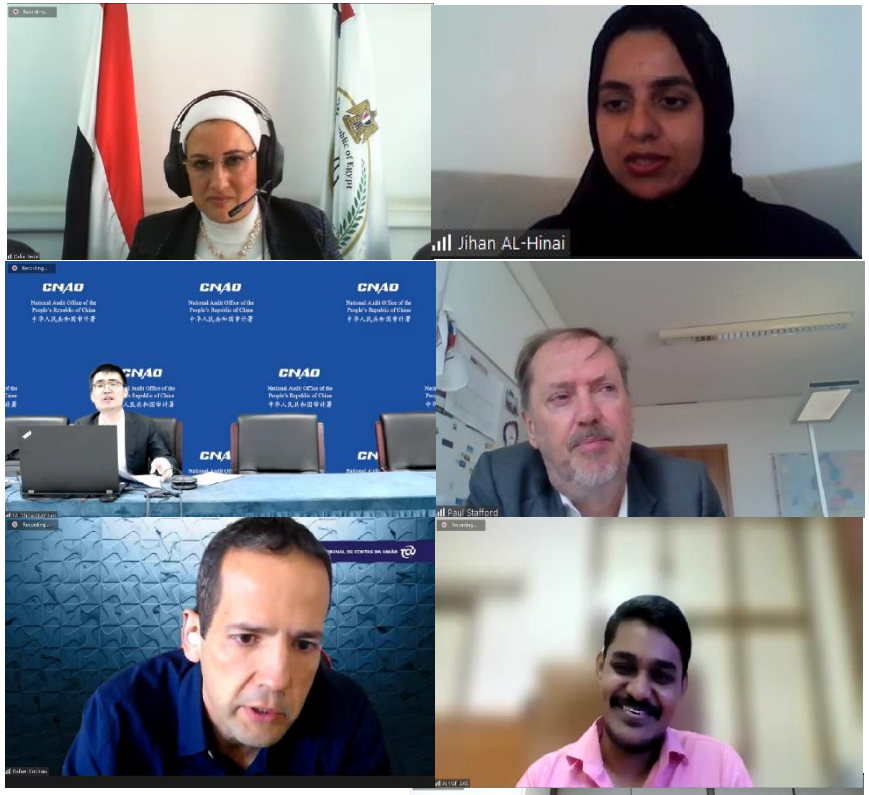


Ms. Sayantani Jafa, ADAI & DG, iCED, Mr. Deen Dayal Verma, Director (Administration), Dr Nanda Dulal Das, Director (Training & Research), during inauguration of the Webinar

Dr. Nanda Dulal Das, Director (Training & Research), iCED welcomed virtually all the participants, guest faculty, Ms. Sayantani Jafa, Additional Deputy Comptroller & Auditor General and Director General, iCED and Mr. Deen Dayal Verma, Director (Administration) to the inaugural session. Ms. Sayantani Jafa, Additional Deputy Comptroller & Auditor General (ADAI) and Director General (DG), iCED, inaugurated the webinar. During the webinar, eight experts from seven renowned organisations. Dr Manish Anand, Senior Fellow, Centre for Resource Efficiency & Governance, TERI, India, presented an overview of the Blue Economy. This session was followed by experience sharing in the Audit of the Blue Economy by experts from SAI India, European Court of Auditors (ECA), Accountability State Authority (ASA) Egypt, National Audit Office of the People's Republic of China (CNAO), State Audit Institution of Oman, and the Federal Court of Accounts – Brazil.



Participants from various SAIs during the webinar



Experts sharing their experience on the Audit of the Blue Economy during the webinar

The webinar ended with a valedictory address by Ms. Sayantani Jafa, ADAI and DG, iCED wherein, she thanked the participants for their active participation in the webinar. Ms. Sayantani Jafa, ADAI and DG, iCED, thanked the Hon'ble Comptroller and Auditor General of India, Shri G. C. Murmu for expounding the vision for iCED as a Centre of Excellence for Audit of Blue Economy to establish a global outreach through knowledge and experience sharing. She also thanked the Deputy Comptroller & Auditor General (HR, IR and Coordination), Ms Parveen Mehta for her kind guidance in the project.

13.2 Workshop on 14th Foundation Day of iCED, Jaipur

On the occasion of its 14th Foundation Day (1st June 2023), the International Centre for Environment Audit and Sustainable Development (iCED), Jaipur organised a virtual workshop on "Multi-Dimensional aspects of Audit of Climate Change and Blue-Economy". The workshop was inaugurated by Ms. Sayantani Jafa, Additional Deputy Comptroller & Auditor General and Director General, iCED. The workshop was attended by all the officers at iCED and IAAS officers posted at Jaipur.

During the workshop, Dr. Nilanjan Ghosh, Director, Centre for New Economic Diplomacy & ORF Kolkata enlightened the participants on the topic of Climate Change: Green Finance and Global Initiatives. Dr. K Siva Kumar, Professor, Pondicherry University, Pondicherry gave a presentation on "An Overview of Blue Economy: Multi-Dimensional Perspective".

Dr. Nilanjan Ghosh, Director, CNED & ORF Kolkata delivering his presentation

Dr. K Siva Kumar, Professor, Pondicherry University during his presentation

ADAI & DG, iCED, Ms. Sayantani Jafa, Mr. Deen Dayal Verma, Director (Administration) and Director (T&R), Dr. Nanda Dulal Das along-with other officers at iCED, during the inauguration of the iCED's Foundation Day.

14th Foundation Day of the

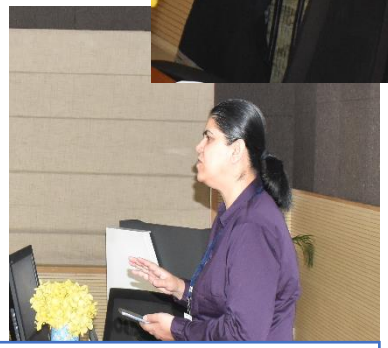
International Centre for Environment Audit and Sustainable Development

Greening Initiative:

A Plantation Drive at iCED, Jaipur

13.3 National Training Programme on "Audit of Climate Change, Mitigation and Adaptation Strategies" from 5th June to 9th June, 2023 at iCED, Jaipur

The National Training Programme on "Audit of Climate Change, Mitigation and Adaptation Strategies" was organised at iCED, during the period 5th June to 9th June, 2023. A total of 15 participants from seven field audit offices including four IA&AS officers, participated in the training programme.



Experts during the National Training Programme at iCED, Jaipur

Ms. Sayantani Jafa, ADAI & DG, iCED inaugurated the training programme and highlighted the role of audit to combat the challenges posed by Climate Change and to ensure a sustainable future for generations to come.

Group Photo during National Training Programme on "Audit of Climate Change, Mitigation and Adaptation Strategies"

Experts from reputed organisations such as Birla Institute of Technology and Science (BITS), Pilani, Goa Campus; The Energy and Resources Institute (TERI), New Delhi; World Resources Institute (WRI), India; Ministry of Earth Sciences, Government of India, New Delhi; Indian Institute of Technology, Delhi;

Centre for Science and Environment (CSE), New Delhi; SMEC India, Independent Researchers delivered sessions on Climate Change and Sustainable Development Goals: An Overview, Socio-Economic Impact of Climate Change with special reference to India, Carbon Neutrality and Global Framework for Climate Change Mitigation and Adaptation, Risk Assessment using indicators of Climate Change, Transportation, Sustainability and Decarbonisation – A Paradigm Shift in Climate Change, and Incorporation of Auditing perspectives in Climate Change Issues.

The Research Associates from iCED, delivered sessions on Toolkit on Marine Renewable Energy, Marine Plastic Pollution and Ocean Acidification with special reference to Climate Change. Other sessions included presentations on National Action Plan on Climate Change (NAPCC): Approach and Achievements, Audit of Climate Change with special reference to Climate Finance in India and Audit of Climate Change: Case Studies from SAI India (Audit of RINL-2022.

Ms. Sayantani Jafa, ADAI & DG, iCED , Dr. Nanda Dulal Das, Director (T&R), iCED with the participants during Group Presentation

Ms. Sayantani Jafa, ADAI and DG, iCED graced the valedictory session of the National Training Programme. She emphasised the importance of trainings related to Climate Change, Mitigation and Adaptation Strategies. ADAI and DG, iCED wished that the sharing of experiences and perspectives during the training would suitably equip the participants to take the learning process forward.

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International Organisation of Supreme Audit Institutions (INTOSAI) Working Group on Environmental Auditing (WGEA) News

By: Manoj Kumar, AAO

INTOSAI WGEA present at the High-level Political Forum (HLPF) 2023

The INTOSAI WGEA organised a side event on 13 July titled *Moving towards full SDG implementation by partnering for greater impact of SDG audits* in collaboration with several partners. This event took place during the High-level Political Forum on Sustainable Development (HLPF) during the period 10th to 19thJuly in New York, USA.

The discussion highlighted that the audits on Sustainable Development Goals (SDGs) have created tangible results which can drive change when communicated well. On the other hand, SDGs have been a catalyst for new audit methods and enhanced collaboration between the Supreme Audit Institutions (SAIs).

The INTOSAI WGEA organised a roundtable conversation jointly with the INTOSAI Development Initiative (IDI), the INTOSAI General Secretariat, the Permanent Missions of Austria and Indonesia, the Supreme Audit Institutions of Brazil, and Indonesia, and in collaboration with United Nations Department of Economic and Social Affairs (UNDESA) to share experiences, audit insights, recommendations and examples of actions taken which have led to positive change in the implementation of the SDGs in different areas. Special focus was given to the goals on Drinking Water (SDG 6), Renewable Energy (SDG 7), Transport and Air Pollution (SDG 11), Sustainable Public Procurement (SDG 12.7), Gender Equality (SDG 5) and Public Health (SDG 3.d), amongst others. WGEA provided input especially to SDGs 6, 7 and 11.

The session pointed out that SAIs have worked with the SDGs from the very beginning. There was experience sharing on sustainable public procurement (SDG 12.7) and public health (SDG3.d). Emphasis was also laid on developing innovative approaches and methods in audits alongwith a systematic approach, competent auditors, robust follow-up mechanisms and systems of audit quality management.

Key Takeaways

1. Audits on SDGs have created tangible results which should be communicated well to drive change. On the other hand, SDGs have been a catalyst for new audit methods and mutual support between the SAIs. Finally, it was noted that there are good examples of collaboration with stakeholders which should be replicated.

The WGEA also published a blog post which summarised the results of the audit reports related to SDG 6 Clean Water, SDG 7 Affordable and Clean Energy as well as SDG 11 Sustainable Cities (INTOSAI WGEA, 2023).

Two new collaborative projects on Climate Change (INTOSAI WGEA 2023)

The INTOSAI WGEA collaborates with two global projects on Climate Change.

The Federal Court of Accounts of Brazil's initiative, Climate Scanner, is a global assessment of government actions related to Climate Change. The Climate Scanner will work as a tool for rapid reviews of government actions related to combating Climate Change. The INTOSAI Development Initiative's (IDI's) Global Cooperative Audit of Climate Change Adaptation Actions (CCAA) is a cooperative audit that aims to help SAIs in providing a timely audit response to Climate Change.

More information on the project is available on the Climate Scanner website: https://sites.tcu.gov.br/climatescanner/ingles.html

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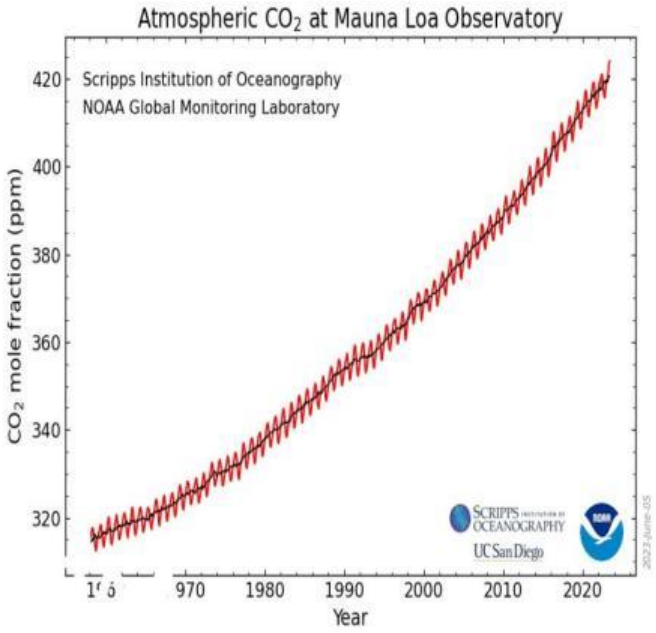
Environmental News

By: Lokesh Kumar Meena, AAO

1. Carbon dioxide levels breach another record: National Oceanic and Atmospheric Administration (NOAA)(Rohini, 2023)

Scientists from the National Oceanic and Atmospheric Administration (NOAA) and Scripps Institution of Oceanography at the University of California announced on June 5, 2023 that the levels of heat-trapping carbon dioxide in the Earth's atmosphere breached another record in May 2023. CO_2 levels now spiked more than 50 per cent than at the commencement of the industrial age, showed measurements obtained from atop a Hawaiian volcano.

This year's annual increase "measured at NOAA's Mauna Loa Atmospheric Baseline Observatory peaked at 424 parts per million in May, continuing a steady climb further into territory not seen for millions of years," noted a statement by NOAA. Every year, we see the impacts of Climate Change in the heat waves, droughts, flooding, wildfires and storms happening all around us. While we will have to adapt to the climate impacts we cannot avoid, we must expand every effort to slash carbon pollution and safeguard this planet and the life that calls it home," said NOAA administrator Rick Spinrad in a press note.



Source: NOAA Global Monitoring Laboratory.
Image Source:(Rohini, 2023)

2. The High Seas Treaty adopted by 193 UN member states (United Nations, 19 June 2023)(The Wire, 2023)

The High Seas Treaty is the world's first treaty to protect biodiversity in international waters. It will require signatories to assess any planned activities that may impact ocean life beyond national jurisdiction. The UN's 193 Member States adopted a landmark legally binding marine biodiversity agreement following nearly two decades of fierce negotiations over forging a common wave of conservation and sustainability in the high seas beyond national boundaries – covering two thirds of the planet's oceans.

Here are five key points on why it is important for the world.

(i) **Fresh protection beyond borders:** While countries are responsible for the conservation and sustainable use of waterways under their national jurisdiction, the high seas now have added protection from such destructive trends as pollution and unsustainable fishing activities. The new agreement contains 75 articles that aim at protecting, caring for, and ensuring the responsible use of the marine environment, maintaining the integrity of ocean ecosystems, and conserving the inherent value of marine biological diversity.

(ii) **Cleaner oceans**: The treaty aims at strengthening resilience and contains provisions based on the polluter-pays principle as well as mechanisms for disputes. Under the treaty's provisions, parties must assess potential environmental impacts of any planned activities beyond their jurisdictions.

(iii) **Sustainably managing fish stocks**: The treaty underlines the importance of capacity building and the transfer of marine technology, including the development and strengthening of institutional capacity and national regulatory frameworks or mechanisms. This includes increasing collaboration among regional seas organisations and regional fisheries management organisations.

(iv) **Lowering temperatures**: Global heating is pushing ocean temperatures to new heights, fueling more frequent and intense storms, rising sea levels, and the salinisation of coastal lands and aquifers.

(v) **Vital for realising 2030 Agenda**: Some of the goals and targets include Sustainable Development Goal (SDG) 14, which aims at, among other things, preventing and significantly reducing marine pollution of all kinds by 2025, and ending overfishing through science-based management plans in order to restore fish stocks in the shortest time feasible. The new agreement will enable the establishment of area-based

management tools, including marine protected areas, to conserve and sustainably manage vital habitats and species in the high seas and the international seabed area.

3. India's Blue Economy sets sail to unlock a sea of opportunities!(The Economic Times , 2023)

The Indian government has launched a mission-mode project called the "*Deep Ocean Mission"*. Spearheaded by the Ministry of Earth Sciences, this initiative brings together various line ministries, research institutions, and academia to tackle the multifaceted opportunities and issues plaguing the oceans.

With the implementation of the Deep Ocean Mission, the government endeavours to harness the boundless potential of the ocean and fortify India's Blue Economy. This ambitious initiative, aligned with the visionary agenda of Hon'ble Prime Minister Shri Narendra Modi, aims to elevate the contribution of the Blue Economy from single-digit figures to double-digit growth in our nation's Gross Domestic Product (GDP). Also, United Nations announced the decade (2021 to 2030) as the "UN Decade of Ocean Science for Sustainable Development" seeks knowledge of Ocean, essentially to drive "the Science we need for the ocean we want". Ministry of Earth Sciences is dedicated to spearheading the triumph of the Deep Ocean Mission by collaborating with experts, stakeholders, and international partners.

4. G20 Environment and Climate Sustainability Ministerial Meeting: EU reaffirms its international environmental and climate ambition

G2o Environment and Climate Sustainability Ministerial Meeting took place in Chennai, Tamil Nadu from July 26th to July 28th 2023. The three day meeting brought together around 300 delegates from G20 member countries, invitee countries and several international organisations. The pre-event media briefing in Chennai, was addressed by Mr. Bivash Ranjan, ADG, MoEFCC, Mr. Naresh Pal Gangwar, AS, MoEF&CC, Ms. Richa Sharma, AS, MoEFCC - the theme chairs of Ministry of Environment Forest and Climate Change (MoEFCC) for land restoration, circular

economy, and blue economy. These discussions emphasized on identifying global solutions that could help tackle the multidimensional challenge of climate and environment degradation. (G20 Org, 2023)

5. July 2023 officially declared hottest month ever on the planet.

The month of July 2023 has been confirmed as the hottest month ever recorded according to the European Union's Copernicus Climate Change Service. The year of 2023 is currently the third warmest year on record, with temperatures in July reaching 1.5 degrees Celsius above pre-industrial levels as stated by Samantha Burgess, Deputy Director of Copernicus. She further emphasised the urgent need for ambitious efforts to reduce greenhouse gas emissions, the primary driver behind these record-breaking temperatures. (India Today , 2023)

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The Role of Supreme Audit Institutions in auditing Sanitation and Industrial projects in accordance with Goal No. 6 of the SDGs with reference to the ASA's Experience

By: SAI Egypt (Accountability State Authority- Egypt)

Introduction

Goal No.6 of the Sustainable Development Goals (SDGs) recognises that sustainable water management goes beyond just providing safe water supplies and sanitation services. The two targets (6.1 and 6.2) aim to address the broader water context such as water quality, wastewater management, water scarcity, water use efficiency, water resource management, and the protection and restoration of water-related ecosystems. The delivery of water supply and sanitation services is no longer just a challenge to service provision, but is intrinsically linked to Climate Change, water resource management, water scarcity, and water quality.

SDG 6- Clean Water and Sanitation

Image source: United Nations

Although some progress was achieved between 2015 and 2019 according to the 2023 Sustainable Development Report, this did not last long due to the crises that ravaged the world, including the "Covid-19" pandemic, the Russian-Ukrainian war and other geopolitical tensions, which indicates that the world is not on the right track to achieve the Sustainable Development Goals that United Nations' (UN) member states pledged in 2015 to reach by 2030.

The Importance

The importance of this article is due to the adoption of the 2030 Agenda for Sustainable Development by the UN member states in 2015, which established a set of development goals to be achieved by 2030. Perhaps the most important of these goals is the sixth goal related to the availability of water and sanitation services for all, because it is linked to most of the SDGs such as health, combating poverty and hunger, quality of education and other goals. Egypt also faces many challenges related to achieving these goals, including Climate Change, population increase, the Corona

pandemic. SAIs, including the Accountability State Authority (ASA), audit/monitor the achievement of these goals as well as their achievement rates according to the set indicators, and demanding correction of deviations if discovered, which will be explained in this article.

The Goal

This article aims to track the progress attained by the Egyptian government towards achieving the sixth goal of the 2030 SDGs: which states ensure availability and sustainable management of water and sanitation for all, and follows the two targets No." 6.2" and "6.3", where target "6.2" of the SDG aims to: Achieving the goal of adequate and equitable access to sanitation and hygiene services for all, paying special attention to the needs of women, girls and people in vulnerable situations, by 2030.

Target "6.3" of the SDG aims to improve water quality by reducing pollution, preventing and minimising leakage of waste, chemicals and hazardous materials, reducing the proportion of untreated wastewater to the half, and significantly increasing recycling and safe reuse globally, by 2030.

This is done by measuring the indicators related to them, as the indicator“6.2-1a” monitors the percentage of the population that benefits from sanitation services that are managed in a safe manner. This is during the period 2015-2022. The indicator “6.3.1” also monitors the percentage of total wastewater flows, both industrial and domestic, that are subject to safe treatment according to national or local standards.

The facts of implementing the sixth goal of the 2030 SDGs in the world are as follows:

- More than two billion people lack access to basic sanitation services.
- Six out of 10 people lack access to safely managed sanitation facilities.
- Every day, nearly one thousand child die from diarrheal diseases linked to water and sanitation facilities.

- About 842,000 people die each year due to diarrhea as a result of unsafe drinking water, poor sanitation services, or the absence of public health. The problem appears acutely especially in rural areas in South Asia and Sub-Saharan Africa.
- Seven out of ten people who lack access to safe and sanitary toilet facilities live in rural areas, mostly in Sub-Saharan Africa and South Asia.

In addition, the rapid pace of urbanisation contributes to the fact that more than 700 million people living in urban areas do not have access to sanitation services. An estimated 10 per cent of urban wastewater is treated in low and middle-income countries, and as the amount of wastewater increases, so does the impact on health.

The challenges of achieving improved sanitation services in developing countries are as follows:

- Only 68 per cent of the world's population has access to improved sanitation facilities, falling short of the Millennium Development Goal target of 77 per cent.

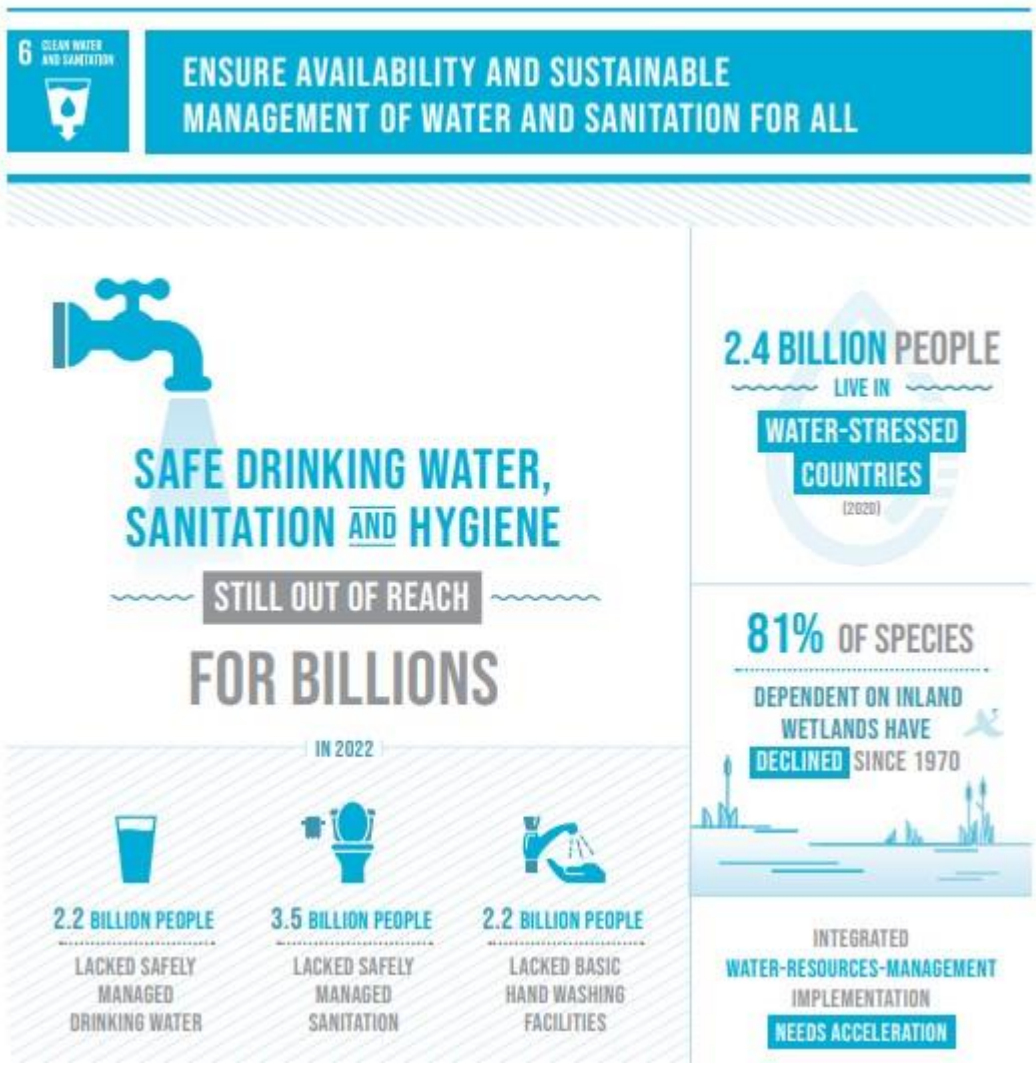

Image source: United Nations

- More than 80 per cent of the wastewater generated by human activities is discharged into rivers or the sea without any removal, which leads to its pollution.
- Some countries also suffer from a funding gap for water and sanitation projects of 61 per cent of the financing needed to achieve their water and sanitation targets.
- More than $250 million of Gross Domestic Product (GDP) is lost each year in low and middle-income countries due to inadequate water supply and sanitation services. In some countries, this figure may represent up to 7 per cent of GDP, and many sectors may be affected by inadequate sanitation services such as health and tourism.
- The Egyptian government faces many challenges in the field of sanitation and achieving the sixth goal of the SDGs, which led the state to move towards treating agricultural wastewater to benefit from it in agriculture and tree forests, and the cultivation of the jojoba plant to obtain biofuel.

This is in addition to Climate Change, as water needs increase with rising temperatures, which leads to increased pressure on sewage networks out of industrial and domestic uses, and raining, in addition to the population increase.

The Corona pandemic crisis also posed an urgent and additional challenge for the Egyptian government, as the crisis doubled the domestic consumption of fresh water, which has become an important means of hygiene and disinfection, which puts increasing pressure on the sewage networks in a sudden and unprecedented manner.

The Role of SAIs

By auditing the sixth goal, the SAIs aim to track the progress tolled by different countries towards achieving the sixth goal of the SDGs 2030: which stipulates ensure availability and sustainable management of water and sanitation for all, and tracking the two targets No. 6.2, 6.3 and the indicators associated with them, the most important of which is the progress towards this goal to be tracked according to indicator "6.2-1a" which indicates proportion of the population using safely managed sanitation services, and that during the period 2015-2022, and the indicator "6.3.1"

which indicates the percentage of total wastewater flows, industrial and domestic, that are subject to safe treatment according to national or local standards.

Additionally, auditing infrastructure projects and the amounts spent on them in accordance with the financial audit, compliance and environmental audits, as well as auditing the performance evaluation according to its three elements of economy, efficiency and effectiveness, along with defining deficiencies or deviations, reporting these reports to governments and parliaments, and providing information to scientific entities and international and local organisations concerned within SDGs.

The Role of the ASA in the field of auditing sanitation projects:

The ASA seeks to empower auditors to help assess the interlinkages and complementarities between the SDGs, highlight specific findings and recommendations through various audits of the SDGs, and direct government towards addressing shortcomings by carrying out financial, performance, and compliance audit, as well as providing information for governments and stakeholders to benefit from and work towards the full implementation of the 2030 Agenda.

The ASA has developed a model and framework for implementing a financial audit programme for sanitation projects in accordance with the sixth goal of the SDGs, and the two targets No. "6.2, 6.3", and the related indicators, including indicator "6.2-1a" and indicator "6.3.1", as well as to audit and evaluate performance during the implementation process, and to ensure the extent of compliance with international agreements and the timetable of the 2030 Agenda and Egypt's strategy 2030, and the laws, plans, programmes and protocols signed with countries, donors and lenders, and verifying that environmental, social and governance studies “ESG” have been conducted before implementation begins.

In order to achieve the goal of audit process, a model was designed in accordance with INTOSAI’s audit standards and Guide No. 140 related to the quality of the audit process, as the audit work is carried out since the start of implementing these projects on an ongoing basis.

The ASA also followed up the companies conducting environmental impact assessment studies of new activities and expansions prior to implementation, associated economic feasibility studies, and the availability of funds necessary for implementation.

Recommendations mentioned in the ASA's report about its role in auditing the projects implemented by the state in the field of sanitation in accordance with the sixth goal of SDGs, and the two targets No. 6.2, 6.3:

- Studying the deficiencies in the treatment stages of the sewage treatment plants and giving priority to providing technical and material support and capacity building to move towards green financing necessary to implement and develop the treatment plants in order to be in conformity with the standards stipulated in the laws, with the connection of sewage networks to villages deprived of them to raise their environmental level.
- The need to work on rehabilitating and raising the efficiency of the sewage and industrial sewage treatment plants that are suspended from work and that discharge raw sewage into drains without treatment, which leads to pollution of waterways.
- Commitment to periodic sampling from treatment plants in application of the applicable laws.
- The need to work on intensifying inspection (preview) on the violating facilities to avoid the irregularities therein in order to reduce the pollutants dumped on the waterways and follow up the implementation of plans to adjust the conditions of their disposal and urge facilities to finalise them, in order to preserve the national wealth.
- The need to take legal action against either the violating industrial establishments that have not reconciled the conditions of their drainage on the waterways, or that remain violating of conditions' reconciliation during the period in which they are implementing the plan to reconcile the situation.
- Following up the removal of violations or infringements, collecting fines, and following up the implementation of projects in accordance with the timetables set for implementation.
- The use of treated water in the cultivation of tree forests and biofuel plants (jojoba).
- Promoting sustainable, low-emission and low-cost management of drinking water and wastewater, and the use of integrated water resources management methods among the entities and ministries concerned with water affairs in order to achieve the highest levels of coordination and

support among those institutions and provide information and transparency to make efficient and effective decisions, and to make maximum use of all the country's water resources and thereof associated sewage stations.

- Expanding the intensification of media and advertising campaigns to raise awareness of the importance of rationalising water use and taking the necessary measures to reduce wasteful use of water, to maintain the efficiency of sewage stations, and launching environmental campaigns aimed at reducing environmental pollution rates.

Government Response

- Most of the ASA's recommendations have been responded, especially in the field of following up on the removal of violations or infringements, collecting fines, and following up the implementation of projects in accordance with the timetables set for implementation.
- Acknowledge a fund to compensate "losses and damages" incurred by developing countries as a result of Climate Change.
- Egypt launched the National Strategy for Climate Change 2050, and it also launched during its hosting of the "COP27" in November 2022, the initiative "Action for Adaptation in the Water Sector and Resilience" to address the challenges facing the water file in Africa, where climate shifts witnessed a dangerous junction, as the temperature in Africa increased by 0.90 Celsius over the past 30 years, with expectations of an increase in temperature rates during the coming decades. The imitative pivots contained six key factors, inter-alia fostering the low emissions', low costs, sustainable management for sewage and drinking water and linking national water policies to climate action to reflect the long-term impacts of Climate Change on water resources and demand.
- The 2023 Sustainable Development Report indicated that Egypt advanced six places this year in the SDGs Index, as it ranked No. 81 out of 166 countries included in the report, compared to its rank last year, when it was No. 87 out of 163 countries. "Egypt's score increased in this indicator, to achieve 69.6 degrees in the current year, compared to 68.7 in 2022; which means Egypt's increasing efforts to achieve the SDGs.

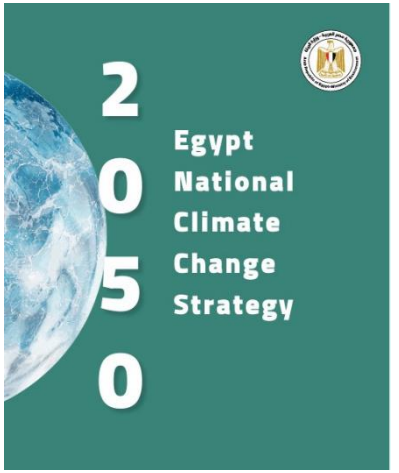

Image Source: Egypt National Climate Strategy (NCCS)-2050

- The Egyptian policy orientation towards extending drinking water and sanitation services throughout the country, especially in marginalised and remote areas with an aim to provide and support the means of life and well-being for the rest of the Egyptian people, This is done within the framework of the “Decent Life” initiative, which aims to increase sanitation coverage to 100 per cent by 2030.
- Indicator 6.2.1a: which indicate the proportion of the population benefiting from sanitation services managed in a safe manner. It’s applied on the period 2000-2022, and percentage amount to about 67.17 per cent in 2022.
- Indicator 6.3.1 which indicates the percentage of wastewater treated in a safe manner, it reached 86.2 per cent in 2021/2022.
- Water quality: The conformity rate for samples taken for examination from production stations was 99.2 per cent, and from distribution networks was 97.1 per cent in 2021/2022.
- The total number of treated sewage stations increased by 1.9 per cent in 2021/2022, and part of the treated sewage was used in irrigating the trees forests.

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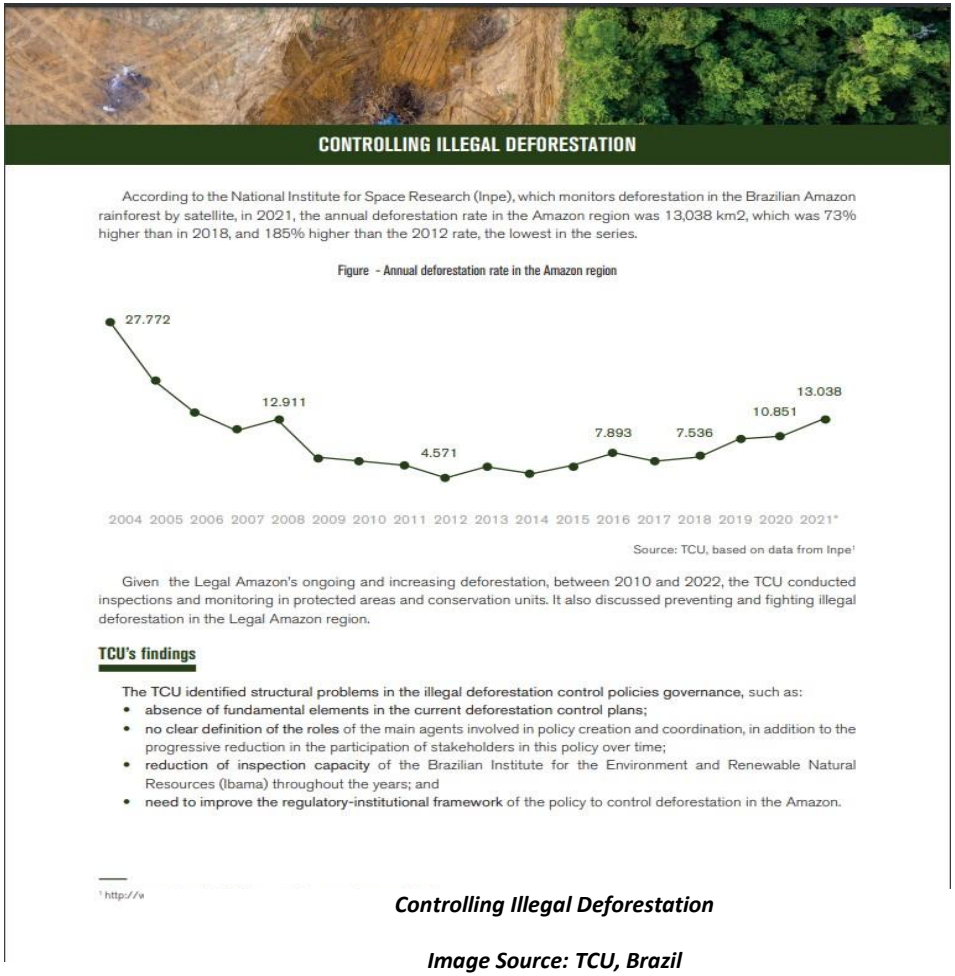
Audit of Illegal Deforestation in the Amazon Rainforest, Federal Process of Punishing Environmental Infractions, and National Solid Waste Policy by SAI-Brazil (Federal Court of Accounts – TCU)

By: SAI Brazil (Federal Court of Accounts-TCU)



Controlling Illegal Deforestation

Image Source: TCU, Brazil

In 2019, the SAI-Brazil (Federal Court of Accounts - (Tribunal de Contas da União) (TCU)) evaluated the actions of the Federal Government to control illegal deforestation in the Amazon rainforest from 2016 to2020. The audit found the absence of fundamental elements in the plans of deforestation control. In addition, it verified the lack of clear definition of the competences of the main factors involved in the formulation and coordination of the policy, besides the reduction over time of the participation of stakeholders in this policy. The TCU also noted that the messages issued by high-ranking government officials have disempowered the work of the institutions involved in the inspection process, impacting this activity negatively. Situations that undermine inspections were identified, such as the reduction of its effectiveness due to the decrease in the number of agents able to carry out the activity, the lack of a social communication strategy, deficiencies in the appointment process for strategic positions, and the weakening of the inspectors' entitlement to use weapons. Recommendations were made for the improvement of the normative-institutional framework of the policy to control

deforestation in the Amazon. It was also recommended that public messages related to combating deforestation and the actions of institutions involved in inspections be aligned with the objectives of the public policy of deforestation control. Recommendations included also measures to mitigate the weaknesses related to inspectors' entitlement to use weapons, deficiencies in appointment to strategic positions, inspection capacity and social communication.

In 2021, the TCU evaluated the federal process of punishing environmental infractions, which aims to promote the environmental control and inspection strategies that help deter illicit acts and the effective recovery of environmental damage. The audit analysed post-inspection stages, namely: conciliation, administrative litigation, and execution of penalties. The TCU identified the need for better structuring of the alternatives for converting fines into environmental preservation services and found insufficient information mechanisms on this procedure. Excessive time was also observed in the completion of administrative processes and delay in notifying offenders. The TCU recommended the adoption of measures to improve the structuring of possibilities for converting fines into environmental preservation services, as well as to address the shortcomings identified in the audit.

In 2022, the TCU evaluated the actions of the Federal Government in relation to the National Solid Waste Policy, which refers to the management of urban solid waste in Brazil. Several problems were identified, such as the low implementation of charges for the municipal solid waste management and handling service, the lack of formation of regional arrangements to reduce costs, the low presence of waste management plans in the municipalities, the absence of detailed mapping of contaminated areas and the lack of coordination between the agencies responsible for implementing the policy. These problems resulted in disjointed and inefficient actions in the management of solid waste, with negative impacts on the health of the population and on the economy. The TCU issued an injunction about the definition of an action plan for the identification, location, and classification of the so-called contaminated orphan areas, detailing the activities that will be developed to recover the degraded areas. It also recommended the establishment of procedures and practices to better articulate and coordinate the activities regarding the management of urban solid waste, considering the adequate implementation of the National Solid Waste Policy.

Impact of Climate Change on Coastal Cities: An 'Integrated Adaptation' Approach PART I

(Article dated 29th November 2020, reprinted with kind permission from the National Maritime Foundation)

By: Chime Youdon, Associate Fellow and a 'Vice Admiral K K Nayyar' Fellow at the National Maritime Foundation

Abstract

A country's coastline is the epicentre of its business, commerce, transportation, and industry. It provides a majority of the global ecosystem goods and services that are central to the country's socio-cultural and economic development. Hence, the threat posed to coastal cities by a rise in the sea level caused by Climate Change is both, high and multi-dimensional. The Indian coastline is one of the most vulnerable, risk-prone and densely populated regions in the world. Indian coastal cities have been altered profoundly in the last few decades due to their rapid growth in population and economic activities. The impact of Climate Change-induced sea-level rise is aggravated by unsustainable and unplanned development, and the growth of densely populated and unstructured settlements in coastal cities. Limited access to housing, public services and infrastructure for the poor, as also poverty itself, add to the vulnerability of coastal cities. Consequently, extreme climate-induced hazards weaken the resilience and coping-capacities of already poor and vulnerable communities, raising socio-economic costs[1]. The impact of Climate Change on coastal cities is a vital strategic, economic and political issue as well.

This article seeks to draw the attention of the Indian populace at large, but most particularly that of India's coastal communities and their governance structures, to the alarming and imminent challenge posed by climate-change-induced sea-level rise. In an attempt to present the arguments in smallish 'bite-sized' morsels, the article is being presented in two parts. Part I dwells on the impact of Climate Change and sea-level rise on coastal cities, while Part II focuses upon the manner in which urban expansion and encroachment have intensified vulnerability of coastal cities to climate-change-induced impacts. It also discusses how the most vulnerable and disadvantage section of the population is overlooked, and how the lack of fair equity in several dimensions of action and decision-making in terms of coastal adaptive measures ends-up reducing the adaptive capacity of coastal cities.

On the one hand, coastlines in general are highly productive and critical elements of any country as they provide a globally-connected ecosystem of goods and services, which is central to socio- cultural and economic development. On the other hand, they are areas that are highly risk- prone vis-à-vis climatic impact. Perhaps the most serious risk, and one that is growing much faster than predicted, involves the adverse impact of climate-change in its several manifestations. These include extreme climatic events such as flooding, drastic changes in the precipitation cycle, a sharp and sustained rise in sea-surface temperature, and, tropical revolving storms (TRS) that are, of late, demonstrating a marked increase in frequency-of-occurrence and in ferocity/intensity, but an equally marked decrease in path-predictability. The occurrence of such extreme weather events is affecting both natural ecosystems and human systems severely and adversely, with socio-economic productivity being correspondingly impacted. Moreover, coastal cities already stand exposed to high and multi-dimensional risks induced by climate- change-related sea-level rise. Coastal cities are also highly vulnerable to anthropogenic Climate Change and have the least capacity to adapt. Yet, exposure to the impacts of climate hazards is expected to increase with growing population and economic relevance of coastal cities[2].

Insofar as India is concerned, the country's coastline runs for some 7,516 kilometres (km) across nine states and four union territories (UTs) — two of the latter, namely, the Andaman and Nicobar island chain on the country's eastern seaboard, and the Lakshadweep chain on the western one, being archipelagos. This coastline is home to roughly 170 million people and, not only is it one of the most densely populated regions in the world, it is also extremely vulnerable to a multiplicity of sea-based threats and hazards, the more obvious of which have already been mentioned. The Indian coastline is studded by a number of human agglomerations, ranging from fishing hamlets and villages to megacities. Climate Change and climate variability will produce an extremely complex web of interrelated and highly adverse impacts on all such human concentrations but will be most severely felt in large coastal cities. Amongst the most worrying of these effects concern is sea-level rise.

Table 1 depicts how the warming of the globe will impact regional climatic variations such as temperature change, precipitation, and sea-level rise, in India.

Table 1: Climate Change Projections for India based on Four Global Environmental Multiscale (GEM) Model Outputs

Year	Temperature Change (°C)			Precipitation Change (%)			Sea Level Rise (cm)
	Annual	Winter	Monsoon	Annual	Winter	Monsoon	
2020s	1.36±0.19	1.61±0.16	1.13±0.43	2.9±3.7	2.7±17.7	2.9±3.7	4 to 8
2050s	2.69±0.41	3.25±0.36	2.19±0.88	6.7±8.9	-2.9±26.3	6.7±8.9	15 to 38
2080s	3.84±0.76	4.52±0.49	3.19±1.42	11.0±12.3	5.3±34.4	11.0±12.3	46 to 59

Source: Aromar Revi 2008[3]

Major factors that contribute to sea-level rise are ocean thermal expansion, the melting of glaciers and icecaps, glacier-melt from the Greenland and Antarctic ice-sheets, and, to a smaller extent, the melting of snow on land and permafrost. The sea-surface temperature (SST) of the tropical Indian Ocean rose by 1°C on average during 1951–2015, which was markedly higher than the global average SST warming of 0.7°C, over the same period. As a direct consequence, the sea-level rise experienced in the northern Indian Ocean, has accelerated to 3.3 mm per year between 1993-2017[4]. This rate of sea-level rise will accelerate further with the rising mean temperature. Table 1 clearly depicts that increasing temperature is contributing to the sea-level rise and its impacts. For instance, the sea-level rise increased from 4-8 cm to 15-38 cm with a temperature-rise of just 2°C. This sort of sea-level rise will inundate a very large number of low-lying areas. It is likely to aggravate flood situations, erode beaches and further impact coastal settlements in terms of population-displacement from presently densely-populated areas. As per studies undertaken by The Energy and Resources Institute (TERI), a one-metre rise in sea level would displace approximately 7.1 million people within the coastal population, and place about 5,764 sq km of land at risk of getting submerged. Several coastal areas — with their constituent population amounting to some 200 million people — are projected to be below the high-tide line by 2100[5].

According to the Intergovernmental Panel on Climate Change (IPCC), climate models are consistent with the ocean temperature observations and indicate that thermal expansion will continue to contribute to sea-level rise over the next 100 years. Since deep-ocean temperatures change slowly, thermal expansion would continue for many centuries even if atmospheric concentrations of greenhouse gases were to be stabilized[6]. Therefore, increasing temperatures and sea-level rise are likely to continue to be major risk factors for coastal cities in India, where one-third of the population [which is nearly 40 million people] is located. This regional temperature-rise, along with the changes being experienced in both, the global climate system and the Indian Ocean monsoon system, may lead to a mean increase in annual precipitation of 123 per cent by 2080, up from the 3.7 per cent change forecast for the 2020s. Even more worryingly, it is assessed that many regions in the semi-arid and drought- prone central part of India will also experience a simultaneous decline in precipitation of the order of 5-25 per cent. As if there were not challenge enough, a sharp decline in winter rainfall across northern India is also projected[7] .This lethal combination of severe disruptions to the country's precipitation cycle will severely affect food security and agriculture production. According to a 2011 study conducted by the Indian Agricultural Research Institute and the CGIAR Research Program on Climate Change, Agriculture and Food Security, Climate Change could lead to a 15-50 per cent decrease in the yield of irrigated maize and a 10 per cent drop in yields of irrigated paddy in the majority of coastal districts by 2030[8].

Chronic flooding, too, should be expected in the future. The Climate Central study on global vulnerability to sea-level rise and coastal flooding estimates that 36 million Indians are at risk of chronic flooding by 2050 and estimated that number will grow to 51 million Indians by 2100 [See Figure 1]. It also predicted that extreme precipitation similar to the Mumbai floods in 2005 and Gujarat floods in 2006 could occur over other parts of the west coast in the absence of effective measures[9].

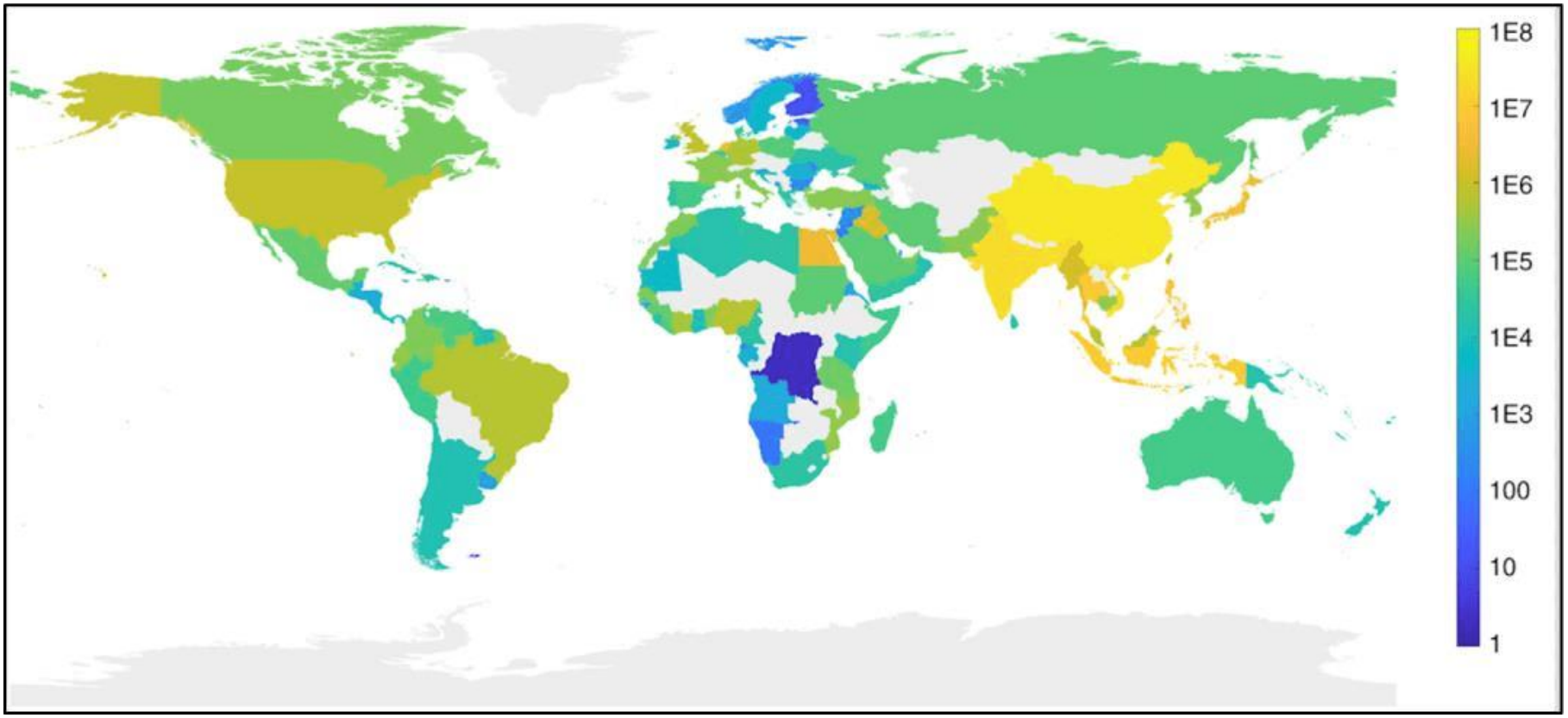


Fig. 1: Number of People on Land Exposed to Sea-level Rise and Coastal Flooding by 2050 Source: Scott A. Kulp and Benjamin H. Strauss, "New Elevation Data Triple Estimates of Global Vulnerability to Sea-Level Rise and Coastal Flooding", Nature Communication, 10, No. 4844 (2019).

Cyclones and storm surges are very likely to be devastating for coastal mega-cities such as Mumbai, Chennai, Visakhapatnam, Surat, Bharuch, Bhavnagar and Jamnagar, apart from causing critical bottlenecks in important ports such as Kandla[10]. It needs to be remembered that a storm surge, accompanied by coastal flooding and cyclonic winds, is the second most destructive, rapid onset hazard in Gujarat. It accounts for 12 per cent of

the risk to the state and a potential loss of over 11,000 lives for a probabilistic 100-year event[11]. Increased migration to the coast, drawn by huge investments in coastal infrastructure, settlements and enterprise would be disastrous as there are future risks involved, which have not been considered.

Another major big loss of Climate Change-induced changes on the coastal region is infrastructure, predominantly ports because India has 12 major and 205 notified minor and intermediate ports. Indian port operator handles significantly large number cargo movement and 95 per cent of the country's trade by volume and 70 per cent by value is done through the ports. "Sea level rise, storm surges and waves are likely to induce major impact on coastal transport hubs and networks, including transient or permanent flooding of seaports and connecting coastal roads and rail lines," says a report by the United Nations Conference on Trade and Development.

The ongoing-and-accelerating rise in sea level poses a clear, direct and imminent threat to the populations of each such coastal city, and adversely impacts their livelihoods, the city's economy, its tourism, coastal infrastructure, and marine ecosystems. For instance, the degradation of coastal ecosystems, especially wetlands and coral reefs, has serious implications for the wellbeing of coastal communities that are largely dependent on the coastal ecosystem for goods and services. It is fairly obvious that coastal flooding caused or accompanied-by sea-level rise will cause serious degradation of drinking-water sources and supply-systems, fishery resources, and, lead to the inundation of low-lying areas, impacting millions of people, with unpredictable consequential political fallouts as well.

A cause of considerable disquiet, if not actual alarm, is that even if Greenhouse Gas (GHG) emissions are stabilised in the near future, sea levels would continue to rise for many decades[12]. The adverse impact of greenhouse gas emissions and the associated global warming would be irreversible and devastating to the coastal cities, whose millions of economically-disadvantaged inhabitants, many of whom dwell in low-lying areas, are extremely vulnerable to the impact of anthropogenic climate induced hazards and also have least coping capacities. In many cases, these slums and informal settlements are built in low-lying areas that are flood-prone and geologically unstable. Hence, sea-level rise due to Climate

Change is likely to pose not just a serious socio-economic, environmental and security threat to these segments of the population, but rather, an existential one.

Conclusion

Clearly, sea-level rise and anthropogenic drivers of Climate Change constitute a serious challenge to India's coastal cities. These challenges are aggravated by unsustainable development and rapid population growth, high-density but unplanned settlements, and, urban poverty with associated high-differentials in access to housing, public services and infrastructure. The impact of extreme climate-induced hazards further reduces the resilience and coping capacities of poor and vulnerable communities within these cities. At the same time, these hazards increase socio- economic costs very significantly[13]. The impact of climate-change on coastal cities has strong strategic, economic and political repercussions, as well. Clearly, there is an urgent need to integrate Climate Change, developmental projects and population growth in climate adaptation and mitigation policy.

Part II of this article will address urbanisation and the enhanced vulnerability of India's already densely populated coastal cities to the impact of Climate Change. It will discuss how it is important to provide environmental justice and bottom-up solutions on the community level to tackle inequality and eliminate poverty.

About the Author

Chime Youdon is an Associate Fellow and a 'Vice Admiral K K Nayyar' Fellow at the National Maritime Foundation. She is deeply engaged in a set of major studies relating to resilience-assessments of urban agglomerates in the face of Climate Change and is concentrating upon the city of Mumbai.

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Book Review: Global Climate Change and Environmental Policy: Agriculture Perspectives; edited by V. Venkatramanan, Shachi Shah, and Ram Prasad (Venkatramanan, Shah, & Prasad, 2020)

By: Dr. Nanda Dulal Das, Director (T&R)

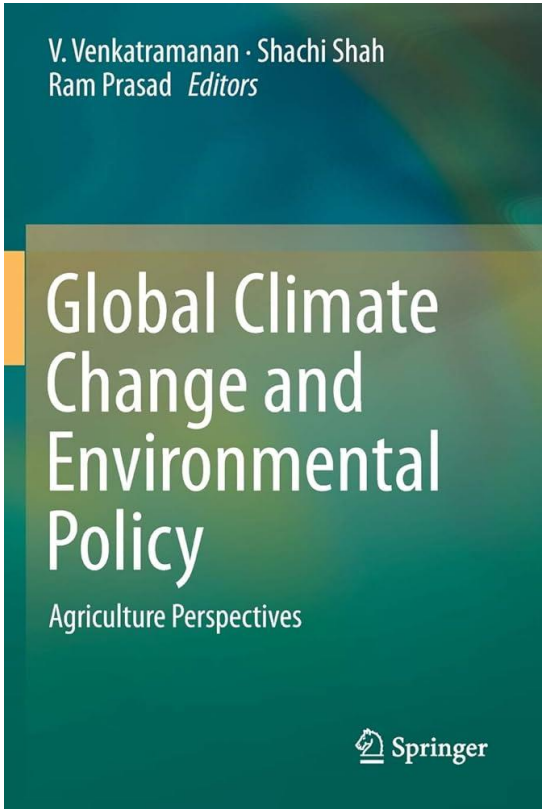

Image Source: Springer

The editors and authors bring out several facets of Climate Change, aspects of governance and policies and their impacts on agricultural practices, socio-economic vulnerabilities in the Indian as well as international context and suggest adaptative solution to deal with the emergent problems.

The book has heavily emphasized on discussion on agricultural sustainability, climate-resilient and smart agriculture as important steps towards adaptation to Climate Change. The chapter on "Ecological Thinking and Agricultural Sustainability" by Anantanarayanan Raman highlights deficiencies of industrialised agriculture which is technology-driven, profit-oriented, and clever management strategy-based. While this might bring short-term fortune to the farmers, it destroys species biodiversity and allows for the spread of invasive species. The chapter, while highlighting principles of sustainability, proposes solutions like adoption of 'Natural Step Framework', Alternative Practices of Agriculture, viz. Organic Farming, Biodynamic Farming, Natural Farming, Permaculture, System of Rice Intensification and development of an "Ecological Knowledge System". However, Mendoza T.C. et al in chapter four highlights the barriers to adoption of Organic Farming and mentions that for innovations in Organic Farming to be successful, initiatives like encouraging innovation from farmers, re-engineering agri-food systems into agro-ecotourism, shifting paradigm from food security to health security, from financesurance to healthsurance, from financial banking to health banking etc. to be

promoted. Shifting from a supply-chain approach to value-chain approach and from consumer-centric approach to the farmer-centric (supply-led) approach are pre-requisites for successful Organic Farming.

The Book also focuses on the problems of Climate Change and their impact on agriculture and vulnerability of agro-based households, while proposing climate-smart agriculture as a way out. Climate-Smart Agriculture (CSA) is a relatively new concept, which was proposed by the Food and Agriculture Organisation (FAO) at the Hague Conference on Agriculture, Food Security and Climate Change, in 2010. CSA focuses on increasing agricultural productivity for food security, increasing adaptive capacity to changing climate and mitigating Climate Change caused by existing agricultural practices. Adaptation measures have both technical and policy perspective with development of stress tolerant and less-water consuming crops being some examples of technological interventions, and water prices, water-allocations, infrastructural reforms, capacity building of stakeholders being some of the policy interventions, as have been highlighted by Durba Kasyap and Tripti Agarwal in chapter seven.

The book provides several case studies from different parts of the world relating to adaptation to changing climate, for e.g., in major coffee-growing regions of Indonesia and capacity building of small holder farmers in Sub-Saharan Africa.

Agriculture (like land-use change, low-land rice cultivation, crop-residue burning, N_2O emission from fertilisers etc.) and livestock also have been one of the major contributing sectors to the global Greenhouse Gas (GHG) emissions. While agriculture in higher altitude and latitude may potentially benefit from Climate Change, disturbance in and loss of current level of biodiversity may bring in unforeseen risks and vulnerabilities to the existing agro-ecosystems. Therefore, it is imperative to control emission taking place from these sectors. C. Valli in chapter eight suggests solutions like reducing the ruminant livestock population, breeding management, manure management, pasture improvement, feed processing, rumen manipulation techniques to reduce Methane emission from ruminants. Restriction on burning of crop residue, switching over to compost-based fertilisers in agriculture can reduce GHG emissions from agriculture to a large extent.

In the face of Climate Change, two chapters (six and nine) highlight the significance of promotion of biofuels, timber-based mixed forestry and agro-forestry as important avenues for improving livelihood of farmers in developing countries. The book, in chapter two and fourteen, brings out

global-level inequity in terms of economic development and gender in the backdrop of Climate Change. While historical emissions and accumulation of GHGs are largely attributed to the developed nations, most vulnerable nations are located in the Global South, owing to lack of financial and technological capability to mitigate or adapt to the challenges of changing climate. Similarly, uneven participation of women in decision-making makes them more vulnerable to the threats of Climate Change and has been highlighted in the book.

While the book provides an extensive coverage on the multiple aspects highlighted above, the arrangement of themes and chapter in a logical sequence would have helped the readers engage more with different chapters and themes. Despite this constraint, the writers and editors have done a commendable job by bringing in knowledge from diverse fields relating to different aspects of Climate Change and agriculture from different corners of the world and deserve accolade.

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Book Review: BLUE ECONOMY Global Best Practices Takeaways for India and Partner Nations, A Study by Core Group of Experts on Blue Economy, December 2019 (KAS, 2019)

By: Kamal Kumar Sahal, Senior Consultant

Introduction: The book offers a comprehensive look at the Blue Economy, with an emphasis on the sustainable use of ocean resources for economic growth, livelihood betterment, and environmental preservation. It covers various topics such as fisheries, aquaculture, renewable energy, marine transportation, coastal tourism, and marine biotechnology, offering insights into successful models and approaches from countries worldwide. The book is divided into nine chapters, providing data and analysis to highlight strategies and policies for sustainable development and economic benefits in these regions. The primary aim is to offer valuable insights and recommendations for India and partner nations to harness their coastal and marine resources sustainably and responsibly. The book explores challenges and opportunities associated with the Blue Economy and presents practical solutions at various levels, including government policies, private sector initiatives, and community engagement. Overall, this book is a valuable resource for policymakers, researchers, and stakeholders interested in understanding and leveraging the Blue Economy's potential for sustainable development and economic progress in India and other partner nations.

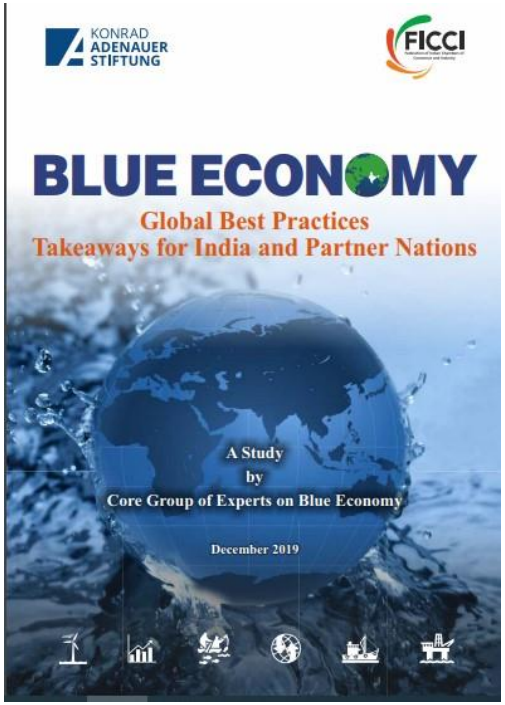

Image Source: Konrad-Adenauer-Stiftung

Concept of Blue Economy: "BLUE ECONOMY Global Best Practices Takeaways for India and I informative study that explores the concept of the Blue Economy and its practical applications in India and other partner nations. Authored by the Core Group of Experts on Blue Economy, in collaboration with Konrad Adenauer Stiftung, this book is divided into nine chapters covering a wide range of topics related to the Blue Economy.

The term "Blue Economy" refers to the sustainable use of ocean resources for economic growth, improved livelihoods, and environmental preservation. It encompasses various sectors such as fisheries, aquaculture, renewable energy, marine transportation, coastal tourism, and marine biotechnology. The Blue Economy is a concept that emphasizes geo-economics, water resource productivity, and the Sustainable Development Goals (SDGs). Collaboration among academics, scientists, technologists, policymakers, business executives, and marine specialists is required to achieve this goal. The Federation of Indian Chambers of Commerce and Industry (FICCI) Task Force investigated the Blue Economy by looking at ten important Indian industries.

Global developments and Initiatives: India's potential for growth, employment, and environmental protection is underlined through a comprehensive strategy based on Public-Private Partnership (PPP). Key developments since the United Nations Conference on Sustainable Development (UNCSD)'s 2012 focus on the "Green Economy" have led to significant changes in the Blue Economy. Fisheries, aquaculture, habitat preservation, and pollution control were highlighted during the 2014 Global Action Summit for Food Security and Blue Growth. In 2015, the Agenda for Sustainable Development, which included SDG 14 "Life below Water," was adopted.

The Indian Ocean Rim Association works to advance the Blue Economy's creation of jobs, inclusive economic growth, and educational opportunities. The Sagarmala Programme in India focuses on the future of the maritime industry through port development, infrastructure, fisheries, aquaculture, and Association of South East Asian Nations (ASEAN)-India cooperation. Indian authorities are developing the Blue Economy strategy for the Indian Ocean Region (IOR), forming a Working Group, and constructing the Information Fusion Centre-IOR. Think tanks and academic institutions are paying attention to the Blue Economy, advocating for a peaceful, stable, and wealthy region.

The World Bank Group (WBG) works with the United Nations (UN) to support international development agendas, emphasizing sustainability through funding, information, and implementation. With a focus on donor support, WBG has generated nearly $660 million through sustainable bonds since 2018. It has a long-standing relationship with India and is a founding member of the International Coral Reef Initiative. The United States has a $13 trillion Gross Domestic Product (GDP) and 256 million workers employed by its coastal and maritime economy. The European

Union's Blue Growth plan generates €500 billion yearly, provides economic resilience, and employs 5.4 million people. Baltic Sea nations are served by Finland's maritime transport plan, and Canada's ocean economy transforms into a knowledge economy powered by technology. Portugal's $5 billion maritime industry is centred on biotechnology, tourism, energy, fisheries, and aquaculture. Therefore, it can be seen, that Blue Economy can be the next GDP-multiplier given the scale observed in other developed countries.

Africa's difficulties in developing a sustainable, inclusive Blue Economy were brought to light during the Nairobi Sustainable Blue Economy Conference. Little Island Pacific Islands and Developing States have the opportunity for ocean-based trade and economic activity, but there is a lack of institutional capacity building and technology for ocean resource extraction.

Working together to prevent marine trash and implement UN Agenda 2030, the ASEAN, UN, Asia Pacific Economic Cooperation (APEC), Norway, and Germany are working to promote the Blue Economy in underdeveloped and developing countries.

Sectors and Opportunities in Blue Economy: The Indian and international sectors present significant opportunities for sustainable growth, including fisheries, aquaculture, port and shipping, marine and coastal tourism, offshore renewable energy, marine biotechnology, pharmaceuticals, insurance and legal services, deep-sea mining, and sustainability. Fisheries and aquaculture are essential for obtaining food, living, and leisure, but resource exploitation has led to increased yields and put fish supplies and marine biodiversity in danger. Sustainable fishing techniques aim to strike a balance between yields and the health of the marine ecosystem. India's coastline, Exclusive Economic Zone, and resources present a potential for market expansion and sustainable growth in the fishing sector.

The Indian government has implemented the Sagarmala Programme to promote port-led development in coastal areas and achieve regional and global marine connectivity. India's tourist industry will have grown significantly by 2028, contributing 117 per cent of the country's GDP and 413 million new employments. The marine leisure industry presents considerable investment and employment potential. Offshore renewable energy sources include wind, wave, tide, and desalination, while gas hydrates play a crucial role in addressing India's 1.5 billion population by 2050.

Insurance and legal services are essential for supporting sectors like offshore wind farms and energy assets. Deep-sea mining permitted by the UN Convention of 1982 and the 1994 Agreement, entails the exploration and exploitation of mineral resources in international waters. State Parties regulate activities to ensure contractual and environmental requirements are met.

Sustainability and Ecological Balance: Sustainability is essential for long-term ecological balance and sustainable growth, as it includes everything from product creation to product disposal. The Blue Economy presents previously unheard-of prospects for investment and development and may outperform the global economy. Unsustainable economic practices harm marine ecosystems by depleting the ocean's natural resources. Marine spatial planning, sustainable management, and the integration of marine and terrestrial ecosystems are necessary for this growth. Marine Knowledge-Based Systems require regional and international cooperation, and India has the technological capacity to produce and analyse data.

Financing the Blue Economy offers the opportunity for large investments in capacity building and adjustments. Small and Medium Enterprises (SMEs), entrepreneurs, and start-ups play a significant role in innovation and entrepreneurship, which are essential to society. Governments prefer to promote Research & Development (R&D) through their institutions rather than allocating cash to non-public organisations. Businesses should grow in industries such as fisheries, tourism, transportation, and energy, investing in deep sea minerals, marine biotechnology, and spatial planning. The maritime industry is also changing due to artificial intelligence, and industries are focussing on production of autonomous vessels.

Based on the content provided, the book "BLUE ECONOMY: Global Best Practices Takeaways for India and Partner Nations" is likely to be appreciated by its target audience, which includes policymakers, researchers, business professionals, and individuals interested in the Blue Economy. The reasons for this positive reception are as follows:

- The book covers a wide range of topics related to the Blue Economy, providing a holistic view of its concept and practical applications. It explores various sectors, best practices, challenges, and opportunities, making it a valuable resource for readers seeking a comprehensive understanding of the subject.

- The book aims to provide practical recommendations for India and partner nations to leverage their coastal and marine resources sustainably. Policymakers and business professionals would appreciate the actionable strategies presented in the book for promoting sustainable development and economic growth.
- It emphasizes collaboration among academics, scientists, policymakers, and business executives and aligns with the global trend of multidisciplinary approaches to address complex challenges. The focus on knowledge sharing and international cooperation adds value to the book's insights.
- The book's focus on India and other partner nations makes it highly relevant to its intended audience. It addresses specific concerns and opportunities faced by these regions, making it a practical guide for local policymakers and stakeholders.
- The book presents thorough research, data analysis, and statistics to back up its conclusions and recommendations. This evidence-based approach enhances the book's credibility and appeals to readers looking for well-founded insights.
- It also has a strong emphasis on the role of policies, public-private partnerships, and the private sector in driving sustainable development, the book aligns with the interests of policymakers and business professionals.

However, each individual's assessment of the book's contents will differ based on their interests and expectations. The Federation of Indian Chambers of Commerce & Industry (FICCI) Core Group recommends a strategy for India's Blue Economy, focusing on economic growth, sustainable development, a PPP, and a multi-disciplinary approach. This strategy should involve a Ministry of Blue Economy, a new Policy Unit, a new India Blue Economy Forum, and a national Blue Economy accounting system. Sectoral studies should focus on marine leisure, Industry 4.0 technologies, smart river management, marine biotechnology, renewable energy, and fisheries. India should support exploitation contracts, explore joint ventures, and expand capacities through capture and culture routes. Overall, the book is likely to be well-received by its target audience and catch the interests of its target audience.

Conclusion:

"BLUE ECONOMY Global Best Practices Takeaways for India and Partner Nations" is a valuable and timely publication that provides comprehensive insights and practical recommendations for leveraging the Blue Economy's potential. The book, published by FICCI, provides a comprehensive study of global best practices, highlighting success stories and significant takeaways that may be applied to India and its partner countries. By addressing sectors, policies, technology, and capacity building, this study serves as a comprehensive guide for policymakers, researchers, and stakeholders interested in harnessing the Blue Economy for sustainable development. With its wealth of knowledge and expertise, this book is a valuable resource for anyone interested in the future of the Blue Economy.

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The High Seas Treaty- A Significant Step to Protect the Oceans

By: Vikas Dhir, AAO

Background

The high seas are of immense importance to humanity, providing invaluable ecological, economic, social, and food security benefits. These areas beyond national jurisdiction encompass a significant portion of the world's ocean, and comprises the high seas and the area (the seabed beyond national jurisdiction). They are home to diverse marine resources and biodiversity, playing a crucial role in supporting ecological systems. Additionally, they offer substantial economic opportunities, social and cultural benefits, scientific research prospects, and food security benefits for communities worldwide. Despite their significance, the high seas face mounting pressures from pollution, including noise pollution, overexploitation of resources, Climate Change impacts, and declining biodiversity. Recognising the urgent need for their protection, global negotiations concluded in March 2023, resulting in the treaty of the High Seas (European Commission, 2023).

Introduction

Almost after two decades of intense negotiations, the United Nations' 193 Member States successfully embraced a ground-breaking legally binding agreement on marine biodiversity. On June 19, the UN adopted the Marine Biodiversity of Areas Beyond National Jurisdiction (BBNJ) or the High Seas Treaty (The Hindu, 2023). It became the third agreement to be approved under United Nations Convention on the Law of the Sea (UNCLOS), after the 1994 and 1995 treaties, which established the International Seabed Authority and the Fish Stocks Agreement. This milestone agreement aims to establish a shared commitment to conservation and sustainability in the vast high seas beyond national boundaries, encompassing a staggering two-thirds of the Earth's oceans (United Nations, 2023).

An innovative agreement in the 21st Century:

The Treaty represents a significant milestone following another major achievement in ocean biodiversity—the establishment of protected areas through the Kunming-Montreal Biodiversity Target 3, agreed upon in December 2022. This ambitious target aims to protect 30 per cent of both land and ocean areas by 2030. However, considering that the high seas cover 64 per cent of the ocean, achieving this target for global ocean protection relies heavily on the implementation of the Treaty. It provides the most viable approach to meeting the target of 30 per cent. Still, the agreement includes a provision that it "shall not undermine" relevant instruments and global, regional, and sectoral bodies. While the UNCLOS already required parties to assess potential pollution or harm to the ocean resulting from activities within their jurisdiction, there was a lack of operationalisation and enforcement for this provision. Therefore, the High Seas Treaty presents a crucial opportunity to establish oversight and reporting mechanisms for the growing list of human activities that could potentially harm marine ecosystems (Frontiers Policy Labs).

High Ambition Coalition:

The High Ambition Coalition, which includes influential entities such as the European Union, United States, United Kingdom, and China, played a pivotal role in facilitating the agreement. Rather than fostering division, these key players worked towards building coalitions and displayed a willingness to compromise during the final stages of the negotiations. It is worth noting that the Global South, taking a leadership role, played a crucial part in ensuring the treaty's implementation in a fair and equitable manner. Virginijus Sinkevičius, the European Commissioner for the Environment, Ocean, and Fisheries, hailed the agreement as a momentous occasion for the ocean. He emphasised that it represents the culmination of over a decade of diligent work and international negotiations. Sinkevičius stated that the UN High Seas Treaty marks a critical step forward in safeguarding marine life and biodiversity, which are indispensable for present and future generations. He also expressed pride in the strengthened multilateral cooperation with partners and acknowledged the treaty as a significant asset in achieving the goal of 30 per cent ocean protection set forth in COP15 (The Guardian).

Why the High Seas Treaty is critical for the whole world? (United Nations, 2023)

- According to the latest Sustainable Development Goals (SDG) report 2022, over 17 million metric tons of plastic were deposited into the world's oceans in 2021, constituting a staggering 85 per cent of marine litter. Disturbingly, projections indicate that these numbers could double or even triple annually by 2040. The report further warns that without immediate action, the amount of plastic in the oceans could surpass the fish population by 2050, as estimated by the United Nations. To address this pressing issue, the treaty aims to enhance resilience and includes provisions rooted in the polluter-pays principle, alongside mechanisms for resolving disputes.
- According to the United Nations, over one-third of global fish stocks are currently being over-exploited. Recognising this alarming situation, the treaty emphasises the significance of capacity building and the transfer of marine technology. This involves the crucial tasks of developing and reinforcing institutional capacity, as well as national regulatory frameworks or mechanisms. Furthermore, the treaty emphasises the need for enhanced collaboration among regional seas organisations and regional fisheries management organisations.
- The impact of global heating on our oceans is undeniable, with rising temperatures leading to a range of alarming consequences. These include the escalation of more frequent and intense storms, rising sea levels, and the salinization of coastal lands and aquifers. Recognising the urgency of these concerns, the treaty provides essential guidance. One of the key approaches outlined in the treaty is an integrated approach to ocean management. This approach focuses on building ecosystem resilience to combat the adverse effects of Climate Change and ocean acidification.
- The UN Secretary-General António Guterres highlighted the crucial importance of the new agreement in addressing the various threats that our oceans face. The success of ocean-related goals and targets, including the 2030 Agenda, relies heavily on this agreement. One of the significant goals outlined is SDG 14, which seeks to prevent and significantly reduce all forms of marine pollution by 2025. It also aims to end overfishing by implementing science-based management plans that allow for the restoration of fish stocks in the shortest feasible time. The new agreement paves the way for the establishment of area-based management tools, such as marine protected areas, which play a vital role in conserving and sustainably managing critical habitats and species in the high seas and the international seabed area. Moreover, the treaty takes into account the

unique circumstances faced by small island nations and landlocked developing countries, recognising the need for tailored solutions to address their specific challenges and vulnerabilities.

High Seas Treaty in India (The Tribune, 2023)

The BBNJ (Biodiversity Beyond National Jurisdiction) (formal title for High Seas Treaty) does not establish a binding obligation to conserve 30 per cent of the high seas by 2030. Rather, its primary function is to provide a legal framework that enables the establishment of marine protected areas and facilitates the implementation of conservation measures in these zones. The BBNJ holds immense significance for India, given its expansive coastline of over 7,500 km and the millions of citizens whose livelihoods depend solely on fishing. It is crucial to recognise the interconnectedness of the oceans, where influences from one region are transmitted to another through ocean currents. These currents, along with the chemical composition and thermal conditions of seawater, greatly impact weather patterns, including the crucial monsoon season. The well-being of humans and other species is intrinsically tied to the health of our oceans. As an oceanic country, India has a unique opportunity to lead in the early adoption and ratification of the treaty, actively participating in the development of its rule-book for effective implementation.

Conclusion

In conclusion, the adoption of the High Seas Treaty in 2023 marks a significant milestone in international efforts to protect and sustainably manage marine biodiversity in areas beyond national jurisdiction. This landmark agreement recognises the urgent need to address the threats facing our oceans, such as overfishing, marine pollution, and the impacts of Climate Change.

By focusing on conservation, sustainable use, and integrated ocean management, the treaty provides a comprehensive framework for global cooperation. It emphasises the establishment of area-based management tools, including marine protected areas, to safeguard critical habitats and species in the high seas and international seabed area. Additionally, the treaty acknowledges the special circumstances faced by small island nations and landlocked developing countries, ensuring their inclusion and participation in decision-making processes.

The High Seas Treaty not only addresses the immediate challenges but also considers the long-term resilience of marine ecosystems. It recognizes the interconnectedness of various ocean-related goals and targets, aligning with the broader global agenda, including the SDGs and the 2030 Agenda.

By providing mechanisms for dispute resolution, collaboration, and information-sharing, the treaty encourages international cooperation and coordination among member states. This collective action is crucial for effective conservation and sustainable management efforts, considering the global nature of the high seas.

Overall, the High Seas Treaty represents a significant step forward in global ocean governance. Its adoption demonstrates a commitment to the preservation and sustainable use of marine biodiversity, paving the way for a more resilient and healthy future for our oceans and the communities that depend on them. However, the successful implementation and enforcement of the treaty will be key to realising its full potential and ensuring the long-term sustainability of our oceans.

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Analysis of the State of the Climate in Europe 2022, World Meteorological Organisation (World Meteorological Organization, 2023)

By: Rohan Sharma, AAO

Introduction

The second edition of the State of the Climate in Europe 2022[1] report offers an overview of crucial climate indicators by utilising operational monitoring systems of the World Meteorological Organisation (WMO) and partner organisations. It also provides the most recent data and information on impacts, risks, and policy from various United Nations agencies.

Occurrences of severe events and their consequences

In 2022, Europe experienced a total of 40 hazardous events related to meteorology, hydrology, and climate, leading to 16,365 reported deaths and directly impacting approximately 156,000 individuals. Around 67 per cent of these occurrences were associated with floods and storms, resulting in numerous deaths and constituting approximately 99.9 per cent of the overall economic losses. The monetary damages amounted to around US$ 2 billion, significantly lower than the total of US$ 50 billion recorded in 2021, primarily due to the floods that occurred in Western and Central Europe in July 2021.

Heavy Precipitation and Floods

Southern Europe witnessed heavy rainfall and floods in September, impacting various areas. Specifically, the Marche region in Central Italy experienced torrential rain leading to severe flooding which caused the closure of Valencia airport.

[1] Published by the World Meteorological Organisation's Regional Association for Europe (WMO-RA6) and the Copernicus Earth observation programme of the European Union.

Storm **Gaia** resulted in more than 200 mm of rainfall within 24 hours, causing floods in certain areas of Antalya province in Turkey. Similarly, Storm **Diomedes** caused significant precipitation, particularly in Greece, with a notable impact on the eastern region of Thessaly, the Sporades islands, and nearby prefectures of Macedonia.

Droughts

Throughout the year, Europe experienced extensive drought conditions. As a result of favourable winter North Atlantic Oscillation (NAO) and blocking patterns, significant portions of South Western Europe faced prolonged drought during the winter season from December 2021 to February 2022. At the onset of August, the severity of drought conditions reached its highest

Extreme Climatic Events in Europe during 2022

Image Source: (Copernicus Climate Change Summary 2022)

point. This followed a series of previous drought episodes in the summers of 2018, 2019, and 2020, which had affected both western and central Europe.

Central Europe experienced widespread and impactful drought, affecting agricultural activities. Germany, for instance, witnessed reduced cereal harvests, followed by diminished yields for sugar beets, maize, and grapes later in the summer. Additionally, various locations along the Rhine River recorded new local record lows in water levels.

Heatwaves and Wildfires

Intense heat and drought contributed to widespread wildfires throughout the region, leading to the second-largest recorded burnt area (following 2017). France, Spain, Portugal, Slovenia, and Czechia experienced significant wildfires, while numerous other countries also witnessed larger-than-average burnt areas in 2022. According to the European Forest Fire Information System (EFFIS), the estimated burnt area across the European Union exceeded 800,000 hectares.

Marine Heatwaves

During 2022, regions such as the western Mediterranean Sea, the English Channel, the southern Arctic, and the northern Barents and Kara Seas endured marine heat wave episodes lasting approximately four to five months. During the summer of 2022, the Mediterranean Sea encountered significant anomalies in sea-surface temperatures. In specific areas, these anomalies reached exceptionally high values, with a local peak of + 4.6 °C.

Cold Waves, Heavy Snow and Freezing

In January 2022, a severe winter storm named Elpida (or Elpis) struck Greece, including Athens, bringing subzero temperatures of -14°C and heavy snowfall. Schools, public offices, and most private businesses in the capital were closed, with exceptions made for supermarkets, pharmacies, and gas stations. It was unusual for central Athens and the Aegean islands to experience such intense snowstorms and traffic disruptions, marking the second occurrence within a year. In December, a cold spell affected northwest Europe, marking the most significant cold event since December 2010. Iceland experienced its coldest December since 1973, with the capital city, Reykjavik, enduring its coldest December in 100 years.

Storm Eunice in Britain

Image Source: (NDTV, 2022)

Severe Windstorms: One of the strongest storms was **Storm Malik**, which swept through eastern central Europe on January 29-30. This winter storm caused hurricane-force winds, resulting in the loss of at least six lives and widespread power outages across northern and central Europe. The United Kingdom, Denmark, Poland, and Germany were among the most severely impacted, with destroyed homes and cars, closed bridges, cancelled trains, and halted ferry services due to flooding caused by coastal surges.

During February, Western Europe and northern central Europe experienced the passage of three consecutive windstorms. The notable storm among them was **Storm Eunice**, which traversed Ireland, England, and Wales. An unprecedented gust of 196 km/h was recorded at The Needles on the Isle of Wight, setting a new wind speed record in England. The storm resulted in four fatalities in the United Kingdom, one in Ireland, and an additional two in Belgium. Moreover, over a million households in England and Wales were left without power due to the storm's impact.

Advancing Climate Policy and Climate Action in the Energy Sector

The variability of wind speed and precipitation, with fluctuations of -40 per cent to +80 per cent and ±30 per cent respectively, is much higher compared to surface solar radiation, which experiences approximately ±15 per cent variability. Solar and wind energy resources complement each other, with higher solar radiation in late spring and summer, and stronger wind intensity in winter. Understanding the temporal and spatial variations of these renewable energy sources is crucial due to their increasing significance in the European energy mix.

In Europe, the proportion of renewable energy sources in global energy consumption reached 143 per cent in 2019. By 2022, wind and solar power in Europe accounted for 223 per cent of the EU's electricity generation, surpassing both fossil gas (20 per cent) and coal power (16 per cent) for the first time. This shift was attributed to various factors, including a substantial rise in installed solar power capacity during 2022.

During the period spanning 1991 to 2020, surface solar radiation has experienced an increase, while wind speed and precipitation have not exhibited any notable trends.

To reach net-zero CO_2 emission by 2050, many governments in Europe have committed with deep cuts in energy sector emissions, and remaining emissions compensated by carbon capture and increasing sinks in the land use sector.

Thus efforts are required towards identifying the right technology with sustainable energy sources i.e. wind, solar, etc. This can be done by raising awareness, developing policy frameworks, and financing a just transition towards carbon neutral energy systems.

Climate Services

Climate services, which involve the provision and utilisation of climate information for decision-making, including data collection, monitoring, analysis, predictions, and projections of climate variables, are crucial in supporting the global energy transition towards achieving net-zero emissions. Climate services are important for site selection, resource assessment and financing; operations, maintenance, and management of energy systems; electricity integration into the grid; and impact assessment of energy systems.

Based on a survey conducted by the WMO among National Meteorological and Hydrological Services (NMHSs), it was found that 83 per cent of Members in Europe offer climate services for the energy sector. However, less than half of them provide climate predictions specifically tailored for the energy industry. This suggests that there is untapped potential for NMHSs to further contribute to and support the ongoing energy transition.

Conclusion

Out of all the regions monitored by the WMO, Europe has experienced the most rapid warming, with temperatures rising twice as much as the global average since the 1980s. The impact of this warming is evident in the significant loss of glacial ice in the European Alps, which can be attributed to a combination of factors such as reduced winter snowfall and elevated summer temperatures.

Europe's warming trend has been twice as pronounced as the global average since the 1980s, resulting in extensive consequences for the region's socioeconomic structure and ecosystems. By 2022, Europe's temperature had risen by approximately 2.3°C above the pre-industrial baseline (1850-1900) utilised in the Paris Agreement on Climate Change.

However, there is a glimmer of optimism for the future. In a noteworthy development, renewable energy sources surpassed polluting fossil gas in electricity generation for the first time in the previous year. Wind and solar power accounted for 22.3 per cent of the European Union's electricity production in 2022, surpassing the share contributed by fossil gas (20 per cent).

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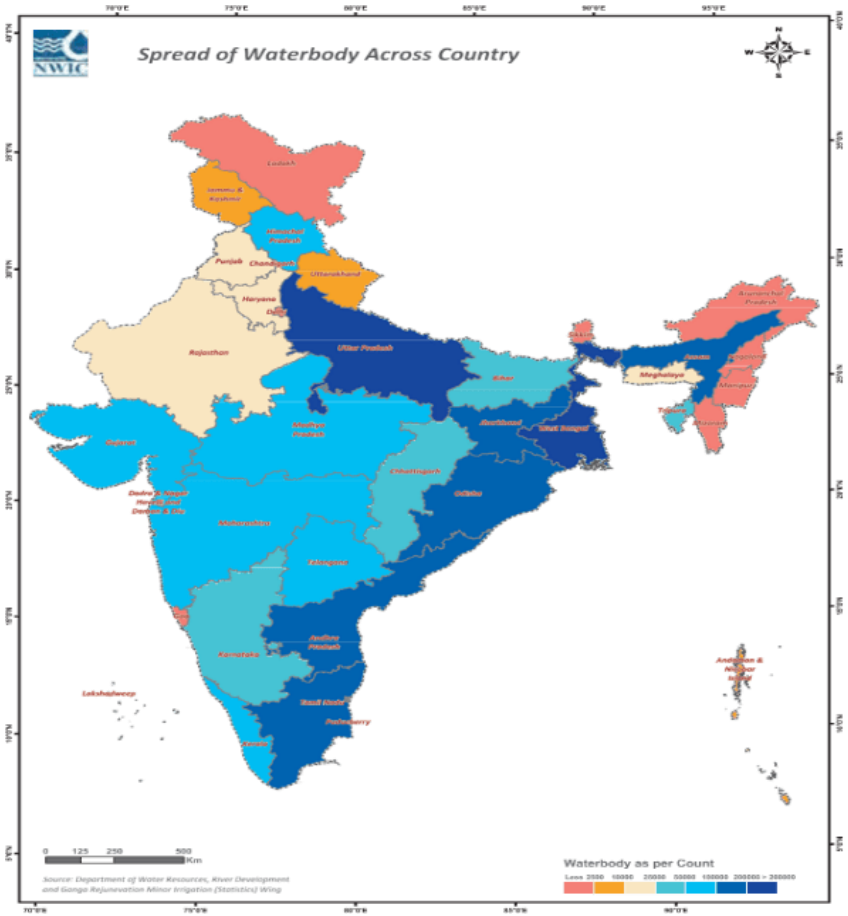
Analysis of the Water Bodies: First Census Report, Ministry of Jal Shakti

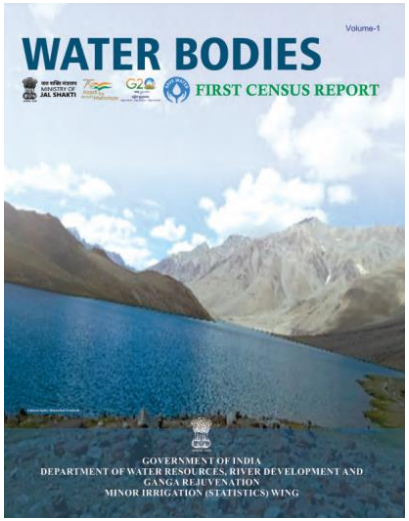
By: Lokesh Kumar Meena, AAO



Spread of Water Bodies across the Country

Image Source: Ministry of Jal Shakti Government of India 2023

The Ministry of Jal Shakti has released the report of India's first water bodies (WBs) census, which includes a comprehensive database of the country's ponds, tanks, lakes, and reservoirs. The census was done in 2018-19, and it counted over 2.4 million bodies of water across all states and union territories (Ministry of Jal Shakti Government of India, 2023).

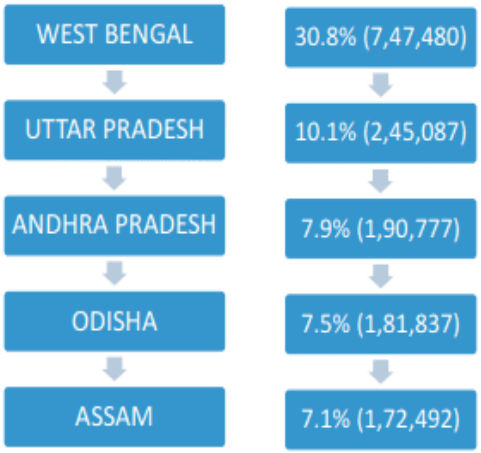


Water Bodies: First Census Report (Volume-I)

Image Source: Ministry of Jal Shakti Government of India 2023

Water bodies are defined in this Census as all natural or man-made units bordered on all sides by some or no masonry structure and used to store water for irrigation or other purposes (e.g., industrial, pisciculture, domestic/drinking, recreation, religious, ground water recharge, etc.). These are frequently of many types and are known by various names such as tanks, reservoirs, ponds, and so on.

Key findings of this Census and parameter-wise analysis are presented in the following paragraphs (Ministry of Jal Shakti Government of India, 2023)**.**



Top Five States in number of water bodies
Image Source: Ministry of Jal Shakti Government of India 2023

- During the first census, 24,24,540 water bodies were counted in the country, with ponds accounting for 59.5 per cent (14,42,993), tanks accounting for 15.7 per cent (3,81,805), reservoirs accounting for 12.1 per cent (2,92,280), and water conservation schemes/check dams/percolation tanks accounting for the remaining 12.7 per cent (3,07,462). The image illustrates the top five states in terms of the number of bodies of water.
- **Analysis of Water Bodies by type**: (Ministry of Jal Shakti, 2023)

According to the survey, there are 24,24,540 water bodies in the nation, with 97.1 per cent (23,55,055) in rural regions and just 2.9 per cent (69,485) in urban areas. Ponds account for 59.5 per cent (14,42,993) of all water bodies, followed by tanks (15.7 per cent, or 3,81,805), reservoirs (12.1 per cent, or 2,92,280), water conservation schemes/percolation tanks/check dams (9.3 per cent, or 2,26,217), lakes (0.9 per cent, or 22,361), and others (2.5 per cent, or 58,884).

- **Analysis of Water Bodies by Ownership:** (Ministry of Jal Shakti Government of India, 2023)

Among the total of 24,24,540 water bodies, 55.2 per cent (13,38,735) are privately owned, while 44.8 per cent (10,85,805) are in the public domain. Out of all public owned water bodies, 62.4 per cent (6,77,003) are owned by Panchayats, 23 per cent (2,49,869) by State Water Resources Department (WRD)/State Irrigation, 3.8 per cent (41,428) by Co-operative, and 2.1 per cent (22,654) by Municipal Authorities, with the remaining 8.7 per cent (94,851) being owned by other Government agencies. States can implement strategies to put public water bodies to productive use by putting them under the jurisdiction of Panchayats, Municipal Bodies, and Co-operative Societies.

Analysis of Water Bodies by Nature & Man-made Water Bodies by Original Cost: (Ministry of Jal Shakti Government of India, 2023)

According to the Ministry of Jal Shakti's First Census Report, of the total 24,24,540 water bodies, 78 per cent (18,90,463) are man-made, while the remaining 22 per cent (5,34,077) are natural. Out of 5,34,077 natural water bodies, 96.5 per cent (5,15,328) are in rural regions, while just 3.5 per cent (18,749) are in urban areas, possibly as a result of urbanisation. Similarly, of the 18,90,463 man-made water bodies, 97.3 per cent (18,39,727) are in rural regions, while 2.7 per cent (50,736) are in urban areas.

More than 45 per cent of man-made water bodies in both rural and urban regions had an initial construction cost of up to Rs 50,000. The number of water bodies in each cost class of construction is about the same in rural and urban regions, while water bodies with construction costs surpassing Rs. 50 lakh are essentially non-existent.

- **Analysis of Water Bodies by Use:** (Ministry of Jal Shakti Government of India, 2023)

Out of 24,24,540 water bodies, 83.7 per cent (20,30,040) water bodies are in use and remaining 16.3 per cent (3,94,500) water bodies are not in use due to being dried up, construction, siltation, destroyed beyond repair, due to industrial effluents, salinity and some other reasons. Among 'in use' water bodies, 58.2 per cent (11, 81,077) are ponds, 15.6 per cent (3, 15, 974) are tanks, 14. 2 per cent (2,89,163) are reservoirs, 9.3 per cent (1,88,915) are water conservation schemes/ check dams/ percolation tanks, 0.5 per cent (9,558) are lakes and 2.2 per cent (45,353) are other water bodies. Out of all (20,30,040) 'in use' water bodies, 55.5 per cent (11,26,830) water bodies are used for pisciculture, 16.5 per cent (3,35,768) are used for purpose of Irrigation, 12.1 per cent (2,44,918) are used for ground water recharge, 10.1 per cent (2,05,197) are used for domestic/drinking, and remaining for religious, recreation, industrial and other purposes.

Out of 19,75,205 'in use' water bodies **located in rural areas**, 55.9 per cent (11,04,027) water bodies are used for pisciculture, 16.8 per cent (3,31,408) are used for purpose of Irrigation, 12.1 per cent (2,39,282) are used for ground water recharge, 9.9 per cent (1,94,885) are used for domestic/drinking, and remaining for recreation, industrial, religious and other purposes.

- **Analysis of Water Bodies by present storage capacity:** *(Ministry of Jal Shakti Government of India, 2023)*

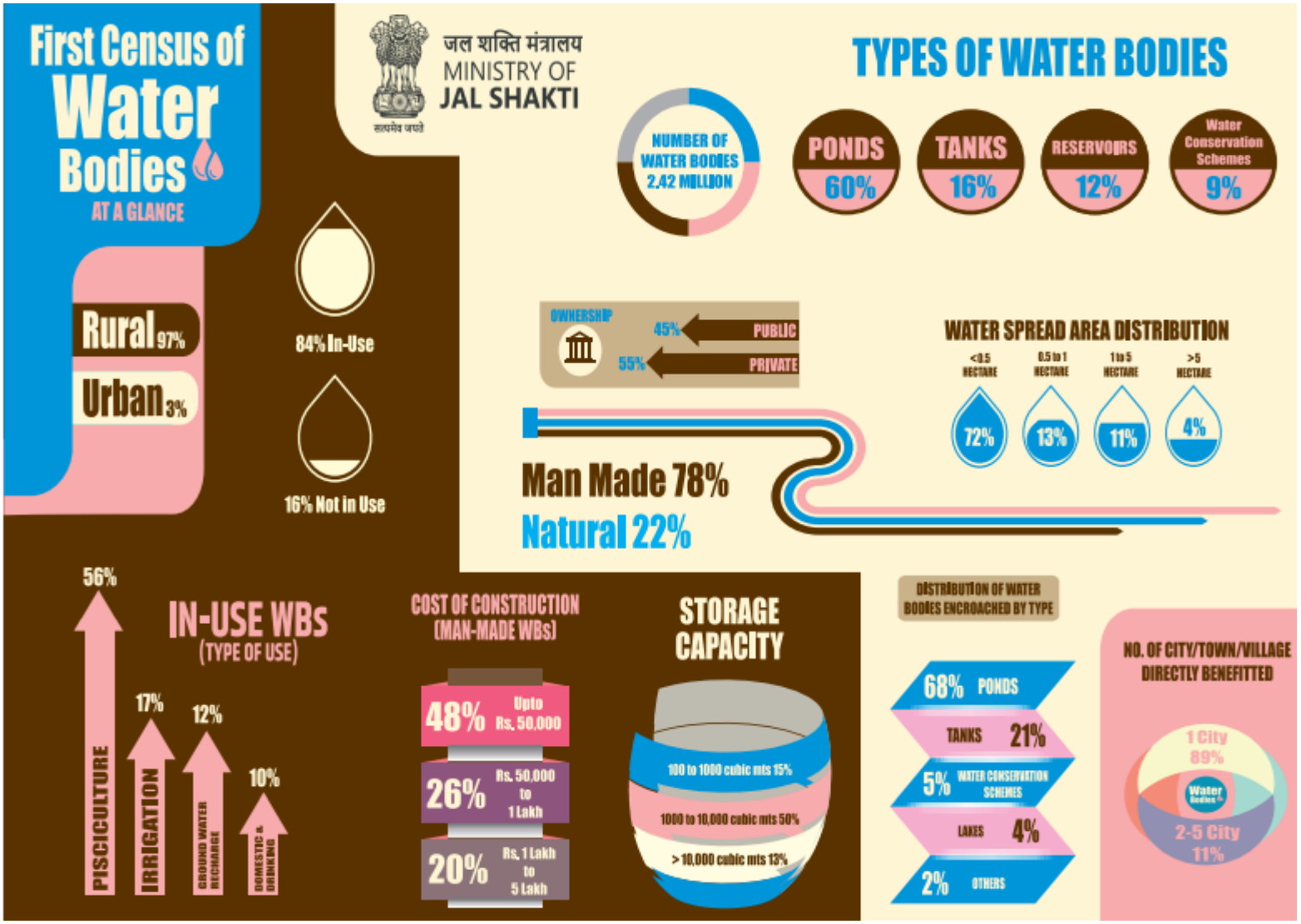
Nearly half of the total water bodies in the country, 12,12,283, have storage capacity ranging from 1,000 to 10,000 cubic meters, 37.3 per cent (9,05,297) have storage capacity ranging from 0 to 1,000 cubic metres, and the remaining 12.7 per cent (3,06,960) have storage capacity greater than 10,000 cubic metres.

- **Analysis of encroached Water Bodies:** (Ministry of Jal Shakti Government of India, 2023)

The word "encroachment of water bodies" refers to the illegal intrusion within the designated border of a water body for different human activities such as building, agriculture, and so on. 38,496 water bodies have been recorded as encroached upon. It is worth noting that the bulk of encroachments (95.4 per cent) were identified in rural areas. 62.8 per cent (15,388) of encroached water bodies have less than 25 per cent area under encroachment, 17.8 per cent (4,367) have encroachment area ranging from 25 per cent to 50 per cent, 11.8 per cent (2,888) have more than 75 per cent area under encroachment, and 7.6 per cent (1,873) have encroachment area ranging from 50 per cent to 75 per cent. However, 67.6 per cent (26,005) of all encroached water bodies are ponds, 21 per cent (8,082) are tanks, 4.5 per cent (1,745) are water conservation schemes/check dams/percolation tanks, and the remainder are lakes. Lakes, reservoirs, and other bodies of water account for 6.9 per cent of all water bodies.

- **Analysis of Water Bodies by year and cost of renovation:** (Ministry of Jal Shakti Government of India, 2023)

The majority of water bodies, i.e. 45.2 per cent have never been repaired, 15.7 per cent water bodies were repaired before 2009 and 3.6 per cent were repaired after 2018. The proper repair and up keep of water bodies is required in order to have their optimum utilisation. Among all water bodies which underwent repair, 62.9 per cent water bodies had cost of last repair/renovation up to Rs 50,000 and 21.7 per cent water bodies had cost of last repair between Rs 50,000 to Rs 1 lakh.



First Census of Water Bodies at a Glance

Image Source: Ministry of Jal Shakti Government of India 2023

- **Analytical Recommendations:** (Ministry of Jal Shakti Government of India, 2023)

Based on the provided analysis of the water bodies census, several important recommendations can be made to address the issues and improve the management of water bodies in India. These recommendations are as follows:

I. **Water Conservation and Management:** Given the vast number of water bodies in India, it is essential to focus on water conservation and effective management of these resources. Encouraging proper maintenance and preventing encroachment can help preserve and sustain the water bodies for future generations.

II. **Rural vs. Urban Water Bodies:** There is a significant disparity between the number of water bodies in rural and urban areas. To ensure equitable access to water resources, efforts should be made to create and maintain water bodies in urban areas, especially as urbanization expands.

III. **Pisciculture and Irrigation:** Ponds, tanks, and reservoirs are mainly used for pisciculture and irrigation. Government agencies and communities should invest in aquaculture practices and modern irrigation techniques to enhance agricultural productivity and improve the livelihoods of rural communities.

IV. **Groundwater Recharge:** Water conservation schemes, percolation tanks, and check dams play a crucial role in recharging groundwater. Promoting the construction and maintenance of these structures can contribute to addressing water scarcity issues and supporting sustainable water management practices.

V. **Cost-effective Repair and Renovation:** A considerable number of water bodies have never been repaired or renovated, while some are in need of restoration. Prioritising cost-effective repair and renovation, particularly for ponds, tanks, and reservoirs, can help maximize their usage and lifespan.

VI. **Public Ownership:** Given that a significant proportion of water bodies are privately owned, state governments can explore strategies to transfer ownership of water bodies to Panchayats, Municipal Bodies, and Co-operative Societies. This could improve collective management and ensure broader benefits to the community.

VII. **Data-Driven Decision Making:** The census provides valuable data on various aspects of water bodies. Policymakers, researchers, and local

authorities should utilise this information to make informed decisions on water resource management, conservation efforts, and infrastructure development.

VIII. **Addressing Encroachment:** Encroachment is a pressing issue affecting water bodies, particularly in rural areas. Strict enforcement of laws and active community participation can help prevent further encroachments and initiate efforts to reclaim encroached areas.

IX. **Integrated Water Resource Planning:** The data from the census should be incorporated into an integrated water resource planning framework. Such planning should take into account the interconnections between various water bodies, river systems, and the surrounding ecosystems to ensure sustainable water management practices.

X. **Monitoring and Regular Updates:** Water bodies are dynamic resources, and their status can change over time due to natural and human-induced factors. Regular monitoring and updates of the database are crucial to track changes, identify emerging issues, and implement timely interventions.

By following these recommendations, India can make significant strides in water resource management, sustainability, and equitable distribution of water, benefiting both rural and urban communities while preserving these vital natural assets.

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Innovative Solutions for Management of Marine Litter: A Comprehensive Review

By: Akash Sharma, Research Associate

Abstract

Marine litter poses a significant threat to the health and well-being of our oceans and marine ecosystems. In recent years, there has been a growing recognition of the urgent need to address this issue and develop innovative solutions for its management. This review article provides an overview of various innovative approaches that have been proposed and implemented to tackle marine litter. The article focuses on technological advancements, and community-based efforts. Additionally, it includes tables that summarize key information on each solution, including their effectiveness, limitations, and potential for scalability.

Introduction

Marine litter refers to any solid waste material, predominantly composed of plastic, which ends up in marine and coastal environments. This includes items such as plastic bottles, bags, fishing nets, and microplastics (Bettencourt 2021). The impact of marine litter on marine ecosystems is profound and far-reaching. As these waste materials accumulate, they can entangle marine animals, leading to injury, suffocation, and even death. Marine litter also poses a significant threat to marine biodiversity, as animals may mistake it for food and consume it, causing internal blockages or toxic build-up. Moreover, the presence of marine litter alters natural habitats, damages coral reefs, and disrupts the balance of marine ecosystems. The long-term consequences of marine litter extend beyond environmental harm, affecting human health, fisheries, tourism, and the overall economic well-being of coastal communities. Addressing the issue of marine litter is imperative to safeguard the health and integrity of our oceans and the diverse life they support (Ryan 2015).

Importance of Innovative Solutions for Marine Litter Management

The importance of innovative solutions for marine litter management cannot be overstated. Traditional approaches alone have proven insufficient in tackling the scale and complexity of the marine litter problem. Innovative solutions are crucial to effectively address the challenges posed by marine litter and prevent further damage to our oceans and marine ecosystems. Solutions encompass a wide range of strategies, including technological advancements, policy initiatives, and community-based efforts. Innovative technologies such as autonomous marine vehicles, remote sensing, and waste-to-energy systems offer promising avenues for detecting, collecting, and recycling marine litter (Bellou 2021). Policy and regulatory initiatives play a vital role in promoting sustainable practices, reducing plastic consumption, and enforcing responsible waste management. Community-based solutions, including beach clean-ups, citizen science programs, and education campaigns, empowering individuals and local communities to actively participate in tackling marine litter at its source. By embracing innovative solutions, we can enhance our ability to address marine litter comprehensively, minimise its impact on marine ecosystems, and work towards a cleaner and more sustainable future for our oceans (Talvitie 2017).

Technological Solutions

A. Autonomous marine vehicles for litter detection and collection:

Autonomous underwater vehicles (AUVs) may be able to help solve this problem by locating and eventually eliminating waste. An AUV was developed to collect trash from aquatic settings, which will be a crucial tool in our fight against ocean pollution. Deep-learning systems recognize garbage visually in realistic underwater habitats, with the ultimate objective of exploring, mapping, and extracting such material using AUVs (Fulton 2019).

B. Remote sensing for monitoring and mapping:

Remote sensing facilitates detection and real-time monitoring of litter distribution, hotspots, and accumulation areas. This data helps in identifying sources, evaluating the effectiveness of clean-up efforts, and informing targeted interventions (Booth 2023).

C. Waste-to-energy technologies for marine debris utilisation

Several Waste-To-Energy (WTE) conversion systems are used to convert MSW into usable energy. The use of high-density polymeric wastes in the production of oil and synthetic gas as by-products for use as higher calorific value fuels. Thermal cracking or pyrolysis is used to convert plastic waste into hydrocarbon compounds. However, the scale and sustainability of sectors such as plastic to fuel pose a difficulty (Parashar 2020).

D. Innovative recycling methods for plastic waste

Smart Bins and Waste Tracking, Internet of Things (IoT) -enabled smart bins equipped with sensors and connected to a network provide real-time data on waste levels, allowing efficient waste collection and management (Vishnu 2021). Additionally, waste tracking systems can digitally monitor the movement of waste from collection points to treatment facilities, ensuring proper disposal and reducing the risk of litter entering water bodies.

Mobile Applications, Mobile apps empower individuals and communities to participate in marine litter management actively. These apps offer features such as Massive Open Online Courses (MOOCs) to expand environmental education. MOOCs are effective tools for promoting environmental activism and developing local answers to global problems, such as clean beaches, the replacement of plastic bottles, educational programmes, and the elimination of single-use plastic (Tabuenca 2019).

E. Microplastics removal technologies

Microplastics removal from water is a challenging task due to the small size and widespread distribution of microplastic particles. Filtration Systems, Coagulation, and Flocculation are methods used to remove microplastics from water. Biological treatment processes, such as Bioreactors and Biofilters, can also degrade microplastics. Ozonation, Electrocoagulation, Sedimentation, and Advanced Oxidation Processes (AOPs) are also effective methods for removing microplastics. These methods involve Chemical Additions, Clumping, Adsorption, Biological Treatment, Ozone

gas, Electro-Coagulation, Sedimentation, and AOPs. However, these methods may not be efficient for small particles or turbulent waters (Yu 2018).

F. Block chain technology

Block chain provides transparency and traceability in waste management by creating an immutable and decentralized record of waste transactions. It can ensure proper disposal, promote recycling and waste reduction, and enable accountability across the supply chain (Gong 2022).

Table 1 below exhibits the summary of Technological Solutions for Marine Litter Management.

Table 1: Summary of Technological Solutions for Marine Litter Management

Solution	Effectiveness	Limitations	Scalability
Autonomous marine vehicles	High	Cost and maintenance	Moderate to high
Remote sensing and imagery	Moderate to high	Limited spatial resolution	High
Waste-to-energy technologies	Moderate to high	Technological readiness	Moderate to high
Innovative recycling methods	Moderate to high	Limited waste types	Moderate
Microplastics removal technology	Low to moderate	Limited efficiency	Low to moderate

G. Predictive Modeling and Machine Learning

Advanced algorithms and machine learning techniques can analyse historical data and environmental factors to predict the likely pathways and accumulation of marine litter. This information aids in planning effective clean-up operations, optimising resource allocation, and preventing litter from entering vulnerable areas (Veerasingam 2022).

H. Virtual Reality and Augmented Reality

Virtual Reality (VR) and Augmented Reality **(**AR) technologies have the potential to raise awareness and educate the public about the impacts of marine litter. The use of Virtual Reality Technology in Marine Ecotourism (VRTME) improves the trip experience. They can simulate virtual environments and immersive experiences, allowing individuals to witness the consequences of litter first-hand and fostering behavioural changes (Yuen 2022).

Pointer for the auditors:

- **Remote sensing and satellite imagery**: These technologies can be used to track the movement of marine litter, identify hot spots of marine litter pollution, and monitor the effectiveness of clean-up efforts.
- **Block chain Technology**: This technology can help to identify the sources of marine litter and to track the effectiveness of clean-up efforts along with transparency and accountability among stakeholders.

Conclusion

The convergence of cutting-edge technologies has opened up exciting possibilities for addressing the pressing challenges posed by marine pollution. Autonomous marine vehicles are crucial for exploring and safeguarding oceans, enabling efficient data collection and analysis. Remote sensing and imagery enhance understanding of marine ecosystems and detect plastic waste accumulation. Waste-to-energy technologies and recycling methods can transform marine litter into valuable resources, reducing plastic waste and promoting a cleaner, more resilient ecosystem. Microplastics removal technology is promising in combating microplastics pollution, restoring ocean health and balance. Block chain technology, predictive modelling, and machine learning facilitate efficient tracking and tracing of plastic waste, promoting transparency, accountability, and

sustainability. Virtual Reality and Augmented Reality applications engage the public and decision-makers in marine litter management, fostering greater awareness and support for combating the marine litter crisis.

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Endangered Islands

By: J Andrew Pon Jebakumar, Sr.AO O/o The PAG (Audit I), Chennai

(Image: Vaan island, near Thoothukudi (Tuticorin) , Tamil Nadu)

Disappearance of islands are not stories from other parts of the world or science fictions. It is indeed a grave reality concerning a group of small islands in the Gulf of Mannar, off the coast of Tamil Nadu. How Government plans to deal with this ghastly effect of global warming is a matter of interest for environmental auditors.

Gulf of Mannar is a shallow bay, lying south of Ram Setu / Adam's Bridge, between India and Sri Lanka. The Gulf of Mannar Biosphere Reserve was set up in 1989 by the Government of India, covering 10,500 sq km area between Rameshwaram and Kanyakumari, with Gulf of Mannar Marine National Park as its core area with 560 sq km, mostly uninhabited, dot this biosphere. The rich wealth of flora and fauna in the Gulf of Mannar include coral reefs, sea grasses, sea weeds, mangroves and hundreds of species of vertebrates and invertebrates. The coastal zone outside the biosphere supports the local fishing communities numbering over one lakh.

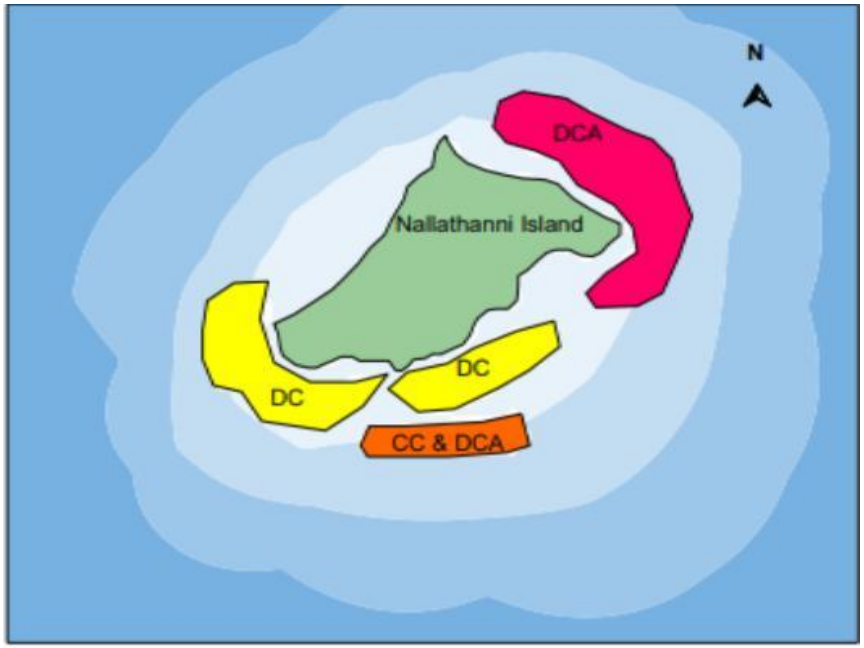
Climate Change has a predatory behaviour on small islands across the globe. Raising sea levels submerge low lying islands. Climate Change induces destruction of coral reefs and sea weeds and the resultant sea erosion hastens the death of small islands. The 21 small islands in the Gulf of Mannar are fighting a losing battle with Climate Change; but Government's support in the fight against the Climate Change will have a decisive impact on the future of these islands and the delicate ecosystem in the Gulf of Mannar.

Island name	Area (1969)	Area (2017)	Expected yr of submergence
Koswari	19.59	7.70	2036
Kariyachalli	20.85	5.97	2036
Upputhanni	38.50	18.08	2064
Puduvinichalli	11.24	7.45	2122
Nallathanni	134.40	105.02	2193
Analpar	16.28	12.21	2170
Valimunai	11.38	6.75	2090
Appa	30.17	25.37	2180
Thalaiyari	93.51	76.15	2170
Valai	24.56	5.65	2032
Mulli	15.03	10.93	2091
Hare	141.97	152.31	--
Manoli	31.85	33.17	--
Poomarichan	22.21	15.66	2140
Manoliputti	4.15	3.01	2317
Pullivasal	44.76	40.93	2525
Krusadai	61.01	70.58	---
Shingle	11.28	15.64	---

Over the years, two of the 21 islands have completely vanished and others have lost a sizable chunk of their land mass. While reckless human behaviour played its role in the past, Climate Change has now become a major enemy due to destruction of coral reef and weeds. A decade ago, alarm bells started ringing in scientific and environmental circles about the impending danger to these islands. It was estimated that over the years most of these islands would disappear.

Unless the corals reef and sea weeds are protected and rehabilitated, these islands would not be saved. The raising surface temperature of the sea and multiple changes to the ecosystem on account of Climate Change left little to hope for the survival of these islands. It is a ticking time bomb.

The authorities were well aware that any effort to protect these islands involve protection from poachers and aiding the regrowth of coral and weeds.



Nallathanni Island

Corals and see weeds standing guard to one of the islands

DCA- Dead Coral and Algae

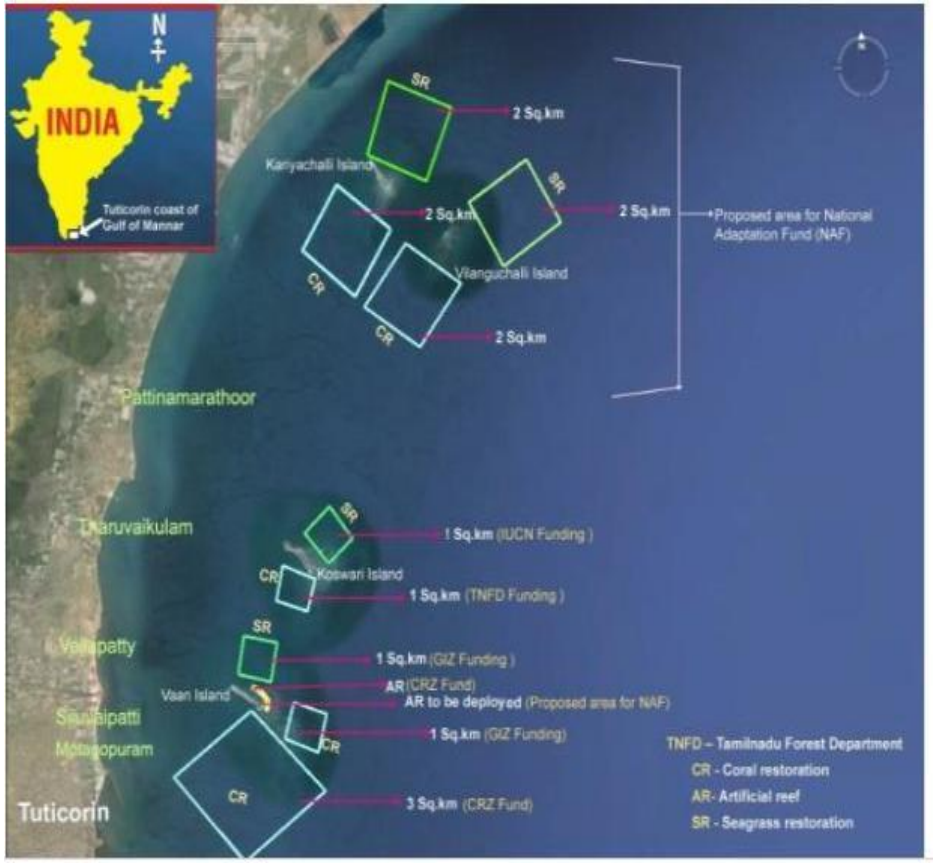
DC – Dead Coral

CC- Coral Cover

The project to save these islands is part of the goal set for the conservation of Gulf of Mannar Biosphere Reserve. It is a multipronged strategy with the involvement of Central and State Governments and their agencies. Inclusion of corals under Schedule I of the Wildlife (Protection) Act by Government of India in 2001 heralded a new beginning. It was estimated that about 32 sq.km reef area and over 22sq.km sea grass bed area were degraded in the Gulf of Mannar, requiring rehabilitation. A United Nations Development Programme (UNDP) project, with Global Environment Facility (GEF) funding, launched in 2002-03, was the earliest attempt to conserve the Gulf of Mannar. The Department of Environment and Climate Change of Government of Tamil Nadu followed the initiatives taken under the UNDP project and continued to implement the project.

The ongoing initiatives received a major push in 2016 on inclusion of the Gulf of Mannar Climate Adaption Project under the Grants-in-Aid component of the National Adaptation Fund for Climate Change (NAFCC) at a total cost of Rs. 24.74 crore. The activities under the Government of India funded project include Coral reef rehabilitation and Artificial Reef deployment, Sea grass rehabilitation and a variety of Eco-development adaptation activities, including enlisting the support of the coastal community**.** The ongoing project has already started showing results as one of the targeted island (Vaan island) has gained some land mass.

Recent Audits conducted by the Comptroller and Auditor General of India, towards the conservation of coastal ecosystems include a **Performance Audit on Conservation of Coastal Ecosystems** (C&AG Audit Report No. 4 of 2022) which highlighted absence of baseline data for marine environment at the Biosphere Reserve and lack of strategy to control alien invasive algae species at Biosphere Reserve. Non-conduct of impact assessment of the artificial reef was commented in an Audit Report on Government of Tamil Nadu (C&AG Audit Report No.3 of 2019).



The takeaways include a need for a follow-up audit after five years to assess:

(i) capacity building for this unique task,
(ii) project management
(ii) fund flow, and
(iii) monitoring and evaluation.

Further, community involvement being a critical determinant in the success of the project in banning coral reef mining and anti-poaching activities, C&AG's expertise in capacity building for Social Audit could be of use for project managers to effectively use the coastal community in project implementation.

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Analysis of the Norway's Government High North Strategy (Norwegian Ministry of Foreign Affairs, n.d.)

By: Gaurav Jain, Sr.AO

Background: The Norwegian Government's policy platform identifies the High North as its top strategic priority area, aiming for sustainable growth and development. Key objectives include strengthening Norway's presence, leading in knowledge development, ensuring environmental protection, supporting petroleum activities, safeguarding indigenous cultures, promoting people-to-people cooperation, and strengthening cooperation with other countries.

The Norwegian Government's High North Strategy Report

Image Source: Norwegian Ministry of Foreign Affairs

A new dimension of Norwegian Foreign Policy

Overall, the report emphasizes Norway's commitment to addressing the challenges and opportunities in the High North through cooperative diplomacy, resource management, and engagement with its neighbouring countries.

Knowledge generation and competence building: The Government of Norway emphasises a long-term approach to knowledge generation in the High North. Education, competence, and knowledge are essential for realising opportunities in the region. The focus is on improving the quality of education at all levels and preventing dropouts from upper secondary education. Surveying, monitoring, and research activities are necessary for sustainable utilisation of natural resources.

Cooperation between public authorities, the business sector, knowledge institutions, civil society, and research institutions is vital to develop cross-cutting knowledge. Norway has well-established knowledge infrastructure and leading centres of excellence in areas like petroleum production, maritime transport, marine resource management, environmental protection, climate research, and indigenous studies.

The government allocates significant funding for High North research through the national research system. Key priorities for knowledge generation include filling knowledge gaps in Ecosystem Interactions, Marine Environment Monitoring, Seabed Surveys, seabird Populations,

Environmentally Hazardous Substances, Geological Surveys, and Long-term Management-related Research. The government also seeks to expand fish farming, promote marine bioprospecting, and focus on petroleum research and development in the High North.

Furthermore, they prioritise research on Climate Change and its impacts on the Arctic, focusing on generating knowledge for future strategies in managing the High North's resources. The government also acknowledges the importance of involving indigenous peoples in Climate Change adaptation measures.

Issues relating to indigenous people and People-to-people cooperation in the north: The Norwegian government emphasizes the importance of integrated resource management in the High North, particularly in protecting the natural resource base for indigenous peoples' economic activities, cultural heritage, and traditional knowledge. The government aims to safeguard reindeer husbandry areas and traditional sea-water and salmon fisheries. Climate Change's impacts on indigenous peoples' way of life are being studied, and efforts to build knowledge in this field are prioritized, including cooperation with other countries in the High North.

The government seeks to involve indigenous people in High North issues and maintain regular contact with the Sami Parliament. It aims to promote trade opportunities for indigenous peoples and apply common standards concerning indigenous rights to all economic activities in the High North. Capacity building and the development of indigenous peoples' competence and influence in society are crucial, and the government plans to contribute to research and educational institutions focusing on indigenous people in the High North. Overall, the government seeks to strengthen cooperation, understanding, and communication in the High North region through various initiatives and support for local development.

The management and utilisation of marine resources: The Government's goal is to ensure a clean and resource-rich marine environment in the High North through sustainable, ecosystem-based management. Efforts to combat illegal, unregulated, and unregistered (IUU) fishing are a priority, and new legislation and control systems are being developed. The Government seeks to strengthen international cooperation on fisheries management and prevent illegal fishing in foreign ports. Measures will be implemented to deny vessels involved in illegal fishing access to

Norwegian ports, and tracing systems will be established to track sales of illegally caught fish. Additionally, marine bioprospecting will be regulated to protect Norway's interests in marine genetic resources and potential financial gain.

Petroleum activities: The Government has established an integrated management plan for the Barents Sea–Lofoten area to regulate petroleum activities while ensuring protection for valuable and vulnerable areas. The development of petroleum operations in the southern Barents Sea is generating interest and optimism, potentially leading to significant investments and job creation. The Government aims to stimulate growth in the Finnmark and Troms counties through these activities and will strengthen higher education capacity in the region. Additional exploration activities are essential to discover more reserves and ensure long-term exploration in the Barents Sea. The Government will follow an active licensing policy to open up new areas for exploration.

Maritime transport – safety and emergency response systems: The Government is focusing on improving maritime safety, oil spill response, and search and rescue services in the High North due to increasing economic activity and shipping in the region. They have proposed the establishment of a ships' routeing and traffic separation scheme along the coast of North Norway to improve safety and monitor vessel traffic. The Government aims to extend the scope of the Harbour Act to include Svalbard and Jan Mayen to strengthen maritime safety in those areas. They are also considering a satellite-based AIS system to enhance monitoring of maritime traffic and resources. Improved meteorological observation systems are also being developed to support the increasing activity in the High North.

Business development: The Government's policy platform aims to develop industry and promote new industrial activity in North Norway and other parts of the country. They are focused on improving the electricity supply situation for energy-intensive industries in the region. The Government is also supporting business development, innovation, and the fisheries sector in North Norway. They are encouraging the growth of knowledge-based industries, such as space-related activities and aquaculture. Infrastructure development, including transport, communication, and air services, is a priority.

The strategy will guide the Government's future efforts in the High North region, with budget implications for specific measures to be considered during the regular budget process. The Ministry of Foreign Affairs will be responsible for reporting regularly on the implementation of the strategy on behalf of the Government.

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Intervention Management System in the Case of a Sudden Pollution of the Adriatic Sea Republic of Slovenia, Court of Audit 2021

By: Anupam Srivastava, Sr.AO

Background

Marine pollution may be caused by various cases of emergency or constant/regular pollution which may not be seen at first sight. The majority of risks of marine accidents derive from marine and, consequently, inland activities including trans-shipment and storage activities in the cargo port. Most accidents occur while manoeuvring the vessel upon arrival to or departure from the port, while less accidents happen during navigation itself.

Objective of the Audit

A performance audit was conducted to express an opinion on the efficiency of the intervention management system in case of sudden pollution in the Adriatic Sea in the period from 1 January 2017 to 31 December 2019.

Criteria

The system of managing interventions in case of sudden pollution in the Adriatic Sea was assessed on the basis of following criteria and was considered efficient if:

- measures for preventing sudden marine pollution are being implemented;
- procedures for intervention in case of sudden pollution are appropriate;
- basic conditions enabling appropriate intervention are established;
- functioning of the system in practice is being inspected and verified, and
- handling with collected substances is defined.

Audit Approach and Limitations

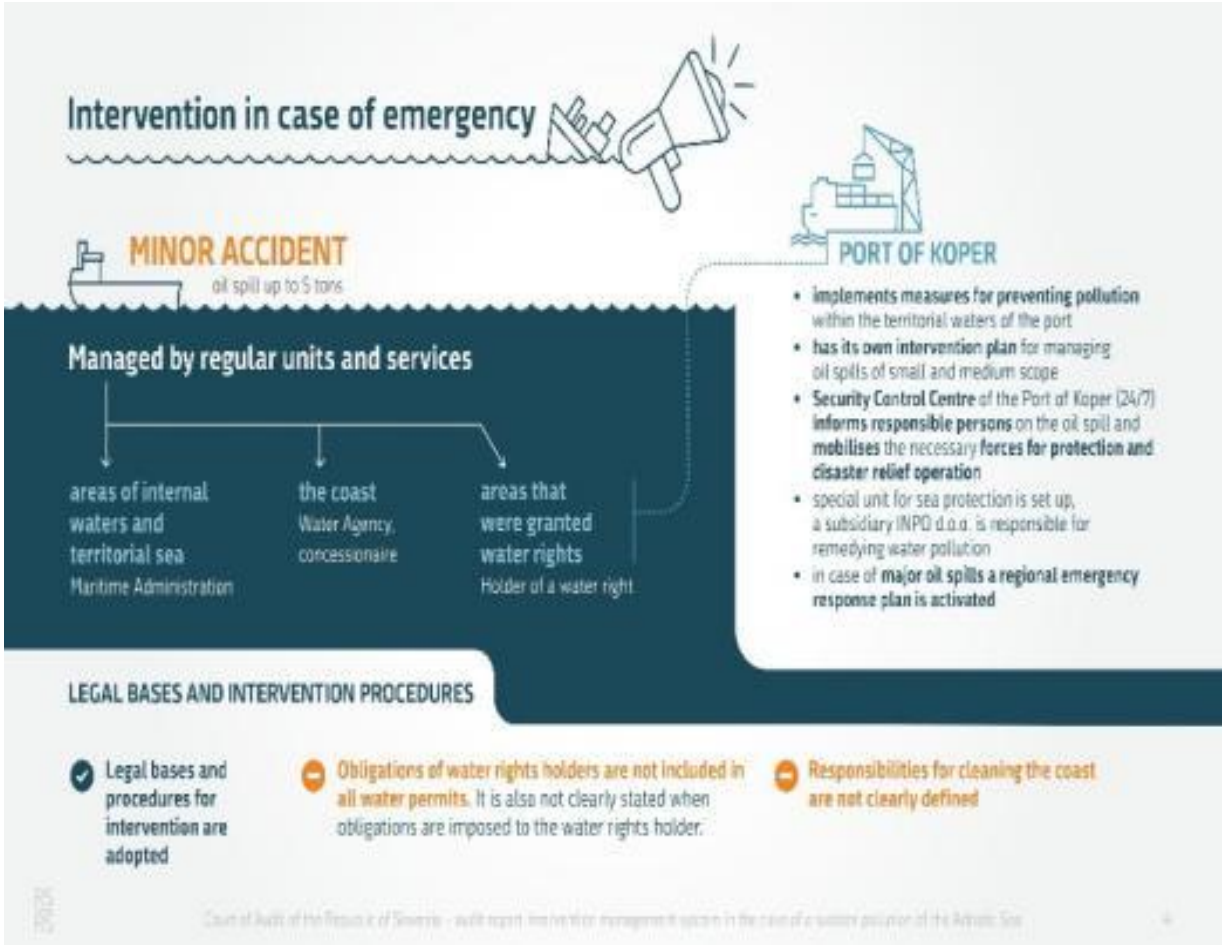
Assurance was obtained by reviewing legal and other bases, as well as publicly accessible data pertaining to the audit field, collecting, reviewing and assessing documentation obtained from the auditees, and interviews with auditees and written questions.

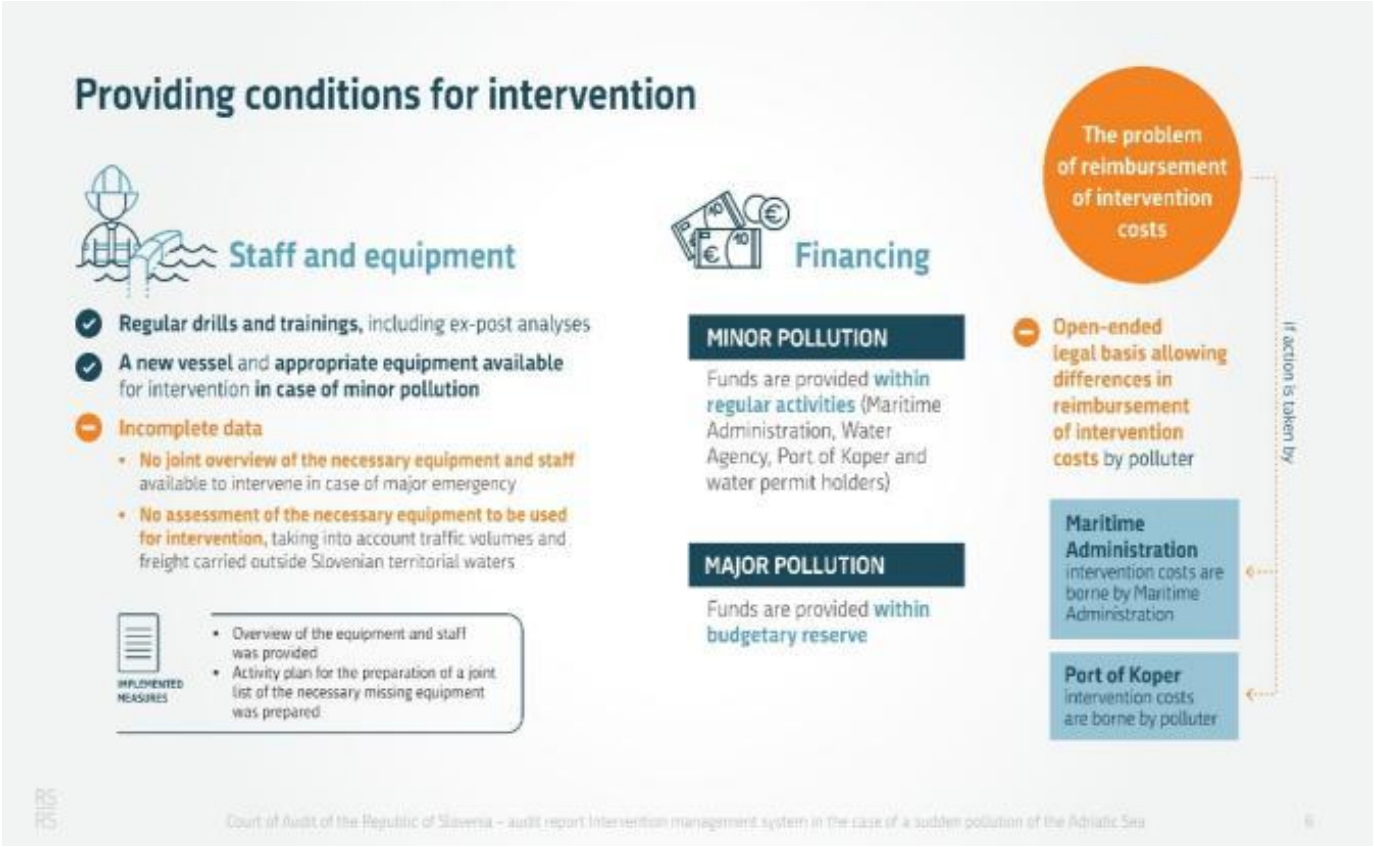
Key Audit Findings

- The audit observed that: In order to reach the desired level of monitoring and control over the maritime transport, the Maritime administration purchased the necessary equipment for several years, but the Ministry of Infrastructure and the Maritime Administration had not started with the preparation of relevant content and necessary amendments to the provisions of the legal bases.
- Related to implementing the measure of regular maintenance of facilities for the safety of navigation and navigation routes, the Court of Audit found out material weaknesses as it was based on a 17-year-old concession contract which was out of date .

Key Audit Findings

- Regulations concerning the maintenance of water depth of navigation were not clear enough to identify obligations for the maintenance. The system of hydrological and meteorological measurements and for providing data necessary for safe navigation at sea was upgraded but was not fully set up.
- Authorities for cleaning of the coast and coastal land were not clear. Additionally, tasks related to cleaning and remedy of consequences of pollution including removal of collected waste and substances in the area of granted water rights were not clearly presented in all water right permits.
- Services of cleaning and removing of collected waste and substances were not charged to the holders of water rights, who should in line with Water Act, borne the costs.





- In Emergency Response Plan, not all foreseen plans of activities of state bodies were developed where tasks should be defined for each body in case of activating the Emergency Response Plan.
- In cases where capacities of the Maritime Administration would not suffice to remedy the consequences of the pollution, the Administration for Civil Protection and Disaster Relief concluded several contracts with organisations that can provide help. Procedures of activating forces, were not defined in practice, namely who can activate additional forces when resources of the Maritime Administration do not suffice.
- Requirements for additional human resources were not sufficiently explained and presented the needs for additional staff to set up the desired level of control over the maritime transport. Providing appropriate level of continuous maritime inspection in future was detected and the issue of providing human resources in case of longer intervention was not addressed. The analysis of the needs of personnel in case of major sea

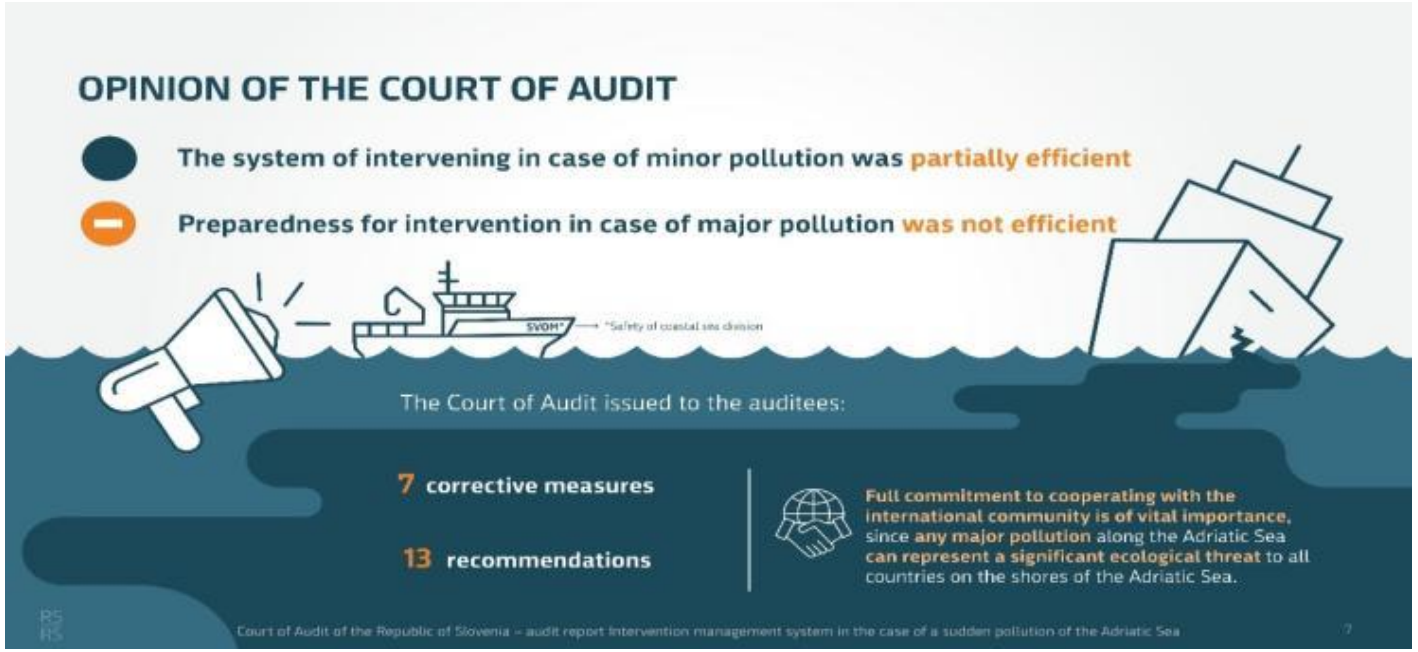
pollution was not developed, while the data in the Emergency Response Plan related to available human resources were not complete. There was thus no joint overview of human resources that could be involved in intervention when sudden pollution at sea might occurred.

- The legal bases did not clarify enough for the Maritime Administration and the Administration for Civil Protection and Disaster Relief to be able to impose on the polluters the costs of activities undertaken when fighting the pollution at the sea.
- Managing the collected waste is based on the principle that remedying of sudden smaller scope of pollution is undertaken by existing capacities. When available capacities are filled, the manner of management of collected waste and substances is decided on the spot, from case to case and not by following the procedure defined in advance, since there is no such procedure at the level of the State in case of occurrence of larger quantities of waste. Furthermore, in the Republic of Slovenia there is no temporary storage or waste disposal at the State level, i.e. in case of larger quantity of waste and substances collected at sea.

Recommendations

- **The Ministry of Infrastructure** was recommended to adequately regulate the field of maintenance of sea navigation safety, to uniformly define facilities and devices designed for the purpose of sea navigation safety and safe mooring, review whether it is necessary to approach towards the amendments of regulations under the authority of the Ministry and, if needed, to perform the activities and to review whether measures must be adopted from the field of the Ministry and, if needed, to perform the activities.
- The Ministry of the Environment and Spatial Planning was recommended to clearly define Article 99 where it refers to defining the ministry or its subordinated body that is authorised for paying costs of accepting and disposing floating debris, waste and other abandoned or discarded objects or materials from the sea.
- The Administration of the Republic of Slovenia for Civil Protection and Disaster Relief was recommended to provide appropriate list of contacts from services or organisations from countries near the Adriatic Sea that are authorised to intervene in case of sea pollution, and to take care for setting up a mechanism for regular updating the contacts and to include in the intervention system the coordination of services at sea and operational maritime coordination.

- The Ministry of Defense and the Administration of the Republic of Slovenia for Civil Protection and Disaster Relief were recommended to update plans of activities of those stakeholders who are included in the intervention in case of accident at sea; thereby they should review which data are needed and have added value in case of intervention, they should provide regular review of the data from the plans of activities and their attachments.



Audit Report Intervention Management System in the case of sudden pollution of the Adriatic Sea

- The Maritime Administration of the Republic of Slovenia was recommended to provide that the content and manner of cooperation are clearly defined and that all stakeholders involved are properly informed.
- The Administration of the Republic of Slovenia for Civil Protection and Disaster Relief and the Maritime Administration of the Republic of Slovenia were recommended to review the needs of services provided by the Port of Koper and, upgrade the existing manner of analysing emergency events and in future implement drills also for other types of pollution, mainly for the pollution with hazardous chemicals, and to review the availability of equipment to intervene and protective equipment for rescuers involved in such interventions.
- The Ministry of Environment and Spatial Planning and the Slovenian Water Agency were recommended to clearly provide the wording of the permit which includes all responsibilities of the holder of water rights in case of pollution at sea where water rights are granted. Thus, related

implementation of measures to prevent the spread of pollution and to remedy the consequences of the pollution also including collecting, storing and removing waste. (Court of Audit, Republic of Slovenia, 2021)

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From the Archives: Critical discussion of Rules/Laws: Coastal Regulation Zone Notification

By: Lokesh Kumar Meena, AAO

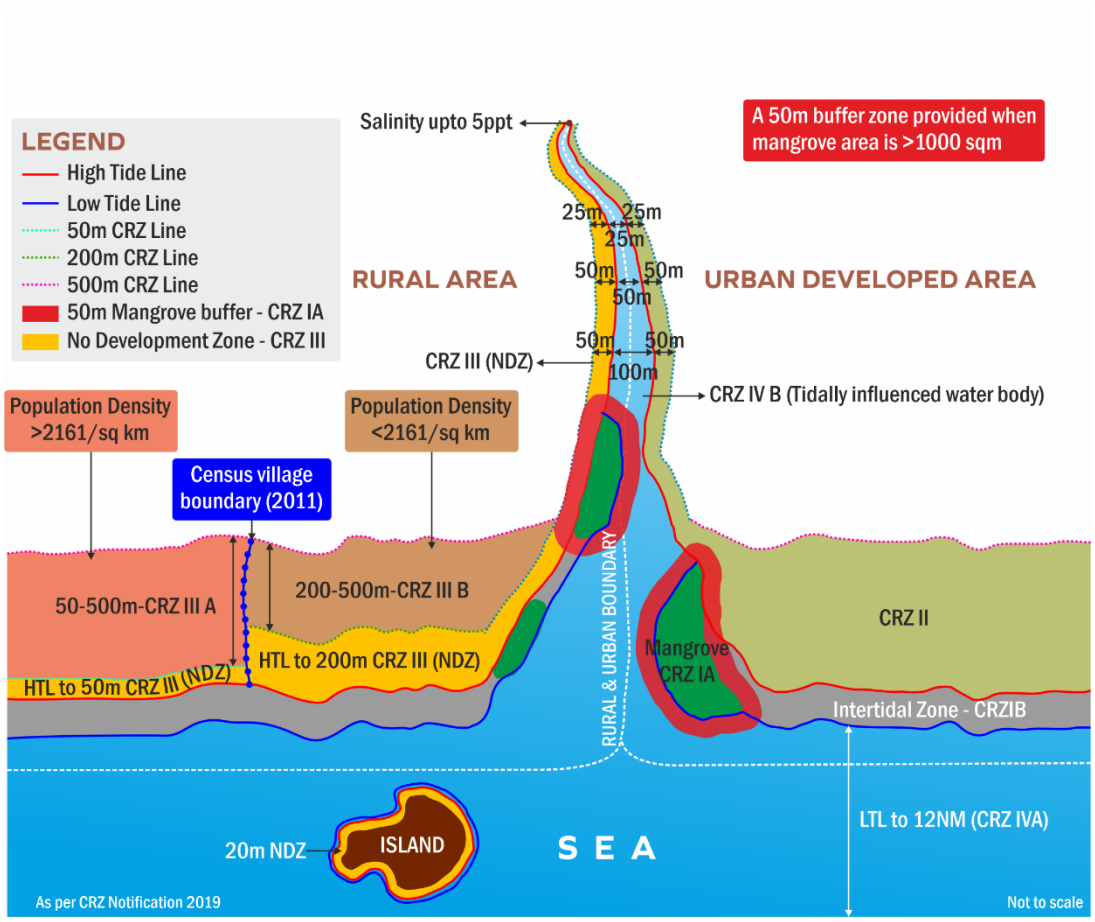
The Ministry of Environment, Forest and Climate Change (MOEFCC) notified the Coastal Regulation Zone (CRZ) Notification 2018 on 18 January, 2019 which was last reviewed and issued in 2011, with periodic amendments to some clauses.

Salient features of CRZ Notification, 2018 are as under: (Government of India, 2018)

- **Easing of Floor Space Index (FSI) Urban Area Norms**: In the CRZ, 2018 Notification, it has been decided to de-freeze the Floor Space Index (FSI) or the Floor Area Ratio (FAR) and permit FSI for construction projects to enable redevelopment of these areas to meet the emerging needs.
- **New Categories for densely populated rural areas**: For CRZ-III (Rural) areas, two separate categories have now been stipulated as below:
  (a) ***CRZ-III A*** –Rural areas with a population density of 2161 per square kilometer shall have a No Development Zone (NDZ) of 50 meters from the High Tide Line (HTL).
  (b) ***CRZ-III B*** – Rural areas with population density below 2161 per square kilometer shall continue to have an NDZ of 200 meters from the HTL.
- **Tourism infrastructure for basic amenities to be promoted**: Temporary tourism facilities such as shacks, toilet blocks, change rooms, drinking water facilities etc. have now been permitted at Beaches and also in the "No Development Zone" (NDZ) of the CRZ-III areas. However, minimum distance of 10 meters from HTL should be maintained for setting up of such facilities.
- **CRZ Clearances streamlined:** Only such projects/activities, located in the CRZ-I (Ecologically Sensitive Areas) and CRZ-IV (Area covered between Low Tide Line and 12 Nautical Miles Seaward) will be required to be cleared by MOEF&CC. In respect of CRZ-II (Urban) and CRZ-III (Rural), authority has been delegated at the State level.

- **A No Development Zone (NDZ) of 20 metres has been stipulated for all Islands:** For islands close to the mainland coast and for all Backwater Islands in the main land, in wake of space limitations and unique geography of such regions, bringing uniformity in treatment of such regions, NDZ of 20 metres has been stipulated.
- **All Ecologically Sensitive Areas have been accorded special importance** through Specific guidelines.
- **Pollution abatement has been accorded special focus** by permitting pollution treatment facilities in CRZ-I B (the area between the Low tide line and High tide line) area subject to necessary safeguards (Government of India, Ministry of Environment, Forest and Climate Change, 2018)**.**

Amendment in CRZ, 2018 (Government of India)**:** On 1st November 2021, the Ministry of Environment, Forest and Climate Change issued a draft notification on the amendment of the coastal regulation zone notification, 2019. The recent amendments provide that development, production and all related facilities to oil and natural gas shall be exempted from prior Coastal Regulation Zone (CRZ) clearance. Moreover, Exploratory drilling operations shall also be exempted from prior CRZ clearance.



CRZ Mapping as per CRZ Notification 2019, Image Source: Coastal Zone Management Plan

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Sustainable Fisheries Management: Food and Agriculture Organisation's Principles and Their Applications in India

Dr. Gulshan Sharma, Research Associate

Image Source: The Maritime Executive 2020

Background

Sustainable fisheries refer to the responsible management and utilization of aquatic resources, such as fish and shellfish, in a manner that ensures their long-term viability while minimizing negative impacts on the environment and other species. The aim is to strike a balance between meeting the current needs for fish and seafood products and ensuring the preservation of fish populations and the marine ecosystem for future generations (Ogden 2017).

Key principles and practices of sustainable fisheries include:

1. Fisheries Management: Implementing science-based management strategies to regulate fishing activities, including setting catch limits, establishing fishing seasons, and implementing gear restrictions. This helps prevent overfishing and allows fish populations to replenish and maintain healthy stock levels.

2. Ecosystem Approach: Considering the broader ecosystem in fisheries management decisions, taking into account the interdependencies between different species and their habitats. This approach aims to minimize negative impacts on marine biodiversity, including protecting vulnerable or endangered species and preserving essential habitats such as coral reefs, seagrass beds, and mangroves (Bundy 2017) .

3. Regulation and Enforcement: Enforcing regulations and monitoring compliance with fishing rules and regulations, such as fishing quotas, size limits, and protected areas. This helps prevent illegal, unreported, and unregulated (IUU) fishing, which contributes to overfishing and depletion of fish stocks (Antonova 2016).
4. Gear and Fishing Practices: Encouraging the use of sustainable fishing gear and practices that reduce bycatch (unintended catch of non-target species) and minimize habitat damage. Innovations such as selective fishing gear, escape panels in nets, and turtle excluder devices (TEDs) help reduce the impact of fishing activities on non-target species and their habitats.(Qi Chen 2018).
5. Traceability and Certification: Establishing traceability systems to track fish from the point of capture to the consumer, ensuring legal and sustainable practices throughout the supply chain. Certification programs like the Marine Stewardship Council (MSC) provide a framework to assess and verify sustainable fishing practices, allowing consumers to make informed choices when purchasing seafood products (Qi Chen 2018).
6. International Cooperation: Promoting international collaboration and agreements to manage shared fish stocks and combat illegal fishing practices. Regional fisheries management organizations (RFMOs) play a crucial role in coordinating efforts among countries to sustainably manage fish populations in areas beyond national jurisdictions (Bose 2019).

By implementing these principles and practices, sustainable fisheries aim to ensure the long-term health and productivity of aquatic ecosystems, support the livelihoods of fishing communities, and provide a consistent supply of seafood for current and future generations. Sustainable fisheries management involves various interconnected components that work together to ensure the long-term health and viability of fish populations and the ecosystems they inhabit. Here are some key components of sustainable fisheries management depicted in **Figure 1** below:

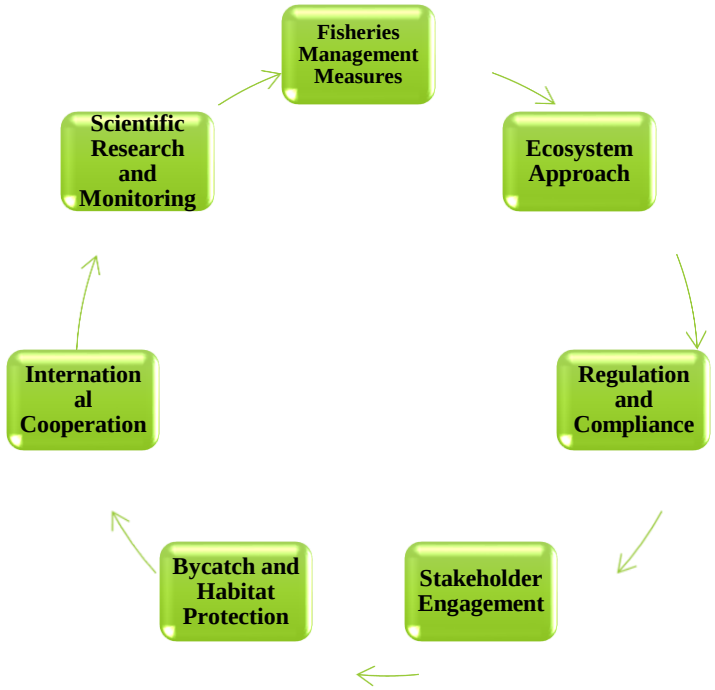

Figure 1: Components of Sustainable Fisheries Management (Source: Figure created by author).

The Food and Agriculture Organisation (FAO) has developed several principles and guidelines for sustainable fisheries management that can be applied globally, including in India. The FAO's principles and their applications in the context of fisheries management are given below:

1. **Precautionary approach:** It suggests that action should be taken to prevent potential risks even in the absence of complete scientific information. In the case of Indian fisheries, this principle can be applied by setting conservative catch limits and implementing measures to protect vulnerable species and habitats, even if the full extent of their vulnerabilities is not yet known (Bose 2019).
2. **Ecosystem-based approach:** This approach emphasizes the importance of considering the interactions between different species and their environment. In India, this can involve adopting holistic management strategies that take into account the ecological relationships between

target fish species, non-target species, and their habitats. It may also involve implementing measures to minimize bycatch and habitat destruction (Ogden 2017).

3. **Sustainable exploitation of fish stocks:** This principle promotes the use of fisheries resources in a manner that ensures their long-term sustainability. India can apply this principle by establishing science-based fishing quotas and implementing effective monitoring and enforcement systems to prevent overfishing. This may involve implementing tools such as catch documentation schemes and promoting the use of selective fishing gear (Ogden 2017).
4. **Governance and management:** Effective governance and management are crucial for sustainable fisheries. In India, this can be achieved by developing comprehensive fisheries management plans that involve all stakeholders, including fishers, coastal communities, and relevant government agencies. These plans should incorporate mechanisms for collaboration, participatory decision-making, and adaptive management(Ogden 2017).
5. **Responsible fisheries:** Responsible fisheries management involves minimizing negative impacts on the environment, ensuring the safety and well-being of fishing communities, and complying with relevant laws and regulations. India can promote responsible fisheries by implementing measures to reduce marine pollution, encouraging the use of sustainable fishing practices, and providing support and training to fishing communities to enhance their livelihoods (Bose 2019)..
6. **Monitoring, control, and surveillance:** Effective monitoring, control, and surveillance systems are essential for enforcing fisheries regulations and detecting and deterring illegal, unreported, and unregulated (IUU) fishing activities. India can strengthen its monitoring and surveillance capabilities by investing in appropriate technologies, enhancing its enforcement capacity, and promoting regional and international cooperation to combat IUU fishing (Bose 2019).
7. **Data collection and information sharing:** Timely and accurate data collection and information sharing are fundamental for evidence-based decision-making in fisheries management. India can enhance its data collection systems by improving its fisheries statistics, conducting

scientific surveys, and promoting cooperation between fisheries research institutions, government agencies, and fishing communities(Bundy 2017).

By applying these FAO principles, India can promote sustainable fisheries management practices that ensure the long-term availability of fish resources, protect ecosystems, support fishing communities, and contribute to food security and economic development. It is important to note that the specific implementation strategies may vary depending on the unique characteristics and challenges of India's fisheries sector (William W. L. Cheung 2015).

Pointers and Inputs for Audit

From an audit point of view, the assessment of Sustainable Fisheries Management entails a meticulous evaluation of its implementation and effectiveness in achieving sustainable practices in the fishing industry and verifying the transparency of data reporting and accessibility, allowing for scrutiny and validation of fishery-related information. Audit could assess whether the management strategies consider the impacts of extreme climatic events on fish stocks and ecosystems, and incorporate adaptive measures. Overall, the audit could focus on ensuring that sustainable fisheries management practices are ecologically sound, economically viable, and socially responsible, aiming to safeguard marine resources for present and future generations.

Conclusion:

As would be evident, sustainable fisheries management is of the utmost importance to ensure the long-term viability of marine ecosystems and the livelihoods of millions of people dependent on fisheries worldwide. In India, the application of FAO's principles has the potential to address several challenges faced by the fisheries sector. By implementing measures such as selective fishing gear, spatial planning, and habitat restoration, India can enhance the resilience of its fisheries and promote the conservation of biodiversity. Additionally, the FAO principles recognise the significance of responsible trade and market access. India can benefit from promoting sustainable fishing practices and obtaining certifications, such as the

Marine Stewardship Council (MSC) certification, which can enhance market opportunities for Indian seafood products in both domestic and international markets.

Overall, the application of FAO's principles for sustainable fisheries management in India holds great promise for the conservation of marine resources, the protection of livelihoods, and the promotion of responsible and accountable governance in the fisheries sector. By embracing these principles and implementing appropriate measures, India can contribute to global efforts towards achieving sustainable fisheries for future generations.

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The Ocean Economy in 2030

By: Pavan Kumar Meena, AAO

Overview

The ocean economy is a term used to describe the various economic activities and industries that are dependent on or linked to the ocean and its resources. It covers industries including fishing and aquaculture, shipping and maritime transportation, offshore oil and gas development, marine tourism, the production of renewable energy (such as offshore wind farms), and marine biotechnology.

The blue economy, often known as the ocean economy, is a theory that aims to advance economic development while simultaneously protecting ocean ecosystems and the environment (UNCTAD 2014).

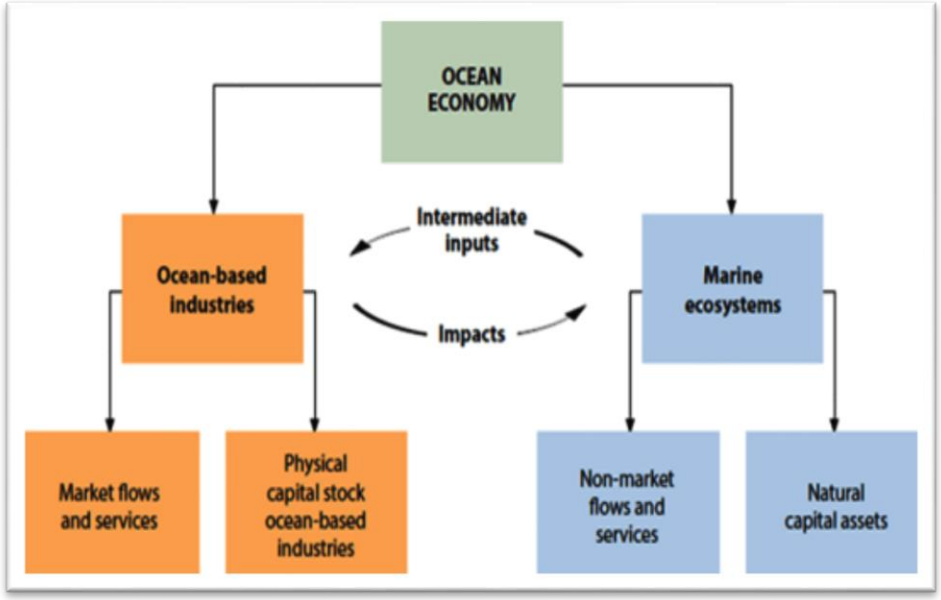

Image 1 The Concept of Ocean Economy

Image Source: OECD (2016)

The emerging "ocean economy" is being pushed by a blend of population increase, growing affluence, decreasing natural resources, climate change solutions, and cutting-edge technologies. While conventional marine businesses continue to innovate at a rapid pace, emergent ocean industries are capturing the majority of the focus. Offshore wind, tidal, and wave energy; oil and gas exploration and production in ultra-deep water and very hostile settings; offshore aquaculture; seabed mining; cruise tourism; maritime surveillance and marine biotechnology are among these businesses. These industries have a significant long-term potential for innovation, job development, and economic growth. Image 1 shows the intermediate inputs and impacts of the Ocean Economy.

Scope

The ocean economy encompasses ocean-based industries (such as shipping, fishing, offshore wind, and marine biotechnology), but also the natural assets and ecosystem services that the ocean provides (fish, shipping lanes, CO_2 absorption, and the like).

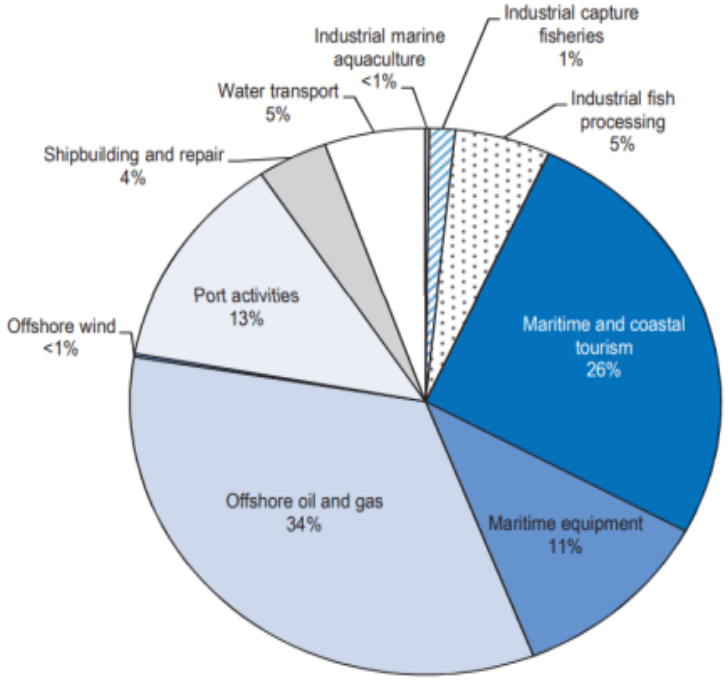

Image 2 Value added of Ocean-based industries in 2010 by Industry.

Image Source: OECD 2016

The contribution of ocean-based industries to economic production and employment indicates the size of the global ocean economy. According to preliminary calculations using data from the OECD's Ocean Sector Database, the ocean sector contributed US$ 1.5 trillion, or around 2.5 per cent of global gross value added (GVA), in 2010.

Offshore oil and gas accounted for one-third of the total value added of the ocean-based industries, followed by maritime and coastal tourism, maritime equipment, and ports. The largest employers were industrial capture fisheries with over one-third of the total, and maritime and coastal tourism with almost one-quarter. Image 2 shows the value added to the ocean-based industries in 2010 (Copernicus marine service).

Potentials and Challenges

According to the forecasts, the ocean economy may more than double its contribution to global value-added between 2010 and 2030 under a "business-as-usual" scenario, reaching more than US$ 3 trillion. Marine aquaculture, offshore wind, seafood processing, and shipbuilding and repair are all predicted to increase rapidly. Ocean industries have the potential to contribute significantly to job creation. In the best-case scenario,

they will employ nearly 40 million full-time equivalent workers by 2030. Future growth of ocean-based industries on the scale suggested in an OECD report on the ocean economy 2030 highlights the prospect of increasing pressures on ocean resources and ocean space, which are already under considerable strain, not least in economic Exclusive Economic Zones (EEZs), where the majority of the activity occurs. However, several impediments to more efficient integrated ocean management must be addressed in the near future (Copernicus marine service).

Initiatives by India in the Fisheries and Aquaculture sector

- There have been efforts to boost the fisheries sector of India in order to harness its full capacity. The Blue Revolution: Integrated Development and Management of Fisheries Centrally Sponsored Scheme (CSS) was launched in 2015-16 with a five-year budget of Rs 3,000 crore (US$ 384.3 million).
- The 'Fisheries and Aquaculture Infrastructure Development Fund (FIDF) was established in 2018-19 with a fund size of Rs 7,522.48 crore (US$ 963.5 million) to provide concessional credit to state/UT governments, their entities, and the private sector to fill significant gaps in the fisheries infrastructure.
- The Government of India launched the Pradhan Mantri Matsya Sampada Yojana (PMMSY), in May 2020, with the highest investment of Rs 20,050 crores (US$ 2.5 billion) to bring about a Blue Revolution through sustainable and responsible development of the country's fisheries sector (Department of Fisheries 2020).

Way Forward

In order to boost the long-term development prospects of emerging ocean industries and their contribution to growth and employment, while managing the ocean in responsible, sustainable ways, it is essential to:

- Foster greater international cooperation in maritime science and technology as a means to stimulate innovation and strengthen the sustainable development of the ocean economy.

- Improve the statistical and methodological base at national and international levels for measuring the scale and performance of ocean-based industries and their contribution to the overall economy.

- Build more capacity for ocean industry foresight, including the assessment of future changes in ocean-based industries. (OECD 2016)

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Blue Accounting in India

By: Jayant Sharma, Senior Consultant

Introduction:

The field of accounting has long been synonymous with economic activities represented by numbers and financial statements. However, with the increasing awareness of environmental issues and the need for sustainable development, conventional accounting is undergoing a transformation. Green Accounting and Blue Accounting are two evolving approaches that recognise the influence of environmental factors on economic activities, particularly within the context of the Blue Economy.

Blue Economy, Blue Accounting and their interconnection

The Blue Economy is a way to use the ocean's resources to create jobs and grow the economy, while also protecting the ocean's health**.** (United Nations n.d.). The Blue Economy covers many ocean-related activities, such as shipping, fishing, tourism, renewable energy, desalination, and marine resources, while Blue Accounting is a method of providing useful information to citizens and stakeholders based on international standards. **Hon'ble Prime Minister Shri Narendra Modi has highlighted the importance of the Blue Economy for India, comparing it to the potential of the Blue Chakra in the Indian national flag** (Mongabay 2023). The government's vision for new India by 2030 also highlights the Blue Economy as a crucial dimension of growth (Geospatial World 2023).

Blue Accounting (BA) is a framework for measuring the value of the ocean economy and its impact on the environment. It considers marine ecosystems to be assets and monitors their extent and quality, as well as the benefits they provide. Blue Accounting can also be used to assess the success of Marine Spatial Planning (MSP) (Mongabay 2023). It considers the needs of all stakeholders and focuses on the three pillars of sustainability: economic, social, and environmental. Blue Accounting is designed to raise awareness of the importance of protecting marine ecosystems. (India Brand Equity Foundation 2022, n.d.)

System Environmental Economic Accounting (SEEA) and its importance in all accounting framework related to the environment

System Environmental Economic Accounting (SEEA) is an accepted international standard for environmental-economic accounting, providing a framework for organising and presenting statistics on the environment and its relationship with the economy. (MoSPI, GoI 2022). The global commitment to the 2030 Agenda has led to a significant increase in the use of the System of Environmental-Economic Accounting (SEEA) for natural resource assessments. The SEEA provides a framework for monitoring and measuring ecosystem extent, condition, and services, as well as the supply and use of these services. It can also be used to inform a wide range of climate change policy questions related to impacts and adaptation.

India's Blue Economy and its linkage with Blue Accounting

The Ministry of Statistics and Programme Implementations (MoSPI) is responsible for compiling environmental accounts for India. MoSPI has formed an Inter-Ministerial Group (IMG) to facilitate this process and has begun compiling environmental accounts using the System of Environmental-Economic Accounting (SEEA) framework. The Supreme Audit Institution of India (Comptroller and Auditor General (CAG) of India) has also begun to compile data on the receipts and expenditures associated with the exploitation of natural resources. The Ministry of Environment, Forest and Climate Change (MoEFCC) is conducting a project to estimate the economic value of coastal ecosystems. MoSPI will provide advisory and technical inputs on the methodology of assessment and reporting mechanisms.(The Ministry of Statistics and Programme Implementation n.d.).

Interesting data related to Blue Accounting in India:

India's Blue Economy is all about the economic activities related to its oceans and seas, such as fishing, shipping, and tourism. It makes up about 4% of India's GDP and has the potential to grow. India has a long coastline, many islands, and nine coastal states, which gives it a big advantage in developing its Blue Economy. There have been efforts to boost the fishing sector to make full use of its potential. The Government of India launched the Pradhan Mantri Matsya Sampada Yojana (PMMSY), in May 2020, with the highest investment of ₹ 20,050 crore (US$ 2.5 billion) to bring about a Blue Revolution through sustainable and responsible development of the country's fisheries sector. India's fish production has

increased by 70 lakh metric tonnes (MT), aquaculture productivity has doubled from 3 tonnes per hectare (ha) to 5 tonnes per ha, and exports have doubled from ₹46,589 crore (US$ 5.72 billion) to ₹100,000 crore (US$ 12.28 billion) (India Brand Equity Foundation 2022).

India's vast coastline, Exclusive Economic Zone (2.24 M sq km and 5,30,000 km harbour), and Continental Shelf are home to a diverse range of ecosystems**.** These ecosystems are home to a diverse range of 21,663 species, including many commercially important species. The value of these ecosystems to India is estimated to be ₹1.9 trillion per year, or 2.4 per cent of India's net national product in 2012-13 (Ministry of Statistics & Programme Implementation 2013).

Foreign tourists are increasing over a rate of 7 per cent in the 2005-15 period. In 2015, India earned USD 147.7 billion from foreign tourists, which rose to US$ 418.9 billion in 2022. The country now has 12 'Blue Beaches' having a certificate of cleanliness by a prestigious international foundation.

The Indian Ocean is a major global economic zone, rich in natural resources and home to billions of people. It is the world's third-largest body of water, covering 68.5 million sq. km. and rich in oil and mineral resources, and countries around the ocean's periphery are home to about one-third of humanity. The development of inland waterways in India is expanding the reach of the Blue Economy, and the first containerized freight has already been shipped through the India-Bangladesh Protocol.

Conclusion

The Blue Economy in India is poised for substantial growth in the coming years, driven by the government's dedicated Blue Economy Mission. Recognizing the immense contribution of ocean and coastal resources to India's economic output, the Government of India's Vision of New India by 2030, unveiled in February 2019, highlighted the Blue Economy as one of its ten core dimensions for growth. (India Brand Equity Foundation 2022).

The Blue Accounting paradigm in India aim to achieve long-term and sustainable economic benefits, encompassing goals such as fostering growth, job creation, promoting equity, and protecting the environment. The key priority lies in the establishment of a robust mechanism for a National Accounting Framework for Blue Economy and Ocean Governance (Ministry of Statistics and Programme Implementation, Government of India

2022). The potential opportunities for accountants in Blue Accounting are the new approach to accounting implies that accountants play a pivotal role, not just recording transactions but actively contributing to shaping the rules and practices within the sector (Sultan Syah n.d.). In conclusion, Blue Accounting represents a significant leap forward in recognising the value of marine ecosystems and their role in the Blue Economy. By aligning economic growth with environmental sustainability and societal well-being, Blue Accounting can play a crucial role in shaping a prosperous and sustainable future for India's ocean economy.

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Assessment of Kunming Montreal Global Bio-diversity Framework

By: Kailash Chand Bajya, AAO

Introduction

Biodiversity stands for biological diversity (United Nations 2021). It refers to the variety of life forms found on Earth, including species, ecosystems, and genetic variations. It covers all types of living organisms, from bacteria to plants, animals, etc. As per the United Nations report 2019(UN 2023), 75 per cent of the terrestrial environment has been altered (66 per cent of marine environments). In 2022, the Living Planet Report (WWF 2022) revealed that there was an average 69 per cent decline in the global population of species since 1970.

Kunming Montreal Global Biodiversity Framework

The Kunming Montreal Global Biodiversity Framework was adopted, during the second day of the 15th meeting of the Conference of the Parties (COP15) held in Montreal, Canada from 7th to 19th December 2022, in relation to the Convention on Biological Diversity (CBD), (UNEP 2022). The framework is a landmark agreement that contains global targets to be achieved by a particular time and beyond to safeguard and sustainably use biodiversity, to reverse biodiversity loss keeping in view the rights of indigenous peoples and local communities. The Kunming-Montreal global biodiversity framework, sets out an ambitious plan to implement broad based action to bring about a transformation in our societies' relationship with biodiversity by 2030, in line with the 2030 Agenda for Sustainable Development and its Sustainable Development Goals, and ensure that, by 2050, the shared vision of living in harmony with nature is fulfilled (UNEP 2022).

The vision of this framework (The vision of the Kunming-Montreal Global Biodiversity Framework 2023) is to live in harmony with nature and till 2050, either biodiversity is conserved and restored or used wisely. As per the vision, the ecosystem should be maintained and all the people are getting benefited by 2050 onwards.

The framework has 23 action-oriented global targets for urgent action over the decade to 2030. The actions set out in each target need to be initiated immediately and completed by 2030. Together, the results will enable achievement towards the outcome-oriented goals for 2050.

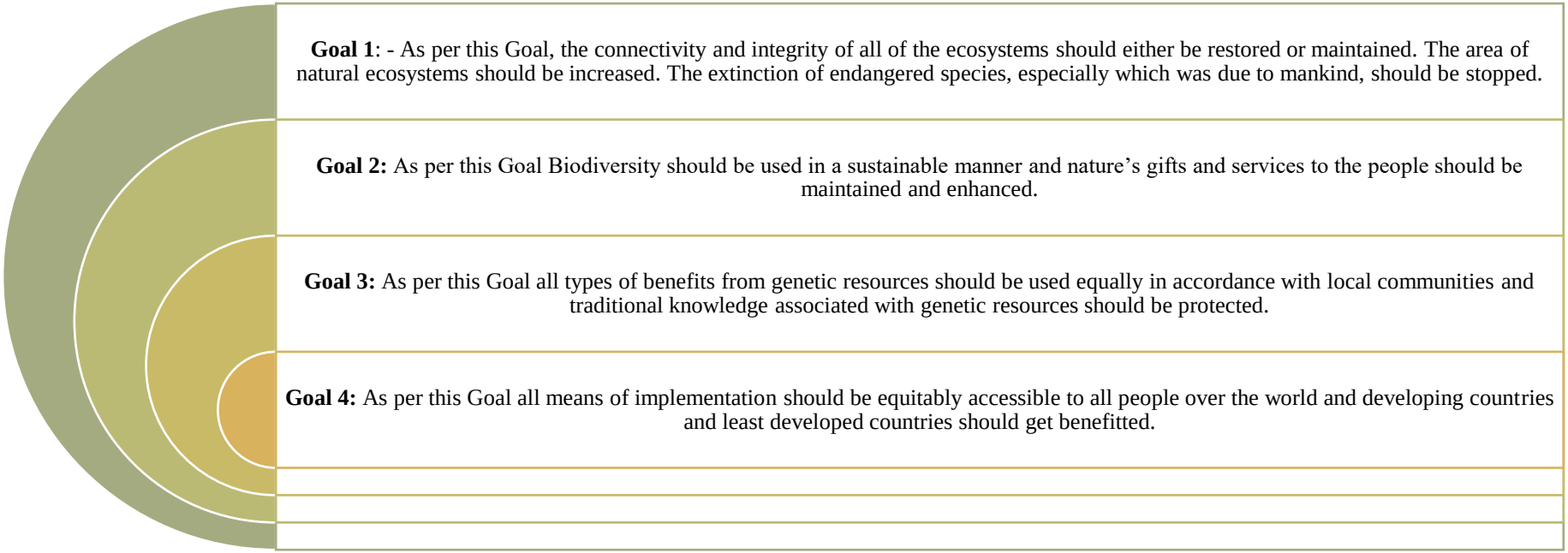
GLOBAL TARGETS

Part 1: Reducing threats to biodiversity: As per this target**,** the loss of areas of high biodiversity should be reduced to zero by 2030 keeping in view the rights of people and the local community.

Part 2: Meeting people's needs through sustainable use and benefit-sharing: - As per this part of the targets management and use of wild species should be sustainable and people in vulnerable situations should get benefits of biodiversity. Areas under agriculture, aquaculture, fisheries, and forestry should be managed sustainably. Nature's contributions, gifts, and services to people should be enhanced.

Part 3: Tools and solutions for implementation and mainstreaming: As per this part of the targets, the Integration of biodiversity may be ensured into policies, regulations, planning and development processes, poverty eradication strategies, strategic environmental assessments, and environmental impact assessments.

Goals of the Framework: The Kunming Montreal Global Bio-diversity Framework has four (04) long-term Goals which are to be achieved by 2050 (UNEP 2022)**.**



Relationship with the 2030 Agenda (UNEP 2022)**:** This framework also helps to achieve Goals and Targets of Sustainable Development for the 2030 agenda. This framework will help to protect biodiversity and it will also help in sustainable use of natural resources.

India's Stand on COP15 and Biodiversity: The Union Minister for Environment, Forest and Climate Change, Government of India, Shri Bhupender Yadav delivered India's National Statement at the fifteenth meeting of the Conference of Parties (COP 15) to the Convention on Biological Diversity (CBD) at Montreal, Canada in December 2022, wherein he informed, that despite less land area and less water in comparison to the population, our country is doing well to save biodiversity and also we are on track to fulfil our national and international commitments to reduce biodiversity loss. Shri Bhupender Yadav said (Hindu , 2022) that there is a need to create a new and dedicated mechanism for the provision of financial resources to developing-country parties. He said that the developing nations bear most of the burden of implementing the targets for conservation and therefore, require adequate funds and technology transfer for this purpose. He further said the successful implementation of a post-2020 GBF

will depend on the "ways and means we put in place for an equally ambitious 'Resource Mobilization Mechanism' (MOEFCC, 2022). In line with the implementation of the GBF, India planned to amend the Forest (Conservation) Act, 1980, and to implement the Forest (Conservation) Amendment Act, 2023(Lok Sabha Bill 2023). It has been presented in the Lok Sabha on 29th March 2023.

Conclusion

- As mentioned in the targets of this framework, at least 30 per cent of the land, inland waters, coastal areas, marine environment and oceans should have been protected/recovered/restored by 2030. The forests, wetlands, soil, and oceans are natural 'carbon sinks' and they absorb more carbon than they release and can play a big role in the natural carbon cycle and will help in the direction of 'Net Zero' Emission and the global goal of limiting warming to $1.5^{O}C$.
- This Global Biodiversity Framework (GBF) contains targets (7, 10, and 16) to halve global food waste and significantly reduce overconsumption and waste by 2030. This can also decrease Climate Change-related shocks to the supply chain.
- There are limited directions in this GBF to decide the priority of marine and terrestrial areas for protection.
- As committed in the GBF in Target 19, at least 200 billion USD are necessary (including $30 billion per year for developing countries), to be mobilised by 2030 to implement national biodiversity strategies and action plans. However, it is not clear how this funding would be disbursed.
- Overall, it may be assumed that with the help of the careful implementation and good governance arrangements of the Kunming-Montreal Global Biodiversity Framework could help and can play an important role in achieving Net Zero Emission and can protect biodiversity.

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Offshore Wind Energy: Prospects and Challenges in India

By: Dr. Mahesh Kumar Saini, Research Associate (iCED)

Introduction

Energy is a fundamental concept in physics that refers to the ability to do work or cause a change. There are several different forms of energy, such as kinetic energy, potential energy, thermal energy, electric energy, light energy, chemical energy, and nuclear energy. Most countries in the world depend on petroleum, hydrocarbon gas liquids, natural gas, coal, nuclear-based energy, etc. for energy sources. These sources are non-renewable and limited on the earth. Hence, there is a gradual need for renewable energy as such sources also help in climate change mitigation, energy security, improve air and water quality, and sustainable development (Elum 2017). Different types of renewable

Figure 1: Different type of renewable energy sources (Created by the author)

energy sources are available such as solar, hydro, geothermal, biomass, tidal, wave, wind, etc. as shown in Figure 1.

Wind Energy

One such form of renewable energy which is being used extensively around the world is "Wind Energy". Wind energy is caused by differential heating of the earth's surface by the sun. It has been estimated that roughly 10 million MW of energy is continuously available in the earth's wind (Kalogirou 2005). Wind energy is a lucrative option to ensure energy security at a time when global reserves of fossil fuels are decreasing. Wind energy is a clean and renewable source of energy because it does not produce greenhouse gases or other pollutants. Different types of wind energy such as offshore, onshore, small wind energy systems, distributed wind energy, vertical axis wind turbines, and utility-scale wind farms are shown in Figure 2 and Table 1.

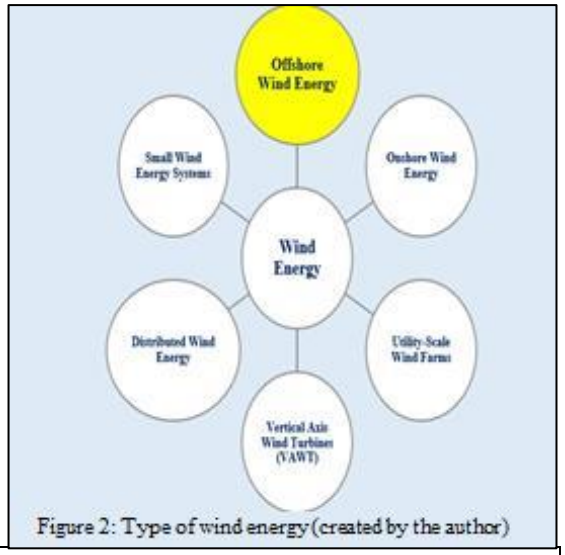

Figure 2: Type of wind energy (created by the author)

Table 1: Wind energy types, based on the scale of the installation, location, and the specific technology

Sl. No.	Types of Wind Energy	Description
1.	Offshore	Offshore wind energy refers to wind farms or turbines installed in bodies of water, usually in coastal areas or offshore locations.
2.	Onshore	Onshore wind energy refers to wind farms or turbines that are located on land, typically in open areas such as plains, hills, or agricultural fields.
3.	Small Wind Energy Systems (SWES)	SWES are designed for residential, commercial, or community use on a smaller scale. They typically consist of small wind turbines with capacities ranging from a few kilowatts to a few hundred kilowatts. These systems are commonly installed in rural or remote areas, where they can provide electricity for individual homes, farms, or small businesses.

4.	Distributed Wind Energy	Distributed wind energy refers to the installation of small to medium-sized wind turbines in or near the locations where the energy will be consumed. These installations can be connected to the electrical grid or used for off-grid applications. Distributed wind energy systems are commonly found in rural areas, industrial facilities, schools, and communities.
5.	Vertical Axis Wind Turbines (VAWT)	VAWT have a rotor shaft that is vertical or perpendicular to the ground. Unlike Horizontal Axis Wind Turbines (HAWT) where the blades rotate in a horizontal plane. VAWTs have unique design advantages and can be suitable for certain applications, such as urban environments or areas with turbulent wind patterns.
6.	Utility-Scale Wind Farms	Utility-scale wind farms are large-scale installations consisting of multiple wind turbines, typically with capacities ranging from several megawatts to hundreds of megawatts. These wind farms are connected to the electrical grid and supply electricity to utility companies for distribution to consumers.

Offshore Wind Energy: Prospects in the Indian Context

Offshore wind energy has significant prospects in the Indian context due to the country's long coastline and the availability of strong winds in offshore areas (Charles R. K. 2021).There is growing interest and momentum toward tapping into the offshore wind potential (Mani 2013).

India's coastline spans over 7,500 km, offering abundant offshore wind resources (Kalogirou 2005). Offshore wind farms can generate large amounts of electricity, leading to job creation and economic growth. Offshore wind energy offers environmental benefits, such as reducing greenhouse gas emissions, improving air quality, and mitigating Climate Change impacts. It also has a smaller land footprint, reducing potential land-use conflicts. Technology development and innovation in offshore wind energy can stimulate growth in the domestic offshore wind industry and create research opportunities. Figure 3 shows offshore energy production centre established by the California Energy Commission.

Figure 3: Offshore Wind Energy production centre Image Source: (California Energy Commission (CEC) 2023)

The Government of India has launched many initiatives to capitalise on the promise of offshore wind energy. To establish a regulatory and policy framework for offshore wind development, the Ministry of New and Renewable Energy (MNRE) has developed the **National Offshore Wind Energy Policy Framework** (Charles R. K. 2021). In addition, the government has selected specific zones along the coastline which are appropriate for offshore wind projects and has begun the process of feasibility studies, resource assessments, and techno-economic evaluations. Furthermore, international agencies and experts have collaborated in order to use their experience in offshore wind development. For example, India and Denmark, a global leader in offshore wind, have signed a Memorandum of Understanding (MoU) to collaborate on offshore wind projects. However, it is important to note that there are obstacles to overcome (Sarangi 2022).

Challenges for offshore wind energy in India

Offshore wind energy in India holds great potential, but several challenges need to be addressed for successful implementation and deployment (Nagababu 2017). High upfront costs, technical complexities, grid integration, environmental and ecological considerations, policy and regulatory frameworks, infrastructure and supply chain development, stakeholder engagement, risk mitigation and insurance, and research and development are essential for successful offshore wind projects (Quirapas 2021). India needs to develop a skilled workforce, strengthen grid infrastructure, and address environmental and ecological concerns. Policy refinement, tariff structures, project allocation mechanisms, and streamlined permitting processes are needed to create a conducive environment for offshore wind development. Developing risk mitigation strategies, insurance mechanisms, and financial instruments are crucial to attract investors and ensure project viability.

Collaborations with international organisations and knowledge sharing can accelerate technology development in the Indian offshore wind sector. Overcoming these challenges requires a multi-stakeholder approach involving the government, industry players, research institutions, local communities, and international collaborations (Holthus 2009).

Pointers for Auditing Offshore Wind Energy

The wind resource assessment is the initial step in an offshore wind energy audit, involving wind speed, direction, and turbulence levels. The audit may consider long-term trends and the availability of suitable turbines for the projects. The foundation design is crucial for ensuring safety and

stability, and the electrical system design must handle the variability of offshore wind power. The audit may assess existing operations and maintenance procedures and identify areas for improvement. Environmental impacts and the project's economic viability should be assessed (Gonzalez 2017). Audit can check the compliance with laws and regulations. As offshore wind energy projects are more risky than onshore project, safety features along with social acceptability should be assessed to mitigate negative impacts on the local communities (Gatzert 2016).

Conclusion

Offshore wind energy is a sustainable, high-capacity renewable energy source. It is environmentally friendly, cost-effective, and can be located at high wind speeds. However, challenges include installation and maintenance costs, environmental impacts, and the need for new infrastructure. India is gaining investment in offshore wind power projects, and is aiming to attract investors and build offshore wind farms. The development of offshore energy can create jobs and economic opportunities in coastal communities, and also contribute to global efforts in reducing greenhouse gas emissions and combat Climate Change.

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State in Focus: Chhattisgarh

By: Maneesh Mangal, AAO

The state of Chhattisgarh, in Central India was formed in the year 2000. It has an area of 135,190 sq km. The city of Raipur is the capital of Chhattisgarh. The state is characterised by hilly regions in the north and south, a fertile central plain, and extensive deciduous forests covering 44 per cent of its area. Rice cultivation is prominent in the fertile upper basin of the Mahanadi. The southern part lies on the Deccan plateau, with the Godavari and Indravati rivers. The Mahanadi is the main river, along with other significant rivers like Hasdo, Rihand, Indravati, Jonk, Arpa, and Shivnath.

Figure 1 Map of Chhattisgarh
Source: (MapsofIndia 2021)

Chhattisgarh has a tropical climate. The temperature ranges from 30°C to 47°C (86°F to 117°F) in summer and 5°C to 25°C (41°F to 77°F) in winter. However, extreme temperatures can occur, ranging from below 0°C to 49°C (Chhattisgarh State Centre for Climate, 2023). The state receives an average of 1,292 millimetres (50.9 inches) of rainfall. Winters from November to January, are pleasant with lower temperatures and reduced humidity.

Natural Resources of Chhattisgarh

Mineral Resources: Chhattisgarh is recognised as one of the most mineral-rich states in India. It boasts a diverse range of almost 29 minerals, including precious stones, iron ore, coal, limestone, dolomite, tin ore, bauxite, and gold. The state also exhibits significant potential for mining high-quality diamonds. The State also possesses various minerals like corundum, clay, quartzite, fluorite, beryl, alluvial, granite, illuminate, talc, garnet, and silica sand. Rare precious minerals like alexandrite and kornerupine are also reported. Additionally, vast reserves of attractive granite for decorative purposes are available in the state (MSME Raipur, 2023).

Forest Resources

Chhattisgarh is home to forests which can be classified into two types: Tropical Moist Deciduous Forests and Tropical Dry Deciduous Forests. The recorded forest area (RFA) in the state is 59,772 sq km, including 25,786 sq km of Reserved Forest, 24,034 sq km of Protected Forest, and 9,952 sq km of Unclassed Forest. Chhattisgarh has three national parks and 11 wildlife sanctuaries, collectively constituting 4.93 per cent of the state's geographical area(India 2019). However, its forests face threats from agriculture, industry, and urban expansion, as well as unsustainable resource collection and land diversion.

Biodiversity

Chhattisgarh State boasts over 44 per cent forest coverage and supports 7.8 million indigenous communities. It is rich in biodiversity and serves as the origin of major rivers. The state of Chhattisgarh lacks sufficient ecological research and scientific publications on its flora, fauna, biodiversity status, and conservation challenges. Ecological research is crucial to ensure sustainable biodiversity management, supporting local livelihoods and the rural economy. Recently, the Zoological Survey of India completed a biodiversity survey, but information on tiger density and prey abundance in the tiger reserves is scarce. Rising human-elephant conflict in north Chhattisgarh remains unresolved due to insufficient information on elephant movement and habitat use (Dhanpal, 2016).

Flora

The state has inventoried 645 medicinal plant species and possesses diverse insects that are utilised in traditional medicinal practices. An exclusive survey conducted by the Central Council for Research in Ayurveda and Siddha, New Delhi documented 750 herbal species belonging to 499 genera in 147 families. Additionally, 190 folklore claims are based on 113 medicinal plants. The National Botanical Research Institute, Lucknow conducted a comprehensive floristic study and identified 45 species as endangered within the state (Envis Chattisgarh, n.d.).

Fauna

Chhattisgarh State falls under the Deccan Bioregion, representing the fauna of Central India. It is home to various representative species, including the Tiger, Leopard, Gaur, Sambhar, Chital, Nilgai, and Wild Boar. The state also takes pride in its rare wildlife, such as the Wild Buffalo and Hill Myna. The state is known for being the possible last home of genetically un-swamped and critically endangered wild Buffalo and Bastar myna, designated as State Animal and State bird respectively (Envis Chattisgarh, n.d.).

Agriculture Diversity

Chhattisgarh state is divided in three agro climatic zones namely Bastar Plateau, Northern Hills, and Chhattisgarh Plains. Chhattisgarh, known as the Rice bowl of India, boasts a vast diversity of indigenous rice varieties cultivated by local communities across different soil and micro ecosystems. With 3.9 million hectares of rice fields out of India's total 42.2 million hectares, the state's paddy diversity rivals that of the Philippines (Envis Chattisgarh, n.d.).

Fisheries

The ichthyofaunal (Ichthyofauna refers to the assemblage of fish in a water body or zoogeographical region) richness at Ghunghutta Dam in Surguja District, Chhattisgarh, was identified in 2023, where study on fish diversity was conducted from December 2020 to November 2021. Through 2020-21, the state has 1.920 million acres of water available for fisheries development. There are 918 rural ponds covering 1.094 million acres and 1770 irrigation reservoirs covering 0.826 million acres. 1.812 million hectares of potential water resources have already been utilised for fish farming (Soni 2023).

Wetlands

Chhattisgarh State Centre for Climate Change estimated the area of various wetland categories by using Geographic Information System layers of wetland boundary, water-spread, aquatic vegetation, and turbidity. In total, 7711 wetlands in the state have been mapped. In addition, 27823

wetlands (smaller than 2.25 ha) have also been identified. Total wetland area estimated is 337966 hectares that is around 2.5 per cent of the total geographic area. The three main forms of wetlands are reservoirs (90389 ha), tanks/ponds (40226 ha), and rivers/streams, which account for around 53 per cent of the total area of wetlands (179088 ha).The small wetlands (< 2.25 ha) accounts for about 8.2 per cent assuming that each is of one ha. Chhattisgarh also has belowground wetlands which are called Karst wetlands and majority are unexplored since these cannot be identified by remote sensing images (Chhattisgarh state centre for climate change 2023).

Pollution

The state houses 165 large and medium-scale industries, which contributes to increasing air and water pollution. The lack of Common Effluent Treatment Plants (CETPs) results in harmful effluent discharge. Approximately 60 per cent of small and medium industries pose significant environmental threats.

Air Pollution: Urban air pollution in Chhattisgarh is escalating due to emissions from various human activities. A study published in Indian Journal of Public Health conducted by Neha Singh from Pt. Jawahar Lal Nehru Memorial Medical College, Raipur, Chhattisgarh has revealed that PM 2.5 levels in all samples in the cities of Raipur and Korba ranged from 131.4-653.8 $\mu g/m^3$ to 150.3-1699.2 $\mu g/m^3$ which is 2.18-10.88 and 2.5-28.3 times higher than standards prescribed by the Ministry of Environment, Forest and Climate Change (MoEFCC) of 60 $\mu g/m^3$. Heavy metals such as silica (Si), lead (Pb), nickel (Ni), and manganese (Mn) levels were recorded higher than the standard level reported by the National Ambient Air Quality Standards in locations of Raipur and Korba, Chhattisgarh (Neha Singh 2023).

Water Pollution: Growing urban areas in the state generate significant amounts of both liquid and solid waste. Unfortunately, district towns lack proper facilities for waste treatment and disposal, leading to the conversion of abandoned quarries and local depressions into landfills. Individual households rely on septic tanks for waste management. Leachate from old mine tailings and settling ponds contribute to groundwater pollution. Sanitation is inadequate in most cities, with untreated or partially treated wastewater being discharged into urban centres, polluting water resources. The toxicants present have a direct impact on the local fauna, flora, and human population. Towns like Raipur and Bilaspur have sewerage systems that suffer from a lack of maintenance, exacerbating the sanitation problems.

Performance under the Sustainable Development Goals (SDGs)

As per the Sustainable Development Goal India Index 2020, the state of Chhattisgarh ranks 19th with a composite score of 61 which is below the national average. Highest score achieved by Chhattisgarh is 89 in SDG 6 (Clean water and sanitation). The State has poor performance in SDG 2 (Affordable and Clean Energy), SDG 9 (Industry Innovation and Infrastructure) and SDG 13 (Climate Action). SDG 14 (Life below Water) score is not available for Chhattisgarh (Aayog 2021).

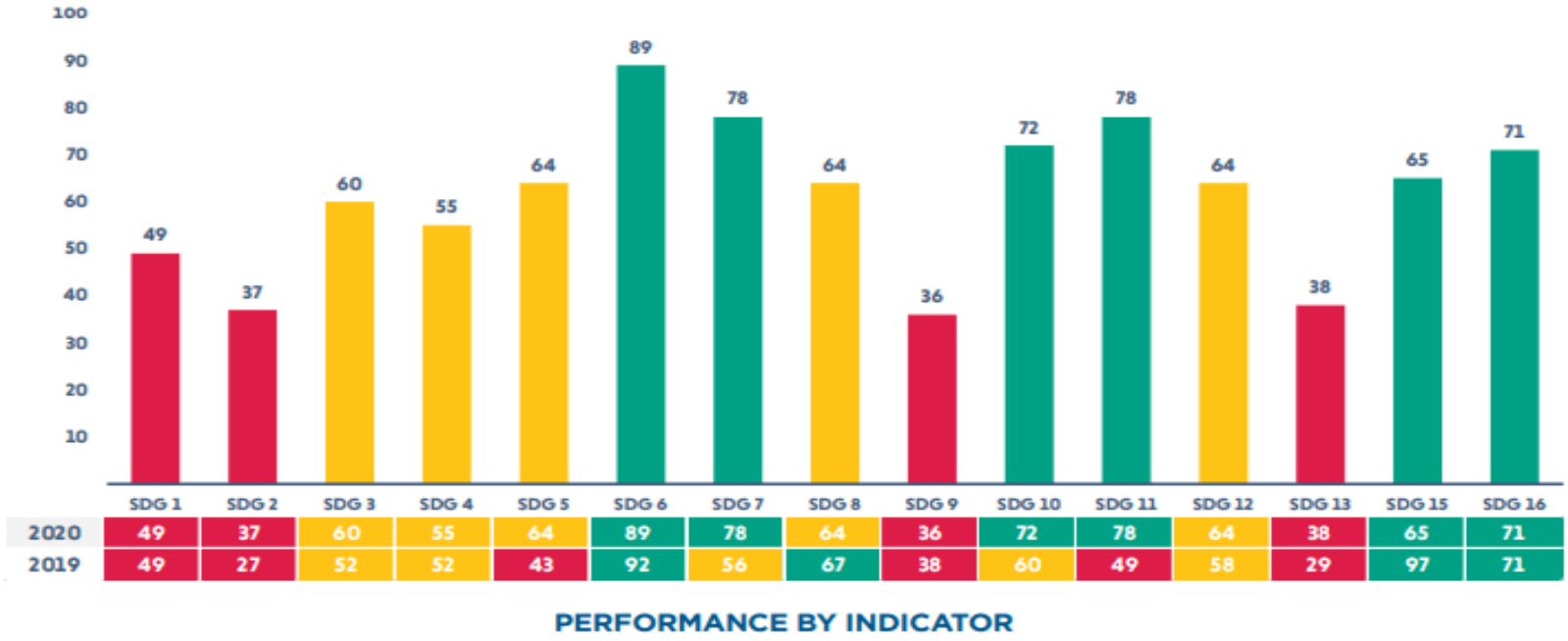

Figure 2: Performance of Chhattisgarh in Achieving SDGs

Audit may examine:

- The implementation of Chhattisgarh's environmental protection policies, key environmental acts, state specific priorities aligned with national policies may be reviewed with reference to the State Action Plan on Climate Change and its targets.
- Furthermore, there is a pressing need for a comprehensive clean fuel policy in the state to address pollution and reduce the impact of emissions on the environment and public health. The state lacks state-of-the-art laboratories, which are crucial for accurate and timely assessment of pollution levels and environmental data analysis (Planning 2022). During the audit of power plants, it is vital to highlight any deviations from emission standards, as these could have significant implications for the environment and public health (Planning 2022).
- One of the major challenges identified is the gap between reported pollution data and the actual on-ground pollution levels, which can be pointed out during audit. Accurate and reliable data is essential for effective decision-making and policy formulation.
- Audit may examine environment conservation projects sanctioned by MoEFCC such as "Climate Adaptation in Wetlands along Mahanadi River Catchment Area in Chhattisgarh" or carrying out health and environment impact assessment.
- The audit may examine the status of implementation of the air quality standards notified by the MoEFCC on January 29, 2018, to safeguard the well-being of the residents.

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Maritime Transport and Shipping: Challenges and Opportunities

By: Neha Jakhar, AAO

Introduction

India's maritime sector plays a significant role in the global trade, with a vast network of ports and waterways along its more than 7500 km coastline. Approximately, 95 per cent of the country's trade volume and 70 per cent of the trade value rely on maritime transport, with key commodities being petroleum, coal, iron ore, and containers. In recent years, the cargo traffic through Indian ports has seen remarkable growth, outpacing the global and developing economies' average. To meet the increasing demand, the Ministry of Ports, Shipping and Waterways has planned to enhance the port capacity to 3,300 metric tonnes per annum (MTPA) by 2025. The government's vision includes developing world-class infrastructure, promoting *Atmanirbhar* initiatives in shipbuilding and recycling, and enhancing waterway transportation and river cruise tourism. Various incentives, such as 100 per cent Foreign Direct Investment (FDI) allowance for port development and shipbuilding, tax holidays for infrastructure development, and support for investors, make the Indian maritime sector an attractive investment opportunity (Ministry of Ports, Shipping and Waterways 2021).

Shipping and Inland Water Transport

Globally, India ranks second in ship recycling and 21st in shipbuilding. India is ranked amongst the top five countries supplying trained manpower, with 17 per cent growth in seafarers in the last three years (Ministry of Ports, Shipping and Waterways 2021). India has increased the modal share of cargo from 0.5 per cent to 2 per cent and has witnessed 19 per cent year-on-year growth in cargo volumes over the last five years. India has over 5,000 km of navigable inland waterways under development (Ministry of Ports, Shipping and Waterways 2021).

Opportunities

Blue Economy: India's extensive coastline and marine resources offer significant opportunities for the development of the Blue Economy, including Fisheries, Aquaculture, Coastal Tourism, and Marine Renewable Energy.

The Sagarmala Programme: With 70 projects already sanctioned for coastal berths, roll-on, roll-off, and passenger jetties out of which 15 projects have been completed, there are lucrative prospects for investment and participation in port modernisation and expansion. The introduction of green channel clearance and reduced Goods and Services Tax (GST) on bunker fuels streamlines cargo evacuation, benefitting logistics and shipping companies (The Economic Times, 2023).

Contribution to GDP: The shipping and logistics industry is a vital component of the Indian economy, contributing significantly to the country's Gross Domestic Product (GDP). As per the Economic Survey 2021, the logistics industry accounts for 13-14 per cent of the country's GDP. The industry's contribution to the economy is mainly due to the efficient movement of goods, which helps reduce costs and increase productivity (The Times of India, 2023).

Evolving maritime clusters: The establishment of maritime clusters in Gujarat and Tamil Nadu provides opportunities for businesses to collaborate, innovate, and attract foreign investment. These clusters can serve as hubs for industry expertise, research and development, and technological advancements, fostering growth and competitiveness.

Infrastructure development: The growth of the industry in India has led to the development of the country's infrastructure. The government has taken various measures to improve the transportation and logistics infrastructure in the country, such as developing new ports, upgrading existing ones, and constructing new highways and railways. These initiatives have enabled the industry to grow and contribute significantly to the economy (The Times of India, 2023).

Challenges (The Hindu, 2022)

Institutional challenges: The bureaucratic rigidity and reluctance to decentralise control lead to delays in decision-making and implementation. Multiple layers of government involvement with overlapping powers create confusion in the regulatory environment. The absence of a single-window clearance system adds further complexity for shipping companies**.**

Infrastructural challenges: The capacities of major and minor ports in India need urgent expansion to accommodate the increasing demand for shipping services. Transhipment points in other countries cause longer cycle times for Indian cargoes, making them less competitive globally. The overall development of roads, electricity, and other infrastructure is also crucial for the smooth functioning of the shipping industry.

Financial challenges: Shipping companies in India lack access to government schemes available to other sectors. Heavy taxes, such as Customs Duty on Bunkers, Landing Fees, and Income Tax, without significant exemptions, burden the companies and hinder their growth.

Slow process: Cumbersome shipment procedures in comparison to other transportation modes waste valuable shipping and labour time, impacting overall logistic efficiency.

Vessel size: The trend of larger vessels in response to increased shipping demand poses challenges for many Indian ports that are struggling to handle such large vessels effectively. This may limit accessibility for some ports.

Lack of containers: The scarcity of containers has been a significant issue in India, leading to a surge in sea freight rates. Factors like reduced production of new containers since 2019 and an increase in container disposals contribute to the overall growth in container supply falling from 11 per cent in 2019 to 5 per cent in 2021 (Economic Times, 2022).

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Analysis of SAI Australia Report on Regulation of Great Barrier Reef Marine Park Permits and Approvals (Performance Audit Report No. 44 of 2020–21 by Australian National Audit Office)

By: Saurabh Sharma, AAO

Background

The Great Barrier Reef Marine Park at north-east coast of Australia is home to the awe-inspiring Great Barrier Reef, an extraordinary location renowned for its diversity and beauty. Boasting an astonishing array of marine life, it proudly houses the world's largest collection of coral reefs, encompassing a staggering 400 coral species, 1,500 fish species, and an astounding 4,000 mollusk varieties (United Nations Educational, Scientific and Cultural Organization, n.d.).

It encompasses over 2,900 individual reefs, making it the largest coral reef system on the planet. This expansive network represents approximately 10 per cent of the world's total coral reefs and recognised as United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Site and one of the Seven Natural Wonders of the World (The Great Barrier Reef Marine Park Authority, n.d.).

The Great Barrier Reef Marine Park Authority (GBRMPA) was established in 1975 and entrusted with the task to regulate all particular activities of this marine park. It was estimated that it contributes approximately $ 6.4 billion each year to the Australian economy and around 64,000 full time jobs (Great Barrier Reef Marine Park Authority n.d.).

Rationale for undertaking the audit

Ensuring effective regulation of permits and compliance is crucial for the long-term protection and preservation of the environment, biodiversity, and heritage of the Great Barrier Reef Region. Reports from parliamentary committees and the Auditor-General highlight potential risks and areas for improvement in achieving desired outcomes. Thus, Australian National Audit Office (ANAO) decided to conduct this follow-up audit to assess

whether GBRMPA has implemented appropriate systems to manage risk and preserve the environmental, social and economic significance of this Marine Park and its World Heritage listing (Australian National Audit Office 2021).

Audit objective, scope and criteria

The audit objective was to examine the effectiveness of GBRMPA's regulation of permits and approvals, including its implementation of recommendations from Auditor-General ReportNo.3 2015–16 Regulation of Great Barrier Reef Marine Park Permits and Approvals.

The ANAO adopted the following criteria for this audit:

- Are there appropriate arrangements for processing, assessing and approving permit applications?
- Are there appropriate arrangements for managing and monitoring permissions?
- Has an appropriate non-compliance framework been established?

Audit methodology

The audit methodology involved reviewing GBRMPA's documentation with special focus on implementation part.

It also included examination of permit assessment, monitoring, and compliance-related activities as well as an assessment of GBRMPA's IT system documentation and controls. Additionally audit evidences were collected through field visits and interviews.

Figure 1: Collection of audit evidence through field visits

(Image source: Australian National Audit Office (Australian National Audit Office))

Audit findings/Key conclusions

The GBRMPA's permitting system was found to be weakened due to several shortcomings in the regulatory processes and practices. These shortcomings have specifically impacted GBRMPA's ability to regulate permits effectively. GBRMPA had not fully implemented the recommendations outlined Auditor-General earlier audit Report No.3 2015–16 on "Regulation of Great Barrier Reef Marine Park Permits and Approvals".

Besides, audit identified other shortcomings such as weaknesses in the quality and completeness of the assessment of permit applications, insufficient monitoring of permit holder compliance to ascertain adherence to permit conditions and numerous instances of non-compliance to stipulated guidelines.

Pointers and Inputs for Audit

The audit findings of this report hold significant value for the audit fraternity. They offer valuable insights that can guide audits related to the regulatory processes governing industrial permits, especially those issued to polluting industries. It is essential to evaluate these processes thoroughly ensuring that all necessary documents are complete, accurate and in compliance with regulatory requirements.

Furthermore, audits can also focus on assessing the effectiveness of the regulatory framework itself for all such organisations. This involves evaluating the clarity, consistency and adequacy of the regulations and guidelines governing various environmental permits. By identifying areas of improvement, the audit fraternity can contribute to strengthening the regulatory framework, promoting sustainable practices and minimising the negative environmental impacts of industrial and other allied activities.

Conclusion and Recommendations:

All seven recommendations made by the ANAO were agreed by the GBRMPA. The recommendations include reviewing and revising permit assessment operating procedures, assessment templates and risk assessments. The GBRMPA also agreed to better document permit application assessments, periodically review the adequacy of standard permit conditions, implement a coordinated and risk-based compliance monitoring program and improve processes for responding to instances of permit non-compliance.

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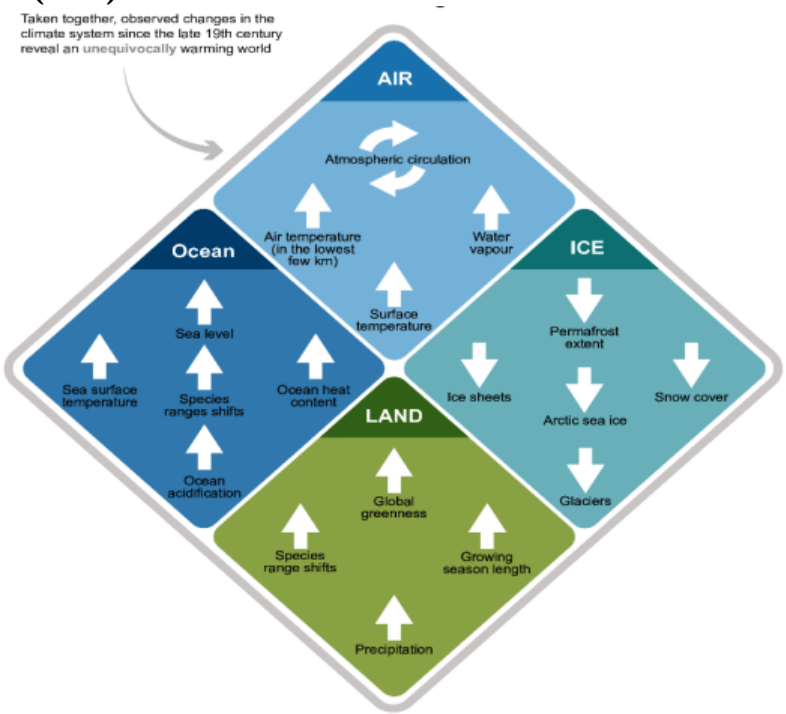
Analysis of the Sixth Assessment Report of the Intergovernmental Panel on Climate Change

By: Vijendra Singh Tanwar, AAO

Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6)

The Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the assessment of Climate Change. It was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organisation (WMO) in 1988 to provide the world with a clear scientific view on the current state of knowledge about Climate Change and its potential environmental and socio-economic impacts. The IPCC's Sixth Assessment Report (AR6) was released in 2021-22. It is the most comprehensive assessment of Climate Change to date, and it provides a stark warning about the future of the planet if we do not take immediate action to reduce greenhouse gas emissions.

This preliminary analysis of the IPCC report, presents the current state of the climate, including how it is changing and the role of human influence, the state of knowledge about possible climate futures, climate information relevant to regions and sectors, and limiting human-induced Climate Change after analysing the key findings of IPCC Sixth Assessment Report (AR6) on the physical science basis of Climate Change.



Global warming has triggered widespread changes across the entire climate system.
Image Source: (IPCC Sixth Assessment Report n.d.)

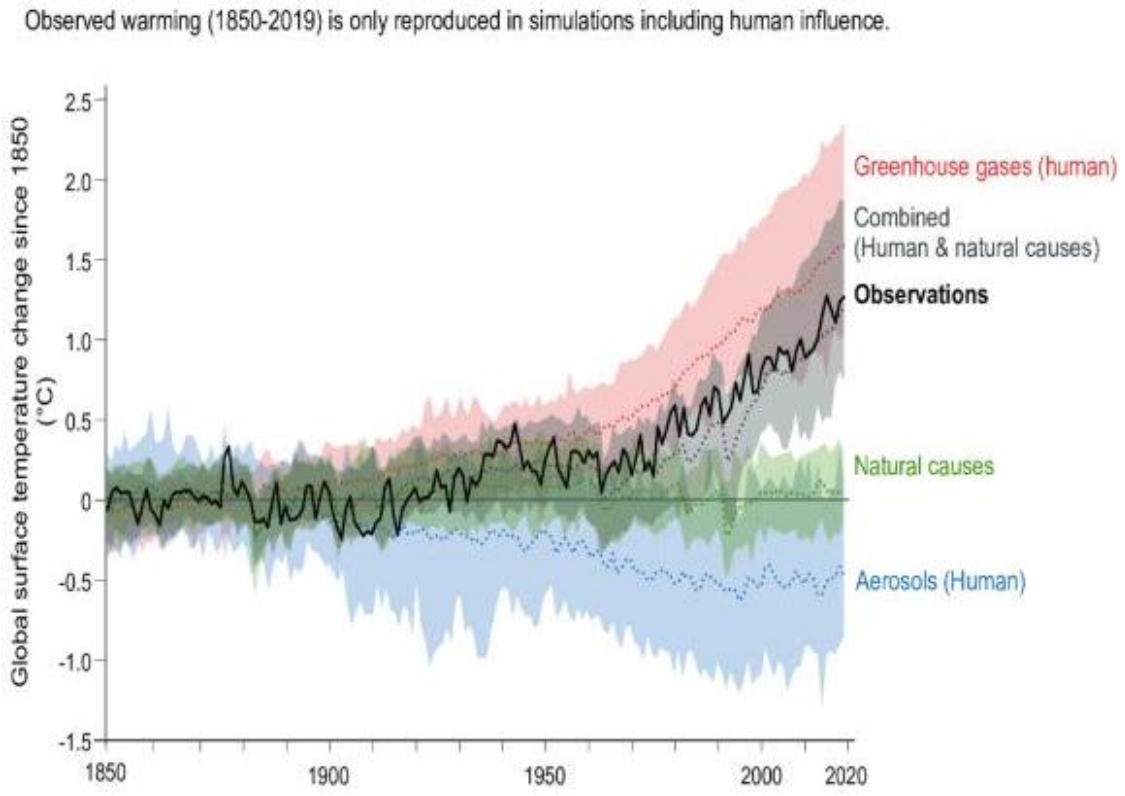


Figure 1
Image Source: Graphic adapted from IPCC AR6 Working Group I FAQ 3.1, Figure 1 in Chapter 3. (IPCC Sixth Assessment Report n.d.)

It is unequivocal that human influence has warmed the atmosphere, ocean and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred as depicted in Figure 1. Climate model simulations (coloured shading) can only reproduce observed change in global temperature (black) when they include human-caused emissions. This graphic shows how global temperatures change when using climate model simulations that include: greenhouse gases only (red band); or aerosols (air pollutants) and other human drivers only (blue band); or natural causes only (green band); or when all causes are included (grey band). Combined = natural + aerosols +greenhouse gases. Solid/dashed coloured lines show the average of all models and shading shows the uncertainty ranges of the simulations.

Figure 2 shows that Climate Changes become more severe with every increment of global warming and how temperature extremes, droughts, heavy rainfall (precipitation) events, snow cover and tropical cyclones change at different levels of global warming compared with the late 19th Century (1850–1900). For example, the hottest day in a decade now is already +1.2°C (2.2°F) hotter than compared with the hottest day in a decade before the industrial revolution. By 1.5°C (2.7°F) global warming, it would be around +1.9°C (3.4°F) hotter, by 2°C (3.6°F) global warming it would be around +2.6°C (4.7°F) hotter and by 4°C (7.2°F) global warming it would be around +5.1°C (9.2°F) hotter. The figure is extracted from Infographic TS.1 in the Technical Summary.

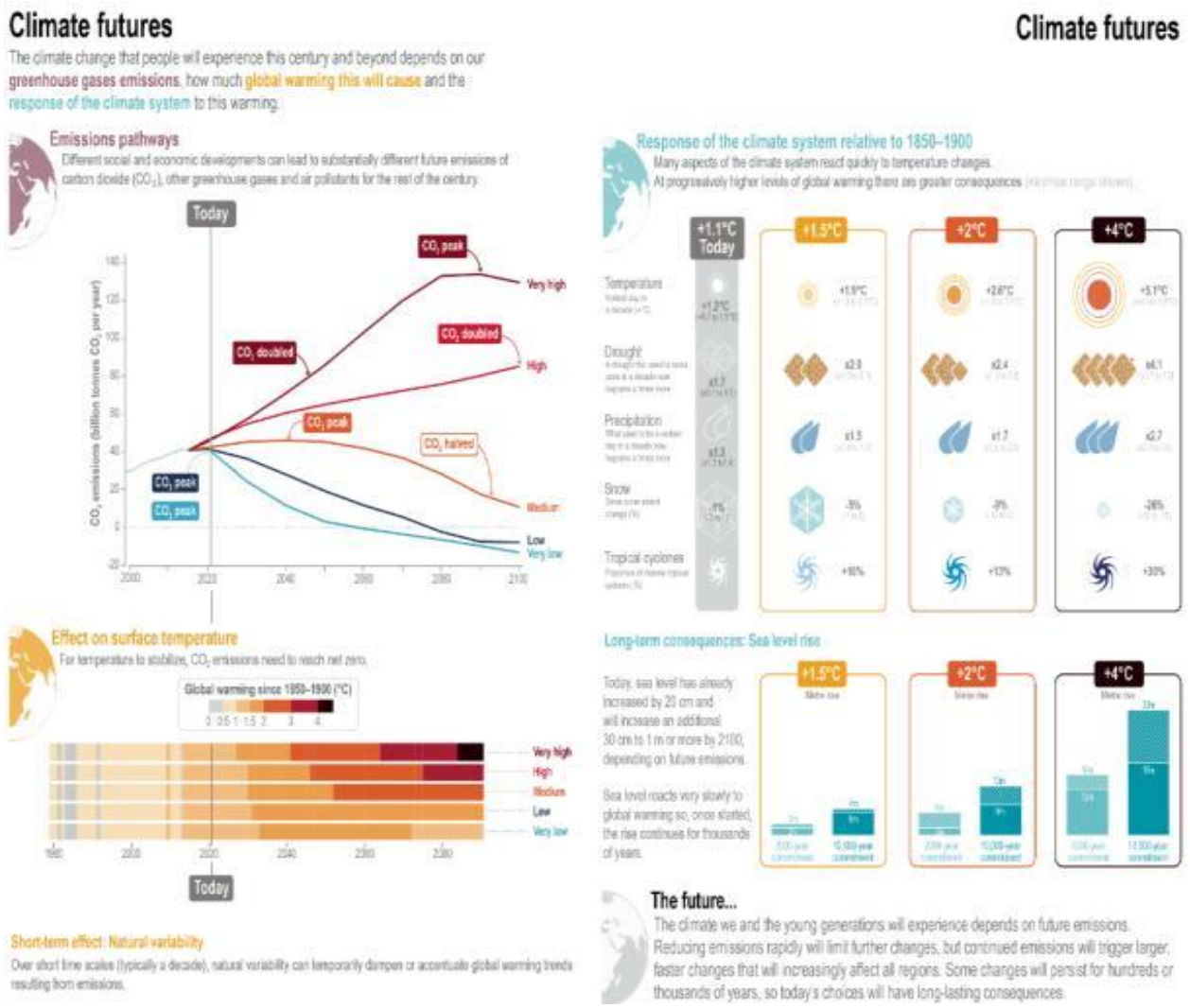


Figure 2

Image Source: Technical Summary **(Infographic TS.1 n.d.)**

Figure 3 shows the variability in Climate Change and it is proportionality to the global warming. The figure shows that all regions of the world will experience further Climate Change, and these changes will be different for all different places.

The colour scales at the bottom of the graphic show the size of these changes as percentages. Some changes may be relatively large in terms of percentage even if the actual change is relatively small. For example, in very dry areas like the Sahara, even a small increase in actual precipitation shows as a relatively larger percentage increase. Graphic adapted from IPCC AR6 Working Group I FAQ 4.3, Figure 1 (IPCC Sixth Assessment Report n.d.).

Figure 4 shows the balance and imbalance in the Climate. The Earth's energy budget compares the flow of incoming and outgoing energy that is relevant for the climate system. Since at least the 1970s, less energy is flowing out than is flowing in, which leads to excess energy being

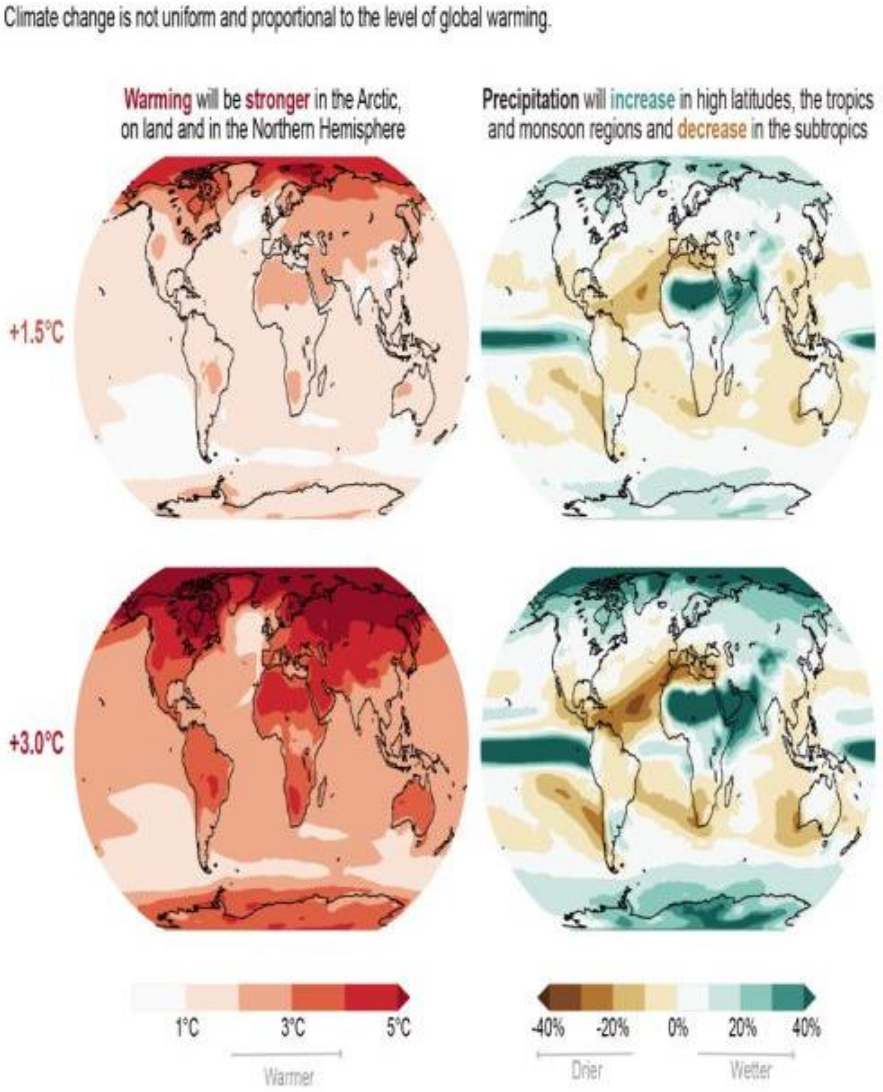


Figure 3- Image Source: (IPCC n.d.)

absorbed by the ocean, land, ice and atmosphere. Graphic adapted from IPCC AR6 Working Group I FAQ 7.1, Figure 1 in Chapter 7.

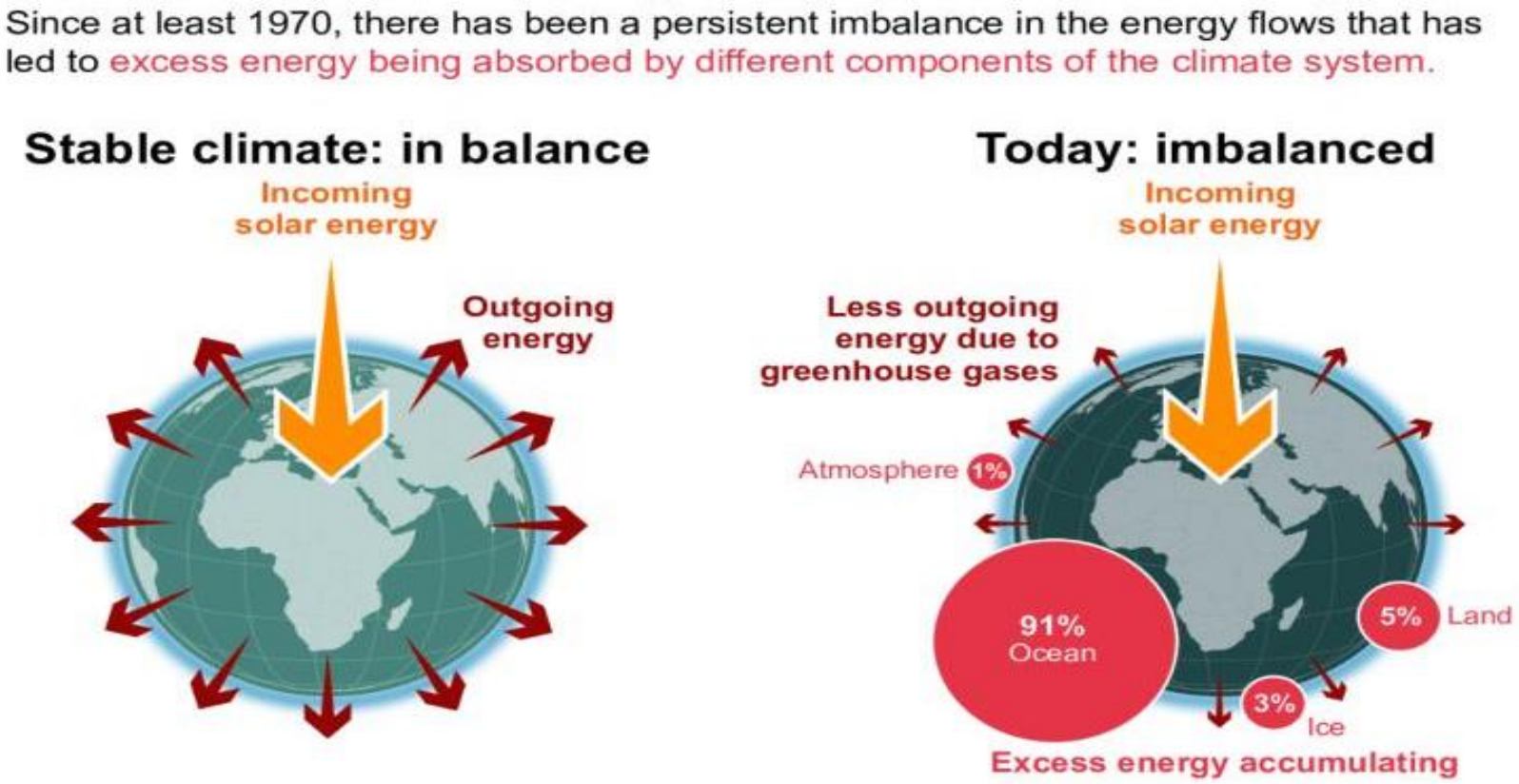
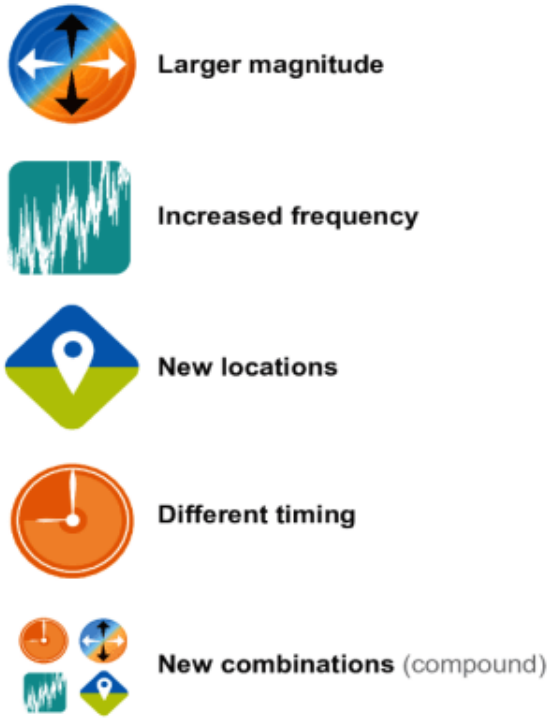


Figure 4: The Earth's energy budget compares the flows of incoming and outgoing energy that are relevant for the climate system. Since at least the 1970s, less energy is flowing out than is flowing in, which leads to excess energy being absorbed by the ocean, land, ice and atmosphere. Graphic adapted from IPCC AR6 Working Group I FAQ 7.1, Figure 1 in Chapter 7.

Image Source: (IPCC Sixth Assessment Report n.d.)

Analysis as per the IPCC Reports:

- The impacts of Climate Change are expected to become more severe in the future, even if we take action to reduce emissions.
- Limiting global warming to 1.5 degrees Celsius (2.7 degrees Fahrenheit) above pre-industrial levels will require rapid and far-reaching changes to our energy systems, economies, and lifestyles.
- If we do not take action, the impacts of Climate Change could be catastrophic, leading to widespread food insecurity, mass displacement, and the extinction of many species.
- The global average temperature is likely to reach 1.5 degrees Celsius above pre-industrial levels between 2021 and 2040, even if we take strong action to reduce emissions.
- If we do not take action, the global average temperature could reach 2 degrees Celsius above pre-industrial levels by the end of the century.
- Even at 1.5 degrees Celsius of warming, we will see more extreme weather events, such as heat waves, droughts, floods, and wildfires.
- Sea levels are likely to rise by 0.2 metres by the end of the century, even if we take strong action to reduce emissions.



- The impacts of Climate Change are already being felt around the world, and they are expected to become more severe in the future.

The IPCC report is a wake-up call. We must act now to reduce greenhouse gas emissions and build a more sustainable future.

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Biodiversity at iCED

Cinnyris Asiaticus found in iCED Campus
Photo Credit: Capt. Shashank (Dy. Chief Mechanical Engineer-North Western Railway)

The **Purple Sunbird** (*Cinnyris Asiaticus*) is a small bird in the sunbird family found mainly in South and Southeast Asia but extending west into parts of the Arabian peninsula. Like other sunbirds, their primary source of nutrition is nectar, although they also consume insects, particularly when feeding their offspring. Instead of hovering at flowers, they usually perch and forage for nectar. Additionally, they have been observed feeding on small berries such as those found on *Salvadora persica* plants and cultivated grapes. Occasionally, they engage in fly catching to catch insects (Animalia n.d.).

Zosterops Palpebrosus found in iCED Campus
Photo Credit: Capt. Shashank (Dy. Chief Mechanical Engineer-North Western Railway)

The **Indian White-eye** (Zosterops Palpebrosus), previously known as the Oriental white-eye, is a small passerine bird belonging to the white-eye family. It is commonly found in open woodland throughout the Indian subcontinent. These birds exhibit a social behaviour by foraging in small groups, primarily feeding on nectar and small insects. The species is versatile in terms of habitat and can be found in a variety of environments, ranging from scrublands to moist forests. They have been observed in mangrove areas, such as the Karachi region, and on islands, where they tend to adopt a more insectivorous diet. The breeding season of the Indian white-eye spans from February to September, with the peak breeding season occurring in April (Animalia n.d.).

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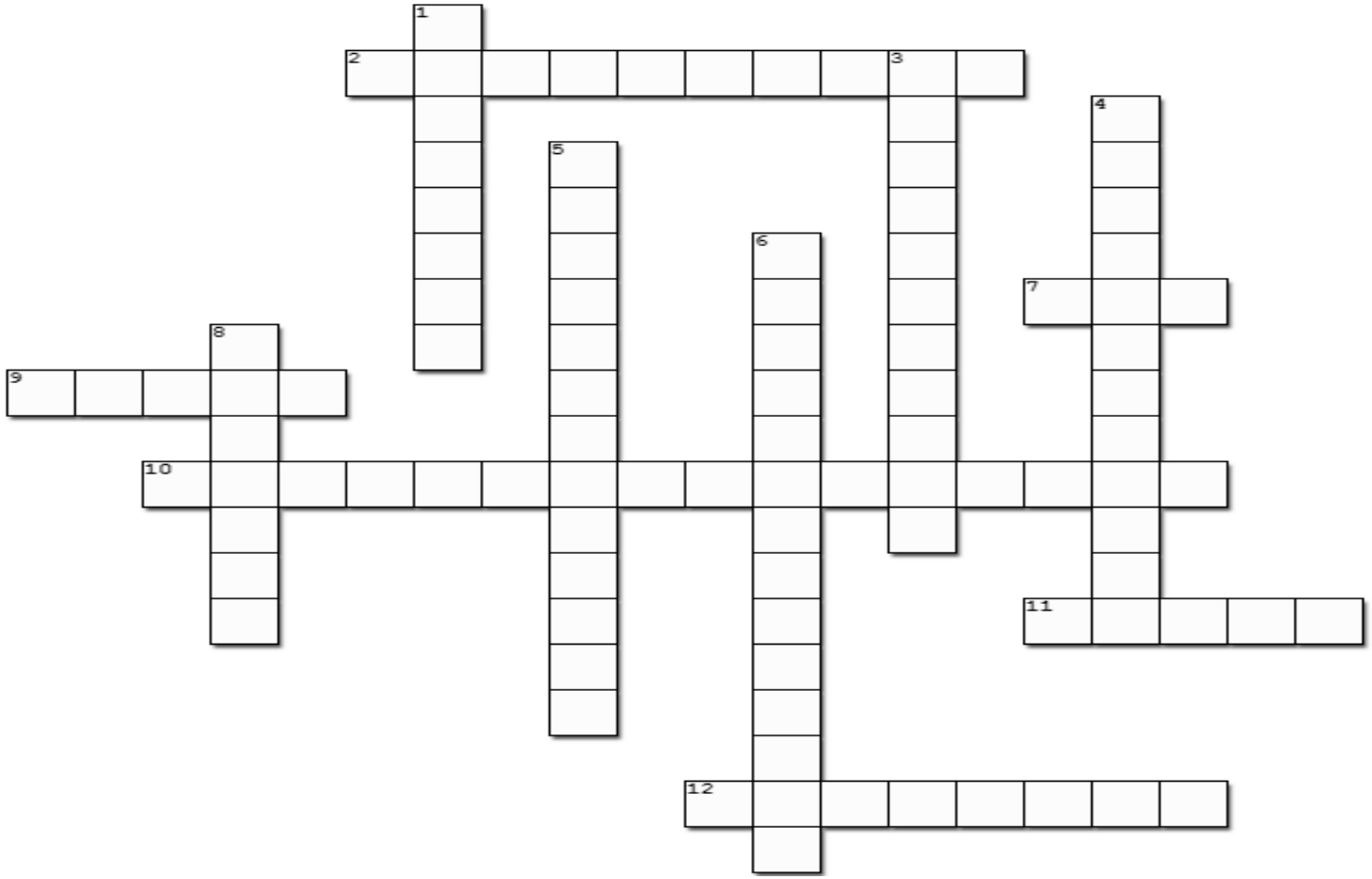
CROSS the Green WORD

By: Vikas Dhir, AAO



Across (Gaps between words may be ignored or considered, depending on answers)

2.) Which plant will be the second largest floating plant of NTPC?

7.) SAI 20 Summit was held in which part of India?

9.) Which energy is derived from the ocean?

10.) Which treaty aims at strengthening resilience and contains provisions based on the polluter-pays principle as well as mechanisms for disputes?

11.) Increasing acidification of which body is a fallout of Climate Change, caused primarily by uptake of carbon dioxide (CO2) from the atmosphere?

12.) Which mining is the process of extracting and often excavating mineral deposits from the seabed?

Down (Gaps between words may be ignored or considered, depending on answers)

1.) Which forests are important sink for carbon?

3.) Which industry involves farming of aquatic organisms?

4.) Which cells are mounted on a structure that floats on water bodies?

5.) Which energy is a form of renewable energy that uses the power of moving water to generate electricity?

6.) Which Ministry prepares the Blue Economy policy framework in line with the Government of India vision of New India by 2030?

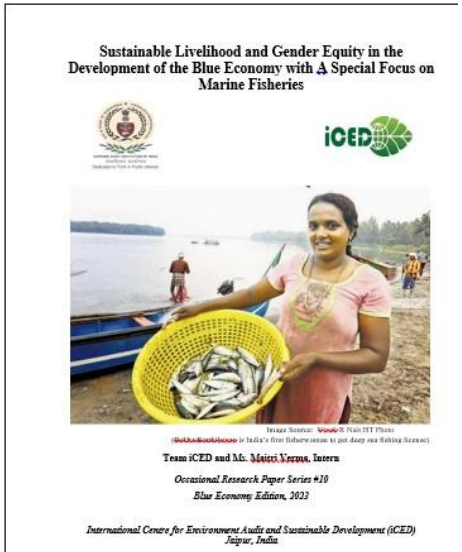
8.) Which sustainable yield is a theoretical concept, used extensively in fisheries science and management?

Answers:

Across: **2.) Kayamkulam. 7.) Goa. 9.) Tidal. 10.) High Seas Treaty. 11.) Ocean. 12.) Deep Sea.**

Down : **1.) Mangrove. 3.) Aquaculture. 4.) Photovoltaic. 5.) Hydroelectric. 6.) Earth Sciences. 8.) Maximum.**

Research Initiatives by iCED, Jaipur


Sustainable Livelihood and Gender Equity in the Development of the Blue Economy with A Special Focus on Marine Fisheries

Team iCED and Ms. Maitri Verma, Intern

Occasional Research Paper Series #10

Blue Economy Edition, 2023

International Centre for Environment Audit and Sustainable Development (iCED)
Jaipur, India

The research paper **"Sustainable Livelihood and Gender Equity in the Development of the Blue Economy with A Special Focus on Marine Fisheries"** signifies the important role that Gender Equity plays in today's socio-economic conditions and highlights the challenges that women face, especially focusing on fisheries.

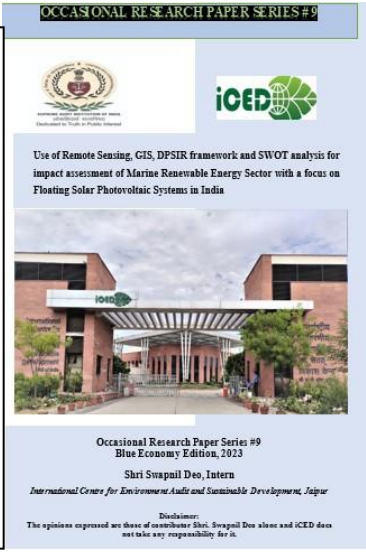
This research paper serves as a valuable tool to identify areas to be strengthened and new approaches to be developed in the Blue Economy sector in general. It would be of particular relevance to gender auditing in the marine fisheries sector.

The research paper can be accessed at: https://iced.cag.gov.in/wp-content/uploads/Final%20copy%20approved%20Ms.%20Maitri%20Verma%2006.09.2023.pdf

Helen Keller said, "Keep your face to the sunshine and you cannot see a shadow". The quote is much more significant in the present scenario, and humanity needs to adopt the same. The research paper **"Use of Remote Sensing, GIS, DPSIR Framework and SWOT Analysis for Impact Assessment of Marine Renewable Energy Sector with a focus on Floating Solar Photovoltaic Systems in India**" highlights the Global and Indian Floating Solar Photovoltaic (FSPV) systems through a case study approach.

Further, an assessment of environmental aspects relating to the marine renewable energy sector, especially focusing on Floating Solar Photovoltaic Systems in India using DPSIR framework work (Drivers, Pressures, State, Impacts, and Responses) and a SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) has also been incorporated in this case study.

The research paper can be accessed at: https://iced.cag.gov.in/wp-content/uploads/Swapnil%20paper_revised_ORP_11-08-2023%20Final%201.0.pdf


OCCASIONAL RESEARCH PAPER SERIES #9

Use of Remote Sensing, GIS, DPSIR framework and SWOT analysis for impact assessment of Marine Renewable Energy Sector with a focus on Floating Solar Photovoltaic Systems in India

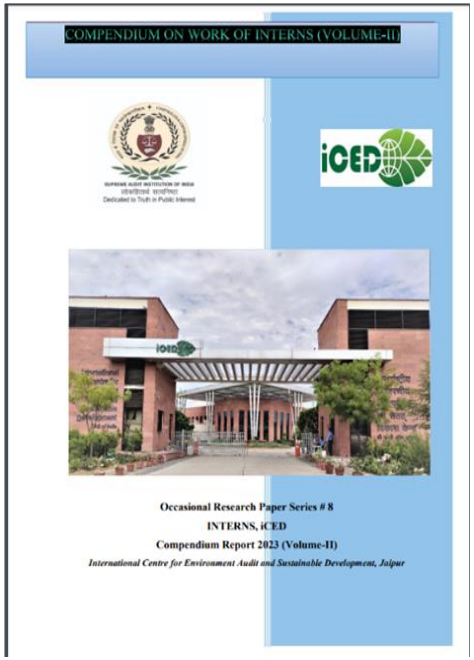
Occasional Research Paper Series #9
Blue Economy Edition, 2023

Shri Swapnil Deo, Intern

International Centre for Environment Audit and Sustainable Development, Jaipur

Disclaimer:
The opinions expressed are those of contributor Shri. Swapnil Deo alone and iCED does not take any responsibility for it.

Compendium Report 2023 (Volume II)



The International Centre for Environment Audit and Sustainable Development (iCED), Jaipur released the **Compendium Report 2023 (Volume-II)**, which is the second volume of a compendium of the work done by the interns at iCED and **the eighth in the Occasional Research Paper Series** of iCED.

This compendium is a compilation of three case studies conducted by the interns during the period 2021-22 to 2022-23 at iCED.

- The research paper **"Sustainability Issues in Groundwater Usage and its Management in Rural Areas"** highlights the issues in the management of groundwater, especially in the rural areas of the country through a case study of a village (Jawalarjun and its surrounding areas) in the State of Maharashtra. In this study, the issue of groundwater depletion, its contamination, and groundwater-related challenges in rural areas are highlighted. The study suggests some conventional and unconventional methods to overcome these problems of water in rural areas.

- The research paper **"Municipal Solid Waste Management" in three selected cities in India (Indore, Surat, and Jaipur)** highlights the aspect of improper segregation of waste as the basic problem for improper Municipal Solid Waste Management in the study areas. The study uses Causal Loop Diagrams to analyse the systems that have either a negative or positive impact on waste segregation at the source and help in identifying possible solutions to address this issue.

- The research paper **"Pollution Caused by Road Dust: A Case Study in Delhi and Mumbai",** has been developed following the guidelines outlined by the United States Environmental Protection Agency (USEPA 2001) regarding road dust and incorporates scientific calculations as part of its methodology. The study is aimed to assess the pollution levels using various indices such as contamination factor, ecological risk index, and degree of contamination. Furthermore, the study also assesses the health effects associated with the presence of heavy metals in road dust.

The **Compendium Report 2023 (Volume-II)** can be accessed at https://iced.cag.gov.in/wp-content/uploads/Compendium%20on%20Work%20of%20INTERN%20(Vol-II)%20%20Final.pdf

Activities at iCED:

International Yoga Day celebrated at iCED

“We are going through, at the moment, a faster loss of Biodiversity than any of the previous five extinctions”

Peter Frankopan

Professor of Global History at Oxford University
Author of the book: The Earth Transformed: An Untold History

Source: JLF International: The Earth Transformed: An Untold History | Peter Frankopan in conversation with William Dalrymple

Website: https://www.youtube.com/watch?v=bg5aLnD5BUs