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VOLUME 16 | ISSUE 9 | December 2023

## TERRA YOUTH

The Issue of  
Single-Use Plastic Pens

# COP28

Drove Momentum towards a  
Sustainable Future

## SPECIAL HIGHLIGHTS

Mumbai Festivals Highlight  
Environmental Concerns  
COP28 Chronicles

## IN CONVERSATION

Rodrigo Fernandes  
Director of ES(D)G (Empowering  
Sustainable Development Goals) at  
Bentley Systems

FUTURE

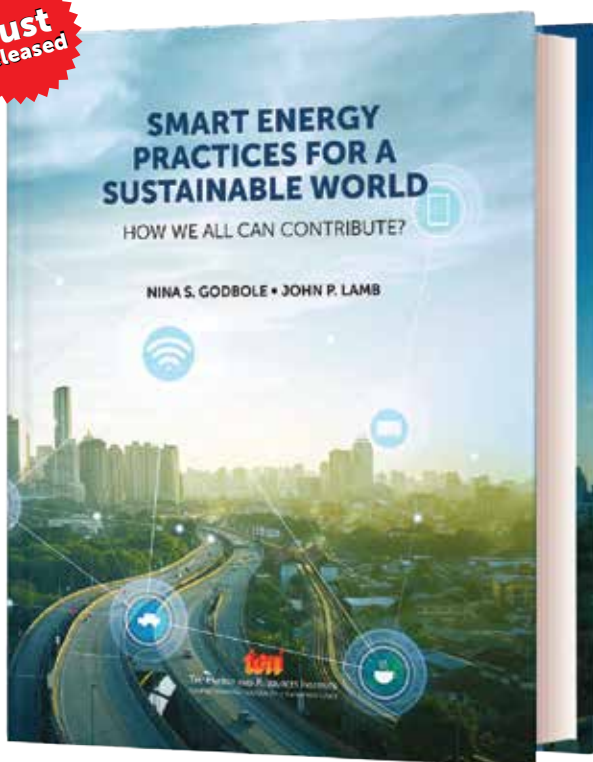


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This book stresses the need for us to judiciously, sustainably, and smartly harness and use energy techniques in order to effectively combat climate change. The book also gives an in-depth discussion on utilization of artificial intelligence and information technology to realize energy efficiency in various sectors of economy including such as transportation, buildings, infrastructure, health care, and other services.

Text is supplemented by case studies that depict ground-level reality to facilitate comprehension of the subject matter. The appendices serve as an extended learning of the concepts discussed in the chapters. The publication would serve as a valuable reference for both scholars and researchers engaged in the domain, in addition to, being a guide to industry and the academic world.

The Energy and Resources Institute  
Attn: TERI Press  
Darbari Seth Block  
IHC Complex, Lodhi Road  
New Delhi – 110 003/India

Tel. 2468 2100 or 4150 4900  
Fax: 2468 2144 or 2468 2145  
India +91 • Delhi (0)11  
Email: [teripress@teri.res.in](mailto:teripress@teri.res.in)  
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# EDITORIAL



“India’s leadership in renewables remains crucial for global goal achievement. With its commitment and potential for further growth, India will continue to play a vital role in transitioning to a sustainable energy future.”

Recently, COP28 concluded in Dubai with an agreement signaling the “beginning of the end” of the fossil fuel era. The consensus lays the groundwork for a rapid, just, and equitable energy transition, emphasizing substantial emissions reductions and increased financial support.

This month, our cover story on the UN Climate Change Conference highlights that COP28 made significant strides by operationalizing the Loss and Damage Fund established at COP27, conducted the inaugural ‘Global Stocktake’ (GST), and laid the foundation for a fossil-fuel-free future through groundbreaking decisions. While climate negotiators reached a consensus on a roadmap for ‘transitioning away from fossil fuels,’ it falls short of the aspirations of some countries and other players who sought a complete phase-out rather than a transition. Nevertheless, this marks the first time a UN climate conference has explicitly acknowledged the imperative to end reliance on fossil fuels.

During this climate summit, the World Meteorological Organization (WMO) released a report whose key findings revealed that the decade from 2011 to 2020 was the hottest on record for both land and ocean, accompanied by alarming increases in greenhouse gas (GHG) levels and a rapid decline in land ice mass, leading to accelerated sea-level rise. Furthermore, the report highlighted the significant threats posed to marine life and coastal communities due to ocean warming and acidification. These alarming findings underscore the pressing need for immediate action to attain the Paris Climate Goals and Sustainable Development Goals (SDGs).

At COP28, 118 countries pledged to triple renewable energy capacity by 2030, signifying a collective commitment to a cleaner future. This ambitious goal entails achieving at least 11,000 GW of renewable energy generation and doubling annual energy efficiency improvements. Notably, India, with its current 132 GW renewable energy capacity and a commitment to reaching 500 GW by 2030 as part of its NDCs, did not join the signatories. Nevertheless, India’s leadership in renewables remains crucial for global goal achievement. With its commitment and potential for further growth, India will continue to play a vital role in transitioning to a sustainable energy future. Furthermore, India introduced and promoted the concept of “LIFE” (‘Lifestyle for Environment’) at COP28 as a key strategy to combat climate change. Emphasizing mindful consumption, daily adoption of sustainable practices, living in harmony with nature, and fostering community engagement, LIFE encourages individuals to make small but impactful choices for a greener future.

I sincerely hope that this issue of *TerraGreen* will resonate with our readers, and I encourage you to share your thoughts and invaluable inputs. Your contributions will go a long way in strengthening this publication and promoting a space for an engaging dialogue around sustainable planet.

A handwritten signature in black ink that reads "Vibha Dhawan".

**Vibha Dhawan**  
Director-General, TERI



I liked reading the November 2023 issue of *TerraGreen*. In the face of our planet's alarming rate of warming, businesses across all industries are increasingly committing themselves to a sustainable future that harmonizes the well-being of people, the health of the planet, and the pursuit of profits. Recognizing the urgent need for responsible and environmentally conscious practices, companies are embracing a triple-bottom-line approach that goes beyond mere financial success. This commitment entails implementing strategies that reduce environmental impact, promote social responsibility, and foster economic resilience. In this collective effort, businesses are not only acknowledging the imperative to address climate change but are also actively participating in shaping a future where sustainability is not just a choice but a

fundamental principle guiding every facet of operations. Through innovation, collaboration, and a dedication to ethical business practices, industries are striving to strike a balance that ensures a thriving planet for future generations, aligning the interests of people, the environment, and profitability.

**Manish Kaul**  
New Delhi

I liked reading the feature story on North Atlantic's Major Current System published in the November 2023 issue of *TerraGreen*. The currents of the Atlantic Ocean function as a continuous global conveyor belt, facilitating the movement of crucial elements such as oxygen, nutrients, carbon, and heat around the world. Throughout the entirety of human civilization, this colossal oceanic machinery has operated relatively steadily. Warmer, saltier, and denser southerly waters move northward, cooling and sinking in higher latitudes. Subsequently, these sunken waters gradually flow southward, warm up, and the cycle repeats. However, in the mere blink of our species' existence, our collective actions over the past millennium pose a threat to this grand order, a natural scheme that typically takes millennia to undergo significant changes—a magnificent system from which we all benefit.

**Pallavi Krishna**  
Hyderabad, Telangana

#### Editor-in-chief

Vibha Dhawan

#### Editorial Board

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#### Editorial Team

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#### Design & Illustration

Santosh Gautam

Vijay Nipane

#### Production

Aman Sachdeva

#### Marketing, Sales & Distribution

Sanjeev Sharma

#### Head office

##### TERI

Darbari Seth Block, IHC Complex

Lodhi Road, New Delhi – 110 003

Tel. +91 (11) 2468 2100 or 7110 2100

Fax +91 (11) 2468 2144 or 2468 2145

#### Regional centres

##### Southern Regional Centre

TERI, CA Site No. 2, 4th Main, 2nd Stage

Domlur, Bangalore–560 071

Email: terisrc@teri.res.in

##### North-Eastern Regional Centre

Chachal Hengrabari, Express Highway

Guwahati- 781 036

Tel: 0361-2334790, Fax: 0361-2334869

Email: terine@teri.res.in

##### Western Regional Centre

House No. 233/GH-2, Vasudha Housing Colony,

Alto-St Cruz, Tiswadi, Goa-403 202

Tel: 0832-2459306, 2459328

Email: teriwrc@teri.res.in

Published by Dr Ajay Mathur on behalf of The Energy and Resources Institute, Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi – 110 003. Editor-in-chief Dr Vibha Dhawan

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## Climate Change Delaying Arrival of Migratory Birds in Delhi

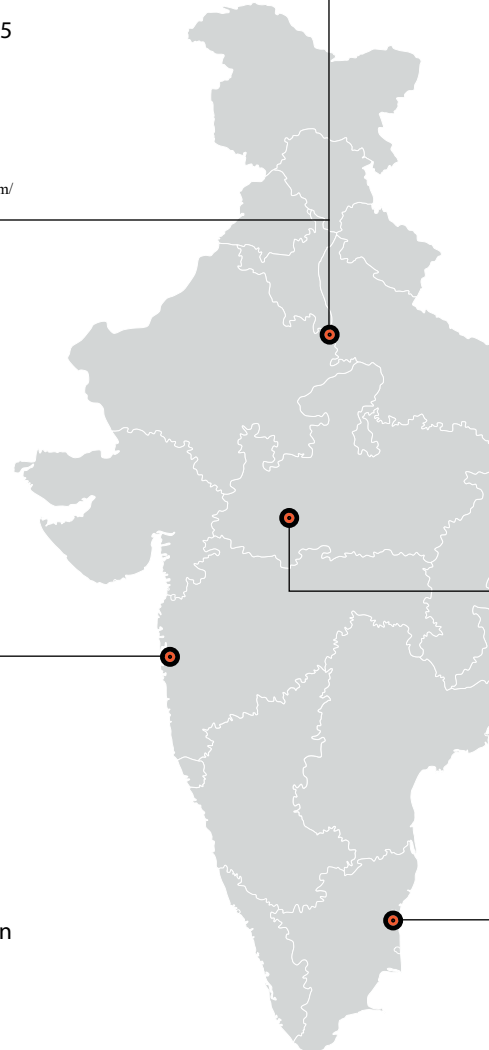
Global climate change is causing delay in the arrival of migratory water birds in prominent wetlands in Delhi, said TK Roy, Delhi State Coordinator, Asian Waterbird Census. The ecologist said habitats were witnessing decline, degradation and extreme human intervention in the foraging and roosting of water birds. The Najafgarh Lake is the second largest wetland in Delhi-NCR and a prominent wetland habitat for migratory water birds during the winter. Roy said, "It has the largest number of species, however, the number of migratory birds has seen a decline due to degradation of habitats and severe human intervention." He said, "Around 50 species of winter migratory birds with a population of around 30,000 were recorded annually in the Najafgarh Lake."

Source: <https://www.tribuneindia.com/>

## Delhi Leads Cities That Lag in Meeting Clean Air Targets

Delhi recorded the highest PM2.5 levels among the cities that are far behind the target of reducing PM10 and PM2.5 under the National Clean Air Programme. Logging an average PM2.5 of 102 micrograms per cubic metre in 2023, an increase of 2.5 per cent over the level in 2022, Delhi did, however, make a marginal improvement of 5.9 per cent from the PM2.5 in 2019. NCAP was launched five years ago on January 10, 2019, and targeted a reduction in PM10 and PM2.5 by 20–30 per cent by 2024 and 40 per cent by 2026 in 131 non-attainment cities.

Source: <https://timesofindia.indiatimes.com/>



## Reliance Turns Plastic Waste into High-Quality Materials for New Plastic

Reliance Industries Ltd has said it has become the first Indian company to chemically recycle plastic waste into high-quality materials for new plastics. In its attempt to reduce plastic waste and support the circular economy in India, Reliance becomes the first in India to chemically recycle plastic waste-based pyrolysis oil into International Sustainability and Carbon Certification (ISCC)-Plus certified circular polymers. "Chemical recycling has many benefits, including turning plastic waste into high-quality materials for new plastic. These materials can be used for packaging that comes into contact with food," the firm said in a statement.

Source: <https://www.deccanherald.com>



## Solar Micro Grids to Light Up Over 9000 Remote Households in Tripura

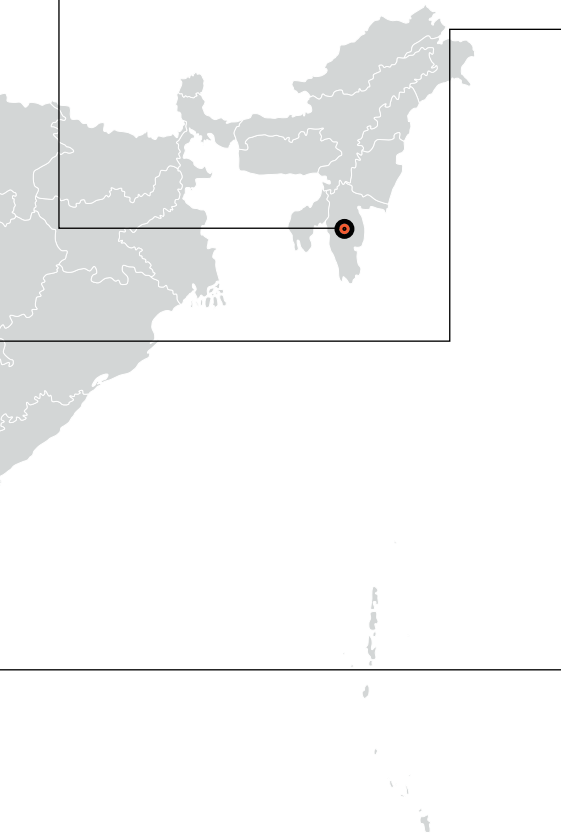
The Centre has sanctioned INR 81 crore to Tripura for setting up 274 solar micro grids in remote areas of the northeastern state to light up over 9000 houses. Under the project of the Ministry of Development of Northeast Region (DoNER), the micro grids will be established in hamlets in Dhalai, Unakoti, and South, West and North Tripura districts, where “conventional electricity appears non profitable” to the state power utility because of low population density. “A total of 9250 families will be benefited under the project,” an official of the Tripura Renewable Energy Development Agency (TREDA) said.

Source: <https://economictimes.indiatimes.com/>

## Indore Bags Cleanest City Tag for 7th Time

Indore secured the top position among the ‘cleanest cities’ of India for the seventh consecutive time recently, with civic officials saying the city’s effective, sustainable and durable waste management system played a big role in this success. This time, Indore, also known as Madhya Pradesh’s industrial capital, shared the top position with Gujarat’s Surat city in the central government’s annual cleanliness survey for 2023. The survey, based on the theme ‘Waste to Wealth’, saw a tough competition among more than 4400 cities in different categories. President Droupadi Murmu gave away the awards to the winners at an event held in New Delhi.

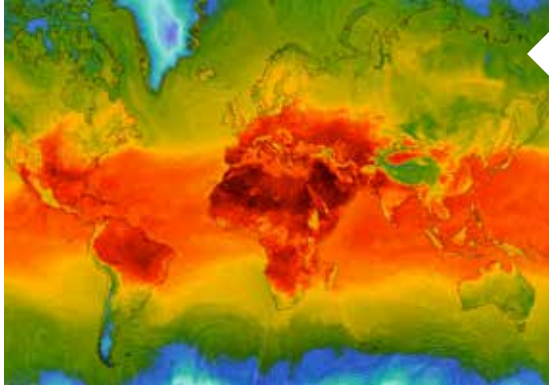
Source: <https://www.deccanherald.com>



## Study Finds Harmful Toxins in One of Chennai’s Primary Drinking Water Sources

The concentration of toxins found in Veeranam Lake, one of Chennai’s main sources of water, contains cyanotoxins above the recommended levels prescribed by the World Health Organization (WHO), according to a study conducted by the University of Madras and Presidency College. Cyanotoxins, produced by the Cyanobacteria (blue-green algae) found in the lake’s water, could be harmful to humans, affecting the liver, nervous system, and skin. It could also cause gastrointestinal illnesses. The sample for the study, published in the Springer *Nature Environmental Sciences Europe* journal on January 2, 2024 was collected between August 2018 and March 2019 across three seasons.

Source: <https://www.newindianexpress.com/>



## 2023 Among Warmest in At Least 100k Years

2023 was Earth's warmest by far in a century and a half. Global temperatures started blowing past records midyear and didn't stop. First, June was the planet's warmest June on record. Then, July was the warmest July. And so on, all the way through December. Averaged across last year, temperatures worldwide were 1.48°C, higher than they were in the second half of the 19th century, the European Union climate monitor announced recently. That is warmer by a sizable margin than 2016, the previous hottest year. To climate scientists, it comes as no surprise that unabated emissions of greenhouse gases caused global warming to reach new highs.

Source: <https://economictimes.indiatimes.com/>



## Greenpeace, Islanders Sue Dutch State Over Rising Seas

Greenpeace and residents of Bonaire have filed a lawsuit against the Dutch government saying not enough was being done to protect the tiny Caribbean island from rising sea levels. Eight residents of the Dutch territory and the climate activists filed a summons before The Hague District Court, demanding that the government take "concrete measures" to shield the island from rising waters. The group announced in 2022 it was taking legal action after a study by Amsterdam's Vrije Universiteit showed that as much as a fifth of Bonaire could be swallowed up by the sea by the end of the century.

Source: <https://economictimes.indiatimes.com/>

## Deforestation in Brazilian Amazon Halved in 2023

Deforestation in the Brazilian Amazon fell by half last year, according to figures released recently, as President Luiz Inacio Lula da Silva's government bolstered environmental policing to crack down on surging destruction. However, the news was far less bright from the crucial Cerrado savanna below the rainforest, where clear-cutting hit a new annual record last year, rising by 43 per cent from 2022, according to the national space research agency's DETER surveillance programme. Satellite monitoring detected 5152 square kilometres of forest cover destroyed in the Brazilian Amazon last year, down 50 per cent from 2022.

Source: <https://economictimes.indiatimes.com/>







## World Added 50 Per Cent More Renewable Energy But More Needed: IEA

The world added 50 per cent more renewable energy capacity in 2023 over the previous year but more is needed in the battle against climate change, the International Energy Agency said recently. The increase was the fastest growth rate in the past two decades and the 22nd year in a row that renewable capacity additions set a new record, the Paris-based IEA said. But the world is not on pace to reach the goal of tripling renewable capacity by 2030, a target agreed by nearly 200 nations at the UN's COP28 climate summit in Dubai last month, the IEA said.

Source: <https://economictimes.indiatimes.com/>



## COP28 Summit Agreement Hailed as 'Beginning of the End' for Fossil Fuels

Delegates at the COP28 international climate summit have agreed to move away from fossil fuel consumption in a first-of-its-kind deal signalling the possible end of the oil age, although some participants said the pact did not go far enough. The agreement, announced by the president of the COP28 meeting, Sultan al-Jaber of the United Arab Emirates, to a standing ovation, commits the international community to avoid the worst effects of climate change and to move to a low-carbon future. It is the first time a COP summit has agreed to move away from fossil fuels, but the language stops short of calling for them to be phased out, to the disappointment of some nations.

Source: <https://www.nbcnews.com/>

## Largest Great Ape to Ever Live Went Extinct Because of Climate Change

An ancient species of great ape was likely driven to extinction hundreds of thousands of years ago when climate change put their favourite fruits out of reach during dry seasons, scientists reported recently. The species *Gigantopithecus blacki*, which once lived in southern China, represents the largest great ape known to scientists—standing 10 feet tall and weighing up to 650 pounds (295 kilograms). But its size may also have been a weakness. The giant apes, which likely resembled modern orangutans, survived for around 2 million years on the forested plains of China's Guangxi region. They ate vegetarian diets, munching on fruits and flowers in tropical forests, until the environment began to change.

Source: <https://economictimes.indiatimes.com/>



# Waste to Wonder

## Zinc Mining Waste Can Be a Source for Essential Plant Nutrients

In this article, **Dr Suneeti Singh** and **Dr Pushplata Singh** have highlighted that TERI has pioneered the development of a zinc-iron nanocomposite as a nanofertilizer. In the creation of this nanofertilizer, researchers utilized jarosite, a by-product of zinc extraction from its ore, employing a biogenic synthesis process. Keep reading to delve into the details...

Urbanization and industrialization have placed a heavy load on the environment by generating billion tonnes of harmful garbage every year. A study by TERI found India, in a year, produces over 62 million tonnes (MT) of waste, making it a leading cause of environmental and public health concerns in the country. Industrial waste, the residue discharged from various production processes, is known to have hazardous properties as they are primarily made of heavy metals such as lead, cadmium, nickel, and zinc. Since heavy metals cannot be degraded, biologically or chemically, they can persist in the environment for a long time resulting in serious environmental pollution. Industries such as mining, electroplating, textile, tanneries, agriculture, are major sources for the emission of harmful heavy metals in the waste streams.

One of the industrial waste material produced as a by-product of the extraction of zinc from its ore is jarosite. Jarosite is a basic hydrous sulphate of ammonium and ferric iron (Fe-III) with the chemical formula of  $\text{NH}_4\text{Fe}_3(\text{SO}_4)_2(\text{OH})_6$ . The Debari zinc smelter plant (HZL) is one of the largest plants, in Udaipur, India, and has an annual production capacity of 92,000 MT of high zinc metal using electrolytic



extraction.<sup>1,2</sup> A large amount of zinc, along with other contaminated elements like lead and cadmium, is being emitted into the environment during the processing of zinc mining, which may cause sinkholes, soil erosion, and the loss of biodiversity.

Sadly, the recycling rate in India is just 20 per cent. The rest ends up in landfills and the ocean, harming both marine life and human beings in addition to destroying the environment. This has greatly put the emphasis on a robust waste management system.

### Converting Waste into Nano Form

The use of industrial waste as a starting material for the synthesis of nanomaterial

is currently gaining attention due to its route towards sustainable growth and its significant economic gains. The synthesis of nanomaterials from industrial waste is an efficient method of waste treatment and recycling that complies with the ideas of minimal waste generation and wealth from waste.

Due to their distinctive characteristics, such as their high specific surface area and reactivity, nanoparticles are useful for various industries including medical, agriculture, petroleum industry, paint, and solar energy. However, before conversion of waste material to nano form, it is important to remove inorganic pollutants such as heavy metals such as lead and cadmium. Hence, several methods, including chemical precipitation, adsorption, ion exchange, and membrane filtration, have been utilized over the years to immobilize and remove harmful metal from waste.<sup>3</sup>

<sup>1</sup> Details available at <https://www.hzllindia.com/business/operations/smelter/debari/>

<sup>2</sup> A. Pappu, M. Saxena, and S. R. Asolekar. Solid Wastes Generation in India and Their Recycling Potential in Building Materials, Building and Environment 42, 2007, 2311–2320.

<sup>3</sup> M.A. Barakat. New trends in removing heavy metals from industrial wastewater, Arabian Journal of Chemistry, 4, 2011, 361–377.

## TERI Develops Zinc–Iron Nanofertilizer

Zinc is an essential micronutrient required for the growth of living beings. The average daily zinc intake requirement from foods and supplements is 8–11 mg/day in adults.<sup>4</sup>

However, a large amount of zinc, along with other contaminated elements such as lead and cadmium is emitted into the environment during the processing of zinc mining, triggering soil erosion, sinkholes, and the loss of biodiversity. Research for fortification or biofortification of staple foods such as wheat, rice, or maize with zinc is underway to increase the intake of zinc in vulnerable communities around the world.

The Energy and Resources Institute (TERI) has developed zinc–iron nanocomposite as a nanofertilizer. For the development of zinc–iron nanofertilizer, the researchers have used jarosite, (by-product of zinc extractions from its ore) in a biogenic synthesis process. When the effectiveness of this biogenic nanomaterial was tested on wheat seed emerging activity, greater growth was seen at a concentration of 20 ppm.<sup>5</sup> In addition, researchers at MPKV, Rahuri, found that foliar spray of zinc–iron nanocomposite improves chickpea seed production and quality.

## TEM Image of Zinc–Iron Nanocomposite

Nano zinc–iron as nanofertilizer supplies nutrients to the plant in their available forms. In this way, an assimilation of the nutrients in plants is increased and plant production is significantly expanded.

<sup>4</sup> Details available at <https://ods.od.nih.gov/factsheets/Zinc-Consumer/>

<sup>5</sup> A. Bedi, B. R. Singh, S. K. Deshmukh, N. Aggarwal and C. J. Barrow, A. Adholeya. Development of a novel myconanoming approach for the recovery of agriculturally important elements from jarosite waste, *Journal of environmental sciences*, 67, 2018, 357–367.



Zinc and iron support plant growth, yield, participate in several cellular and physiological processes and maintain the chloroplast structure and function.

However, due to the inclusion of poisonous heavy metals such as lead, cadmium, copper, arsenic, and aluminium, jarosite is environmentally harmful, and its disposal has raised significant concerns. Therefore, it is essential to remove the pollutants. The correct processing of jarosite is essential to ensure that the heavy metals contained do not pollute the plants, soil, or groundwater. Except for Pb (II) within permissible concentration, all heavy elements in jarosite are below the permitted level.

## Safe and Efficacious

To avoid contamination of zinc–iron nanofertilizer with nascent inorganic contaminant (heavy metals) present in jarosite, TERI researchers have developed a method for pre-processing of the waste. TERI has designed a pre-processing step for toxic heavy metals removal and amelioration of solid waste (jarosite). In this method, Pb (II) has been removed from jarosite in a bid to generate zinc–iron nano-composite fertilizer with the retention of zinc and iron. This goal could only be attained by using soluble phosphate materials as adsorbents.<sup>6</sup>

<sup>6</sup> S. Singh, P. Singh and H. B. Bohidar. Phosphate-Assisted Remediation of Pb (II) From Jarosite, *ChemistrySelect*, 8, 2023, 1–14, e202204153.

Due to their higher efficiency, three phosphate materials (calcium dihydrogen phosphate, ammonium dihydrogen phosphate, and potassium dihydrogen phosphate) have been combined to chemically immobilize Pb (II). Additionally, the pyromorphite complex is formed when all three phosphate materials interact with Pb (II). In situ, formation of the pyromorphite complex took place within the contaminated solid sample. This complex is exceptionally stable in comparison to other pyromorphite complexes and the chemical lability and bioavailability of the Pb (II) were reduced during this process without the metal being removed from the contaminated media. This technology is novel and has not been used yet.

Therefore, the zinc–iron nanofertilizer produced by TERI is not only highly efficacious but also completely safe to the environment as it does not contain any toxicants. Conclusively, this technology proposes the generation of phosphate assisted remediation of Pb (II) from jarosite that may find wider application due to its lower cost. By all means, it fits the paradigm of “waste to wealth”. ■

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*Dr Suneeti Singh, Associate Fellow, Sustainable Agriculture Division, TERI and Dr Pushplata Singh, Senior Fellow & AC, Sustainable Agriculture Division, TERI.*

# Beyond 1.5°C

## What Lies Ahead?

2023 was Earth's hottest year ever recorded, beating the previous record set in 2016 by a huge margin. 2023 was also the first in which the world was close to 1.5°C (1.48°C) hotter than the pre-industrial average (1850–1900). We are brushing against the threshold scientists urged us to limit long-term warming to. Some scientists, including former NASA climatologist James Hansen, predict 2024 will be humanity's first year beyond 1.5°C. As once dire warnings from climate experts become our shared reality, what can you expect?

The 1.5°C temperature target, enshrined in the 2015 Paris agreement, is not shattered on first contact. Most of the climate tipping points scientists fear could send warming hurtling out of control are not expected until Earth is consistently warmer than 1.5°C. The global average temperature is likely to dip down again once the present El Niño (a warm phase in a natural cycle

focused on the equatorial Pacific Ocean) dissipates.

Instead, 2024 could be our first glimpse of Earth at 1.5°C. Here's what research suggests it will look like for people and nature.

### Ecosystems on the Brink

Tropical coral reefs are in hot water. These habitats comprise a network of polyp-like

animals (related to jellyfish) and colourful algae encased in calcium carbonate. The complex forms they build in shallow water around the Earth's equator are thought to harbour more species than any other ecosystem. "Corals have adapted to live in a specific temperature range, so when ocean temperatures are too hot for a prolonged period, corals can bleach—losing the colourful algae that





live within their tissue and nourish them via photosynthesis—and may eventually die,” say coral biologists Adele Dixon and Maria Beger (University of Leeds) and physicists Peter Kalmus (NASA) and Scott F Heron (James Cook University).

Climate change has already raised the frequency of these marine heatwaves. In a world made 1.5°C hotter, 99 per cent of reefs will be exposed to intolerable heat too often for them to recover according to Dixon’s research, threatening food and income for roughly one billion people—not to mention biodiversity.

Coral reefs will earn their reputation as the “canaries in the coal mine” for climate change’s impact on the natural world. As global heating ticks up towards 2°C, the devastation already seen on reefs will become evident elsewhere according to an analysis by biodiversity scientist Alex Pigot at UCL: “We found that limiting global warming to 1.5°C would leave 15 per cent of species at risk of abruptly losing at least one-third of their current geographic range. However, this doubles to 30 per cent of species on our present trajectory of 2.5°C of warming.”

## Heat beyond Human Tolerance

Above 1.5°C, humanity risks provoking

heatwaves so intense that they defy the human body’s capacity to cool itself. Intense heat and humidity have rarely conspired to create “wetbulb” temperatures of 35°C. This is the point at which the air is too hot and humid for sweating to cool you down—different from the “drybulb” temperature a thermometer reports.

Earth’s rising temperature could soon change that according to climate scientists Tom Matthews (Loughborough University) and Colin Raymond (California Institute of Technology). “Modelling studies had already indicated that wetbulb temperatures could regularly cross 35°C if the world sails past the 2°C warming limit... with The Persian Gulf, South Asia and North China Plain on the frontline of deadly humid heat,” they say.

But different areas of the world are warming at different rates. In a world that is 1.5°C hotter on average, temperatures in your local area may have actually risen by more than that.

To account for this, Matthews and Raymond studied records from individual weather stations worldwide and found that many sites were closing in much more rapidly on the lethal heat and humidity threshold. “The frequency of punishing wetbulb temperatures

(above 31°C, for example) has more than doubled worldwide since 1979, and in some of the hottest and most humid places on Earth, like the coastal United Arab Emirates, wetbulb temperatures have already flickered past 35°C,” they say. “The climate envelope is pushing into territory where our physiology cannot follow.”

## How Long do We Have?

Species extinctions and deadly heat become more likely after 1.5°C. So do catastrophic storms and collapsing ice sheets. For a chance to avoid these horrors, we must eliminate the greenhouse gas emissions heating Earth and that means rapidly phasing out coal, oil, and gas, which account for 80 per cent of energy use worldwide.

How fast? According to the latest estimate, published in October 2023, very fast indeed. “If humanity wants to have a 50-50 chance of limiting global warming to 1.5°C, we can only emit another 250 gigatonnes (billion metric tonnes) of CO<sub>2</sub>,” say climate and atmospheric scientists Chris Smith at the University of Leeds and Robin Lamboll at Imperial College London. “This effectively gives the world just six years to get to net zero...” ■

Source: [imagine@theconversation.com](mailto:imagine@theconversation.com)

# COP28 Chronicles

## India's Ambitious Climate Agenda for a Sustainable Future

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In this article, **Amit Patjoshi** asserts that India has made commendable strides towards its climate goals, actively participating in initiatives such as the International Solar Alliance and the Green Hydrogen Mission. These endeavours underscore a robust commitment to cleaner and renewable energy sources. By fostering a sustainable ecosystem, the Government of India is not only benefiting the nation but also making a substantial contribution to global climate efforts. The author applauds India's unwavering commitment, setting a positive example for the world in the pursuit of a greener future.

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**COP 28**

**EMIRATE OF DUBAI**  
**UNITED ARAB EMIRATES 2023**

## India's Commitment to Global Climate Action

India has been committed to the global fight against climate change since it became an international concern, actively engaging in multinational negotiations under the United Nations Convention on Climate Change (UNFCCC). Since joining the UNFCCC in 1993, India has proactively upheld its commitments to multilateralism by ratifying the groundbreaking Kyoto Protocol in 1992 and the landmark Paris Agreement of 2015. The country has prioritized the UNFCCC processes, declaring Nationally Determined Contributions (NDCs) and fulfilling reporting obligations under the Paris Agreement. This includes submitting its National Communications (NATCOM), Biennial Update Reports (BUR), and Long-term Low-Carbon Strategy. Recognizing that addressing the

climate change problem requires global cooperation and observing a 1-degree rise in global temperatures today with minimal responsibility, India has taken independent yet enhanced actions to decouple its economic growth from greenhouse gas (GHG) emissions.

As per the recent Biennial Update Report of 2021, India is among the few countries already on track to overachieve the '2°C compatible' NDC targets set as part of the Paris Agreement, with its GDP emission intensity reduced by 24 per cent from 2005 to 2016. During COP26 (2021) in Glasgow, Scotland, India announced its updated NDC or climate pledges for 2030, further strengthening its commitment to addressing the climate conundrum.

The pledges include enhancing its renewable energy capacity to 500 GW, meeting 50 per cent of its energy requirements through renewable



sources, reducing its carbon footprint by 1 billion tonnes through forest cover expansion, decreasing its carbon intensity by 45 per cent, and achieving net zero by 2070. India aims to better adapt to climate impacts through investments in vulnerable sectors, including agriculture, water resources, and disaster management, and to mobilize domestic as well as international





climate finance. This year, COP28 at Dubai takes centre stage, focusing on devising measures to curtail emissions, adapt to the escalating impacts of climate change, and extend financial and technological aid to developing countries. Within this global dialogue, India emerges as a leading voice representing the Global South at COP28 events. With all eyes on India as it navigates this hyper-growth phase, the nation holds the potential to shape the trajectory of global climate action.

## Navigating Climate Challenges: Understanding the Adverse Impacts

Although India has been a part of the solution and is doing more than its fair share to address climate change, yet it continues to face the adverse consequences of climate change and grapples with an existent environmental crisis. A report by the Centre for Science and Environment has said that India faced extreme weather on 86 per cent of days from January to September 2023 causing extensive damages to crops, infrastructure, livelihoods, and human & animal lives. Climate-induced disasters have been on a sharp rise in the country during the past few decades. As per the World Meteorological Organization (WMO), India has witnessed 573 climate- and water-related disasters claiming



over 130,000 lives between 1971 and 2021. As per the report by the National Institute of Disaster Management, India has experienced a total 1058 incidences of climate-related disasters between 1995 and 2020, which include 347 floods, 48 cyclones, 176 droughts, 253 heat waves, and 234 cold waves. In the year 2023 itself, India has been experiencing disasters linked to climate change through short-term variability manifesting in extreme weather events such as floods in Assam in the Northeast region before the monsoon season, glacial lake outburst flow (GLOF) events in Himachal Pradesh and Sikkim in the Himalayan region, and as we speak, Tamil Nadu in South India reels under extreme winds flash floods due to the tropical cyclone Michaung.

## India: Building Strategies for Climate Resilience

India has taken several initiatives to combat climate impacts on its land and people while exemplifying its commitment to building climate and disaster resilience in the country and achieving mitigation targets pledged under the NDC. We are implementing several programmes to tackle climate change as part of the National Action Plan on Climate Change (NAPCC) which comprises missions in specific areas of solar energy, energy efficiency, water, sustainable agriculture, Himalayan ecosystem, sustainable habitat, green India, and strategic knowledge for climate change. States have also prepared their State Action Plan on Climate Change (SAPCC) in line with the NAPCC considering the sub-national issues relating to climate change. These SAPCCs outline sector-specific and cross-sectoral priority actions, including adaptation and climate resilient infrastructure. India has also set up the National Adaptation Fund for Climate Change (NAFCC) to support adaptation activities in the regions that are vulnerable to the adverse effects of climate change. Under the NAFCC, 30



projects have been sanctioned across the country till date.

Further, India has set up comprehensive governance, policy, and planning structures for Disaster Management in the country through setting up the National Disaster Management Authority (NDMA), which has issued several disaster-specific guidelines for managing extreme weather-related disasters such as cyclones, floods and heat waves in the country. The NDMA also has laid out the National Disaster Management Plan (NDMP) to assist all stakeholders in disaster risk management of various hazards related to climate change. Furthermore, advanced early warning systems are being implemented by the Indian Meteorological Department to facilitate anticipatory action and timely evacuation during extreme climate events.

Apart from resolutely addressing climate change domestically, India has taken a leadership role in addressing global climate change issues by launching international coalitions such as the International Solar Alliance (ISA)

and Coalition for Disaster Resilient Infrastructure (CDRI). New initiatives under CDRI and ISA, viz., Infrastructure for Resilient Island States (IRIS) and Green Grids Initiative—One Sun One World One Grid (GGI-OSOWOG) have been launched. Along with Sweden, India co-leads the Leadership Group for Industry Transition (LeadIT) for voluntary low carbon transition of hard-to-abate sectors.

## **COP28: India's emergency as a trailblazer for climate equity and justice**

The 28th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), or COP28, marked a pivotal moment in the global fight against climate change, a moment filled with both promising strides and lingering challenges, particularly for India. While leaders and negotiators from around the world convened to deliberate on urgent measures, several outcomes stood out with significant implications for India.

The major outcome of COP28 included the decision on the Outcome of the First Global Stocktake, intensifying global climate ambition before the end of the decade. First time in the history of climate negotiations, the term “fossil fuels” was included in the decision text of the global stocktake report. The report emphasizes on phasing away from fossil fuels to net zero energy sources, which aligns with its climate pledges and ambitious targets pledged under the NDCs.

Another important decision for India came in the form of the newly established Loss and Damage (L&D) Fund. This dedicated Fund serves to support vulnerable countries facing the brunt of climate-induced devastation, directly aligning with India's vocal advocacy for recognizing and addressing historical responsibility for climate damage. An amount of around USD 700 million to date has been pledged by several countries, including the United Arab Emirates, Germany, the United Kingdom, the European Union, and Japan for the newly formed L&D Fund. At COP28, India submitted its Third



NATCOM based on the GHG inventory of 2019 along with Initial Adaptation Communication to the UNFCCC highlighting that India has successfully reduced its GDP emission intensity by 33 per cent, thus achieving the initial NDC target for 2030, 11 years ahead of the scheduled time. Furthermore, India abstained from signing the Global Renewables and Energy Efficiency Pledge, endorsed by a staggering 130 countries. The weakened language on coal phase-out in the draft text proved a concern for India, a nation heavily reliant on coal for its energy needs. This divergence from a complete phase-out raises questions about how future energy demands will be met while adhering to ambitious climate goals.

India had its hopes pinned on reaching a collective consensus towards a strengthened Global Goal on Adaptation (GGA) during COP28. However, the removal of targets and thresholds for adaptation in the new draft presents a weaker text than previous COPs. Also, there is no resolution on the inclusion of Common but differentiated responsibilities and Respective Capabilities (CBDR-RC) in the new draft of GGA. What is most concerning for India is the absence of targets for adaptation finance under Means of Implementation (MOI). India has already spent 5.5 per cent of its GDP on Climate Adaptation in 2020–21 and expects to further spend around INR 57 lakh crore on climate adaptation under the Business-as-usual (BAU) scenario



till 2030 demonstrating its resolution and commitments to saving its people and resources from climate impacts. However, the funds required to meet the larger adaptation goals cannot be solely met by India's domestic resources as the funds promised by the developed nations fall far too short of its adaptation requirements. This requires the developed nations to enhance their financial contribution to achieve the global goal of adaptation. To ensure a just transition, India can leverage its leadership position to advocate for fair and accessible finance mechanisms for developing nations.

Similarly, the lack of agreement on carbon markets presents both challenges and opportunities. While robust measures to ensure transparency and integrity are crucial, the absence of a final framework leaves the door open for India to play a leading role in shaping future carbon market mechanisms.

COP28 presented India with a

mixed bag of wins and challenges. By strategizing alliances, effectively voicing its concerns, and capitalizing on emerging opportunities, India has positioned itself as a leader in the global fight against climate change. India being a significant voice representing the global south, our position in the climate negotiations is unique and has evolved in shaping the narrative of global climate leadership. By putting climate justice at the core of the negotiations with the developed nations, we have managed to pave a balanced way that is not based on the dictums of the global West but defined by the needs of the developing and the vulnerable. The position of India would be seen as a pivotal watershed moment in the history of COPs and will also play a crucial role in shaping the future COPs.

India's strides towards climate goals are commendable with its active involvement in the International Solar Alliance and the Green Hydrogen Mission. These initiatives signify a strong commitment to cleaner and renewable energy sources. By encouraging a sustainable ecosystem, the Government of India is not only benefitting the nation but also contributing significantly to global climate efforts. Cheers to India's steadfast commitment to set a positive example for the world in the pursuit of a greener future. ■

*Amit Patjoshi is CEO, Palladium India.*





# ES(D)G

## Empowering Sustainable Development Goals

**Rodrigo Fernandes** is director of ES(D)G (Empowering Sustainable Development Goals) at Bentley Systems. Here, we are in conversation with him for *TerraGreen*.

**Could you describe Bentley Systems' product strategy for supporting carbon footprint reporting and optimization in infrastructure projects?**

We believe in a holistic approach to carbon footprint reporting and optimization. Accurately predicting the carbon footprint for all lifecycle stages allows infrastructure engineers and sustainability experts to optimize infrastructure design, minimizing the embodied and operational carbon footprint. This holistic approach can help

clarify, in the design stage, the carbon benefits or consequences of investing upfront (such as with insulation) versus investing downstream (such as with heat pumps or solar PV panels). Design is indeed a critical stage in terms of carbon reduction potential—the opportunity to significantly reduce embodied carbon will be influenced by our choices during the initial design stages, where designers can “build clever” by optimizing material usage and designing with low carbon materials. Other Bentley solutions that are part of iTwin will also improve





environmental performances at multiple levels and lifecycle stages.

In 2022, Bentley enabled the iTwin Platform to automate generating embodied carbon reports for infrastructure projects by integrating One Click LCA, a platform for lifecycle assessment, and EC3, an application for calculating embodied carbon. In 2023, we started an early access programme using iTwin Experience technology, providing bidirectional integration with EC3 and visualizing carbon assessments in a digital twin without the need to write code. The solution exports a data model to EC3, which performs embodied carbon calculations that iTwin Experience seamlessly reads and visualizes.

Early adopters accelerated the process for embodied carbon calculation from six months to six minutes. However, during

the ongoing early access programme, it became evident that, in many cases, 3D models do not always sufficiently describe materials. Based on existing experience and feedback from the product team, there is a 75 per cent chance that a model does not have any specified material data. These gaps require users to manually complete the missing data. Otherwise, it is impossible to successfully generate an accurate bill of materials and quantities—critical for reliable carbon analysis. This manual process is usually very tedious and can take several days, especially in large infrastructure projects. We are currently testing a way to automate and optimize the process by integrating generative artificial intelligence (AI) with these infrastructure digital twins. Generative AI automatically recognizes, groups, and

maps materials in 3D models, expediting the creation of bills of materials and simplifying carbon calculation and analysis. Integrating generative AI in embodied carbon workflows is expected to create new avenues for exploring more intelligent, assisted carbon analysis and optimization in infrastructure projects, such as enabling the engineer to manually prompt complex questions on the fly.

We are conscious that there is still hard work to be done. We want to ensure carbon is an intrinsic element and variable of every infrastructure digital twin in all lifecycle stages.

### **How can organizations involved in infrastructure successfully integrate sustainability and resilience into their development and project delivery?**

Managing and delivering infrastructure projects brings multiple challenges—long-lived assets, numerous lifecycle stages, siloed data, and various stakeholders, disciplines, applications, and formats. At the same time, engineering firms are struggling to find talent. There are simply not enough engineers graduating from college to fulfill the growth in project pipelines, particularly for projects requiring extensive environmental sustainability knowledge.

We are facing a monumental effort to decarbonize and climate-proof our infrastructure on a scale and pace never seen before. Going digital plays a key role in achieving Sustainable Development Goals (SDGs) during this decisive Decade of Action on climate change. Digital twins can combine technologies, including AI, cloud computing, and Internet of Things (IoT), support the implementation of essential sustainability principles such as circularity and efficiency, and help us move towards infrastructure intelligence, dramatically accelerating decarbonization while reducing costs, even in hard-to-abate sectors. But the same digital twins also play a critical

role in adapting infrastructure to climate change. They can anticipate, quantify, or prepare for problems, such as the structural integrity of critical infrastructure, that are exacerbated by climate change phenomena, including water scarcity, floods, storms, heatwaves, or wildfires.

Yet no one company or entity can adapt to climate change alone. The solution is to build digital twins in an open, interoperable, vendor-agnostic infrastructure digital twin platform. With a foundation in open source and open data standards, stakeholders can take their IP, applications, and data with them without being locked into a specific vendor. In addition, this approach can also accelerate engineering firms' digital integrator initiatives for creating and curating asset-specific digital twins, incorporating their proprietary AI, analytics, and asset performance algorithms.

This strategy ensures the needed data federation, reuse, interoperability, flexibility, and transparency, reducing data siloes and establishing more efficient collaboration across the entire lifecycle and supply chain. These aspects are essential for facilitating and automating lifecycle assessments, as well as properly quantifying associated carbon emissions in all lifecycle stages and in all scopes.

Digital technology—particularly

infrastructure digital twins—is crucial for accelerating SDGs and driving climate action. We have reached the point when “double transition” or “twin transition”—digital transformation and green transition go hand in hand—is no longer a vision or an option. It is imperative for future-proofing infrastructure, organizations, and communities, and this advancement is already taking place.

**What are your plans to develop strategies to fully integrate ESG within a corporate business framework and showcase real action?**

We recognize our responsibility to lead by example in creating a sustainable future. As such, we will continue to manage the environmental footprint of our operations and lead business practices for environmental stewardship. Our UN-backed net-zero science-based targets (SBTi) have been recently validated and approved.

We also recognize our distinct opportunity to empower our users to drive change. We will continue to deliver environmental impact through our product offerings in alignment with global efforts for sustainable development and the UN SDGs. We recognize that we cannot operate alone to create industrywide change worldwide. Therefore, we will continue our work with partners, organizations, and communities to support a

sustainable future. We are actively supporting ecosystem collaboration and partnerships to increase infrastructure digital twin adoption, which we believe are essential enablers and accelerators of our mutual efforts towards a sustainable future.

What we call Empowering Sustainable Development Goals (ES(D)G—a combination of ESG and SDG acronyms) is one of our most strategic priorities for the company over the next decade.

As part of our ES(D)G strategy to help our users realize more sustainable outcomes with our software and services, we are supporting communities and organizations with infrastructure digital twin solutions that help accelerate the implementation of UN SDGs in four core areas:

- Energy transition and efficiency
- Climate action and resilience
- Land and water resources
- Healthy cities and communities

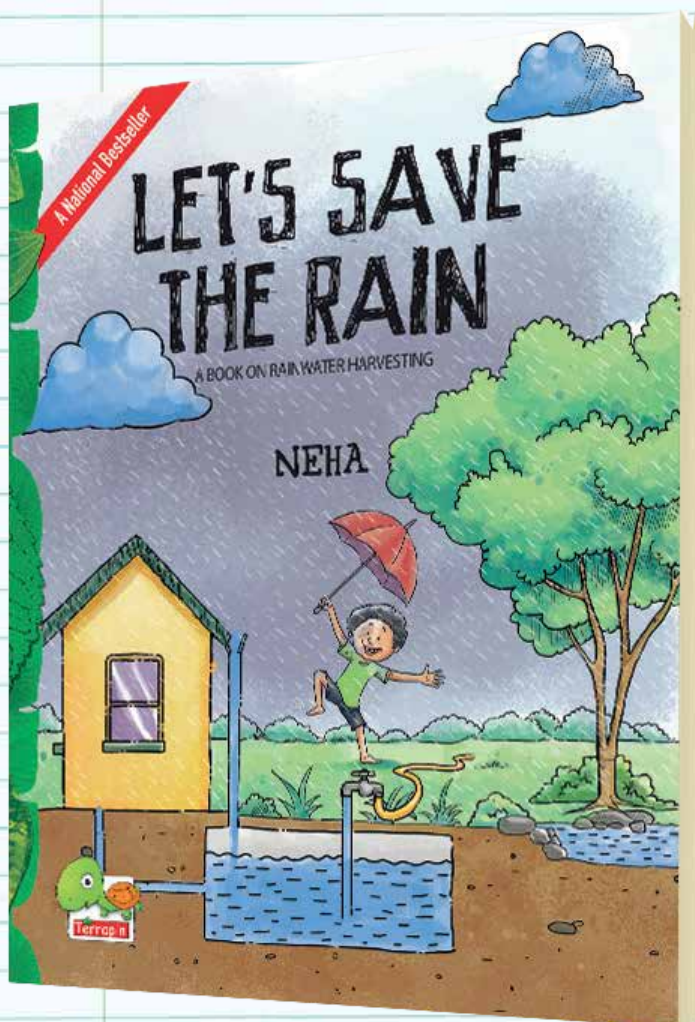
**How do you ensure quick wins on carbon reduction by prioritizing mature technologies and principles?**

While investing in disruptive technologies and innovation will allow us to decarbonize in the middle to long term, we need results now, at little or no cost, even in hard-to-abate sectors, including steel, cement, construction, trucking, fossil fuel production, aviation, and shipping. Quick wins on carbon reduction are achieved by prioritizing mature technologies and principles such as circularity/recycling (5%), efficiency (20%), diversifying renewables, and digital twins.

Today, digital twins are the most efficient way of combining multiple existing technologies, including AI, IoT, modelling, and augmented and virtual reality with sustainability principles to move towards a more sustainable, resilient, and intelligent infrastructure. We can do more with less and do it better than ever before. We can reimagine what is possible, embrace existing technology, and drive sustainability. ■



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An aerial photograph showing a two-lane asphalt road cutting through a dense, lush green forest. A white car is driving on the road, moving from left to right. The road has yellow dashed lines in the center and white solid lines on the edges. The forest is thick with various shades of green, suggesting a healthy ecosystem.

# COP28

## Drove Momentum towards a Sustainable Future

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The UN Climate Change Conference, also known as COP28, recently concluded in Dubai, UAE. COP28 made significant progress on various fronts, including the operationalization of the Loss and Damage Fund established at COP27. It also conducted the inaugural 'Global Stocktake' and laid the groundwork for a fossil-fuel-free future through a groundbreaking decision. In this article, **Dr Anil Pratap Singh** sheds light on the deliberations that transpired at COP28, emphasizing India's pivotal role in the conference.

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**C**OP28, the 28th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), wrapped up in Dubai, United Arab Emirates (UAE) in December 2023. The conference witnessed a momentous gathering of over 70,000 delegates from around 200 countries of the world. COP28 delivered on multiple fronts which operationalized the Loss and Damage Fund, set up at COP27; conducted the first 'Global Stocktake' (GST), and paved the way for a fossil-fuel-free future through its groundbreaking decision. While climate negotiators finally agreed on a roadmap for 'transitioning away from fossil fuels' like oil, coal, and gas but it doesn't go as far as some countries and activists wanted, that is, a complete phase-out of fossil fuels, rather than simply transitioning away from them. However, it's for the first time, a UN climate conference has explicitly acknowledged the need to end reliance on these fuels. The unifying motto of COP28 was "Uniting the world to Act and Deliver for a just and sustainable future."

Looking back, the Kyoto Protocol at COP3 in 1997 marked a notable moment when nations united to address greenhouse gas (GHG) emissions. In 2015, the Paris Agreement adopted at COP21 became a landmark, legally binding treaty with the aim of limiting global warming well below 2 degrees Celsius, preferably to 1.5 degrees Celsius, above pre-industrial levels. Today, the international community's approach to climate change has shifted primarily towards transitioning away from fossil fuels as a key strategy for mitigation.

COP28 thrived with engaging events, insightful discussions, and innovative exhibits. Over 150 Global

Climate Action events fostered collaboration, while 195 exhibits showcased cutting-edge solutions. This transformative event served as a crucial hub for climate action. Besides, in two weeks, COP28 undertook diverse issues through themed days: Health, Energy & Industry, Urbanization & Transport, Youth & Education, Nature & Oceans, and Food & Water.

Dr Sultan Al Jaber, President of COP28, during the opening ceremony emphasized on urgency and unity for immediate action on climate change by urging world leaders to unite and "rise above our differences to make the difference for future generations." He also stressed the need for "no delays" and "no excuses," and highlighted the importance of translating negotiated outcomes into tangible results.

At the launch of COP28, UN Secretary-General



António Guterres drew attention to the issue, declaring climate change a “moral outrage” and an existential threat and urged for immediate action to avert cataclysm. He criticized developed nations for failing to meet their climate finance commitments, demanding accountability and swift delivery of promised funds.

COP28 President Dr Sultan Al Jaber is the UAE’s Minister of Industry and Advanced Technology and Special Envoy for Climate Change. He is also the CEO of the Abu Dhabi National Oil Company (ADNOC). This dual role flashed criticism, further igniting concerns about conflict of interest due to his controversial statements denying the science behind fossil fuel phase-out. This cuttingly contrasted with UN Secretary-General *António Guterres’* call for fossil fuel leaders to embrace the transition to renewables—a clear message for the future of both the planet and their companies.

## COP28 Warns of Devastating Climate Impacts

During this climate summit, the World Meteorological Organization (WMO) released a sobering report, the key findings of which revealed that the 2011–2020 decade was the hottest on record for both land and ocean, with alarming increases in GHGs and a rapid decline in land ice mass, accelerating sea-level rise. Additionally, ocean warming and acidification pose a significant threat to marine life and coastal communities. These alarming findings underscore the urgent need for action to achieve the Paris Climate Goals and SDGs. In the line of these findings, UN Secretary-General recalled his recent trips to Antarctica and Nepal, and pointed out how he witnessed first-hand the scale and extent of melting ice and glaciers. “These two spots are far in distance, but united in crisis,” said Mr Guterres.

## ‘Global Stocktake’, Climate Plans, and LIFE Initiative of India

A feather in COP28’s cap was the adoption of a decision by the parties on the first Global Stocktake (GST) under the Paris Agreement and echoed the necessity for deep, rapid, and sustained reductions in GHG emissions to stay on track for a 1.5°C future. This also encouraged parties to come forward in their next nationally determined contributions (NDCs) with ambitious, economy-wide emission reduction targets by 2030, covering all GHGs, sectors and categories by aligning to limit global warming to 1.5°C. It is worth mentioning here that the GST is a fundamental component of the Paris Agreement, being used to



monitor its implementation and evaluate the collective progress made in achieving the agreed goals. GST links implementation of NDCs with the overarching goals of the Paris Agreement, and has the ultimate aim of raising climate ambition. Governments took decision on the GST at COP28, leveraged to accelerate ambition in their next round of climate action plans due in 2025.

UN Climate Change Executive Secretary Simon Stiell conveyed a strong message at COP28, urged for rising above “lowest-denominator politics” and take bold action on curbing global warming and ending the climate crisis. He said that “if we do not signal the terminal decline of the fossil fuel era as we know it, we welcome our own terminal decline. And we choose to pay with people’s lives.” During COP28, Simon Stiell’s vision for the next two years demanded transparency and action, as 2024’s Biennial Transparency Reports will reveal progress, COP29 will focus on financing the transition, 2025 will see new ambitious NDCs due, and COP30 will demand that all commitments align with a 1.5°C world.

At COP28, 118 countries signed a pledge to triple renewable energy capacity by 2030, aiming for a cleaner future. This ambitious goal commits them to achieving at least 11,000 GW of renewable energy generation and doubling energy efficiency improvements annually. India, with its existing 170 GW renewable energy capacity and a commitment to 500 GW by 2030 as a part of its NDCs, was notably absent from the signatories. The US and Brazil, second and third in renewable energy capacity respectively, have joined the pledge.

India’s leadership in renewables is crucial for achieving this global goal. However, with its commitment and potential for further growth, India will continue its vital role in transitioning to a sustainable energy future. Moreover, India also put forward and



further propagate the concept of “LIFE” (‘Lifestyle for Environment’) as a key to combat climate change. This initiative empowers individuals to combat climate change. By embracing mindful consumption, adopting sustainable practices daily (like using public transport and choosing energy-efficient appliances), living in harmony with nature, and fostering community engagement, LIFE encourages small, impactful choices for a greener future. Also, as discussed at COP28, LIFE emphasized the importance of taking collective action and encouraging individuals to work together in order to implement sustainable practices in their communities. India, in the second week of COP28, on December 9, 2023, also submitted its “*Third National Communication and Initial Adaptation Communication*” to the UNFCCC as Party authored report. Chapter 6 of this report authentically portrayed country’s financial and technological needs for low-carbon development and for adapting to the impact of climate change, contextualizing international and multilateral climate finance as were relevant to India and the barriers to the flow and adequacy in meeting the needs.

Simultaneously, the country’s climate plans underscored at COP28 include a reduction in emissions intensity of Gross Domestic Production (GDP) by 45 per cent by 2030 (from 2005 levels), achieving 50 per cent cumulative electric power installed capacity

from non-fossil fuel-based energy resources by 2030, and promoting a healthy and sustainable way of living based on traditional values of conservation and moderation. India’s focused commitments were duly highlighted at COP28, emphasizing de-carbonization through a clean energy transition, sustainable and responsible consumption patterns, and climate-resilient development practices.

## COP28 Gained Significant Ground

Significant progress was witnessed at COP28 towards addressing climate change on a global scale. A loss and damage fund was designated as vital support for vulnerable nations, with hundreds of millions of dollars pledged thus far. The Green Climate Fund was replenished with USD 3.5 billion, empowering green projects worldwide. The Least Developed Countries Fund (LDC) and Special Climate Change Fund (SCCF) received USD 150 million boost, strengthening climate resilience. Demonstrating a strong commitment to combating climate change, the World Bank pledged USD 9 billion annually to support climate-related projects during 2024 and 2025. COP28 Declarations on Health & Agriculture united beyond 120 countries, forging a path towards healthy and sustainable food systems. Global Cooling Pledge expanded, with 66 nations pledging a 68 per cent reduction in cooling-related emissions.

## Beyond the Headlines: An Analysis of Key Commitments of COP28

While significant progress was made in several areas, significant challenges remain, and continued efforts from governments, businesses, and civil society are crucial to translate the promises of COP28 into concrete action and achieve the Paris Agreement goals. Delving into the core takeaways:

### Sustainable solutions:

- Echoes of a Decarbonized Future: The first Global Stocktake (GST) highlighted the urgency of accelerating emission reductions. Parties agreed to significantly increase their ambition, with some calls for a 43 per cent reduction by 2030 and 60 per cent by 2035 compared to 2019 levels.
- Enhanced Focus on Adaptation: COP28 recognized the critical need for adaptation, especially for vulnerable countries and delivered hope with a new global adaptation goal and pledges of financial and



technical support for vulnerable nations.

- **Progress on Nature-based Solutions:** The importance of nature-based solutions for climate change mitigation and adaptation was emphasized with several initiatives promoting ecosystem restoration and conservation were launched.
- **Transparency and Accountability:** Parties agreed to strengthen transparency mechanisms to track progress towards climate goals which will help in safeguarding accountability and building trust among nations.
- **Civil Society Engagement:** Civil society voices, from youth groups to indigenous communities, resonated at COP28 whilst shaping the final decisions.

## Limitations

- **Gap between Ambition and Action:** While the ambition level increased, there is still a significant gap between the agreed-upon goals and the actual actions being taken by countries. Closing the gap needs clear pathways, not just pronouncements. Robust implementation plans are crucial.
- **Insufficient Finance for Adaptation:** The pledged financial support for adaptation remains insufficient, especially considering the increasing need for vulnerable countries. Innovative financing mechanisms need to be explored to address this gap.
- **Loss and Damage Debate:** The concern of loss and damage, that is, compensation for countries suffering from climate impacts beyond their capacity to adapt, remained unresolved largely. Despite some progress, concrete solutions are urgently needed to tackle the challenges head-on.
- **Equity and Justice Concerns:** Several developing countries intoned concerns for addressing their needs and perspectives adequately. Ensuring an equitable and just transition to a low-carbon future requires greater involvement and support for these countries.

## Transition to the Energy System of the Future and India's LeadIT

COP28 took significant steps towards accelerating the transition to the energy system of the future. Energy Transition Day of this COP witnessed a transformative shift: fast-tracking a clean energy future, decarbonizing the present, and ensuring a just and inclusive transition. New alliances were forged, mobilizing USD 83 billion for climate solutions and supporting vulnerable communities. Discussions on a market-based system to close coal plants were held, alongside discussions on



accelerating emissions reduction through technology and energy efficiency. Industry leaders tackled decarbonization challenges in sectors such as shipping and steel. Additionally, the Breakthrough Agenda and Hydrogen Declaration of Intent fostered international collaboration and clean energy solutions for a 1.5°C future.

Industry's significant share of global CO<sub>2</sub> emissions (around 30 per cent) demands a sharp reduction to achieve the Paris Agreement's target of limiting global warming. Established at the UN Secretary General's Climate Action Summit in September 2019, Leadership Group for Industry Transition (LeadIT) being a collaboration between Sweden, India, and the World Economic Forum (WEF), tackles this challenge by promoting public-private partnerships for a smooth industrial transition. At Swedish Pavilion of COP28, India has jointly hosted LeadIT's 2.0 version which has emerged as a beacon of leadership, bringing together industry pioneers, experts, and stakeholders to foster collaboration and drive meaningful change.

Besides leadership engagements and high-level ministerial dialogue, COP28 corroborated India's individual and collaborative determinations that not only included LeadIT initiative but also joined its forces with Solar Alliance, Coalition for Disaster Resilient Infrastructure (CDRI), Big Cat Alliance, and the Green Credit Initiative worthy enough to get mention.



## India at COP28: Balancing Ambition, Equity, and Development

India played a crucial role at COP28 by focusing on two key pillars of 'ambition' and 'equity' backing with leadership, advocacy, and widening range of its engagements.

- i. **Ambition:** Reiterating its commitment to the Paris Agreement, India pledged to achieve net-zero emissions by 2070 and updated its NDCs with more ambitious targets. These include:
  - a. Reducing emissions intensity by 45 per cent from 2005 levels by 2030 (increased from the previous target of 33–35 per cent);
  - b. Increasing the share of non-fossil fuels in the energy mix to 50 per cent by 2030 (increased from the previous target of 40 per cent), and
  - c. Creating an additional 3 billion tonnes of carbon sink through afforestation by 2030.
- ii. **Equity:** The country emphasized the principle of common but differentiated responsibilities and respective capabilities, advocating for developed countries to take greater responsibility for historical emissions and provide financial and technological support to developing nations such as India for their climate action efforts.
- iii. **Leadership:** Prime Minister Narendra Modi launched the "Green Credits Initiative" in collaboration with the UAE and COP28 Presidency. This initiative aims to incentivize voluntary environmental actions beyond NDCs.
- iv. **Advocacy:** India championed the interests of developing countries, particularly the BASIC group (Brazil, South Africa, India, and China), pushing for issues like equity in climate action and addressing the letdowns of developed nations in fulfilling their commitments.
- v. **Engagement:** India actively participated in negotiations, side events, and discussions, sharing its experiences and perspectives on various climate change challenges and solutions.

### Hope Bloomed Amidst Challenges

COP28 marked a turning point in the fight against climate change with several significant developments. Besides adoption of the Loss and Damage Fund, stepping forward Global Renewables and Energy Efficiency Pledge (aiming to triple renewable

energy capacity by 2030), Climate and Health Declarations, other notable achievements also include the Declaration on Climate, Relief, Recovery and Peace, with support from 70 governments and 39 organizations, aiming to build resilience in vulnerable regions. Additionally, the UAE's USD 30 billion Climate Investment Fund and the Food and Agriculture Systems Declaration, signed by over 130 countries, further demonstrate global commitment to tackling climate change. The renewed emphasis on achieving zero deforestation by 2030, initially set at COP26, further underscores the urgency and growing global consensus in tackling this critical issue. While challenges remain, COP28 has inculcated hope for a cleaner, healthier, and more sustainable future through concerted global efforts. ■

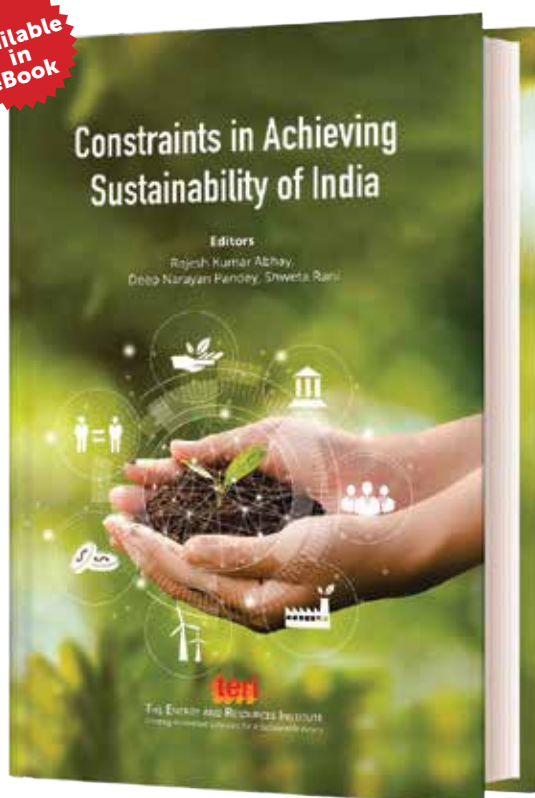
## The Ocean's Voice Amplified in Climate Action

At COP28, partners of the Ocean Pavilion and associated stakeholders called on world leaders to recognize the ocean's critical role in climate regulation and support efforts to expand and improve ocean observations worldwide, including in under-observed regions. This call to action was reinforced by the Ocean Declaration, which emphasized the need for increased ocean observations to inform climate solutions. The declaration highlighted that 2023 saw record-breaking ocean changes, and scientists require more data to fully understand the implications. COP28 was therefore seen as a vital opportunity to acknowledge the ocean's crucial role in climate regulation. Moreover, the author who penned this article also got his slot on "Climate Change and Role of the Ocean," picked under the "Ocean Climate Spotlight" following a global call. This demonstrates the growing recognition of the ocean's importance in addressing climate change. Remarkably, the UN Ocean Decade and Ocean X, located in the blue zone of COP28, curated specific Ocean Climate Solutions Dialogues and Ocean Climate Spotlights, emphasizing the crucial role of the ocean in achieving the ambitious goal of maintaining the 1.5-degree limit and preventing catastrophic climate change.

*Dr Anil Pratap Singh, General Secretary & Founder Director, Global Science Academy (GSA), Basti, Uttar Pradesh; Website: [www.gsaindia.org](http://www.gsaindia.org)*

# Study of the challenges to sustainable development via scientific means

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Purpose of the book is to develop, contribute, and disseminate scientific knowledge pertaining to the issues related to sustainable development. The chapters are developed so that the contents can facilitate comprehension of the major constraints in achieving sustainability including but not limited to environmental, social, economic, and governance-related issues from local, regional, to national level. Resource management, climate change, agriculture, population, education, women, poverty, infrastructure, crime, corruption, governance, are the other relevant topics that have been both identified and suitably discussed. *Constraints in Achieving Sustainability of India* can be utilized as a guiding tool for realizing sustainability in development, especially, in the Indian context.

The Energy and Resources Institute  
Attn: TERI Press  
Darbari Seth Block  
IHC Complex, Lodhi Road  
New Delhi – 110 003/India

Tel. 2468 2100 or 4150 4900  
Fax: 2468 2144 or 2468 2145  
India +91 • Delhi (0)11  
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# Mumbai Festivals Highlight Environmental Concerns

**Manu Shrivastava** says Mumbai has now become the Festival City of India with a new-found focus on environment given the devastating effects of climate change, vehicular pollution, and dipping quality of air. The festivals are promoting sustainable living, awareness about climate change and eco-friendly practices and bringing together people from different walks of life to celebrate nature, discuss environmental issues and share ideas on how to protect the environment.

India's financial capital Mumbai has been abuzz with activity with an array of festivals marking the city's timeline in 2023. Despite a two-year hiatus caused by COVID-19, resolute Mumbaikars have quickly recovered. The city has demonstrated its cultural strength through a series of festivals celebrating art, music, literature, sports, theatre, comedy, and more.

Mumbai has now become the Festival City of India with events happening year-round: And, mostly with a new-found focus on environment given the devastating effects of climate change, vehicular pollution, and dipping quality of air. The festivals are promoting sustainable living, awareness about climate change and eco-friendly practices and bringing together people

from different walks of life to celebrate nature, discuss environmental issues and share ideas on how to protect the environment. Now, Mumbai ensures that environment remains at the top of all priorities even amidst all the festive brouhaha.

In October 2023, the city hosted the 'YVCare Earth Festival' where Mumbaikars got an opportunity to learn about and experience sustainable living. The festival was dedicated to 'Earth, Environment, Ahimsa, Sustainability, Compassion and Health, advocating a Cruelty-free lifestyle' and succeeded in spreading awareness on sustainable lifestyle choices, prevention of animal cruelty and environmental conservation. Events and workshops held here drew attention of visitors on veganism,

deforestation, climate change, global warming, etc., and informed them on the interconnectedness of lifestyle and food choices and environmental sustainability.

## Propagating Timeless Traditions, Indigenous Knowledge

The Government of India's Ministry of Culture's Rashtriya Sanskriti Mahotsav 2023 was held from February 11–19, 2023 at Mumbai's historic Azad Maidan as part of special efforts undertaken by the Indian government to ensure admiration and awareness about indigenous art and culture and the rich heritage. The festival showcased the myriad environment-friendly options, such as jute, handmade paper and wooden artefacts, available for buyers.

The yearly festival organized by the Ministry is hosted by a different state each year where renowned artists and culture icons assemble to showcase India's rich culture and heritage. The Sanskriti Mahotsav was held in Madhya Pradesh in 2019 and, after the COVID-19 induced pandemic, in Telangana in 2022. Mumbai hosted the cultural festivals for the first time this year.

During the nine-day festival in Mumbai, participants and visitors got a chance to experience India's diverse art, culture, craft and cuisine, entrenched in the principles of 'sustainability'



*A medley of tribal dances at the Rashtriya Sanskriti Mahotsav*



and 'aatmanirbharta'. It presented an opportunity for the people to immerse in the vibrant world of Indian culture and indigenous life and gain a deeper understanding of the rich heritage in sync with nature and environment.

Inaugurated by the-then Governor of Maharashtra Bhagat Singh Koshyari, the cultural festival aims to promote National Unity and integrity through cultural exchange. Union Minister of Culture & Tourism, G Kishan Reddy, presided over the opening ceremony that was marked by a melange of multi-hued performances by artistes from across India.

Also present were Maharashtra Minister of Cultural Affairs, Forest and Fisheries Sudhir Mungantiwar and Maharashtra Minister of Tourism, Skill Development, Employment, Entrepreneurship, Women & Child Development Mangal Prabhat Lodha.

Speaking on the occasion, the-then Governor Koshyari pointed out how India is now on a path of renaissance to keep the rich culture and timeless traditions alive. Rashtriya Sanskriti Mahotsav strives to pass on India's rich heritage and indigenous knowledge to the next generation. It is envisioned to become a world-famous event like the Kumbh Mela, symbolizing *Ek Bharat Shreshtha Bharat*.

At the festival, over a thousand performers and artists, including 150



craftsmen from the seven Zonal Cultural Centres of the Ministry of Culture, participated to showcase the art and craft of their respective states. During the cultural celebration, performances of more than 350 tribal and folk dancers, 300 local folk artistes and traditional martial art practitioners enthralled the audience.

## Sustainable and Environment-Friendly Wares

The grand festival venue also housed Angan, an exhibition space, home to more than 70 stalls with artefacts and wares representing different states of India on display for exhibition and sale and 25 stalls of Maharashtra State Handloom Department.

Historically, across India and among indigenous groups, it's the inspiration

derived from nature and the environment that drives talented local artistes and artisans who go on to create works with colours and textures customized for niche landscapes.

The wares on display at the Mahotsav were symbolic of the sustainable and environment-friendly practices adopted by local artisans and tribal craftsmen. Some of these included bamboo craft from Assam; mud pottery or maati shilp from Uttar Pradesh and Haryana; jute wares and wooden artefacts from Puducherry; wooden toys from Uttar Pradesh; and Channapatna wooden wares from Karnataka.

The states also displayed their traditional art, textiles and handlooms including Odisha's Pattachitra—a folk art form with origin that can be traced back to the 5th century CE. Pattachitra comprises cloth-based scroll paintings representing Oriya folktales, scenes and legends from Indian mythology and gods and goddesses. Traditionally made on palm leaves, now it is done on silk or cotton cloth, coated with a cooked solution of powdered tamarind seeds, chalk, and gum.

Bihar's Madhubani art that developed in the ancient city of Mithila was also at display in the festival. Madhubani artwork mostly depicts man and his association with nature. The themes represent a holistic universe with natural objects like sun and moon and flora and fauna. Kalamkari, a type of hand-painted cotton textile produced in Andhra Pradesh and Telangana, was also at



An installation at the Kala Ghoda Arts Festival



An installation depicting plastic waste

display at the venue. Kalamkari uses only natural dyes and the motifs are heavily inspired from the various elements of nature.

Himachal Pradesh's handprint garments, Rajasthan's lac or lacquer jewellery that is made from the resinous secretion of lac insects, bamboo and cane wares were among a sea of sustainable options available for the environment-friendly buyer.

Among the many food options at the venue were local dishes of each state such as Bihar's litti chokha, Gujarat's undhiyu made from fresh seasonal vegetables, Rajasthan's bajra and missi roti made from millet flour, Kashmir's Kahwa, etc. Several food stalls had organic dairy products and organic spices and foods prepared by local women Self-Help Groups that empower women and promote local products.

## Man and the Sea

In December 2022, the Mumbai Urban Art Festival (MUAF) returned to Mumbai for a three-month haul to highlight the intricacies of the man-environment interface. The festival concluded in February 2023.

The theme of the festival rested on making art accessible to diverse audiences while contributing to urban regeneration and the cultural landscape at large. As part of MUAF, immersive

installations, landmark murals and experiential exhibitions were seen at key venues across the city including at Churchgate Station, Sassoon Docks, Mahim East and Bandra that drew attention of the people to environmental issues affecting the city.

Permanent outdoor murals and indoor experiential exhibitions at Sassoon Docks drew people in big numbers. As part of the art festival, large-scale site-specific installations and light-based works highlighted life in the sea and glimpses of human interactions with the sea.

The first part of Sassoon Dock Art Project was 'Intuitions. Between the sea and the city' and the exhibition aimed to pose questions about man's complex relationship with the environment, more specifically with water and the expanding hyper-city. The second part 'Illusions. Between the sea and the city' reflected on some of the 'complexities of the transactional reality, by proposing alternative, fluid and expansive views'.

In Mahim (E) Art District, lying between Mahim Station and Dharavi, large-scale murals and urban tactical interventions such as edible gardens, multipurpose seating, sport courts, etc., were added as part of the festival, to highlight issues of urban spaces and landscaping.

In a city like Mumbai, constantly in flux, where space is a luxury and an

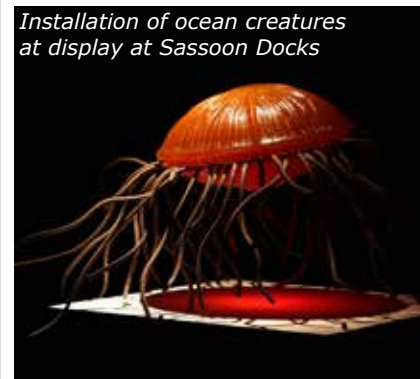
ever-growing population constantly exerts pressure on natural resources, an understanding and awareness of sustainable space management practices is essential. The MUAF also created landmark murals painted on large facades at vantage locations across the city focussing on ecological narratives. In a concrete jungle like Mumbai, the artistic interventions aimed to engage public in the discourse and create in them appreciation and value for the city, its resources and environment at large.

## Advocating Sustainability through Art

One of the most prominent festivals in Mumbai is the week-long Kala Ghoda Arts Festival (KGAF) that takes place every year in February at Kala Ghoda in South Mumbai. The festival is known for its vibrant atmosphere, innovative art installations and events where people from all walks of life participate.

In 2018, Kala Ghoda Arts Festival, following its motto of maintaining and preserving Mumbai's heritage and art, went 'green'. The festival's green theme titled 'Hara Ghoda' emphasized on sustainable and environment-friendly living with many installations incorporating elements of nature and brands experimenting with the theme as well.

At the latest edition of the festival in February 2023, the 'Hara Ghoda' returned with installations drawing attention



Installation of ocean creatures at display at Sassoon Docks

to sustainable living, recycling, and reducing waste. One such installation made with plastic waste was a call for people to 'go green' and segregate waste especially plastic from the non-plastic waste.

A panel discussion, during KGAF 2023, to discuss one of the biggest concerns of the time, climate change, highlighted how climate change does not get sufficient media attention or space in national discourse and there's a need to amplify environmental concerns. During the discussion, the panellists also spoke about 'mindful' consumption and sustainable living and sustainable business practices that do not burden natural resources.

Incidentally, in Mumbai, the year started with a grand music festival held by global music phenomenon Lollapalooza in January 2023. Mumbai was their first-ever edition in Asia. The two-day musical extravaganza at Mahalaxmi Race Course brought together musical talents from across the world.

In a first-of-its-kind gesture, several green initiatives were implemented as part of #LollaForChange during the festival. These included preventing food waste, reducing single-use plastic, minimizing garbage, adopting eco-friendly practices on a large scale and



*Sustainable wares on display for sale at a stall during Rashtriya Sanskriti Mahotsav*

emphasizing on a climate-conscious approach to 'live entertainment'.

To achieve the goal of becoming a zero-garbage festival, steps were taken to minimize single-use plastics and non-recyclable materials through every stage of the festival organization and production. Volunteers assisted attendees with the waste segregation process. To reduce the number of glasses used for drinks, environment-friendly reusable cups made from crop waste were offered.

## Hurling to Freedom

Velas, located in Mandangad Taluka in Ratnagiri, is situated at approximately 230 km from Mumbai. The coastal town

and ecotourism destination is known for its beaches, Harihareshwar Temple, Bankot Fort and the famous Velas Turtle Festival or the Velas Kasav Mahotsav. Also known as Olive Ridley Turtle Festival, it offers visitors a chance to witness the birth of young turtles—as they begin a new life from hatching to crawling their way into the ocean. The annual event is part of the conservation event of sea turtles and their natural breeding process.

Velas is a nesting site for Olive Ridley Turtles and home to 40 per cent of turtle nests along Maharashtra's coastal belt. Turtles come ashore for breeding and lay eggs and hundreds of nature-lovers turn up on the beach to witness the magical event. The best time to visit is between March and April.

Interestingly, it was in 2018, for the first time, that 80 newly-hatched baby Olive Ridley turtles were spotted at Versova beach in Mumbai. Since then, Mumbaikars too have been supporting the endangered species with their presence.

In August 2023, the Supreme Court ordered status quo be maintained after an activist filed an appeal against a National Green Tribunal (NGT) order underlining the eco-sensitivity of the zone. ■

*Manu Shrivastava regularly contributes articles to TerraGreen. Images Credit: Manu Shrivastava.*



*Sustainable wares on display for sale at a stall during Rashtriya Sanskriti Mahotsav*

# Soil and Water

## A Source of Life

World Soil Day, observed annually on December 5, is dedicated to raising global awareness about the pivotal role soil plays in sustaining life. The sustenance of our planet relies on the critical connection between soil and water. In this article, **Muskaan Negi** and **S K Bhardwaj** emphasize that soil and water, essential for nutrient absorption by plants, intricately bind our ecosystems together.

Life begins and ends with the soil. It serves as the foundation for food, medicine, and naturally purifies water through its layers, providing pure drinking water. Unfortunately, soil is often taken for granted, with the assumption that it will always be abundant. However, this is not the case. It takes 200 to 400 years to form a mere 1 cm layer of soil, and creating fertile soil demands nearly 3000 years. Fertile land is essential for maintaining a healthy ecosystem and ensuring food and nutritional security.

World Soil Day is an annual observance that takes place on December 5, dedicated to raising global awareness about the crucial role of soil in sustaining life. Our planet's sustenance depends on the crucial link between soil and water. Over 95 per cent of the food

is produced from these two fundamental resources. Soil and water, vital for nutrient absorption by plants, binds our ecosystems together. This symbiotic relationship is the foundation of our agricultural systems. Given the significance of these elements, the theme for World Soil Day 2023 has been designated as "Soil and Water: A Source of Life". The nexus between soil and water is a fundamental aspect of terrestrial ecosystems, influencing various biogeochemical processes and ecosystem functions. Water plays a pivotal role in the genesis of soil through the processes of weathering and erosion. Over geological timescales, water, acting as a solvent, gradually breaks down rocks into finer particles. This process contributes to soil formation, determining the physical and chemical characteristics of the soil

matrix. Water serves as a primary vehicle for the movement of nutrients within the soil profile. Through processes such as advection and diffusion, water transports dissolved minerals, organic compounds, and essential elements, facilitating nutrient uptake by plant roots. This nutrient transport mechanism is critical for the health and productivity of terrestrial vegetation. Soil, with its intricate pore structure, acts as a natural filtration system for water. As water percolates through the soil profile, physical, chemical, and biological processes contribute to the removal of contaminants and impurities. Soil particles and microbial communities play key roles in adsorption, precipitation, and transformation of substances, resulting in improved water quality. Soil plays a vital role in water conservation and management. Through processes such as infiltration, percolation, and retention, soil regulates the flow of water within the landscape. Soil acts as a reservoir during periods of excess precipitation, preventing surface run-off and potential erosion. Conversely, during dry periods, soil releases stored water to sustain plant life and maintains ecological balance. Understanding the soil-water relationship is crucial for assessing and managing ecosystem health. Changes in precipitation patterns, land use, and climate can have profound effects on soil-water dynamics, influencing nutrient availability, groundwater recharge, and





overall ecosystem resilience. The intricate web of life on our planet is intricately woven into the fabric of soil and water ecosystems, forming the cornerstone of biodiversity and providing crucial ecosystem services essential for life on Earth. Serving as a backdrop for biodiversity, soil and water encompass a diverse range of ecosystems, from microscopic life within the soil to aquatic realms such as wetlands, rivers, forests, and grasslands. These environments serve as vital nurseries, feeding grounds, and shelter for an astounding variety of flora and fauna, emphasizing the indispensable role of soil and water in sustaining diverse ecosystems. Healthy soil, serving as a cradle of life, fosters biodiversity through a complex interplay of physical, chemical, and biological factors, supporting both soil fertility and resilience. This biodiversity, in turn, contributes to the health of above-ground ecosystems by regulating nutrient cycles, enhancing plant health, and providing food. Furthermore, soil and water offer a myriad of ecosystem services crucial for human well-being, including carbon sequestration, water purification, and flood mitigation. Recognizing and nurturing this delicate balance between soil, water, biodiversity, and ecosystem services is not only an

ecological imperative but a fundamental necessity for ensuring the well-being of our planet and future generations in the face of climate change and environmental challenges.

However, in the face of climate change and human activity, our soils are being degraded, putting excessive pressure on our water resources. Erosion disrupts the natural balance, reducing water infiltration and availability for all forms of life. Land and soil water degradation pose a major threat to global food security and to the achievement of the Sustainable Development Goals (SDGs)—compromising the well-being of at least 3.2 billion people around the world. Globally, about 25 per cent of the total land area has been degraded. Four billion tonnes of fertile soil was being lost per year, largely due to unsustainable agricultural practices. If this trend continues, 95 per cent of the Earth's land areas could become degraded by 2050. Around 98 million hectares (29.7%) of India's total geographical area (TGA) of 328.72 mha underwent land degradation during 2018–19. Around 84 mha underwent desertification in 2018–19. This was greater than the 81.48 mha in 2003–2005 and 82.64 mha in 2011–13 that underwent desertification. Loss of soil

biodiversity, soil erosion, pollution and salinization are all critical issues that need to be addressed to ensure food security, livelihoods, and health for all. The health of soil is intricately linked to the success of crop growth and the efficiency of water utilization in agriculture. A fertile and well-maintained soil provides a favourable environment for plant roots, facilitating nutrient uptake and supporting robust crop development. Soil structure, organic matter content, and microbial diversity influence water retention and infiltration, directly impacting water availability to crops. By fostering optimal soil conditions, the overall water use efficiency can be enhanced, ensuring that each drop contributes effectively to crop growth.

Promoting sustainable agricultural practices is the key to preserving soil health and conserving water resources. Techniques such as conservation tillage, cover cropping, and crop rotation help maintain soil structure, reduce erosion, and enhance water infiltration. Precision irrigation technologies and the adoption of drought-resistant crop varieties further contribute to efficient water use. Integrating organic farming practices and agroforestry not only enriches soil fertility but also aids in water conservation by minimizing run-off and improving

water-holding capacity. Embracing these practices forms a sustainable pathway towards ensuring long-term agricultural productivity while safeguarding soil and water resources.

Despite the benefits of sustainable practices, agriculture faces challenges in maintaining soil and water quality. Intensive farming methods, excessive use of agrochemicals, and inadequate irrigation practices can lead to soil degradation and water pollution. Soil erosion poses a significant threat, stripping away topsoil and compromising its structure. Managing nutrient run-off and pesticide residues to prevent contamination of water sources remains a persistent challenge. Climate change-induced shifts in precipitation patterns also contribute to uncertainties in water availability, impacting both soil and crop health. Addressing these challenges requires a holistic approach, emphasizing the adoption of conservation practices, precision agriculture, and resilient water management strategies.

Sustainable land and water management is crucial amidst growing environmental challenges, demanding a delicate balance between agriculture, ecosystems, and water resources for long-term resilience. Conservation agriculture, minimizing soil disturbance and utilizing diversified crop rotations,

reduces erosion and enhances organic matter, ensuring sustainable land use and preserving water quality. Agroforestry integrates trees into agricultural landscapes, offering benefits such as erosion prevention and improved water infiltration. Precision agriculture employs technology for optimized resource use, enhancing crop yields while minimizing environmental impact and conserving water. Integrated water management considers surface and groundwater, incorporating practices such as rainwater harvesting and efficient irrigation to conserve water resources. Cover cropping protects soil from erosion, enhances nutrient cycling, and reduces water evaporation. Sustainable urban planning employs green infrastructure to mitigate storm water run-off in urban areas, preserving both land and water resources. Community engagement and education are pivotal for successful implementation of sustainable practices, fostering awareness about water conservation, responsible land use, and biodiversity. Soil conservation practices, including contour plowing and cover cropping, are indispensable for maintaining soil integrity and protecting water quality. These diverse and interconnected approaches collectively contribute to building resilient ecosystems, ensuring food

security, and preserving water resources for future generations, addressing the challenges posed by climate change and environmental degradation. In response to these threats, global initiatives addressing soil and water conservation have gained momentum. Organizations such as the Food and Agriculture Organization (FAO) and the United Nations Environment Programme (UNEP) are at the forefront, advocating for sustainable land management practices and raising awareness about the importance of preserving soil and water resources. International collaborations, including the Global Soil Partnership and various watershed management projects, aim to implement strategies that mitigate soil degradation, improve water quality, and promote sustainable agricultural practices. These initiatives underscore the necessity of a collective and concerted effort on a global scale to address the imminent challenges posed by the degradation of soil and water resources.

Soil and water, undeniably stands as an interconnected pillar of sustenance for all living organisms, the intricate relationship between soil and water shapes landscape and sustains life itself. Recognizing their profound significance requires a collective commitment to preserving and protecting these invaluable resources. A holistic approach, combining individual responsibility with global initiatives based on conservation and sustainable practices, is paramount to ensure the vitality of these elements. In the changing climate, balancing a relation between soil and water is crucial for fostering ecological resilience and safeguarding the overall health of our planet. ■

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*Muskaan Negi, PhD Scholar and Project Associate, Department of Environmental Science, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh and S K Bhardwaj, Department of Environmental Science, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh.*





# Terra Youth

Joining Hands  
for a Greener  
Tomorrow

# The Issue of Single-Use Plastic Pens

## How Gurgaon Teenagers are Tackling this Problem

Green Forest Ink is an initiative designed to promote the use of eco-friendly newspaper pens, aiming to replace conventional plastic body pens. Crafted by rural women in India, the production of these pens not only provides them with a livelihood but also empowers them. Continue reading to learn more about this impactful initiative led by Gurugram teenagers like **Sadhika Anand**.

The entire world is talking about sustainability and single-use plastic. Worldwide, campaigns have started to combat the issue of plastics with pictures of sea creatures engulfed in plastic. This issue is pressing and the major contributors to single-use plastic have been plastic bags, disposable bottles, and cutlery. However, there is one item that we use daily and yet forget to categorize: plastic pens.

The market is inundated with pens that come in varied types. Most pens are designed to work until they stop. At the end of their lives, they just don't disappear; they land in landfills because most pens are either not recyclable or people don't take the action to send them in for recycling. In India, an

astonishing 1600–2400 million plastic pens flood the market annually, with only a mere 9 per cent of this plastic waste being recycled at best. During an environmental audit at our school, we discovered that a staggering 98 per cent of students rely on plastic pens, which are disposed of after single use.

Upon recognizing this issue, we, as students, felt compelled to take action. The ubiquitous presence of pens in our lives inspired us to envision a better future for the planet and for future generations. This vision gave rise to Green Forest Ink, an organization dedicated to advocating for the use of 100 per cent sustainable newspaper pens. Our primary goal is to diminish the plastic waste generated within our



community. After carefully designing pens with newspaper and a plastic refill, we collaborated with an NGO called "ACT Paper Wings" based in Gurugram (earlier Gurgaon) where the rural women of India make our pens.

The USP of these pens is that they are sustainable and are made from newspapers collected from various societies across Gurugram and act as a raw material. After the ink of the pen is over, the user can cut the end of the pen with a pair of scissors and remove the refill present inside the pen. This helps in the separation of the plastic refill and the



newspaper part of the pen and these two components can be put in different bins and sent for recycling.

Now, we also recognize that not everyone is willing to switch to newspaper pens and that this habit will take some time. What can be done then? While we can do our best to spread awareness about these pens, we cannot force individuals to buy them. What can be done is recycling of the plastic pens that are being currently used.

Recognizing this, Green Forest Ink started collection drives in societies and schools to collect old plastic pens which are further sent for recycling. Till date, we have recycled 2000+ pens and 35 kg of plastic which includes the pen and other plastic wastes such as stationery, bottles. Even if you are using plastic pens, you can make efforts to recycle them once they are over. This ensures that instead of making its way to the landfill, this plastic is being utilized for a good purpose and is helping our planet.

Along with our recycling campaigns, we take pride in being an awareness spreader! Through our blog which houses 8 curated articles ranging from gardening to sustainable fashion, we impact our audience and bring to spotlight the most pertinent issues around the world. Our monthly magazine which got launched in November 2023 is a combination of games, documentary suggestions as well as world news regarding the environment. We house environment-related crosswords, deep insights into the recently conducted COP28, swadeshi sustainable start-ups as well as literature our readers can read to gain deep insights into sustainability. For us, our audience is our main focus and all content from social media to blogs is curated keeping them in mind.

Keeping in mind all sections of our society, we don't want our awareness drives to be limited to just one section. We conduct workshops with underprivileged children as well as bringing into light the issue of single-use plastic with specific regards to pens.



Till date, we have collaborated with 4 NGOs: Lotus Petals Foundation, Amba Foundation, Harmony House and SK Children's Foundation where we have talked about plastic usage and taught our students how a newspaper pen can be made. Our workshops have already impacted over 180 students, and we remain committed to extending this reach.

As young changemakers, even the smallest of actions can help our planet prosper. At the end of the day, every little step counts. None of your efforts go to waste. Even if you've taken small steps like refusing single-use plastic, you are a changemaker and the world admires you for this. If you want to bring change, this article is your motivation to get started! And you don't need to be alone in it, ask

your friends and family to help you out in your initiative.

We started out as a team of two but with the help of our 20+ volunteers we have managed to conduct collection drives in 14 societies across Gurugram and three schools. As a changemaker, don't be afraid to ask for help as all of us care about these issues and we are all working towards a common goal: to save our planet. At this time, we need to stand united and work towards saving our planet and writing a better future! ■

*Sadhika Anand is a 17-year-old studying at The Shri Ram School, Aravali, Gurugram, Haryana. She is a teen writer and an eco-warrior passionate about educating people about the prevailing environmental problems and making them love our ecosystem! In case you are interested to learn more about this initiative, click the link: <https://greenforestink.wixsite.com/green-forest-ink>*

# CoRWA Spreads Its Wings Further to South

## CoRWA-Bengaluru Formed

The Confederation of Resident Welfare Associations (CoRWA) serves as the Pan India Apex Body for Resident Welfare Associations (RWAs) across the country. CoRWA's primary objective is to advocate for a sustainable urban environment, with RWAs playing a crucial role in local urban governance. This article focuses on the inception of CoRWA – Bengaluru.

The Confederation of Resident Welfare Associations (CoRWA) is the Pan India Apex Body of the Resident Welfare Associations (RWAs) in the country. The main objective of CoRWA is to strive for a sustainable urban environment with the RWAs playing a pivotal role in local urban governance.

Founded in the year 2012 at Hyderabad, Telangana, this apex body made rapid strides during the last 11 years and established its Federations in different States. The UFERWAS, APFERWAS, CoRWA-Kerala, CoRWA-Gujarat, CoRWA-UP are such State RWA Federations spreading the RWA Mission in their respective States.

The National Conference of RWAs (NCRWA) organized by CoRWA every year is an ideal occasion where RWAs across the length and breadth of the country meet in a particular city for

two days mostly in the last week of November every year. So far, CoRWA has organized nine such NCRWAs. Every year, the focus discussion revolves around a particular theme on urban environment, such as pollution, greenery, water crisis, rainwater harvesting, solid waste management, urban flooding, encroachment-free footpaths (EFF), Real Estate Regulation Act (RERA), Role of RWAs in local self-governance, electoral reforms, etc. These NCRWAs are attended by hundreds of RWAs of the country.

The 10th National Conference of RWAs (NCRWA) was organized in Bengaluru by CoRWA jointly with the Bengaluru City University (BCU), on November 25–26, 2023 in the BCU campus. The Focal Theme of this Conference was “Save Energy and Protect Environment”.

Speaking on this occasion virtually the Union Cabinet State Minister, Honourable



*CoRWA- Bengaluru Team with the Vice Chancellor of Bengaluru University, Prof. Lingaraj Gandhi*

Rajeev Chandrasekhar said that he himself has been a part of an RWA and played a role in reviving a few lakes in this city. He further said that RWAs must make the Municipalities accountable. RWAs are the big catalysts for change. They must fight against the vested interest of corrupt contractors, municipal officers, and politicians.

Adviser to the Government of Andhra Pradesh, Shri Rajan Chibbar, Guest of Honour, congratulated the members of CoRWA for adopting the “Never Give up approach” and organizing National Conferences of RWAs in different metropolitan cities on an annual basis since last 11 years and raising issues of public interest.



*Release of RWA Annual Status Report (Souvenir) - Copy*



Union Cabinet State Minister, Hon'ble Shri Rajeev Chandrasekhar, speaking in virtual mode

Former Chief Secretary of Karnataka Shri Arvind Jadhav and Director of MQI College of Management, Dr Prabhu Dev, while speaking on the theme of this conference said that protection of environment is a constitutional duty covered in section 51(A) of the Constitution.

The Chief Convener of CoRWA and Conference, Colonel T P Tyagi, Vir Chakra, called for a comprehensive overhaul of Municipalities to enable them to deliver maintenance services with the agility of a quick reaction team. Tasks that can be carried out by a junior unit should not be delegated to a senior unit. "Every RWA serves as a primary school of democracy and, therefore, must be actively involved in decision-making," emphasized Tyagi.

Senior functionaries of CoRWA—Dr KSR Murthy from Visakhapatnam; Shri JMS Nagarjunan from Chennai; Shri Ramesh Prabhu from Mumbai; Shri BT

Srinivasan from Hyderabad; Shri Pawan Kaushik from Ghaziabad; Shri Sharad Kumar from Bengaluru, Smt. Ruby Makhija from Delhi; and Shri Ajith Kumar from Thiruvananthapuram were unanimous in asking the political parties to include the demands of RWAs in their manifesto. They further emphasized that the performance grant to municipalities should be reassigned to RWAs.

In the technical Sessions that followed the Inaugural Function, presentations were given by eminent RWA workers on encroachment free-footpaths, solar energy, rainwater harvesting, Real Estate Regulation Act (RERA), functioning of municipalities, role of RWAs in local urban governance, reforms needed in the election manifesto of political parties, and other important urban civic issues. A Souvenir was also released on this occasion.

HBR RWA, Bengaluru represented by Shri Prasanna Kumar and Vasumati and MSI Bengaluru, represented by Smt. Naveena Shridhar and Smt. Sandhya Pawar were declared as the Men and Women of the 10th NCRWA. Another highlight of this year's NCRWA is the Exhibition of several environmental products related to solar energy, organic food products, electrical vehicles, etc. Sri RSV Badrinath and Uday Shankar Peyyeti of UFERWAS, Hyderabad, made extraordinary efforts in bringing the sponsors to the NCRWA platform.

On the second day of the NCRWA, Mr Sharad Kumar, Senior Executive Vice President of CoRWA and the Convener of the Bengaluru Conference, proudly announced the establishment of CoRWA – Bengaluru, to a resounding applause from the delegates. ■

Article by Dr K S R Murthy, Col. T P Tyagi, Vir Chakra and Shri B T Srinivasan, CoRWA.

# Christmas

## As It Used to Be, As It Should Be

In this article, **Dr Elsa Lycias Joel** reflects on her childhood Christmas experiences. She notes that modern living room conversations often focus on the bygone era when Christmas held more profound meaning than just cakes, gifts, and carol services. Despite concerns about the future decline of the Christmas spirit, she highlights the present season as an opportunity for connection, reconciliation, and meaningful conversations. The power of “Merry Christmas” becomes even merrier when shared with a small cake in hand.

Every year by the end of October, I receive frequent calls and emails from family and friends wanting to know what’s happening at my end or how Christmas is going to be or if I’ll visit my mom. Something about Christmas motivates people to connect. Then the conversation continues until Christmas gets over or we meet and make up for the lost months or maybe years. Two reasons behind all these are the closing down of offices and companies for Christmas or people exhausting their excessive leave

balance. Whether we live in a village or a city or a town, Christmas brings an aura unknown to all irrespective of their faith or religion, as a result of which people transform into beautiful welcoming and hospitable beings. This season gives everyone an opportunity to build a connection, make amends over a wrong, conquer all inhibitions to invite and get invited for a good chat and try to resolve imaginary hostilities, all with those two words ‘Merry Christmas’, which sounds merrier with a small cake in hand. These

magical 12 days of Christmas fly by as fast as the Peregrine Falcons and most people find themselves too busy to share a smile or a kind word, forget receiving a reply in one complete sentence.

These days, conversations in living rooms are mostly centred on bygone years when Christmas meant more than just cakes, gifts and carol services or about how pathetic Christmas is going to be in the future. Since I know what Christmas was like in my childhood, I know aunts, uncles, grandaunts,



granduncles and cousins aren't exaggerating. At homes, there were no heaps of gorgeous goodies that were the best, the most expensive, the latest, the newest or the most exclusive but there was a sense of belonging that nobody could resist. Kind words, deeds and smiles were real, in dead earnest. All they discuss makes a lot of sense to all but the Gen Z who try so hard to get everything into their system.

Thanks to the olden days. Christmas these days is special only because each one tries to recreate or relive good old memories. Cakes and delicacies never looked perfect but they tasted heavenly. In our household, all ingredients that went into the making of eatables had a history such as being carefully processed for months by a dedicated family member or gifted by a loved one or shipped or sent from a far-off place. So, when a delicacy was made or eaten, memories or talks revolved around so many people. Whether it was dark rum or wine or whisky or brandy in which dry fruits were soaked, the person entrusted with the responsibility of shaking the airtight jar or topping it with more alcohol was adored or frowned upon by self-declared cake connoisseurs, after the Christmas fruit cake was baked. Many a time, this role was played by all in turns so that not one person alone bore the brunt of a notorious oven or a bad baker. I don't know who in the family came up with this idea of shared responsibilities, from sourcing ingredients to processing



*Santa is in town*



*Family on a Christmas eve*

dry fruits to measuring the flour to baking the cake. Kudos to her/him, nobody could find fault with anything cooked or baked during Christmas. Yes, love was in the air. Lessons were taught and learnt in a subtle yet profound way. The first best set of delicacies was shared with the less fortunate as well as the missionaries who lived around to make lives better.

There were no Christmas markets in my village. Thankfully, Christmas shopping was not in vogue. Shopping for the sake of shopping was and is too stressful to me. But I was in want of nothing. New clothes were in my clothes chest though I never cared much and gave my parents a tough time to make me wear new clothes to church. My mother still complains that I always chose that one old frock with Chelsea collar over everything and I was the sole reason behind the bickering between her and my dad, as we got ready for church. Aunts and uncles tried in vain to make me feel jealous about well-dressed cousins. Anytime, I was told that my new clothes would be given away I would come up with a list of beneficiaries. Not bragging but unlike many kids, I felt mighty pleased to see 'other kids' wearing

my clothes because those 'other kids' lived in an orphanage nearby. Secretly, I wished my cousins also wore one of their favourite old clothes and gave away the new ones. Later, when I knew I played my best part because generosity isn't about giving away what we do not need but what we may need and that which we are ready to forsake, I felt truly wise.

Even before the box of fireworks and crackers arrived from Sivakasi, the fireworks capital of India, I heard stories from my mom about the children working there. At that tender age I could keep myself away from bursting and burning that stuff for three reasons. One, my dog Tiger was terrified of loud noises. Two, I knew it wasn't right for kids to be working. Three, it felt so horrible to imagine people and kids with corroded nails, asthma and other diseases making those fireworks so that others could enjoy watching the sky being lit up. Neither was I part of the fun that lacked common sense nor did my plans to drench the box with water materialized. Hence, I took away my share of fireworks and sparklers, hid them in the spandrel but never found them again. Also, I believed Father Christmas took them away. I guess I had my own ways of



*Minchin street*

seeking seasonal cheer which always extended for another one year.

Lights, garland, tinsel and ornaments were shared among kids. Every kid wanted every other Christmas tree to look as grand as his/hers. It was never about flaunting the best decorated tree in one's home but it was about making sure all trees of known people lacked nothing that another tree had. For instance, if my tree had a few baubles and I found a tree in another home with none, I readily shared half of what I had. This sharing continued until each tree had only one bauble. And if I had only one candy cane on my tree, I readily made a few, if necessary, with the resources I had at home. Whenever adults glanced at my tree, I had reasons

to begin a conversation about the candy canes without warbles and why certain baubles stayed glued to branches and where all my stuff went. Learning to improvise or make the best use of scarce resources was a Christmas routine. Parents and grandparents did teach us to share and care, giving away the best we had, through their actions. That sense of pride or accomplishment I felt whenever I could make other kids happy matched nothing. Free workshops I conducted with a tone that did not match my smile made me a bit famous among the 6 or 7 I knew. Teaching them to wrap crushed paper balls with gift wrappers or giving them all the bottles of glitter nail paints I found in my house to colour the handmade baubles and woollen threads

to hang them made me an expert of sorts. Friends who could never follow my instructions to use a needle to put a hole ended up sticking those baubles in their trees with glue or tape.

People rarely mentioned the words 'mine' and 'yours'. It was ingrained in us that we'd enjoy Christmas in the right spirit if we just shared. The menage, young and old, transformed into bakers, sous chefs, devoted kitchen staff, patient babysitters, listeners and interior designers, as and how the situations demanded. Given my unbelievable power of imagining things, I remained the undisputed storyteller who could hold the attention of all kinds of kids for hours, making the job of child whisperers easy for them. Happily, I remain so.

In our house, when relatives started trickling in, practising carols would begin in small groups and even two people sounded like a strong team. If ever I sat still in a place while awake, it was when dad, his brothers, cousins or my grandfather sang or made music. At that tender age, I understood they were flawless because they sounded just as the ones I heard from the gramophone records. Mayaki Paati, our housekeeper and also my confidante could sing a few carols and chorus in spite of not having the wherewithal to learn to read or write any language. This is proof of music being an intrinsic part of our home.



Carolling was an integral part soon after the Advent began. It wasn't just about the members of church choirs visiting houses. Friends got together as groups, practised their favourite songs even if few of them could not carry a tune in a bucket and visited people as and when they pleased. Carollers were welcomed with warmth, one of Mayaki Paati's renditions and food. They did not just sing and leave. At times they stayed up late, talking, remembering and laughing. People had the energy for all these and more. Kids waited for carollers till they dozed off and never complained when music and banter woke them up way past midnight. Whenever carollers came and went unannounced, hosts made the most of limited resources with love. Evening strolls to enjoy the Christmas decorations, lights, small Christmas trees and mangers made of Citronella grass locally known as *chukkunaari pullu*, along the Minchin street, Neyyoor felt like a fairy tale. We could hear people singing or playing music in their homes. The musical influence of the British missionaries on the natives was laid bare before us. A stroll around the village to see the Christmas lights which are best viewed only when we are walk around or stop by to enjoy the details. Stars that shone in the highest branches of trees made people talk about the bravest person in particular houses. Pitching in to help friends who were still getting



their houses decorated was also about replacing the serenity and calm with jokes, laughter and carols. People were funny, patient and unbelievably kind.

Christmas Tree Day in school was special. All children looked forward to their role in plays, singing carols, dancing, distributing cakes, and decorating the tree. Nobody went without a role. Each one had a reason to be proud of them. Come November, dancing and singing practice alternated with six periods of school lessons. Nothing was taken for granted. Every student had two businesses: his/her own and Christmas business. Rehearsals were held on holiday evenings too. Since the school

was pretty close to the Dartmouth Chapel, we heard choristers practising their parts. I prayed that my uncles, aunts and cousins would arrive home well in advance so that I could display my talents. Dropping a hat, missing a beat, Santa hats that fell down in the middle of Jingle bells dance, dance partners who pulled and pushed the other too hard and similar instances were not retained as bad memories but as nostalgia and evidence that all of us put on a great show, no matter what. My memory of that day convinced me that behind each remark lay no hidden condescension and behind each smiling face there was no scorn, unlike other days. None of the familiar sights and sounds of celebrations dampened our spirits. Cousins of classmates who visited my hometown for a week or two during Christmas resisted going back to their homes, which pleased us.

It was Christmas. I knew, as surely as I knew anything, that advent season brought with it a magnificent optimism. We were indeed blessed to have the very best, truly the best kind of Christmas. Evidently, we had a Perfect Christmas or we worked together to hide defects, if any. ■

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*Dr Elsa Lycias Joel regularly contributes articles in TerraGreen.*





## Study Finds New Clues about Warming in the Arctic

The Arctic, Earth's icy crown, is experiencing a climate crisis no other. It's heating up at a furious pace four times faster than the rest of our planet. Researchers at Sandia National Laboratories are pulling back the curtain on the reduction of sunlight reflectivity, or albedo, which is supercharging the Arctic's warming. This data dive could be the key to cracking the Arctic amplification code. "The uneven warming in the Arctic is both a scientific curiosity and a pressing concern, leading us to question why this landscape has been changing so dramatically," said Erika Roesler, an atmospheric and climate scientist at Sandia.

Previous studies have suggested that sea-ice albedo feedbacks are likely driving Arctic amplification. These albedo feedbacks can be broken down into two main areas. First, there's an overall reduction in sea ice, leading to more exposure of the dark ocean. This absorbs more sunlight than snow-covered ice and raises temperatures

Source: <https://www.sciencedaily.com/>

## Wastewater Surveillance Is Key Tool in Keeping Schools Open during Public Health Emergencies

Wastewater surveillance is a potent tool in understanding COVID-19 transmission within school settings, according to a groundbreaking study led by epidemiologist David Larsen from Syracuse University. The research team's work that was published recently in *PLOS Global Public Health* establishes the pivotal role of wastewater analysis in managing the public health response to COVID-19 at schools.

The surveillance demonstrated high levels of sensitivity, positive predictive value (PPV), and negative predictive value (NPV) in wastewater surveillance. While the specificity of wastewater surveillance at the school was observed to be lower, the strong correlation between the amount of SARS-CoV-2 RNA recovered in wastewater and COVID-19 cases highlighted its potential in understanding transmission risk within the school.

Source: <https://www.sciencedaily.com/>



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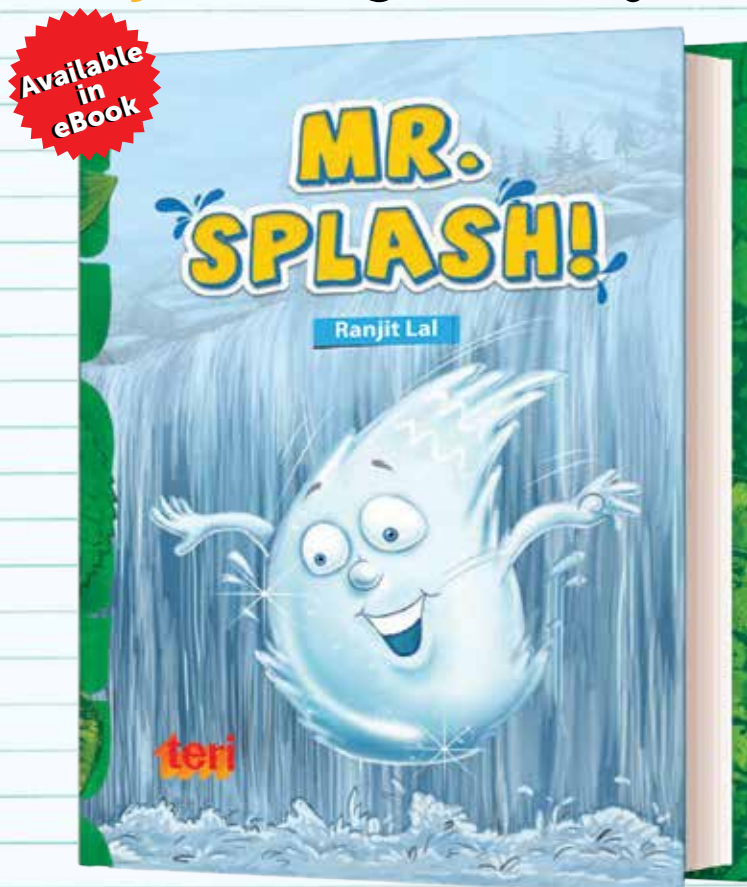
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# The Alternative Tracks Waiting to Be Tapped

Book Review by Parsa Venkateshwar Rao Jr

**Book:** MAKE IT BIG: Inspirational and Motivational Stories of Achievers and Influencers

**Conceptualized and Edited by:** N Kalyani

**Publisher:** Prabhat Prakashan

**Pages:** 139

**Price:** INR 300

This is a unique compilation of unknown and unsung heroes and heroines who have taken brave idealistic decisions in their personal lives and chose passion over career, and in other cases succeeded in turning their choices of passion into life-fulfilling careers. The editor, N Kalyani, has done something different. The temptation of a journalist is to grab an interesting story about an individual and write about her or him. Instead, Kalyani has made the extraordinary individuals write first person accounts of the extraordinary things they did with their lives. Most of the 15 persons chosen do not fit the label of celebrities because then it would be easy to market the book. This one goes against the grain. It is the story of the little known persons who achieve

happiness and fulfilment, and they were not bothered about fame.

The first and the last first-person narratives are that of Isaac D Kehimkar and Dr AJT Johnsingh, who are both wildlife enthusiasts. They grew up surrounded by natural habitat, and found their vocation in nursing wildlife. Kehimkar made a bold choice in choosing a career with Bombay Natural History Society (BNHS), though the salary was modest. And then through an assignment for *Sanctuary Asia* magazine, he got involved with butterflies and they became the mainstay of his life, writing a book on butterflies for the beginners to writing one on butterflies of India. The life story of Johnsingh lies at the other end of wildlife of butterflies of Kehimkar. It is about elephants and lions, and the



preservation of wildlife. These are not usual careers picked by a majority of people. Both Kehimkar and Johnsingh have found the ideal career mixed with passion.

The journeys of Kunal Kumar, Dr Manu Gupta, and Ananthoo take a different turn. While Kunal as chef finds ways of combining food with spiritual living which also takes in ecological concerns as well as he moves from Ananda spa in Rishikesh to a Michelin star chef in Devonshire, UK, where organic food became the theme. It is after his return to India and while working at Hilton Shilim in Western Ghats that he writes *The Original Organics Cookbook*. Then he moved to Tanzania where he lived with Wambulu Masai and there he discovered new ingredients at the farm which



became the input for his cooking. He moved back to India to work at a holistic retreat in Dehra Dun and moved to Costa Rica and then to Maldives. His has been a journey across the world of spiritual and physical well-being through organic cooking and organic farming. Purposeful but it needed the courage to experiment.

Gupta found his vocation away from what he was studying at the School of Planning and Architecture in New Delhi when he went off to Gujarat with a few of like-minded fellow-students to help victims of natural disaster in the cyclone at Kandla in Gujarat in 1998, and thus began his work for helping rebuild shattered habitat and lives. There was the earthquake in the Himalayas and cyclone in Odisha, where he worked along with the people affected by the natural calamities. And the rescue operations became the fulcrum of his work in the years to follow. Writes Gupta who got his doctorate from Kyoto University in 'community-based disaster management': "We have since worked with over 3 million people across India and neighbouring countries, and 'had boots on the ground' in over 35 major emergencies."

The story of Ananthoo, or Ananthasayanan, follows a trajectory close to the growth cycle of cotton, which spreads agriculture and textile business. A telecom engineer who had



*Dr A J T Johnsingh in Eravikulam National Park. Photo: Dr M D Madhusudan*



worked in Switzerland, he returned to India in 2006, and chose to work "in areas of safe food, sustainable agriculture, rural livelihoods, and cotton value chain." As founder of Tula, an organization engaged with growing 'desi cotton' and taking it through the process of yarn, the fabric then woven handlooms and the garments stitched by 'economically and socially marginalized' groups. This also extended to growing cotton through organic farming. Tula was founded in 2007 in the wake of farmers' suicides. Ananthoo is interested in sustainable rural economy, which is environment-friendly.

If these are the stories of individuals who found their life's mission in reaching out to others, then Kalyani has brought in the stories of those who broke away from the career norms and made a mark of finding freedom and fulfilment in their own lives. Simi Rajan enjoyed her stint as a teacher of biology at school. But, she decided to pursue art when she painted during her leisure hours. Then she decided to pursue mural art. She learnt the art in the traditional 'gurukula' system at the Guruvayur temple apart from the masters. It shows that you need not be satisfied with doing one thing well, which in her case teaching biology. But you can master another vocation and be successful at that.

Anjali Pathak's story is dramatic. After getting a PhD in ancient Indian history in the USA, she found herself at a dead-end when she came back to India. So, she chose to turn to naturopathy. She found that she was not able to do much because the roots of the ailments of her patients were in the foods she ate. She studied 'Vrikshayurveda,' an ancient Indian science of organic farming. Her journey led her to the northeast, where she helped tea farmers with organic farming. This experience inspired her to write the book "Annam Brahma: Organic Food in India" in 2009. In 2019, based on her knowledge gained from cultivating medicinal plants like 'vishalata' or Sabah snake grass, proven to be an effective supplement for cancer patients, she founded the company 'Hariyaali Organics.' Pathak chose an alternative path and discovered the significant impact she could have in reaching out to people.

Kalyani has done a tremendous job in bringing to light these extraordinary life journeys, which could prove inspirational to many people feeling entrapped in their humdrum lives with no apparent way out. These stories reveal that a world of opportunities awaits if one reaches out to them. ■

*Parsa Venkateshwar Rao Jr is a freelance journalist based in New Delhi.*

# Geeta Dham

## A Museum with a Twist

In this article, **Rajshekhar Pant** introduces us to **Dr Yashodhar Mathpal**—a multifaceted talent recognized internationally in academic circles as one of the top experts in prehistoric archaeology, particularly in the field of cave art. Additionally, as an acknowledged painter, he has to his credit numerous solo exhibitions in various European countries and the USA.

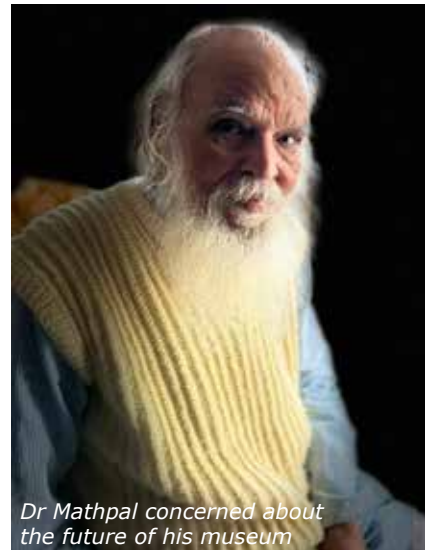
An avid conservationist who upholds Gandhian values, Dr Mathpal has established a museum in his residence named Geeta Dham in Bhimtal. The museum features three expansive galleries projecting the compatibility of human life with the environment as it existed in the central Himalayan region in days gone by. The diverse array of objects and a selection of his paintings on display compel and condition visitors to introspect and sense the degeneration to which we have subjected ourselves.

**B**umping into him for the first time did give me the feel of standing face to face with a 19th century rustic, straight from the pages of some musty volume by Tolstoy, Turgenev or Chekhov. A tall robust frame, broad forehead with a receding hairline, big spatulated palms—he was draped in a coarse khadi *dhoti-kurta* and was putting

on an ordinary flip-flop slippers. I could make it out that his was an arcane profile.

Known in both sides of Atlantic for his original work in the field of prehistoric archaeology, especially the cave and rock art, Dr Yashodhar Mathpal is also a gifted painter and has to his credit several solo exhibitions in India and abroad.

Speedily degenerating environment



*Dr Mathpal concerned about the future of his museum*



*Paddy plantation on the beats of tamborine. An example of community farming, no more in practice. Water colour by Dr Mathpal*

and the eco-degradation consequent upon the paradigm shift in values and traditions in the vast swaths of the Central Himalayan hills—the region he belongs to—have over the decades become such a grave concern for him that at times he finds it difficult to hide his cantankerousness on this issue. For the last few decades through his writings, spoken words, paintings and his unique collection of antique objects and archaeological finds, representing the



*An art work by Dr Mathpal depicting the filtration of potassium rich ash from cobs, to be used with rice polish to clean the clothes*

eco-friendly lifestyle as it was in the days of yore, he has been trying to educate the masses, especially the youngsters, in the ethics of environment and ecological balance—which he refers to as “the indispensable twin requirement of quality life.” Exhausting a major part of his earnings he has set up three huge art galleries in an area of over 17,000 square feet in his residence called Geeta Dham at Bhimtal in the state of Uttarakhand. Having to his credit the experience of setting up quite a few museums in the central India and elsewhere, realizing his long-cherished dream of initiating a personal one as a representative set-up of the environment, art and ethnic-culture of the vast central Himalayan region must not have been a difficult task for him, at least technically. However, getting three huge art galleries constructed and

that too without receiving any financial assistance from the government or any other source, was definitely not an easy accomplishment even for this ingenuous and intrepid Gandhian.

Criss-crossed by the vivid perception of a trained archaeologist and sentimentality of a spontaneous artist, the museum of Mathpal is an authentic commentary on the role of the unique environment of the central Himalayan expanse in conditioning the regional life, art and culture as they were in the days gone by. Looking at the various artifacts, implements, wearing, papers and his own paintings, a visitor inside the museum may feel and understand that besides a wholesome diet how the regional inhabitants would meet most of their requirements from the locally available resources and how all that was taken

would finally get returned to the nature.

It indeed is an astounding experience to reconstruct the whole gamut of life as it was then, taking a lead from a variety of objects displayed in the museum. Astounding, because here you see centuries old hand printed garments made of locally available fibre and they haven't yet lost their original sheen. The locally available fibre of Sisal and Grevia is hardly used now. You notice here the kiln backed bricks of considerable antiquity used by early herder settlers to make chambers for storing grains. Interestingly, brick baking hasn't been in practice here at least for a couple of centuries. A hoard of agricultural implements made of locally mined iron have also been unearthed by him from a nearby ravine. It is a testimony to the hard labour put in by early agriculturists



*Worshipping the threshold by the females of the house was once a common tradition. A canvas by Dr Mathpal*

while cutting stepped fields on the face of mountains. An amazing collection of wooden utensils, once a common household belonging in hills, is also there. This art was once practised by the Van Raji tribals whose population is speedily dwindling. A land record on hand-made paper called 'badua kagaz' dating back to the Chanda dynasty that surfaced up in this region way back in 6th century AD, is also there. It has evidences to show that how community assets such as pastures, springs, etc., were taken care of. The lyrical water colour paintings of Dr Mathpal displayed here project an

authentic picture of quite a few eco-friendly traditions associated with the day-to-day life—like extracting sap from the branches of Grewia tree for washing hairs or filtering the potassium rich ash of cobs to be used as detergent mixing it with rice polish. A beautiful painting captures the celebration of Harela or festival of greenery at the advent of monsoon.

The fascinating objects displayed in the museum combining with his explanatory monologue waft the visitors deep into the corridor of time—when bulldozing the mountains with Pokland

and JCVs was not a way of life. Coming out of the museum one cannot help realizing that how respectful and considerate our ancestors had been in their relationship with the environment well before the expressions like carbon footprints, eutrophication, greenhouse effect, and so on, were coined. Also, that how stupid it is for their inheritors to sit gratified on the gunpowder keg thinking that it is dampened forever and ever.

He has been conferred upon the Padma-award and the state government made him the vice president of the cultural council offering him a beaoned car and other fanfare (which he of course did not accept). Ministers, including the



*Land record of the period of Chanda dynasty. It is on the hand made badua kagaz*

CMs of the state and other big-wigs have been visiting his museum right since the inception of the state. Many a times, substantial grants have been announced by these ministers and their cohorts for the museum in public functions amidst massive cheering and clapping. It all gets covered in the regional press quite prominently but so far no funds have been released. In his recently released autobiography, he speaks without mincing his words of the high-ups and their hangers-on asking him on their visit to his museum to prepare a project report doubling the required amount, so that they may pocket the inflated half in lieu of the service rendered for getting the grant released. "No one in this callous system" he rues, "did ever try to understand me or sympathies with my vision. I am an octogenarian now; I never ran after money or materialistic gains throughout my life. My only concern is to make this museum self-financing so that it continues even after I am gone."

An experienced curator and archaeologist that he is, all the three galleries of the museum have been set in a standard manner. All he wants from the government is a corpus sufficient enough



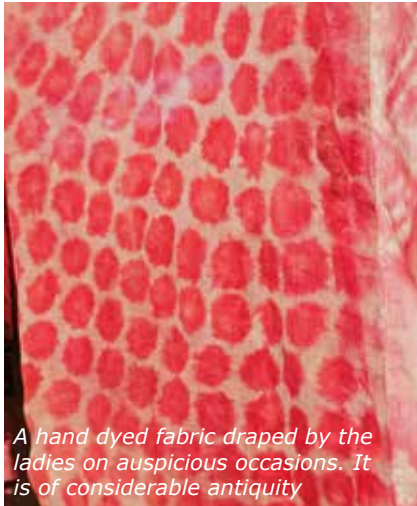
*Colouring the earthen figurines for Harela festival. A painting by Dr Mathpal*

to provide regular salaries to a handful of employees he wants to have to look after the museum. "With the advancing age, it has now become difficult for me to put in the required physical labour for maintaining this museum, to ensure the safety of the rare and perishable displays and keep the things clean," says he. The nonchalance of the government and the administration may well be understood by the fact that despite being praised

by the scholars the world over and being located along the highway on which runs the tourist traffic to the various destinations in hills, the museum hasn't yet been put in the tourist circuit developed by the state government and its agencies. He has requested for this favour several times but save assurances nothing has been achieved so far. A documented remark made on him by Prof. Dr Majeed Khan Advisor, Deputy



*An umbrella made of wild Bauhinia leaves*



*A hand dyed fabric draped by the ladies on auspicious occasions. It is of considerable antiquity*



*Making 'patta' from natural colours. An old water colour by Mathpal*

Ministry of Antiquities and Museum, Kingdom of Saudi Arabia, in the tribal art conference organized by the Asiatic Society at Kolkata in March 2005 hasn't yet lost its edge. It reads—

"I must say that I never met a person of your knowledge, a great artist, scholar, rock art specialist and a man of religion but not fanatic..... I am surprised that your valuable contribution to both the ancient and present art, and your efforts to highlight the image of India in general and that of the traditional, tribal, social and cultural values all over the world

have not been recognized officially by the Govt of India and that of your region..."

The five acres of sprawling slopes at the back of the museum in Geeta Dham—once a sear and brown landscape—is full of the woody vegetation now, of which around 300 species have been documented by his son, a trained forester. Over fifty species

of birds have taken permanent shelter here. This forest has been grown by Mathpals at the altitude technically known as problem zone due to excessive biotic interference. The well-organized forest and land mafia of this region has been eying it for long and a case against illegal felling and extraction of wood by these goons in this forested area, has been filed by him in the district court.

On the wrong side of eighties Dr Mathpal is more like a tired soldier who finds it difficult to withdraw from the din of an ongoing battle. He bids me an adieu with these words putting his heavy hand on my shoulders. "My life, whatever little I could achieve and this museum are all well directed endeavours to establish that a happy, satisfied and meaningful life can be lived in complete harmony with nature, without assuming an aggressive attitude towards it..."

The childlike innocence in his eyes, I know it well, will keep on haunting me for long. ■

*Rajshekhar Pant is an amateur filmmaker, photographer, and writer, who has written over a thousand write-ups, reports, etc., published in the leading newspapers and magazines of the country. He can be reached at [pant.rajshekhar@gmail.com](mailto:pant.rajshekhar@gmail.com).*



*Entrance to the cultural gallery at Geeta Dham*



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Website: [https://](https://internationalconferencealerts.com/eventdetails.php?id=2333315)

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## 3rd Green Investment & Sustainability Summit 2024

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## World Sustainable Development Summit 2024

February 7–9, 2024

New Delhi, India

Website: <https://wsds.teri.in.org/2024/>

## International Conference on Environmental Science and Green Energy

February 14–15, 2024

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## Eco Sustain Expo 2024

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