

TerraGreen

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EARTH
MATTERS

VOLUME 17 | Issue 6-7 | September-October 2024

TERRA YOUTH

Young Indians Ditching
Luxury for Sustainability

IN CONVERSATION

Dr Vishal Singh,
Executive Director, Centre for Ecology Development and Research

SPECIAL HIGHLIGHTS

Navigating the Urban Future
Floods Deadlier than Poaching

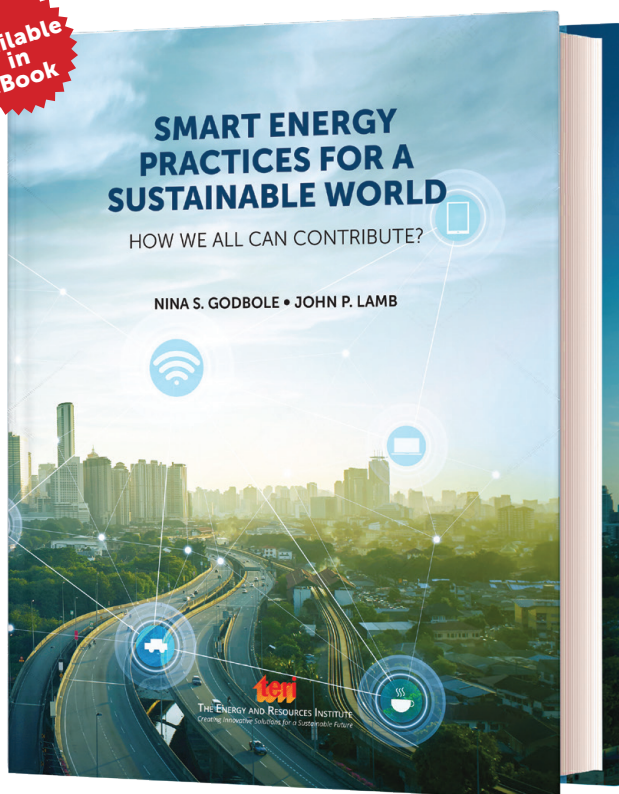
GIS for SDGs

UN SDG Agenda 2030 and GIS in India



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- Smart Buildings
- Sustainable Practices for Green Health Care Services
- Knowledge and Behaviour for a Smart Planet
- Worldwide Case Studies for Green Practices

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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.

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EDITORIAL



“ As a powerful tool, GIS empowers authorities to adapt strategies for SDG implementation, promoting environmental sustainability and achieving set targets. ”

Geographic Information Systems (GIS) are crucial in supporting the implementation and monitoring of the United Nations' 17 Sustainable Development Goals (SDGs), along with their associated targets and indicators. GIS, with its focus on location data, is a key technology that allows individuals globally to monitor progress both locally and across different geographical scales. By providing detailed layers of information, GIS helps people everywhere explore and understand the interconnections between different regions and communities with the potential to enhance and monitor the progress of the goals. Globally, the progress in achieving SDGs by 2030 have not proceeded at the desired pace. Catalysts needed to hasten the SDG process include historical and current demographic data, change in population density for resources estimation, anticipated habitat change, local wildlife and their living conditions, and finally the impacts of climate change in those geographies. Such a granular level data repository may be maintained through leveraging GIS.

This month's cover story, "GIS for SDGs," emphasizes the essential role of GIS in advancing the SDGs. By offering tools for efficient data collection, analysis, and visualization, GIS aids in monitoring environmental changes, managing natural resources, and supporting urban planning. Ultimately, GIS enables the creation of evidence-based policies that drive progress across various SDGs. It allows users around the world to share ideas for addressing resource needs, designing sustainable land use, and protecting the environment, ensuring a viable future for all. As a powerful tool, GIS empowers authorities to adapt strategies for SDG implementation, promoting environmental sustainability and achieving set targets. The ongoing innovation in technology will help leverage advanced spatial analytics to facilitate tracking biodiversity and ecosystems to evaluate climate change and its impact. Such a tool will certainly empower the authorities to redesign strategies in SDGs' effective implementation to achieve environmental sustainability and set targets.

I am confident that the articles in this edition of *TerraGreen* will strongly resonate with our readers. Your insightful suggestions have greatly improved the publication, and I encourage one and all for an open dialogue and sharing your valuable ideas and reflections.

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

Vibha Dhawan
Director-General, TERI



Apropos the cover story on safe reuse of treated water (SRTW) published in the August 2024 issue of *TerraGreen*. I agree with the authors that for effective implementation of SRTW in a city, a pre-feasibility assessment should be carried out, which maps the supply and demand of water, identifying the roles and responsibilities of the different governing bodies, and assessing of the wastewater treatment infrastructure that exists and is planned for. The second step involves potential reuse options, consisting of listing the possible ways of reuse and identifying the treatment technologies appropriate for the purposes of the reuse of the treated water. The last step involves the feasibility assessment, which identifies the business models that would be best suited for the water reuse options and the technology requirements for the same. These need

to be incorporated into state policies too, along with insights from experts, to assist stakeholders in making informed decisions.

Pallavi Krishna
Hyderabad, Telangana

I liked reading the article on managing crop residue published in the August 2024 issue of *TerraGreen*. The article rightly highlights that the burning of paddy straw in Punjab and Haryana significantly contributes to rising pollution levels in Delhi each October and November. To combat this issue, the states are implementing various methods, including the use of Super Seeder machines. These advanced agricultural implements not only incorporate paddy residue into the soil but also help manage crop residue more effectively. By reducing the need for stubble burning, Super Seeders play a crucial role in mitigating air pollution and enhancing soil health. They simplify residue incorporation, improve soil structure and fertility, and support microbial activity and nutrient cycling. Additionally, these machines minimize the need for extra tillage, saving both time and fuel for farmers. The adoption of Super Seeders across India is expected to improve soil management practices, promote environmental sustainability, and boost agricultural productivity.

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<http://www.teragreen.teriin.org>

Contents

VOLUME 17 • ISSUE 6-7 • SEPTEMBER-OCTOBER 2024

- 4 **NEWS**
- 12 **FEATURE**
Navigating the Urban Future
- 18 **IN CONVERSATION**
Dr Vishal Singh,
Executive Director, Centre for
Ecology Development and
Research
- 22 **COVER STORY**
GIS for SDGs
- 30 **SPECIAL REPORT**
Tasty and Healthy Indian Thali

- 34 **GREEN CHALLENGES**
The Role of Branding at MRFs
and MRCs
- 37 **TERRA YOUTH**
- 46 **WILDLIFE**
Floods Deadlier than
Poaching
- 49 **PIONEER**
- 60 **GREEN EVENTS**

12
FEATURE



30
SPECIAL REPORT



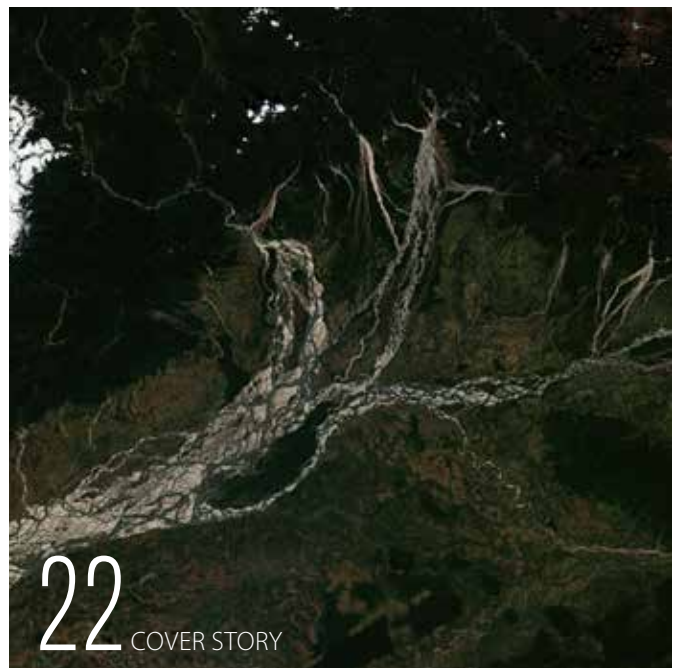
10 ENVIRONMENTAL
RESEARCH



37 TERRA YOUTH



22
COVER STORY





India's First Green Hydrogen Fuelling Station in Leh

Amara Raja Infra has completed construction of India's first green hydrogen fuelling station in Leh, Ladakh, for NTPC Ltd. Union Minister for Power and Housing and Urban Affairs

Shri Manohar Lal inaugurated the facility recently. The fuelling station project with a capacity of producing GH_2 of 80 kg per day was completed in two years, at extreme conditions at a height of 3400 metres above sea level with temperatures varying between -25°C and 30°C , the company said. The landmark project will enable emission-free transport in and around Leh—making India among the few countries to take the lead in the green mobility space. With the completion of the project, NTPC will now operationalize five hydrogen fuel cell buses in the region.

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

Delhi CM Atishi Launches Delhi Solar Portal

Delhi Chief Minister Atishi recently launched the Delhi Solar Portal as a single-window application and tracking site for the installation of rooftop solar panels in the city.

Under Delhi's solar power policy, launched in March 2024, consumers can install solar panels on rooftops and use the power generated to offset electricity bills. Atishi said the new portal will help achieve the target of 750 MW rooftop solar power generation.

The portal will provide all information required for the installation of rooftop panels.

"It will have a solar calculator to estimate solar power generation capacity at a specific rooftop, savings to be made, list of vendors, and rate of solar plants," she said.

Source: <https://indianexpress.com/>



IIT-Delhi, IEA Strengthen Collaboration on Clean Energy Technology, Transitions

The International Energy Agency (IEA) and the Indian Institute of Technology Delhi (IIT-Delhi) have signed a Memorandum of Understanding (MoU) on the role of energy technology innovation in reducing emissions and leading clean energy transitions. The MoU, which establishes a framework for cooperation between the two organizations, was signed by IEA Executive Director Dr Fatih Birol at the energy agency's headquarters in Paris, and remotely by IIT-Delhi Director Prof. Rangan Banerjee and deputy director for strategy and planning, Prof. Ambuj Sagar. The MoU identifies key areas of collaboration, including policy analysis to foster energy innovation and information exchange on energy technology trends, particularly in emerging and developing economies.

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



'The Way Indians Eat Can Save the Earth': WWF's Living Planet 2024 Report

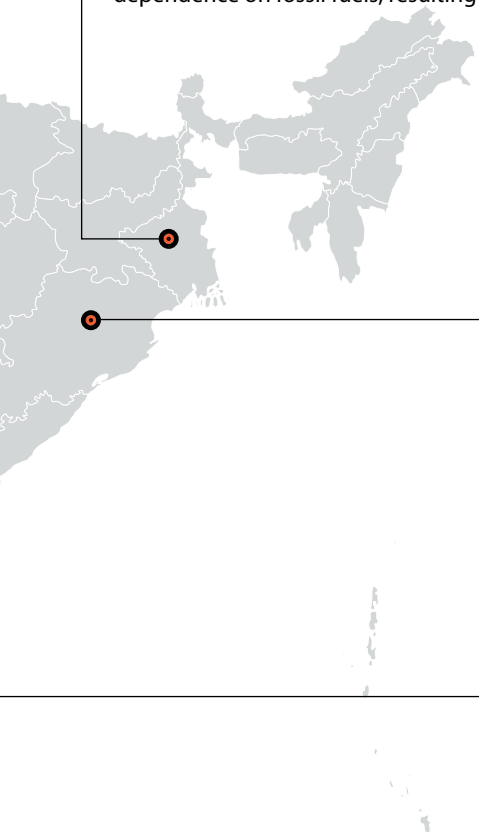
A report by the World Wide Fund for Nature (WWF) indicates that food consumption patterns among Indians are more sustainable than those of several big economies. The way Indians consume food would require less than one earth (0.84) to support food production by 2050 if every country adapts its pattern. That's how green an Indian person's plate is. Indonesia (0.90) comes a close second to India when it comes to sustainable eating habits. Meanwhile, countries like the US, UK, France and Russia are mentioned way below on this list. WWF's Living Planet Report of 2024 says, "Eating more sustainable diets would reduce the amount of land needed to produce food: grazing land, in particular, could be freed up for other purposes, including nature restoration and carbon sequestration."

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

India's Annual Temperature to Rise 1.5°C by 2057, if Emissions Stay Moderate

India is set to experience drastic climate shifts, with annual maximum temperature projected to rise by 1.5°C by 2057 under moderate emission scenarios, while this rise in mercury could occur a decade earlier in case of high emissions, a report by Azim Premji University revealed recently. The projections in the report, Navigating India's Climate Future – Climate Projections for India (2021–2040), are based on scenarios outlined by the Intergovernmental Panel on Climate Change (IPCC). Moderate emissions pathway assumes partial reduction in emissions and adaptation efforts, while high emissions scenario foresees heavy dependence on fossil fuels, resulting in more severe climate impacts.

Source: <https://www.business-standard.com/>



Tamil Nadu to Restore Seagrass in Gulf of Mannar

Indiscriminate use of fishing trawlers in the shallow waters off Tamil Nadu coast has not only resulted in degradation and loss of seagrass over the decades in the ecologically sensitive Gulf of Mannar, but has also put marine species like the sea cow (dugong) and green turtle under threat.

With seagrass serving as one of the three major stocks of blue carbon, the Tamil Nadu government has decided to restore 15 acres of degraded seagrass and new seagrass meadows along the coast of the Gulf of Mannar. The project, which will cover 5 acres each in Thoothukudi, Keelakarai, and Mandapam regions in Thoothukudi and Ramanathapuram districts, is aimed at rehabilitating the vital ecosystems by implementing seagrass plantations using shoots collected from nearby healthy seagrass beds.

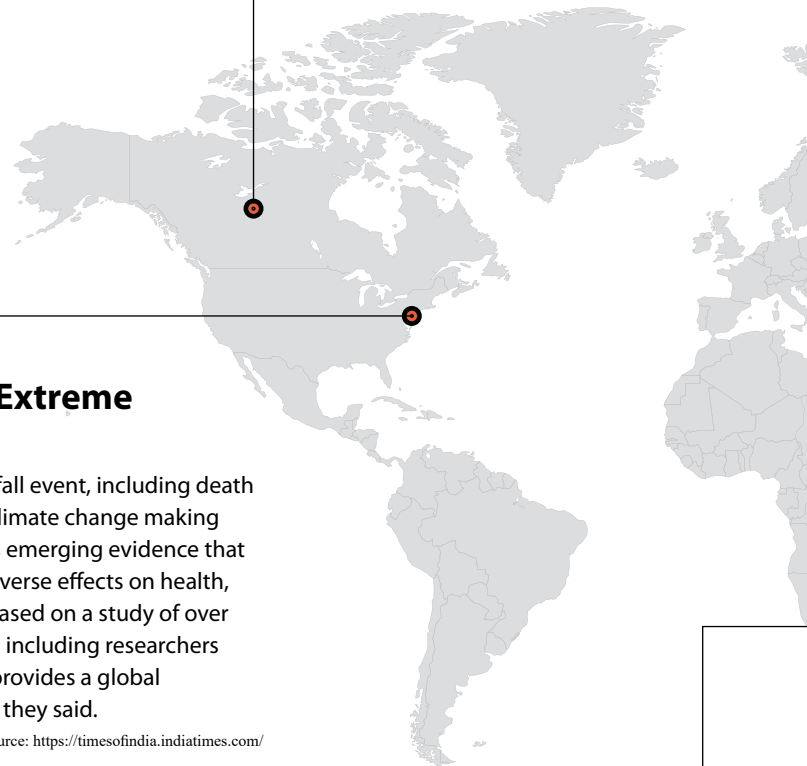
Source: <https://www.deccanherald.com>



Seventy-three Per Cent Decline in Wildlife Populations in Just 50 Years: WWF Report

There has been a steep 73 per cent decline in the average size of monitored wildlife populations in just 50 years (1970–2020), according to WWF’s *Living Planet Report (LPR) 2024*. The report, released globally, warns that, as the Earth approaches dangerous tipping points posing grave threats to humanity, a huge collective effort will be required over the next 5 years to tackle the dual climate and nature crises. The Living Planet Index (LPI), provided by the Zoological Society of London, includes almost 35,000 population trends of 5495 species from 1970–2020.

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



Adverse Effects on Health in Wake of Extreme Rainfall Events

Risk of death was found to rise in the wake of an extreme rainfall event, including death due to heart and lung conditions, according to a study. With climate change making short-term rainfall events more extreme and frequent, there is emerging evidence that suggests a compelling link between these events and their adverse effects on health, especially the spread of infectious diseases, researchers said based on a study of over 62,000 rainfall events across the globe. The study by the team, including researchers from the German Research Center for Environmental Health, provides a global perspective of how extreme rainfall events can impact health, they said.

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

India, South Africa Among Solar ‘Business Hotspots’: Oxford Report

Drawing on the first comprehensive dataset of more than 2300 renewable energy start-ups across Africa and South Asia, a team led by the University of Oxford revealed India and South Africa among solar ‘business hotspots’. The analysis also investigates why some countries, such as Chile and Namibia, produce more solar energy relative to their potential while others fall short—even when factors such as hours of sunlight, availability of fossil fuels or hydropower, and GDP are accounted for. “Our report identifies the countries where—all other things being equal—proactive policies and simple social affinity have created a better-than-expected environment for solar energy,” said lead author Lorenzo Agnelli.

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





COP29 Agrees to \$300 Billion Climate Finance Deal, India Says Amount 'Abysmally Poor'

Developing nations have criticized the \$300 billion annual climate finance commitment from wealthy countries as insufficient at the COP29 summit in Baku. While a deal was reached, establishing a \$1.3 trillion target with significant reliance on private funding, developing nations argued for a greater commitment from historical emitters to address the disproportionate impact of climate change on poorer countries. India was among those who voiced strong opposition to the agreed sum. "The amount that is proposed to be mobilized is abysmally poor. \$300 billion does not address the needs and priorities of developing countries. It is incompatible with the principle of CBDR (Common but Differentiated Responsibilities) and equity, regardless of the battle with the impact of climate change," said Indian delegate Chandni Raina.

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



More than 50 Countries Sign UN Sustainable Tourism Declaration

Tourism often accounts for a large share of a government's hard currency revenues, particularly in emerging countries, and can itself be highly exposed to climate events. In this regard, more than 50 governments have signed a UN declaration to make tourism around the globe more climate friendly, the United Nations said recently, in what it hailed as a major achievement of the climate summit in Azerbaijan. "At COP29 we have achieved a historic milestone by being included in the UN Climate Change Conference Action Agenda for the first time," UN Executive Director for Tourism Zoritsa Urosevic said.

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

World's Oldest Lizard Wins Fossil Fight

A storeroom specimen that changed the origins of modern lizards by millions of years has had its identity confirmed. The tiny skeleton, unearthed from Triassic-aged rocks in a quarry near Bristol, is at least 205 million years old and the oldest modern-type lizard on record. Recently, the University of Bristol team's findings came under question, but fresh analysis, published recently in *Royal Society Open Science*, proves that the fossil is related to modern anguimorphs such as anguids and monitors.

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



Hope amidst Floods and Challenges

IDES technology 'Lighting a Billion Lives Programme' of TERI from Bihar

In this article, **Dr Amit Kumar Thakur**, **Arun Kumar**, and **Prashant Kumar Swain** highlight that in response to the demand for clean energy access in rural households, TERI, in collaboration with JEEViKA and J-WiRES, has implemented 'Lighting a Billion Lives©' in Bihar. The programme has proved to be a game-changer for rural households.

In response to the demand for clean energy access in rural households, TERI, in collaboration with JEEViKA and J-WiRES, has implemented 'Lighting a Billion Lives©' in Bihar. The programme proved to be a game-changer for rural households.

The initiative utilizes clean energy technologies to provide modern and clean lighting solutions to over 50,000

households across 10 districts (Purnia, Katihar, Kishanganj, Saharsa, Khagaria, Madhubani, Gaya, Aurangabad, Nawada, and Nalanda) of Bihar. Additionally, it addresses the energy needs of rural populations, thus ensuring lighting and cooking solutions through the Integrated Domestic Energy System (IDES). These efforts are geared towards rural development, poverty alleviation,

and reducing indoor pollution, while also improving the quality of life for rural communities.

The programme's IDES also promotes rural development, poverty alleviation, and environmental sustainability. In the face of natural disasters, such as the recent floods in four Bihar districts, this programme has played a vital role in supporting affected communities.





Several districts in Bihar, including Saharsa, faced a natural disaster in the form of severe flooding. The Kosi, Gandak, and Bagmati rivers breached their embankments, causing widespread damage to crops, infrastructure, and rural households. Heavy rainfall in Nepal contributed to the flooding, leaving several low-lying blocks submerged.

For instance, in Saharsa's three blocks (Nauhatta, Salkhua, and Maheshi), where 70 per cent of the population was impacted, IDES ensured survival by providing lighting and cooking solutions during the week-long power outage. The IDES systems, which include solar lighting and clean cooking solutions, became lifelines for many households. The solar lighting enabled them to safely navigate during the nighttime and manage their daily activities, while the portable cookstoves allowed for food preparation in safe zones. With no access to electricity, the ability to charge phones became crucial for maintaining communication during the disaster, further demonstrating the system's significance in their survival.

This collaborative effort has transformed households, bringing positive change to families through clean cooking and lighting solutions. It has shown the importance of clean energy technology in both regular and



emergency scenarios. By providing essential lighting and cooking solutions to flood-affected communities, the programme has highlighted the critical role of sustainable energy solutions in disaster-prone areas. With a commitment to expanding its impactful work throughout Bihar, TERI, JEEVIKA, and J-WIRES are making a lasting difference in the lives of rural communities.

What is Lighting a Billion Lives® programme?

Launched by The Energy and Resources Institute (TERI), Lighting a Billion Lives® is a global initiative to facilitate clean energy access and the delivery of last mile energy services for basic and productive use. The initiative enables energy poor communities to transition

from traditional and inefficient energy sources to modern, more efficient and sustainable energy solutions. Operating through an entrepreneurial model of energy service delivery, Lighting a Billion Lives® accelerates market development for clean energy technologies through knowledge sharing, capacity building, and market seeding. This initiative aims to replace kerosene-based lighting with cleaner, more efficient, and more reliable solar lighting devices. LaBL employs an entrepreneurial model of last mile energy delivery to establish micro solar-enterprises in un-electrified or poorly electrified villages. A local entrepreneur trained by TERI and its partner organizations provisions clean energy access to the community for an affordable fee. ■

Climate Change Threatens UNESCO Heritage Sites

Global Sites 'Most at Risk'

Climate risk data analytics company Climate X has modelled how climate change will affect 500 UNESCO Heritage Sites around the world, assessing the physical hazards each site faces including flooding, coastal erosion, landslides, wind-based hazards, storms, and cyclones.

New data has identified which UNESCO Heritage Sites are most vulnerable to climate-related damage. The comprehensive analysis highlights that four of the UK's 35 UNESCO Heritage Sites—The Forth Bridge, St Kilda, and New Lanark in Scotland, as well as Studley Royal Park in Yorkshire—are among the most at-risk sites in the world. Climate risk data analytics company Climate X modelled how climate change will affect 500 UNESCO Heritage Sites around the world, assessing the physical hazards each site faces including flooding, coastal erosion,

landslides, wind-based hazards, storms, and cyclones.

Other UNESCO sites from around the world at highest risk of climate-related risks include India's Sun Temple in Konark, Australia's Sydney Opera House, the USA's Olympic National Park, Switzerland's Swiss Alps Jungfrau-Aletsch, and Korea's Sansa Buddhist Mountain Monasteries. UNESCO selects World Heritage Sites based on their cultural or natural significance through a detailed nomination and evaluation process, requiring them to meet specific criteria of outstanding universal value,

integrity, authenticity, and adequate protection and management.

The analysis was done using Climate X's Spectra platform, which models how climate change will affect properties, assets and infrastructure under various scenarios. The platform's sophisticated algorithms quantify the risk from extreme weather, providing a Google Maps-like interface and allowing users to model the future likelihood of 16 different climate hazards—from extreme heat to tropical cyclones and flooding—across eight warming scenarios over a 100-year time horizon.

Lucky Ahmed, CEO and co-founder of Climate X said: "The potential impact of climate change on these sites is profound. But it's not just our past heritage that's at risk—it's our present, too. While the loss of these cultural treasures—many of which have endured for millennia—would of course be devastating, it's also vital to remember the real societal and economic impact of climate change is happening in the here and now. Our findings serve as a stark warning for governments, preservationists, and the global community to prioritize the safeguarding of our planet—to preserve our ancient monuments and our current assets and infrastructure—and to protect life today and into the future."

Founded in 2020, Climate X is at the forefront of the climate risk data analytics sector, leveraging cutting-edge



technology to provide unparalleled insights into the future impacts of climate change. Its platform creates digital twins of real-world assets and models the climate risk to them based on 500 trillion data points to enable customers (including banks, mortgage lenders, and real estate firms) to assess the impact of climate change events on their assets or real estate.

The 50 most at-risk UNESCO World Heritage Sites globally:

1. The Cultural Landscape of the Bali Province: The Subak System, Indonesia - surface flood, extreme heat days, and drought risks
2. Kakadu National Park, Australia - surface flood and wildfire risks
3. Quanzhou: Emporium of the World in Song-Yuan, China - drought risk
4. Engelsberg Ironworks, Sweden - surface flood and river flood risks
5. Sinharaja Forest Reserve, Sri Lanka - surface flood and extreme heat risks
6. Decorated Cave of Pont d’Arc, known as Grotte Chauvet-Pont d’Arc, Ardèche, France - surface flood and landslide risks
7. West Lake Cultural Landscape of Hangzhou, China - surface flood and drought risks
8. Fujian Tulou, China - surface flood and extreme heat days risks
9. Ombilin Coal Mining Heritage of Sawahlunto, Indonesia - surface flood, extreme heat days, and drought risks
10. Himeji-jo, Japan - surface flood risk
11. Swiss Alps Jungfrau-Aletsch, Switzerland - river flood risk
12. Zollverein Coal Mine Industrial Complex in Essen, Germany - river flood risk
13. Rjukan-Notodden Industrial Heritage Site, Norway - surface flood risk
14. Khangchendzonga National Park, India - surface flood risk
15. Sun Temple, Konark, India - surface flood and drought risks
16. Archaeological Ruins at Mohenjo-Daro, Pakistan - river flood and

- drought risks
17. Cistercian Abbey of Fontenay, France - surface flood risk
 18. Sites of Japan’s Meiji Industrial Revolution: Iron and Steel, Shipbuilding and Coal Mining, Japan - tropical cyclone and storm surge risks
 19. Keoladeo National Park, India - surface flood and drought risks
 20. Srebarna Nature Reserve, Bulgaria - river flood risks
 21. Huanglong Scenic and Historic Interest Area, China - surface flood and drought risks
 22. Historic Centres of Stralsund and Wismar, Germany - river flood, surface flood, and storm risks
 23. Sydney Opera House, Australia - coastal flood and storm surge risks
 24. Studley Royal Park including the Ruins of Fountains Abbey, England - storm risks
 25. Olympic National Park, USA - river flood, surface flood, and landslide risks
 26. Mount Qingcheng and the Dujiangyan Irrigation System, China - river flood and drought risks
 27. Danube Delta, Romania - river flood risk
 28. Komodo National Park, Indonesia - surface flood, extreme heat days, and drought risks
 29. South China Karst, China - river flood, surface flood, and drought risks
 30. Tr’ondëk-Klondike, Canada - river flood and surface flood risks
 31. Bryggen, Norway - coastal flood and drought risks
 32. Provins, Town of Medieval Fairs, France - river flood risk
 33. Doñana National Park, Spain - river flood, surface flood, coastal flood, and drought risks
 34. Red Bay Basque Whaling Station, Canada - coastal flood risk
 35. Ancient Villages in Southern Anhui, China – Xidi and Hongcun - surface flood risk
 36. Royal Tombs of the Joseon Dynasty, South Korea - surface flood risk



37. Sundarbans National Park, India - surface flood and drought risks
38. Ha Long Bay - Cat Ba Archipelago, Vietnam - coastal flood, tropical cyclone, extreme heat days, drought, storm surge, and landslide risks
39. Everglades National Park, USA - coastal flood, tropical cyclone, extreme heat days, drought, and storm surge risks
40. West Norwegian Fjords, Norway – Geirangerfjord and Nærøyfjord - coastal flood risk
41. Archaeological Ruins of Liangzhu City, China - river flood and drought risks
42. Yin Xu, China - river flood, surface flood, and drought risks
43. Vizcaya Bridge, Spain - coastal flood risk
44. New Lanark, Scotland - landslide risk
45. St. Kilda, Scotland - coastal flood risk
46. Jongmyo Shrine, South Korea - surface flood and drought risks
47. Churches and Convents of Goa, India - surface flood and drought risks
48. The Forth Bridge, Scotland - coastal flood risk
49. Zuojiang Huashan Rock Art Cultural Landscape, China - river flood, surface flood, and drought risks
50. Sansa, Buddhist Mountain Monasteries, South Korea - river flood, and surface flood risks ■

For more information, please contact leila@leilapr.com

Navigating the Urban Future

Innovations in City Mobility

Rapid urbanization and rising transportation demands are driving emissions, with the transport sector a key contributor. **Biba Jasmine** highlights how Internet of Things (IoT) and big data are transforming mobility, enabling innovative services and connected ecosystems. IoT integrates sensors into vehicles and infrastructure, enhancing efficiency, safety, and connectivity. She emphasizes that adopting these strategies can improve urban living, making cities more sustainable and resilient. Collaborative efforts among governments, private sectors, and civil society are crucial to building a sustainable urban mobility ecosystem.







Migration to large cities is leading to a rapid increase in the urban population. In developing economies such as India, the demand for personal transportation is increasing due to rising per capita income and aspirations for a higher standard of living. If we were to talk about transportation, it is closely and linked to energy, as it is a major driver of energy demand. There is currently 90 per cent dependence on fossil fuels worldwide, of which 25 per cent of emissions come from the transportation sector. The focus on switching to alternative fuels is steadily increasing but is associated with considerable restrictions. Projections from various studies show that 75 per cent of the increasing demand will come from the transportation sector, as 70 per cent of the population is expected to live in cities by 2050. The desire for mobility hence will have consequences such as poor air quality and congestion, which will affect people's lives in cities.

To create therefore sustainable cities of tomorrow that are multimodal, inclusive and reduce the environmental

impact of mobility, it is evident that a multi-stakeholder approach is essential to generate tremendous momentum.

Transport to Support Human and Economic Development

Transport represents a great opportunity for massive change. The various technologies, from mass transit to advanced technologies such as alternative fuels, must go hand in hand. The combination of the Internet of Things (IoT) and big data is changing the transportation sector today in an unprecedented way. Sources of aggregated data are opening up innovative mobility services and creating new ecosystems.

Although there are several ongoing initiatives in each Indian state, it is clear that there is still much to be done and that the vision to reduce emissions from the transportation sector ultimately depends on a collaborative approach by all stakeholders. This includes the

city administration, urban planners and private sector players, who should work together to develop innovative sustainable mobility solutions. For example, the Indian government has introduced the Phased Manufacturing Programme (PMP) under the FAME (Faster Adoption & Manufacturing of Electric Vehicles in India) India Scheme Phase II. The main objective of the PMP is to promote domestic manufacturing of electric vehicles, their assemblies, sub-assemblies, parts, and sub-components. This is intended to increase domestic value creation.

Internet of Things: Hidden Driver for Transformation in Transport Sector

Mobility is the lifeline of cities and a necessity for urban life, which will be hit by climate change as rising sea levels will have a major impact on major cities, especially coastal cities such as Mumbai and Kolkata. As the population in coastal

cities grows, we need better ways to help people get around getting to work, school and crossings between cities. Therefore, transportation represents a huge opportunity for massive change. It's clear that we have a lot to do. Even if there is no one-size-fits-all solution for transportation, the mix of technologies from mass transit to advanced technologies such as alternative fuels must find a way to work together. There are examples in the energy transition that are quite encouraging: lower energy processes, decentralized generation and access to renewables are creating a revolution in electricity markets and opening up new opportunities through electrification. Based on these trends, many think that the electrification of transportation is the next step, but that is only half the story. The hidden driver of change in the transportation sector is IoT.

IoT is and will continue to play a critical role in transforming transportation by integrating sensors and devices into vehicles and infrastructure, creating a connected ecosystem that improves connectivity, efficiency, and safety. This integration enables smart traffic management, where real-time data on traffic flow, accidents and parking availability enables dynamic adjustments to traffic lights and signs,



significantly reducing congestion and improving traffic flow in cities. Vehicles equipped with IoT technology can communicate with each other and with traffic systems, enabling advanced functions such as collision avoidance and automatic route optimization. In addition, public transportation systems benefit from IoT-enabled tracking and predictive maintenance, which improve reliability and service quality.

Decarbonization of Transport Sector

In parallel with the technological revolution, the decarbonization of the transport sector, which is a major emitter of greenhouse gases (GHGs), is being driven forward. The transition to Electric Vehicles (EVs), supported by a charging infrastructure powered by renewable energy, plays a crucial role in this. However, the adoption and penetration of EVs across the country is highly dependent on the quality and accessibility of charging infrastructure and facilitating a supply chain for storage batteries.

In addition, the promotion of public transportation, micro-mobility options such as bicycles and scooters, and the integration of alternative fuels are important strategies to reduce emissions and create a more sustainable transport ecosystem.

We need a roadmap that sets out what should be done for the transport sector to reach zero emissions by the year 2050 and defines priority areas for improving equity on the path to decarbonization, such as urban transformation, a low-carbon energy strategy, improving the





efficiency of transport modes, shorter supply chains, reducing unnecessary trips, adapted rural solutions, investment in adaptation and economic instruments. This roadmap can be applied to cities, continents, and countries.

Need to Work with Urban Planners

Effective traffic management and planning requires close collaboration between urban planners, transportation authorities, and technology companies. Urban planners play a critical role in designing cities that support efficient public transit and reduced car dependency by integrating mixed-use buildings and pedestrian-friendly spaces. This collaborative approach also extends to the use of innovative traffic management systems and Mobility-as-a-Service (MaaS) platforms that provide seamless travel experiences across different modes of transportation.

That is why we cannot look at the city without including the surrounding countryside and asking ourselves how you organize the connection between the city and the surrounding areas. How will goods be transported, how will people be transported, how will the various industries be located and that is why we need to work with urban planners.

Implement Multiple Forms of Innovation to Public Transport

As the transportation sector harnesses the power of IoT, prioritizes decarbonization, encourages collaboration and embraces innovation, it will become smarter, greener, and more efficient. This transformative journey promises a sustainable future for urban mobility and is in line with global efforts to tackle climate change and improve the quality of life in cities. Through these integrated strategies, the transportation

revolution is paving the way for the creation of more livable and sustainable urban environments worldwide.

More than half of the funds made available to public development finance institutions are earmarked for the public transport system and the sustainable development system. An example of institutional innovation is the Kochi Metro, introduced in phases to support the implementation of the Unified Metropolitan Transport Authority (UMTA). This initiative aims to integrate all modes of urban public transportation under a single framework, enabling seamless connectivity between buses, city rail systems, auto-rickshaws, and, in Kochi's case, water ferries. Another point of innovation could be urban planning, and here too, the city of Kochi is making great efforts to develop pedestrian zones and bicycle lanes to make it easier for citizens to access these soft modes of transportation, thereby promoting last-mile connectivity.

Integration is the key we believe that we do not inherit the earth from our ancestors but borrow it from our children. Today, we may have a choice, belief in climate change is optional but participation is mandatory. Delhi Metro Rail Corporation (DMRC) knew from the beginning that the





expenditure on energy will be high. At that time, the most energy efficient technology available was used. They were environmentally conscious from the beginning and decided that they would not cause any environmental damage during construction. The Delhi Metro carries about 3 million passengers daily and travels about 16–17 km per passenger. It returns 40–45 per cent energy to the system, making it carbon neutral.

Another example is the adoption of electric and hybrid vehicles to reduce emissions and dependence on fossil fuels. The Bangalore Metropolitan Transport Corporation (BMTCL) has introduced electric buses in its fleet, contributing to reduced urban air pollution and showcasing the potential for clean energy solutions in public transport.

Policy reforms, such as the implementation of the National Urban Transport Policy (NUTP), encourage the development of sustainable urban transport systems. This policy promotes non-motorized transport, encourages the use of public transport, and supports the creation of pedestrian-friendly infrastructure. Additionally, the Smart

Cities Mission aims to develop urban areas with efficient public transportation systems, integrating multimodal transit options to enhance connectivity and reduce congestion.

Bottom-Line: Promote Sustainable Urban Mobility

Promoting sustainable urban mobility in India requires a multifaceted approach that addresses various urban mobility challenges and enhances the quality of life for the urban population. Enhancing public transport systems is a critical first step. Expanding and modernizing metros, buses, and trams can significantly reduce congestion and pollution. Investments in infrastructure, coupled with smart technologies for efficient operation, can make public transport more appealing.

Additionally, promoting active mobility is essential. Developing infrastructure for walking and cycling, such as dedicated lanes and safe pedestrian crossings, encourages active mobility. This not only reduces vehicular congestion but also improves

public health. Implementing zero-emission solutions is another vital strategy. Encouraging the adoption of EVs for public transport and logistics can drastically cut down on emissions. In addition to reducing emissions, implementing innovative solutions can bring numerous economic and social benefits such as improved air quality, job creation, and poverty alleviation. Government incentives for EV purchases and investments in charging infrastructure are critical for this transition.

By integrating these strategies, India can strive to improve the quality of life in its urban areas, making cities more liveable, sustainable, and resilient. Collaborative efforts between government, private sector, and civil society are essential to drive these changes and create a sustainable urban mobility ecosystem. ■

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Forest Fires

Poor Management is the Real Problem

Forest fires, especially in the state of Uttarakhand, garner attention only when they occur—in summer. Post that, it's a forgotten chapter. However, **Dr Vishal Singh, Executive Director, Centre for Ecology Development and Research**, believes it is important to tackle the issue by involving communities, spreading awareness and using policy to resolve the challenge, before things go out of hand. He speaks to **Sapna Gopal** on what the real concerns are and what can be done to redress them.



Could you tell us something about forest fires?

Historically, at some point, all ecosystems across the world have experienced fire. California and Oregon have experienced wildfires, while Australia has seen the maximum bush fires and then there are the Peatland fires in Indonesia. They are actually damaging fires, but they also provide an opportunity wherein if one system goes, another new system comes up. Fire also brings in new biodiversity and some ecosystems require fire. For

instance, for some species of pine—if fire doesn't happen, it will not resprout; the seed core will not open because it requires some amount of heat.

What we experience in the mountain regions (in the state of Uttarakhand for instance) are not wildfires, as is widely reported. Fires can be categorized as crown fire, surface fire, and ground fire. Generally, we never have crown fires—what we experience is surface fires where the litter layer gets burnt. So, as the fire moves, it consumes the litter on the ground and is a fast-moving fire. When a fire is sweeping fast, the damage is not that much, but the way it has been reported is that these fires are wildfires and are happening because of excess heat.

We need to understand that fire has a behaviour wherein it climbs and ends there—very rarely is there a reclining fire (going down the slope). The higher the slope, higher is the intensity of the fire and they are all fast moving. Ecologically misinterpreted, the term most often used to describe forest fires is gutted. This can lead to bad (policy) decisions and sadly this is happening all the time due to misinformation about forest fires. Currently, the entire system is such that it is very easy to deflect from the real problem.

Has the state of Uttarakhand witnessed a spurt in forest fires? If yes, why is it so?

What has happened in Uttarakhand and the mountains is real. Fires have happened in the past and some very big fires can be dated to 1995 (when Uttarakhand was a part of UP). Again, the year 1999 was one that recorded big fires. While small intensity fires have always been there, due to climate change and global warming, the fire season, which was restricted to the months of February to May or June, has now extended and is starting from October.

Furthermore, climate change and global warming have also led to a



decline in winter rainfalls and hence, the drought period is increasing. Weather patterns are changing as well—the dry period was restricted post-February, and would peak in March/April and once the monsoon arrived, all the fires would be over. Between December and mid-February, there used to be good snowfall. However, now, there is more dryness in the atmosphere and that has led to a longer duration of forest fires. Earlier, the fires were concentrated, but now, they spread and this has been happening in the months of October-November, which was not the case earlier.

What, according to you, is the underlying root cause of these fires?

All forest fires are man-made (99.9 per cent). It's a very seasonal issue and as soon as there are rains, no one speaks about forest fires. Nobody has understood what the real problem is. If the policymakers don't get the right point, how can they take the right decisions? Therefore, the same problem is recurring.

A study by the World Wildlife Fund (2004) revealed that 63 per cent of fires are intentional and 37 per cent of the fires are accidental. The real problem is that too many people and tourists have access to forest areas and they cause a lot of damage. Hence, the amount of access has to be controlled and some bad policies need to be removed.



Furthermore, there has been a huge detachment of community and forest. The community and the forest have co-survived with each other for thousands of years. The current policies or current Acts such as The Wildlife Protection Act, The Biodiversity Conservation Act, The Forest Conservation Act, are all taking the rights of people and the connection they had with the forest earlier. So, there is no incentive now. The forest department cannot do anything by itself. It needs the cooperation of the community to implement the policies.

What is the solution to the raging problem?

Community and policy need to be resolved. Examples across the world indicate that where communities are involved in forest conservation, there is little damage to the forest. In the state of Uttarakhand, there are van (meaning forest) panchayats. This is a unique institution and they came into being in the 1930s. Currently, there are 12,089 such panchayats in the state of Uttarakhand. It is a concept of co-management of the forest and the mechanism through which people manage forests on which they depend on and they have certain rights/privileges given by the government. Studies have

revealed that some of these areas are very well managed.

There's also a need for incentives and support. If grass can be extracted from the forest, why would it be burnt? When the support mechanism is removed and this continues for several years, the locals will lose their attachment to the forest. There needs to be some sort of incentive for people to conserve the forest. While theoretically there are incentives for the locals to come and support the forest department, in reality, it does not happen.

Sometimes, plantations fail and when the audit is due, someone will set fire on the block—so that they can claim they planted 1,000 seedlings and now, the entire thing has been burnt down. At times, there is the practice of control burning—the forest department does it deliberately. However, there are times that it goes out of control—that is another reason why fires occur.

Does the approach need to change?

Currently, the approach towards forest fires is that of rescue and response, rather than prevention or planning. A major chunk of the budget that is allocated for management of forest fires goes in rescue and response. Then, there are technologies such as remote sensing

tools, drones, which enable or allow spotting a fire. However, they are limited to informing where the fire is—it is therefore not part of a solution.

The problem of forest fires is not a seasonal issue and needs to be addressed throughout the year. There is no understanding of forest fires and the responsibility of addressing the issue does not lie only with the forest department. Solving entails knowing what the causes of the fire really are, but that is not considered.

Whether it is passive (preventing) or active (taking concrete action, involving locals to remove litter) management, these steps are necessary for planning. The real problem is not fire, it is poor management and lack of understanding. This lack of understanding can lead to devastation.

What is the learning for India from other countries?

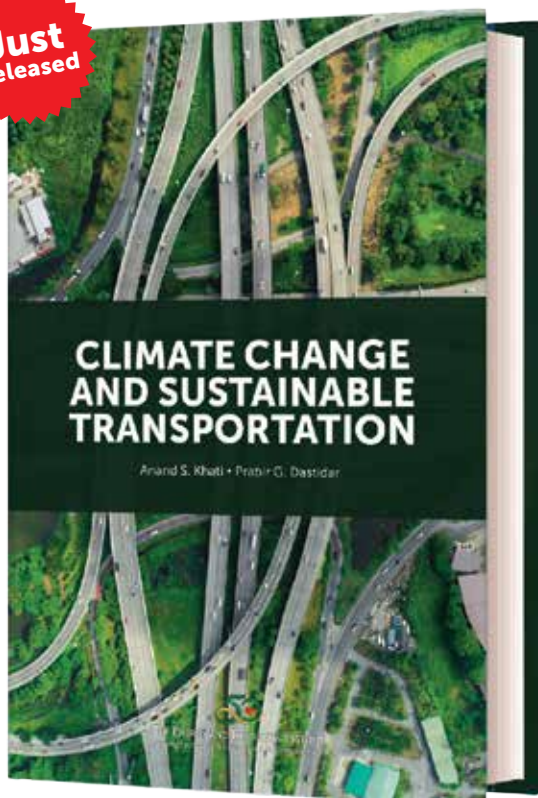
Due to global warming, there is suppression and unscientific conservation. This in turn, may lead to surface and ground fires becoming crown fires, which is catastrophic. The US had the suppression policy for 100 years. However, in 1988, there was a huge fire in the Yellowstone National Park and it was fully burnt. This could be a possibility in Uttarakhand. We need to learn lessons from other countries and a lot more thinking is needed when it comes to managing fires in the forest.

Small-scale fires are actually beneficial to the ecosystem because they wipe away small quantities of litter every year. Every year, litter falls, but the fire comes and clears it up. Also, there is secondary growth. However, if the fire is suppressed, there is accumulation of litter. Then, some of it will decompose, but a fire ladder will be created and chances of a crown fire are very high. ■

*Pictures: Anup Sah, Padma Shri.
Source: Nainital forest division
(An independent writer, Sapna Gopal pens articles on environment and renewable energy.)*

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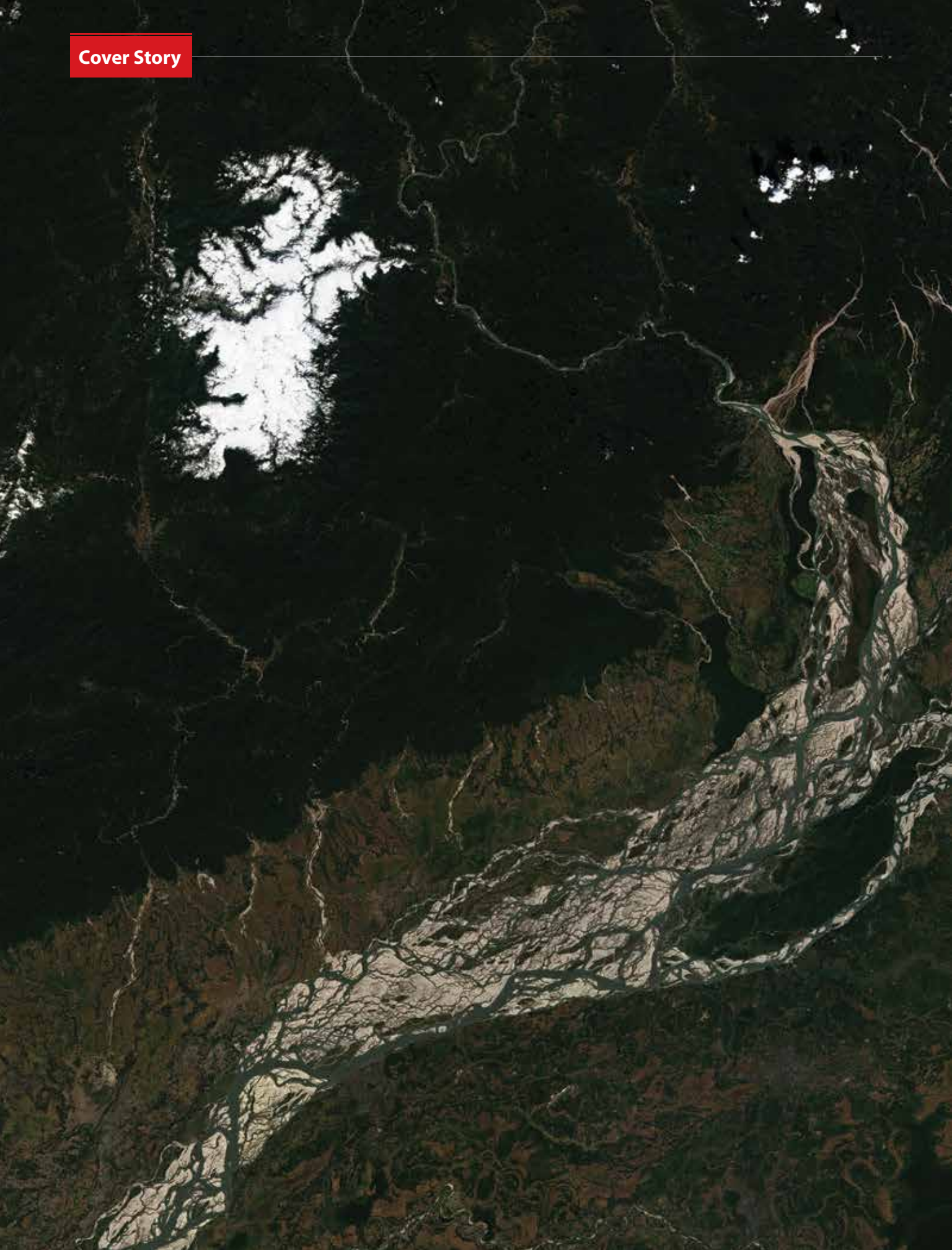
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GIS for SDGs

UN SDG Agenda 2030 and GIS in India

Geographic Information Systems (GIS) play a vital role in achieving the Sustainable Development Goals (SDGs) by providing tools for effective data collection, analysis, and visualization. GIS helps monitor environmental changes, track natural resource use, and manage urban planning, all of which are key to sustainable development. Ultimately, GIS supports more informed, evidence-based policies that can drive progress across multiple SDGs. In this article, **A Jyothi Mahalingam** says the GIS enables worldwide users to exchange ideas to meet resource needs, design effective land use, and safeguard the environment to assure the survival of people in the future. Such a tool will certainly empower the authorities to introduce modified strategies in SDGs' implementation to achieve environmental sustainability and set targets.



The United Nations General Assembly set the Sustainable Development Goals (SDGs) in 2015 and fixed a deadline for achieving them all in 2030. The goals are to bring out a sustainable path for our planet's inhabitants to achieve peace and prosperity in partnership. The five important elements of the agenda include action against climate deterioration, cutting down unemployment levels, supporting gender equality, encouraging peaceful societies, and ending poverty at all levels.

The Inter-Agency and Expert Group on SDG (IAEG-SDGs) developed a global indicator framework that was agreed upon during the 48th session of the United Nations Statistical Commission in 2017. It also established a global indicator framework with 231 distinctive indicators to achieve SDGs. The September 2019 SDG summit found that the efforts of the member countries were not up to the mark and suggested fast-tracked efforts to achieve the 17 goals.

Current Status of SDGs

A look at the 2023 Global Sustainable Development Report (GSDR), reveals globally only 12 per cent of all the proposed SDGs were progressing at the desired level to be achieved by 2030. The report termed the

status as "stagnation in the face of multiple crises," such as the COVID-19 pandemic, the climate crisis, and the Russian invasion of Ukraine. It expressed its concern about some of the most off-track developments related to sustainable land use, prevailing food systems, biodiversity, stable institutions, and global peace. The UN Secretary-General demanded a vigorous global partnership to endorse the efforts of the nations.

The latest SDG 2024 report published by the UN Statistics Division is also not very encouraging and the world continues to fall behind in achieving the 2030 SDGs. The report having 2015 as the baseline level reveals that only 17 per cent of the goals are on track to achieve the desired results in 2030. It adds only moderate progress is made in 18 per cent and marginal progress in 30 per cent of the set goals. It regrets that while 18 per cent show inactivity the other 17 per cent demonstrate a simple regression.

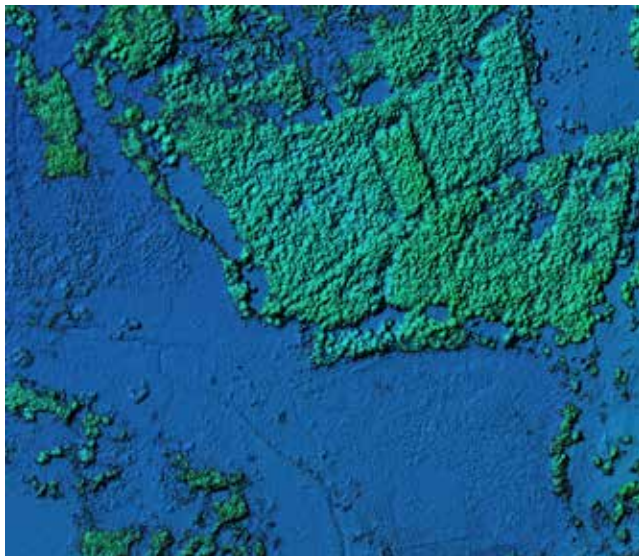
SDGs and India

India eagerly espoused the SDGs and set well-defined targets for execution by placing them within its national development programme. It adopted an elaborate framework and entrusted the task of completing its SDG commitments with the Ministry of Statistics and

Programme Implementation (MoSPI) and the National Institute for Transforming India (NITI Aayog). The complete charge of planning and monitoring of all the 17 SDGs was left with NITI Aayog and 28 states and 8 Union territories are made responsible for the implementation of SDGs.

To measure the progress the States and Union Territories made in SDG implementation, NITI Aayog released a baseline report and a dashboard known as the Sustainable Development Goals India Index 2018 (SDG II 2018) in the year 2018. This report prepared in association with the United Nations and other stakeholders is considered an all-inclusive index with 62 priority indicators relating to 13 Goals and 39 Targets. This Baseline Report offers the groundwork for picking the priority indicators, classifying the challenges in data and sensing the benefits and limitations of the index. More importantly, by using a clear procedure, the report attempts to rank the State Governments and Union Territories on their SDG performance to encourage competition among them.

In SDG II 2019, an additional 20 improved indicators were included for better engagement between government agencies for tracking India's SDG performance. India was working consistently to address the hunger of 195 million people and tackle malnutrition among its children, as highlighted by the UN's Food and Agriculture Organization (FAO). However, the pandemic COVID-19 derailed its plans and forced the Indian economy to brace for a loss of 10–30 per cent in the GDP. The global SDG Index 2020 ranked India at the 117th position with an overall score of 61.92 per cent.



A rapid assessment undertaken revealed rising unemployment levels, wage loss, hunger, malnutrition, and increased poverty. To implement gender equality and end the unfair treatment of women and girls, the government has enacted several legal policies and introduced progressive socioeconomic norms. India is in the process of reverting the derailment caused by the pandemic and putting its development goals on track. It is aware of the gigantic realignment activity needed to make the SDGs more relevant to achieve progress in India.

Now, India has made significant progress in achieving its SDGs. The latest NITI Aayog SDG Index 2023–24, released in July 2024 indicates the country's progress in goals linked to poverty, economic growth, proper employment, climate-controlling action, and safeguarding steps towards life and land. The country could improve its score remarkably. From a score of 57 in 2018, it improved to 66 in 2020–21 and now reached a score of 71 during 2023–24. It is heartening to note during the period from 2020 to 2024 India also improved its global ranking from 117 to 109th position with an overall score of 63.99.

GIS for SDGs

Globally, the progress in achieving SDGs by 2030 did not reach the desired speed or scale level. The elements that are needed to hasten the SDG process include historical and current demographic data, change in population density for resources estimation, anticipated habitat change, local wildlife and their living conditions, and finally the impacts of climate change in those areas. Here, the geographic information systems (GIS) come into the frame for the purpose.



What is GIS?

GIS (Geographic information system(s)) is a distinctive problem-solving computer technology that enables capturing, storing, analysing and exhibiting data connected to various positions on Earth's surface. Its versatility to illustrate dissimilar data such as streets, buildings and vegetation in a single map makes it convenient for use.

The technology can narrate any type of data into a visual map while incorporating the location along with a piece of descriptive data information. GIS helps to map huge data to analyse and find hidden insights with ease. Such a sensing gives an informal understanding of the problem and guides in the decision-making processes.

Global Statistical Geospatial Framework (GSGF) and GIS

The UN suggested Global Statistical Geospatial Framework (GSGF) is considered as a top-level principles-based framework. It assists in integrating a range of data from both geospatial and statistical communities. Such integrated data using its five maxims and endorsing key elements, allow the production of an agreed, standardized and structured and geospatially enabled statistical data, to enable a data-driven decision-making process. The derived data can be unified with statistical, geospatial, and other information systems to assist an evidence-based, data-driven decision-making process, to endorse local, regional, sub-national, national and worldwide development agendas and priorities.

To implement GSGF effectively, various tools were explored and GIS was one among them. The GIS helps GSGF in the decision-making process by combined examination of dissimilar layers of collected relevant

information in the form of visuals. The visual presenting feature of GIS assists in finding areas that face the risk of biodiversity loss, environmental degradation, and suffering from depleted resources. Such socioeconomic and geospatial data helps authorities to manage disastrous conditions. Its inbuilt advanced features to map, blend and examine different data into spatial layers, assist in developing appropriate methodical approaches to achieve SDGs.

The UN-supported DATA4SDG suggests three key pillars of data for SDGs—Geospatial, Statistical, and Big Data. With the United Nations Integrated Geospatial Information Framework (UN-IGIF), the key object is to develop the foundational GIS data that is critical for various aspects of SDGs.

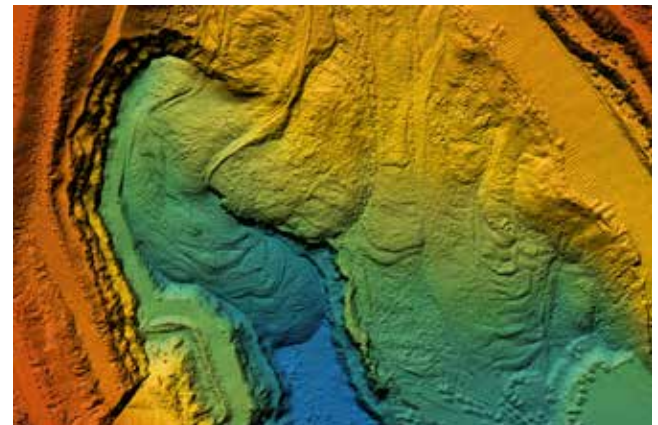
Current Developments in GIS

Some of the recent developments in GIS include:

- i. The Real-time revolution
- ii. Machine learning and artificial intelligence (AI)
- iii. Miniaturization of technologies
- iv. The proliferation of new mobile geospatial sensor platforms
- v. Big data real-time analytics
- vi. Drone-based GIS
- vii. Advances in computing capacity for geospatial research, apps

The unique ability of GIS to collect and study data in real-time makes it an indispensable tool. GIS offers a reciprocal base to all spatial data that includes data representing dissimilar projections, raster or vector datasets, and geodetic datums.

It provides a common area to store any information in distinct data layers to present, query, display and analyse the stored content spatially or temporally. Such features provide the ability to recognize and envisage the changes that took place over time and foresee



trends in the designated areas. In short, GIS captures, saves in memory, maintains, questions, analyses, manipulates and displays any data to produce an output. In a nutshell, the GIS enables worldwide users to exchange ideas to meet resource needs, design effective land use and safeguard the environment to assure the survival of people in the future.

Applying GIS for SDGs

- **Thematic mapping:** GIS can be used for thematic mapping of a location to understand the hydro-structural condition, soil properties, and the available land cover and its use. Using the data obtained on terrain conditions and soil, the land capability and irrigation maps allows the stakeholders to comprehend the progress made towards the goals and reduce duplication in achieving SDGs.
- **Community participation:** GIS can help in community participation in a location by sharing inputs of SDG progress made.
- **Contesting misinformation:** The authoritative data and maps made available using GIS help in challenging misinformation.



- **Ecological usages:** The strength of GIS is its ability to warn about floods, landslides, earthquakes, and more.
- **Managing water resources:** The ability of GIS to monitor and measure water resources for the mapped cultivable land helps in better water resource management.
- **Farming expenses:** The tools available in GIS can find the growth levels of the plantation in deciding the use of seeds, nutrients, fertilizer herbicides and agricultural machinery to save costs.





- **Climate change:** GIS forecasts in predicting climate change and its impact on domestic animals to assist in the efforts of saving and conserving the vulnerable species.

GIS in India?

India was a leader in using modern spatial technologies. The country is known for using its self-developed spatial know-how for a long time. It commissioned its first Indian Remote Sensing (IRS) System in 1988 by launching its IRS-1A satellite and started using the satellite images for GIS applications and creation of database. These satellite data found its use in a range of applications that include hydrology, agriculture, geology, flood and snow monitoring, drought, and use of land. Having realized the real power of GIS, it has unveiled its next-generation GIS programme known as National GIS.

Globally, India has the largest constellation of civilian remote sensing satellites. As of April 2024, the country deployed 11 operational remote sensing satellites in its IRS system. The satellites positioned in polar Sun-synchronous orbit deliver data in a range of spectral, spatial, and temporal resolutions.

According to International Market Analysis Research and Consulting Group of India, the GIS software market in India has already reached \$547.3 million in 2023. It is expected to reach \$1,770.2 million by 2032, demonstrating a compound annual growth rate (CAGR) of 13.5 per cent through 2024–2032.

Conclusion

It is a fact that globally governments are determined to end poverty and inequality in their countries while assuring the people justice, improvement in national health, and prosperity. Unfortunately, one of the key elements in realizing the SDGs is the limited capital inflow experienced by both developed and developing nations. It is estimated that nearly 75 per cent of the global population is living in these countries and some of them in fragile and conflict-affected areas. Worldwide, around 1.9 billion plus people look forward for government funding and private sector investments in carrying through their basic needs. It is to be seen how the countries will contribute to achieving the initiated total SDG targets by 2030.

At the same time, the future of GIS seems to be very bright. The ongoing tremendous signs of progress made in the technology will further let it exploit its advanced spatial analytics to track biodiversity and ecosystems to evaluate climate change and its impact. Such a tool will certainly empower the authorities to introduce modified strategies in SDGs' implementation to achieve environmental sustainability and set targets. ■

A Jyothi Mahalingam, an environmental journalist, has been writing on renewable energy, climate change, and water conservation. He also writes on technology, tourism, and social issues.

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Tasty and Healthy Indian Thali

Festive Season Paves Way for the Vegetarian Thali!

The shift from hard-core non-vegetarianism to pure vegetarianism, especially during Mumbai's festive seasons, is more than just a dietary change—it is a cultural phenomenon. With Ganesh Chaturthi, Navratri, and Diwali setting the stage, a growing number of people are embracing the health benefits and spiritual purity that traditional vegetarian foods bring. The iconic Indian thali, an embodiment of balanced nutrition and regional authenticity, has taken centre stage, representing a full-circle moment in Mumbai's evolving food culture, writes **Gajanan Khergamker**.

“Mumbai has always been a melting pot of tastes,” says food connoisseur Shirish Malhotra. “But lately, even the most dedicated fast-food lovers have started leaning towards healthier, more wholesome options. Festivals like Ganeshutsav and Navratri, which emphasize vegetarianism,

play a huge role in this shift. People are rediscovering the wisdom in traditional diets.”

For years, the allure of convenience dictated food choices across the city. “You could survive an entire week on *vada pavs* and fried snacks,” admits marketing personnel Ramesh Bhargav. “I didn’t care

much about the future—I wanted food that was quick and filling. But after being diagnosed with hypertension, I realized I needed to make a change.”

Nutritionist Seema Kulkarni concurs: “There’s been a marked shift in dietary preferences, especially among younger professionals. The rise in lifestyle





disorders such as diabetes and heart disease has encouraged people to think twice about their food. Festivals offer a great opportunity for people to hit the reset button and embrace the natural, vegetarian meals passed down through generations.” The city’s vibrant festive calendar further fuels this transformation. “During Ganeshutsav, my family strictly avoids non-vegetarian food,” shares Mumbai-based homemaker Anjali Deshmukh. “Earlier, I thought this was an outdated tradition, but now I see the value. It’s a time to detox and cleanse both body and soul.”

This renewed emphasis on vegetarianism during festival seasons has gone hand-in-hand with a broader wellness trend. “Traditional Indian food is rich in grains, vegetables, and spices that naturally detoxify and heal the body,” says restaurateur Sameer Shetty. “Mumbai’s modern palate may have been drawn to fast food for convenience, but today, we see a resurgence of interest in what is nutritious, not just what is fast.”

As Mumbai’s food landscape continues to evolve, it becomes increasingly clear that indulgence, while holding its perennial charm, now shares its pedestal with a more pressing companion: mindful eating. This shift is no longer just a fleeting trend designed to placate health-conscious urbanites—it has transformed into an essential practice, born out of necessity and nurtured by a growing awareness of the direct correlation between diet, health, and lifestyle. In a city famed for its vibrant street food, elaborate festive spreads, and culinary indulgence, this pivot towards mindful consumption signifies a deeper cultural reckoning.

Increasingly, Mumbaikars are waking up to the consequences of unchecked indulgence—an uptick in lifestyle diseases, stress-related ailments, and digestive disorders. As a result, the city’s collective consciousness is recalibrating, recognizing that food is not merely about satiating hunger or satisfying cravings but a tool for preserving health, energy,

and longevity. Mindful eating, once the domain of niche wellness advocates, has pervaded even the fast-food joints and high-end restaurants that once thrived on the city’s insatiable demand for convenience and taste. This shift is also economic in nature. The healthcare burden posed by lifestyle diseases has begun to weigh heavily on families, making preventive measures like healthy eating more attractive than ever before. And the food industry, always quick to respond to consumer demands, has had to evolve or face redundancy. Restaurants that once relied on rich, indulgent dishes are now presenting balanced menus, replete with lighter, nutrient-dense options designed to offer both taste and health benefits. Fusion thalis have emerged, blending the best of traditional Indian vegetarian cuisine with modern superfoods, while detox-friendly options, crafted with minimal oil and fresh, seasonal produce, have become standard offerings even in upscale dining establishments.



Street food vendors too have recognized the winds of change. Once synonymous with greasy, deep-fried treats, Mumbai's iconic food stalls now serve up healthier alternatives without losing their authentic charm. Hot *idlis*, fresh vegetable *parathas*, and piping bowls of *khichdi* are fast becoming the norm, replacing the oil-drenched snacks of old. This evolution is not just a concession to health—it is a response to the growing realization that sustenance and satisfaction need not come at the expense of wellness. Even amidst the excess of celebration, there is a rising consciousness about moderation, about choosing ingredients that not only taste good but feel good. The thali, which once represented a humble meal, has become a symbol of this mindful approach, offering variety without overwhelming the senses.

Ganeshutsav, a festival deeply embedded in Mumbai's cultural ethos, is the perfect trigger for this change. The ten-day celebration, marked by prayers, rituals, and devotion, encourages adherents to abstain from meat and indulge in a 'satvik' diet—one that is vegetarian, wholesome, and

promotes mental clarity. The popularity of vegetarian thalis during this time underscores the growing belief that the body needs a break from indulgence and must be nourished with fresh, simple foods. The thali, in its traditional form, is an example of a complete meal, containing grains, lentils, vegetables, dairy, and a small serving of sweets, all made using time-honoured methods and without artificial additives. For many Mumbaikars, the festive season has become a period of recalibration. Beyond the spiritual dimensions, the decision to adopt a vegetarian diet during festivals like Ganeshutsav, Navratri, and Diwali reflects a broader, more pragmatic understanding of health and well-being. Restaurants across the city are responding to this shift by offering exclusive festive thalis, sometimes creatively adapting traditional recipes to modern tastes but always keeping the focus on nutrition. A typical vegetarian thali, often served during Ganeshutsav, Navratri, or Diwali, includes steamed rice or *chapati*, a medley of vegetables, *daal* (lentil soup), *kadhi* (a light yoghurt-based curry), and a selection of pickles, with a sweet touch like *gulab jamun* or the

festival-special *modak*.

What elevates the festive thali is not merely its simplicity but its reliance on seasonal, fresh ingredients that nourish the body while being easy to digest. The purity of the meal is paramount—eschewing processed foods, artificial flavourings, and an excessive use of oils. Each element of the thali is chosen with care, designed not only to satiate the palate but to uphold a delicate balance between health and indulgence. Every dish reflects a mindful culinary philosophy, aligned with the spirit of the festival—focusing on moderation and purity. Take Navratri, for instance—a celebration spanning nine days, marked by fasting and spiritual introspection. Unlike conventional fasting that demands abstinence, fasting during Navratri is a celebration of the right foods—those that cleanse the body and elevate the spirit. The thali takes on a unique form during these nine days, focusing on ingredients like buckwheat, amaranth, and tapioca, with minimal spices to maintain the lightness and purity of the meal. Even those who usually follow non-vegetarian diets embrace the vegetarian spread during

this time, drawn by the subtle flavours and the deep-rooted cultural significance of the foods that embody the festive spirit.

Diwali, India's most grandiose festival continues the tradition of the vegetarian thali, albeit with a greater emphasis on indulgence. While Diwali is synonymous with sweets and savoury snacks, the festive thali holds its own in offering balance amidst the feast. In homes across Mumbai, families gather to partake in elaborate meals passed down through generations. These meals are not merely about sustenance; they are a reflection of tradition, heritage, and community. Each bite of a Diwali thali evokes a sense of nostalgia, binding families together through recipes that honour the past yet adapt to modern-day tastes.

In the heart of the city, these thalis—whether during Navratri's reflective fasting or Diwali's joyous feasting—do more than fill a plate. They fill a void for mindful eating, embodying values of purity, tradition, and balance. The foods are crafted not only to nourish the body but also to foster joy, connection, and a deeper appreciation of the cultural rituals that surround them. Even in an age of fast food and instant gratification, the festive thali stands as a timeless reminder



that the act of eating can be as spiritual as it is sensory—a reflection of the festivals themselves.

Restaurants are adapting their menus to feature these beloved vegetarian dishes, often reimagining them with a contemporary twist. For instance, fusion thalis now boast quinoa instead of rice, or millet-based *chapatis*, catering to a health-conscious clientele without losing the essence of traditional festive fare. This shift is allowing them to not only stay relevant but also attract a new wave of customers who value authenticity as

much as convenience.

The shift towards simpler, cleaner food is reflective of a broader lifestyle change, especially during festive periods when people are more likely to pause and reflect on what they consume. Vegetarianism, once viewed as an obligation during religious observances, is now celebrated as an opportunity for rejuvenation. Festivals provide the perfect backdrop for this change, with people using the time to not only detox their bodies but to nourish their souls. It's a moment when the city slows down, and food once again becomes a ritual—imbued with meaning, memory, and a sense of well-being.

In a city as dynamic and diverse as Mumbai, this return to traditional, mindful eating is more than a fleeting trend. It signifies a collective awakening—an understanding that even amidst the hustle, the act of eating can be a moment of intentionality. Whether in a high-end restaurant or at a humble street stall, Mumbai's food culture is evolving, with vegetarianism at its heart, reflecting the city's shifting values and priorities. ■

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The Role of Branding at MRFs and MRCs

A Best Practice Approach

In this article, **Prabhjot Sodhi**, **Rohit Maskara**, and **Amarpreet Kaur** discuss how branding at material recovery facilities (MRFs) and material recycling centres (MRCs) can serve as best practices. A key strategic takeaway is that well-branded waste management facilities can partner with citizens bodies, schools, colleges, and universities to offer students real-time learning opportunities through internships, field trips, and research projects. Keep reading to know more!

HDFC Bank – Centre for Environment Education (CEE) are implementing the project ‘Rural & Urban Landscape Free of Dry & Plastic Waste’ in six urban areas and three rural districts across India from October 2021. The project has set up eight material recovery facilities (MRFs) in Ganjam (Odisha), Samastipur (Bihar), Bastar (Chhattisgarh), Guwahati (Assam), Bhubaneswar (Odisha), Ranchi (Jharkhand), Mahabubnagar (Telangana), and Nirmal (Telangana), along with two material recycling centres (MRCs) in Bastar (Chhattisgarh) and Jammu (Jammu & Kashmir). Out of these, six MRFs and one MRC have been

inaugurated with the support and in the presence of local bodies, and officials from Swachh Bharat Mission teams.

Material Recovery Facilities

MRFs typically have shed areas ranging from 5000 to 7500 sq. ft in cities. To optimize waste sorting for maximum resource recovery, simple, low-cost, and easy-to-manage semi-automatic mechanical technologies should be employed. The goal is to shift away from mixed waste streams and assign value to every type of waste. MRFs are designed to optimize the collection and sorting of all types of waste materials, including

plastics (e.g., PET, HDPE, PVC, LDPE, PP, PS), glass, metal, paper, cardboard, and more. By employing user-friendly machinery such as conveyor belts, shredders, bailing machines, etc., MRFs streamline the waste management process, ensuring effective segregation and optimal resource recovery.

Material Recycling Centres

MRCs process sorted materials from MRFs, converting them into raw materials for product manufacturing through specialized recycling processes. The MRC with shed area of 10,000+ sq. ft areas ensure converting recyclables such as low density polyethylene (LDPE), multi-layered plastic (MLP), flexibles, and rigid plastics into valuable granules (separately) and plastic lumps to be used in pipe-making. User-friendly processes and machines lay foundations for a ZERO WASTE Facility. These centres are equipped with latest technologies—washing lines, effluent treatment plants, driers, agglomeration, mixing machines, and extruders, etc. The processes enhance the strengths of granules, etc., by adding desired additives promoting sustainable recycling.

Largely, the purpose of Swachh

SWACHH CENTER - Features of Material Recovery Facility (MRF)

- Better business decisions with inventory tracking
- Comprehensive planning and process optimization
- Operational insights with material flow analysis
- Inbound and outbound activities, planning and management
- Realtime customized reports
- Creates better income and generates employment
- Digital control of complex problems
- Different materials and machines promote material resource efficiency

Logos: CEE, LIFE, HDFC BANK PARIVARTAN

#SwachhtaKeSaath

CEE
Centre for Environment Education

Centre (MRF and MRC) is to make better business decisions through inventory management of the waste (resource) streams, transparency in systems approach, traceability, tracking, and planning. It is to understand what materials are coming and from where and what value we are creating with them. All these things help in lesser production of virgin plastics materials, reducing carbon emissions by 2.1 CO₂e per kg of recycled plastics, thus meeting the climate change commitments of the Government of India. Also, it is reducing the landfill land areas in the cities. One metric tonne of dry waste reduce 2.60 cubic metres of land area.

How Branding at MRF can Serve as a Best Practice?

The branding strategy for Swachh Centre involves using informational and educational boards to create an informative, engaging, and educational experience for various stakeholders. Using visually appealing and clear branding, the goal is to showcase the entire waste management processes and systems ensuring sustainable and efficient operations at the material facilities.

Branding boards offer clear, concise explanations of the waste management process, MRF/MRC operations, safety tips, electrical consumption by machines inclusivity of waste-pickers (*safai mitras*), etc., emphasizing the system's significance and practices in place. Branding also establishes the centres as a visible and appealing facility, enhancing their credibility among visitors. It fosters a sense of pride and ownership among staff and safai mitras, reinforcing the commitment to environmental sustainability. The strategy of Swachh Centre is to have safai mitras and all stakeholders understanding of a visually appealing and memorable identity. All this conveys the importance—waste when segregated at source is a resource.

Material recovery facility (MRF) branding outside the shed



This includes selecting colours, fonts, and imagery that reflect a clean and credible image to attract and engage with the target audience effectively.

Branding has been developed broadly focusing on the following seven aspects:

Processes: Branding boards have been developed for the HDFC Bank-CEE project processes, MRFs, payment mechanisms, rates for purchase of collected waste. This transparency ensures fair price for the materials, with no deductions made makes the prices given by the project more competitive in the markets.

Practices: Boards include dos and don'ts to follow while working at MRFs, such as cleaning machines after use, no smoking, wearing the right dress, fire and safety adherences. Also, good

practices, such as regular cleaning and maintenance checks, and fire safety drills regularly to promote efficient and safe operations.

Health and hygiene: Designed boards emphasize the importance of each safai mitra (waste-pickers) wearing safety equipment and washing their hands with soap after handling waste, ensuring a personal and working hygienic environment.

Safety measures: Fire safety norms and emergency procedures are outlined on the boards to ensure that everyone is aware of and adheres to safety measures, promoting a safe working environment.

Type of plastics and other materials: Small boards have been placed to educate and inform about the different types of plastics and other materials





Material recovery facility (MRF) branding outside the shed

being processed for better and efficient sorting.

Signages: Signages are used to mark specified areas where different categories of materials, such as PET, cardboard, and PVC, are kept. This helps in the systematic organization and easy identification of materials. Signages are also developed for CCTV cameras, NO child labour, NO Smoking, etc.

Monitoring and reporting: A board has been strategically designed to outline the monitoring and reporting system established within the MRF. It includes five registers and six record books used to monitor systems and processes. This serves as a reminder for the team to maintain registers and records timely for better traceability.

Key Aspects of Branding

The branding placed at the MRF serves to raise awareness and inform and educate stakeholders and visitors such as government officials, students, safai mitras, and working professionals from the development sector through exposure visits. The boards have been prepared in the local languages depending upon the needs of the locations. It is also used to train safai mitras and inform other stakeholders about the MRF's processes and systems, encouraging the adoption of similar practices in other regions. The branding

effectively showcases the entire system, providing a visual representation of the efforts made to create a sustainable and efficient waste management system. Clear signages and monitoring systems streamline operations and ensure compliance with safety protocols. Proper documentation and branding not only improve operational efficiency but also enhance the centre's positive image.

Awareness, information, and education: Informing stakeholders about efficient waste management systems through visual representations and clear signages.

Exposure visits: To educate and inform stakeholders including officials about the MRF's processes and systems. This encourages the adoption of similar practices in other regions.

Trainings: Training safai mitras using the branded materials to ensure they are knowledgeable about the processes, safety measures, and best practices.

Streamlining operations: Clear signages and monitoring systems help streamline operations and ensure compliance with safety protocols.

Under the HDFC Bank-CEE project, around 100 exposure visits and trainings have been conducted at the MRF with more than 800 participants. Apart from this, several governments and HDFC BANK officials from states have visited the MRFs to understand the current process and operations followed.

During their visits, the team refers to the branding boards to explain the processes while giving the centre tour. Many virtual meetings happened indirectly. Swachh Centres, therefore, are an example of addressing the UN Sustainable Development Goals.

A key strategic takeaway is that well-branded waste management facilities can partner with citizens bodies, schools, colleges, and universities to offer students real-time learning opportunities through internships, field trips, and research projects. Engaging the local community by hosting open days at the MRF/MRC allows residents to learn about the facility's operations, building community support for waste management initiatives and encouraging responsible waste disposal practices and a 'BIG NO' to burning and littering of waste. As the project strongly advocates for the monetary value of plastics, we must recognize the worth of every piece. This will help us transition from a linear 'make-take-use-and-throw' culture and economy to a more circular approach—'refuse, reuse, recycle, repair, refurbish, and remanufacture.'

 Mr Prabhjot Sodhi, MBE, Sr. Program Director (Circular Economy) & Director MRAI (Hon.) For Jal Shakti Ministry GOI, Thematic Partner - Plastics & Dry waste (Pan India) and State Lead for Goa, Gujarat and Odisha, Centre for Environment Education (CEE); Mr Rohit Maskara, Project Manager, CEE; and Ms Amarpreet Kaur, Project Officer - Communication & IEC, CEE.



Terra Youth

Joining Hands
for a Greener
Tomorrow

How Young Indians are Ditching Luxury for Sustainability

In this article, **Manu Shrivastava** says across the subcontinent, a generation is abandoning opulence and choosing environmental consciousness. Amid the climatic chaos, a transformation is brewing. It is not led by policy changes or corporate mandates but by young Indians. With an eye towards the future, they are rejecting the notion that more is better. For them, sustainability is the real luxury.

India, the land where cultures and climates intertwine, is experiencing a significant shift. The monsoons, once a predictable lifeline, now arrive in erratic bursts, and the summer heat seems to linger longer each year. This shift is no longer an abstract conversation for scientists or policymakers—it's personal. As natural disasters intensify and air quality plummets in major cities, young Indians are re-evaluating their lifestyles. Gone are the days when luxury meant indulgence in excess. Today, sustainability has become the new standard of living.

Across the subcontinent, a generation is abandoning opulence and choosing environmental consciousness. As one

young environmentalist put it, "We don't need a few people living perfectly sustainable lives; we need millions doing it imperfectly."

India's environment, once lauded for its diversity, is under siege. The suffocating heatwaves that claim thousands of lives yearly and the floods that displace millions speak volumes. In rural areas, drought-stricken landscapes are becoming the norm. Yet, these aren't just isolated events; they are the grim reality of a nation contending with climate volatility. "For us, climate change is no longer just a future scenario," notes Rajiv Mishra, a climate researcher. "It's happening now. We're seeing it in the

heatwaves, in the erratic monsoons, in the melting glaciers." The Himalayas, once untouched symbols of nature's grandeur, are rapidly losing their glaciers—taking with them the vital water sources for millions. In urban India, pollution levels choke daily life, while the coastal regions brace for more severe cyclones and rising sea levels.

However, amid this climatic chaos, a transformation is brewing. It's not led by policy changes or corporate mandates but by young Indians. With an eye towards the future, they are rejecting the notion that more is better. For them, sustainability is the real luxury. Rather than viewing climate change as an external force to be feared, they see it as a personal challenge—a call to action that starts with the way they live. "We used to think luxury meant big cars and foreign vacations," says 28-year-old Aarav Khanna, a tech entrepreneur in Mumbai. "Now, it's about how little we can consume without hurting the planet."

In regions across India, new paradigms of living are emerging. Community-led eco-villages, small hubs of sustainability, are cropping up in various corners of the country. These villages provide a sharp contrast to the sprawling urban developments that consume vast amounts of energy and resources. "Living in an eco-village has taught me that we can live richly with very little," explains Meera Joshi, who left her corporate job to join an organic farming community in Uttarakhand. "We grow our own food,





we build our homes from sustainable materials, and we produce almost no waste.” These communities prove that ecological living isn’t just an idealistic dream—it’s a practical and rewarding way of life.

Urban India is also seeing a profound shift. Minimalism, once viewed as a Western phenomenon, is gaining traction in cities such as Bengaluru, Mumbai, and Delhi. Young professionals are turning their backs on large apartments and

luxury brands. Instead, they’re choosing smaller, energy-efficient homes, second-hand shopping, and upcycling. Fast fashion is being rejected in favour of sustainable clothing brands, or even better, wardrobe recycling. “I realized that I don’t need a new outfit for every social occasion,” says Natasha Patel, a marketing executive from Delhi. “It’s liberating to own less and focus on quality over quantity. It’s the small changes that add up.”

India’s notorious traffic jams and pollution-heavy commutes are also undergoing a transformation. Electric vehicles (EVs), once considered a novelty, are quickly becoming mainstream, and India’s cities are seeing a surge in cycling infrastructure. “I used to spend hours in traffic and realized I was contributing to the pollution I was so frustrated by,” says Rajesh Menon, a 25-year-old cyclist in Pune. “Switching to cycling was one of the best decisions I made—for my health and for the environment.” From shared





EV programmes to public bike-sharing initiatives, young Indians are not just waiting for government action—they're leading the charge.

In rural areas, farmers are bearing the brunt of climate change's harsh realities. Yet, they're not sitting idle. Climate-resilient agriculture is on the rise, with innovations like drip irrigation and crop diversification ensuring that food production can withstand unpredictable weather patterns. Organic farming, which once seemed an expensive alternative, is now being adopted widely as a method to reduce reliance on chemical fertilizers and pesticides, helping rejuvenate the land. "We have no choice but to adapt," says Sunil Kumar, a farmer in Maharashtra who switched to organic farming after years of crop failure due to erratic rains. "The future of farming lies in working with nature, not against it."

Movements like the "Clean Ganga"

project highlight the power of community involvement in tackling environmental issues. What started as a campaign to clean India's most sacred river has evolved into a nationwide effort to protect natural resources. Young Indians are at the forefront, organizing clean-up drives, awareness campaigns, and educational workshops to highlight the importance of conserving India's rivers, forests, and biodiversity. "We realized that the government can't do this alone," says Ritu Mehra, a volunteer in Varanasi. "If we don't take responsibility for our environment, who will?"

India's youth are scripting a new narrative for the nation—one that favours sustainability over luxury, community over individualism, and long-term well-being over short-term gratification. Their collective efforts are reshaping not only the nation's relationship with its environment but

also its definition of what it means to live a good life. It's a radical rethinking of values, where eco-conscious choices become the new status symbol, and simplicity is seen as a virtue rather than a compromise.

As young Pune-based activist Ritu Chhabra sums up: "We're not just consumers anymore; we're caretakers of the planet." The road ahead is challenging, but with a generation willing to trade luxury for sustainability, India stands at the brink of a climate-conscious revolution. And as they continue to forge this path, they may just redefine the global standard for responsible living. ■

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Empowering Women with E-Rickshaws

For livelihood support for women from vulnerable communities

In a significant move towards empowering marginalized women, United Way Bengaluru (UWBe), with financial support from NTT DATA, a global digital business and IT services leader, has distributed five e-rickshaws, each equipped with a smartphone, to five women who have successfully completed rigorous driving training.

The distribution event was held at the Office of the Commissioner of Police in Bengaluru on October 3, 2024 and was graced by Bengaluru's Police Commissioner, Shri B Dayananda, IPS, along with Ankur Dasgupta, Vice President & Head of Marketing, India, NTT DATA. Supported by the Bengaluru City Commissioner's Office and the NGO Parihar, this initiative aims to create sustainable livelihood opportunities for women from vulnerable communities. The project provides these women with the skills and tools necessary to operate e-rickshaws and collaborate with cab aggregators. Each e-rickshaw is outfitted with a smartphone to facilitate the

management of ride requests through cab aggregator apps, ensuring a smooth and efficient operation.

"At NTT DATA, we believe in supporting initiatives that create lasting and meaningful change. The E-rickshaw project is a powerful step towards building a more inclusive and equitable society, where women are equipped to take control of their futures. This initiative not only offers sustainable livelihoods to marginalized women and their families but also aligns with our commitment to environmental conservation. By connecting the planet, economies, and people, we aim to drive positive global impact. We are honoured to collaborate with United Way on this initiative, which paves the way for long-term social change," said Ankur Dasgupta. "We believe that empowering women with the tools and skills they need to be financially independent is a critical step towards building a more inclusive society. The provision of these e-rickshaws will not only give them a stable source of

income but also the confidence to shape their futures," said Rajesh Krishnan, CEO, United Way Bengaluru.

UWBe, part of United Way Worldwide, is an NGO focused on social issues that seek immediate and long-term attention. As an organization, UWBe believes in "mobilizing the caring power of the communities." The chapter catalyses unified efforts from corporates, civic bodies, and citizen associations to bring about visible change. The organization works in four key areas— environment, education, healthcare, and livelihood. Currently, UWBe is implementing four flagship campaigns that serve important purposes: 'Wake the Lake' works to protect Bengaluru's lakes, 'One Billion Drops' aims at conserving rainwater through percolation pits, 'Born Learning' helps provide nutrition and education to very young children and 'Rural Rising' aims to develop and empower the rural communities.

NTT DATA is a \$30+ billion trusted global innovator of business and technology services. Their services include business and technology consulting, data and artificial intelligence, industry solutions, as well as the development, implementation and management of applications, infrastructure and connectivity. NTT DATA is part of NTT Group, which invests over \$3.6 billion each year in R&D to help organizations and society move confidently and sustainably into the digital future. ■

For more information, www.uwbengaluru.org and nttdata.com.



Water, Water Everywhere...

A Silent Crisis Brewing in Goa

Pristine beaches, vibrant culture, and booming tourism come to mind when talking about the smallest state of India. In a first-person account, **Marianne de Nazareth** narrates how a Reverend in Northern Goa, facing off against local mafia and a brewing freshwater crisis, has taken up rainwater harvesting across his 100-acre seminary on a war footing.

Would you ever imagine the little state of Goa reels under issues of low supplies of fresh, potable water in the summer months? It does and little villages in Goa have the tanker mafia siphoning out freshwater supplies from borewells across Northern Goa, to supply all the five star hotels around.

The Freshwater Crisis

Even the open wells had begun to dry up in a seminary in Saligao and that's when

Fr Valerian Vaz, The Rector, realized that his 100-acre seminary was in trouble and the surrounding villages of Saligao and Pilerne too, needed help. He decided to take up rain water harvesting (RWH) on a war footing, across the 100-acre property of the Seminary of Our Lady, on the Pilerne plateau.

After a visit from Father Valerian and David De Souza who work alongside the father, we decided to drive down early in the morning to check out what he was

doing on his grounds, before the arrival of monsoon in Goa. It was an eye-opener, as this was not a small but a massive project across the 100 acres, to harvest every drop of run off, of the monsoon rain that fell on the property.

The Reverend Comes to Rescue

The first 'tank' that Father took us to view was a 25-feet deep excavation, lined with plastic sheeting, which had been dug in the path of the rain runoff. It had a pump attached to it and should the water fill to overflowing, the pump was activated to pump the water out into the adjoining playground. There, it could percolate down into the lower strata and into the underground aquifers.

"Let's go in the car with David and see all the tanks and bunds we have built across the property to hold back the rainwater," said Father Valerian "...it's too far to walk across the whole property."

As we walked towards the car, he pointed out to canals dug out alongside the road where the rainwater was directed to flow towards a check dam. A check dam is a small, sometimes temporary, dam constructed across a swale, drainage ditch, or waterway to counteract erosion by reducing water flow velocity. Check dams, themselves



are not a type of new technology; rather they are an ancient technique dating back 2nd century AD.

Importance of Check Dams

So why does one need to construct a check dam, one might ask. Check dam construction improves water availability besides erosion. As and when rainwater flows out of the farmland, it can then be collected and can be used later. The same water can be pumped back to the fields when required. A check dam that we built when we first bought our farm in Hoskote, was with a lorry full of granite blocks, that, we ourselves piled across the rain runoff. It was amazing to see how much erosion it stopped and the water was held back to seep down into the aquifers below the ground?

Over time, the check dam also held back the top soil that was being eroded with the force of the flow of the rain, across the property. It also helped the land to stop sloping towards the runoff and held any soil which may flow off from the surrounding areas. Once the water was held back with the dam, over a period of time, it would seep into the soil and into underground streams, which, the water diviner had tapped to sink our bore well. It was fascinating to learn



The empty mud bowl dug out and then after the rain filled with water

that there were underground streams of water flowing through the rocks.

Father Valerian also built a series of bunds across the property with laterite stones, which also held back the rain runoff and the topsoil erosion. "The erosion of topsoil during the monsoon can be pretty severe, so the bunds help to stem the rush of the water and the loss of topsoil," said Fr Valerian.

Walking around the property with Father Valerian and David made us realize they had set themselves a massive task, to harvest the monsoon rains, due in a couple of weeks in Goa. In another area of the property, a massive earthen bowl

had been scooped out of a large area, into which the rain runoff was being channelized. Earth movers had been used to scoop out the soil, the size of two or three swimming pools.

They had not long to wait, as the monsoon was on time, pouring down in sheets across the property and filling up the scooped-out earthen bowls across the property. The first set of showers just got slurped up by the parched earth and further showers percolated in minutes into the soil. The earthen bowls were full of life giving water, which will slowly percolate down into the soil and both the villages of Pilerne and Saligao will thank Father Valerian and David De Souza for their foresight and investment to ensure the coming summer months have enough freshwater repository.

All of us reading this piece need to understand that with burgeoning population, the government is helpless in being able to supply adequate freshwater across the country. We need to help ourselves and undertake RWH in our own properties to meet rising freshwater needs. Nothing is more pristine than rainwater and it's in our hands to help ourselves. ■

Dr Marianne Furtado de Nazareth is a freelance science and environment journalist, and former Assistant Editor of The Deccan Herald. She is also a former Professor.





Oceans Emit Sulphur and Cool the Climate More Than Previously Thought

Researchers have quantified for the first time the global emissions of a sulphur gas produced by marine life, revealing it cools the climate more than previously thought, especially over the Southern Ocean. The study, published in the journal *Science Advances*, shows that the oceans not only capture and redistribute the sun's heat, but produce gases that make particles with immediate climatic effects, for example through the brightening of clouds that reflect this heat.

It broadens the climatic impact of marine sulphur because it adds a new compound, methanethiol that had previously gone unnoticed. Researchers only detected the gas recently, because it used to be notoriously hard to measure and earlier work focussed on warmer oceans, whereas the polar oceans are the emission hotspots.

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

Oil Spill Still Contaminating Sensitive Mauritius Mangroves

Three years after bulk carrier MV Wakashio ran aground on a coral reef off Mauritius, spilling 1000 tonnes of a new type of marine fuel oil, Curtin University-led research has confirmed the oil is still present in an environmentally sensitive mangrove forest close to important Ramsar conservation sites. Lead researcher Dr Alan Scarlett, from Curtin's WA Organic and Isotope Geochemistry Centre in the School of Earth and Planetary Sciences, said the chemical 'fingerprint' of the oil found in the mangrove sediments was a near-perfect match for the Very Low Sulphur Fuel Oil (VLSFO) spilled by the Wakashio in 2020—the first recorded spill involving this type of fuel. "Local communities in Mauritius have been aware of oil contamination in the mangrove wetlands since the Wakashio spill, but no official confirmation had been made regarding the source," Dr Scarlett said.

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



To know more... Read



POLLUTION SOLUTIONS FOR A CLEANER, GREENER EARTH

Urmi A Goswami

We are living in a fast changing world. Pollution of natural resources, such as air, water, and land is one of the biggest banes of our times. Under such precarious circumstances, it is needed that the young generation is not only made aware about the different kinds of pollution but also about the solutions. This is what this book *Pollution Solutions – For a Cleaner, Greener Earth* is all about.

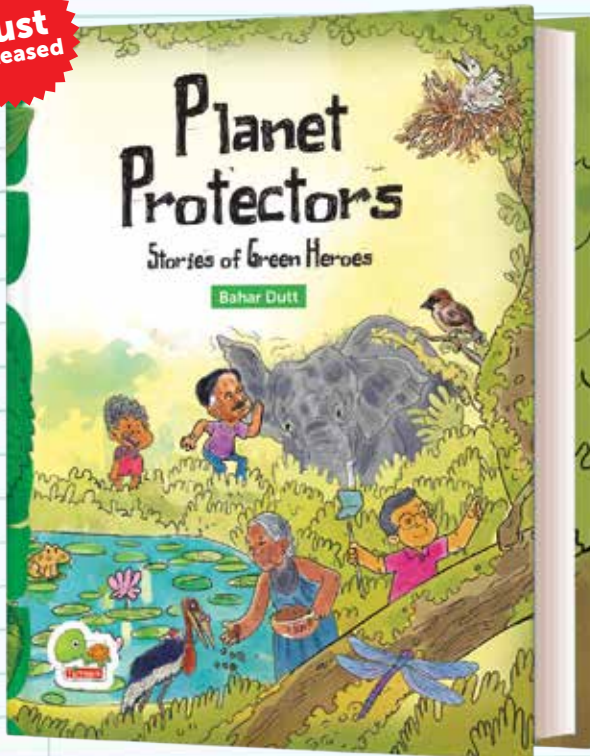
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Floods Deadlier than Poaching

A Grim Scenario Plaguing Assam's Kaziranga

With poaching rate slumped to almost zero, a bigger threat—perennial floods loom over the rhinoceros population in Assam's Kaziranga National Park. **Nava Thakuria** reports on the alarming statistics of over 50 unnatural rhino deaths since 2019.

Safeguarding single-horned rhinoceros in highly protected reserve forests in Assam confronts a major challenge other than the poaching and that's the perennial flood hitting northeast India annually. Often poaching of a one-horned rhino makes international media headlines, but it gets subdued attention when significant numbers of precious rhinos are wiped

out in a single wave of flood caused by incessant rains for days in the vicinity of upper riparian countries. The latest wave of Assam floods snatched away the lives of 13 rhinos, whereas it took 6 years to lose 11 grass-eating pachyderms to poachers inside the forest reserves. Statistics reveal that Assam recorded unnatural deaths of over 50 rhinos due to flood-related disasters since 2019. So,

survival of the precious animals may not solely depend on the strict anti-poaching measures, but pragmatic initiatives to help rhinos to survive during the perennial floods.

A Trail of Devastation

The second wave of floods in July 2024 left a trail of devastation in Assam by killing over a hundred people and





temporarily displacing thousands of families to take shelter in administration run relief camps. At its peak, the deluge hit over 2.7 million people (out of 33 million population) in 30 districts, where more than 3500 villages were submerged by the flood water for many weeks. The muddy flood water from Brahmaputra, Barak, Kushiya, Subansiri, Burhi Dihing, Dikhou, Disang, Dhansiri, Jia-Bharali, Puthimari, Kapili, Beki, Manas, Dhaleswari, Pagladiya, Burhadiya, etc., rivers inundated over 25,000 hectares of crop area across the region. The natural disaster damaged a number of embankments, roads & bridges, buildings and other infrastructures. It also devastated over 10,50,000 domestic animals & poultry, whereas hundreds of wild animals lost their lives in Kaziranga National Park and Tiger Reserve.

The authority in Kaziranga reveals that at least 215 wild animals including 13 rhinos and 170 deer, 8 porcupines, 5 pigs, 1 buffalo died in the forest reserve due to drowning and other causes. No less than 157 animals including two rhino calves were rescued by the staff on duty and later most of them were released to the wild after necessary treatment. Kaziranga's field director Sonali Ghosh informed that most of the forest camps (out of 233) inside the park went under flood water for many days. The UNESCO world heritage site today gives shelter to more than 2600 rhinos along with Asiatic elephants, water buffalo, royal Bengal tigers, and a variety of birds. Once drawn media attention for wrong reasons, Kaziranga drastically reduced the number of poaching incidents in the last few years, thanks

to the brutal laws against the poachers, strengthening of ground staff inside the protected forest areas and increasing public awareness in the fringe areas.

Monsoon Mayhem

The safe habitat for the largest population of one-horned rhinos (*Rhinoceros unicornis*) in the world eventually experiences flooding every year from the inflated water from Brahmaputra River on its northern border. As the core 430 square kilometre area (now extended to 1,300 sq. km) goes under the water, the animals take refuge in hundreds of highlands erected inside it. Many animals try to cross the Asian Highway 1 (NH-37) on its southern border to climb the hilly areas of Karbi Anglong. While crossing

the highway, some animals are killed by the speeding vehicles and hence the authorities instruct the drivers to maintain a safe speed limit to avoid any unwanted incidents. Often the vehicles are escorted by the forest officials while crossing the park to avoid accidents with the fleeing animals.

Rhinos are recognized as vulnerable species by the International Union for Conservation of Nature (IUCN) and India's Wildlife Protection Act formulated in 1972 gives enormous power to the forest rangers to protect the gigantic animal. The rhino horns, grown by both males and females after attaining six years, are believed to have medicinal values supposed to cure typhoid, headache, stomach ailment, food poisoning, snakebites and even cancer. Taiwan, Thailand, South Korea, Vietnam and the Middle East are also known to be huge markets for rhino horns, where its use for medical purposes and scientific research is legalized. Many also unscientifically believe that one can achieve unusual sexual power with the help of rhino horns (using it

as an aphrodisiac/traditional Viagra). However, the veterinarians argue that rhino horns comprise the same protein that constitutes the formation of hair & fingernails and it does not possess any quality for sexual stimulation.

Kaziranga lost two adult rhinos in January 2024 to poachers, who took away the horns understandably to earn an attractive amount of money from the illegal wildlife markets. Last year, Kaziranga witnessed one rhino poaching incident (Manas National Park and Tiger Reserve also lost one rhino to poachers) and it was preceded by two incidents each in 2021 and 2020, whereas three rhinos were killed in 2019. Needless to mention, Assam recorded a zero rhino-poaching year in 2022 to draw the applause from the global conservationists. Another world heritage site of the State, Manas forest reserve currently gives shelter to around 50 rhinos with a host of other inmates like water buffalo, tiger, leopard, golden langur, gaur, pygmy hog, etc. Similarly, Pobitora Wildlife Sanctuary (giving shelter to 107 rhinos) and Orang

National Park (125 rhinos) support the rhino population of Assam to increase up to 2,895 individuals.

Poaching Down, Drowning Up

With a drastic reduction in poaching incidents following the deployment of heavily armed ground forces and other modern gadgets, Assam expects to increase the rhino population to 3,000 very soon. A number of poachers were arrested and many died in encounters with the security forces inside the forest areas. The captured poachers and their associates admit that they had taken the risk of killing rhinos inside the restricted forest reserves because of enormous monetary benefits. While achieving success in preserving the species, it's time to pay serious attention towards the annual deluge, as it continues washing away rhinos and other animals every year. In a major flood that hit Kaziranga in 2017, over 350 animals including 24 rhinos died due to drowning and colliding with moving vehicles on the highway. It was succeeded by 17 rhino casualties in 2019, 10 in 2020, 8 in 2021, etc., due to floods.

But the conservationists argue that Kaziranga inmates cannot survive without the recurrent flood. The flood water helps the ecosystem by depositing nutrients for regenerating the grasslands. The natural water movement also supports cleaning the wetland of many invasive species for the benefit of grass eaters. All wild animals possess instincts to survive during the flood and so move towards the high land, apprehending the surrounding water level in advance. What they need is a natural way to proceed with no or little human intervention, so that they can take the decision correctly to move out and also return back to the forest reserve after the flood water recedes. ■

Nava Thakuria is a northeast India-based journalist.



A Revival Long Due?

Eco-friendly Leaf Plates Making Their Way Back in Shimla

How an initiative by authorities and its adoption by local temples for community meals and occasions to incorporate the use of Taur-made leaf plates is proving to be a sustainable alternative to prevalent usage of plastic plates in Basantpur block, Shimla district, HP, **Sarita Brara** writes.

Peena Devi and several other women in Basantpur block of Shimla district have been making leaf plates from taur (*Bauhinia vahli*) leaves for some years. Earlier, the income made from these leaves however, was not consistent as the order for making these leaf plates depended on the number of

dhams (community lunches) organized in the nearby villages on occasions like marriages. Also, not everyone was using the leaf plates for serving food at these *dhams*. A few months back their income received a boost—thanks to the decision by the Shimla District Commissioner (DC). The DC asked temples in the town to use

leaf plates made from taur leaves to serve *langars* (community lunches) which are prepared in these temples regularly on Sundays and other religious and special occasions. Thousands of people visit the temples on these occasions and as many leaf plates can be used.



Leaf Plates: A Part of Tradition

There was a time when food used to be served on leaf plates at *dhams* in several parts of Himachal Pradesh. Holding *dhams* is part of the tradition in the hill state on occasions like marriages, deaths and even other religious and family functions. The whole village and even people from nearby villages are served meals at these *dhams*. Leaf plates at that time were made by the family involved in the occasion with the help of fellow villagers. But with the disposable plastic

plates and dishes flooding the markets, people stopped using leaf plates and turned to the plastic alternative.

A Refreshing Change

The first temple in Shimla to make use of the leaf plates was Tara Devi temple on July 14, 2024 following the initiative taken by the DC of Shimla district. An order to make 5000 leaf plates was given to Saksham Cluster Level Federation at Basantpur for the purpose. The initiative is part of efforts to provide employment and livelihood opportunities to women self-help groups (SHGs) who are being

roped in this campaign in a big way. This is being done under National Rural Livelihood Mission under the aegis of District Rural Development Authority.

However, the trend started seeing a change, as a campaign to start using leaf plates gathered momentum with more people becoming environment conscious. The Saksham Cluster Level Federation at Basantpur spearheaded the campaign some years ago encouraging the villagers to go back to the tradition of using leaf plates made of taur leaves that grow on vines in some districts of the state. With the revival of the tradition, women started earning from leaf plates even if their income from this skill was small and far in-between.

Procuring Taur Leaves – An Uphill Task

Now with the demand for the leaf plates expected to go up because of the initiative, Peena Devi and other women have more work on their hands. Taur leaves grow on vines that creep on trees and rocks in hill areas, a task that requires a lot of energy and efforts is time consuming and even fraught with the risk of falling from the trees. But women from the hills are hardy—they work in fields, rear their domestic animals, carry loads of fodder from what are called 'ghasnis' and still do not mind learning a new skill or an art to add to the family income.

Taur leaves are soft and flexible and do not break when moulded or when they are being sewn in by pins made of bamboo twigs. Another advantage is that these environment-friendly leaves decompose in two to three days after which they can be buried in pits and then used as manure. On the other hand, disposal of plates made of plastic is a huge problem specially, in villages which do not have a proper garbage collection system in place. These women bring bundles of leaves at the Centre of Basantpur Saksham Level Federation and make the leaf plates.

Peena Devi and Pushpa making leaf plates at Basantpur Centre



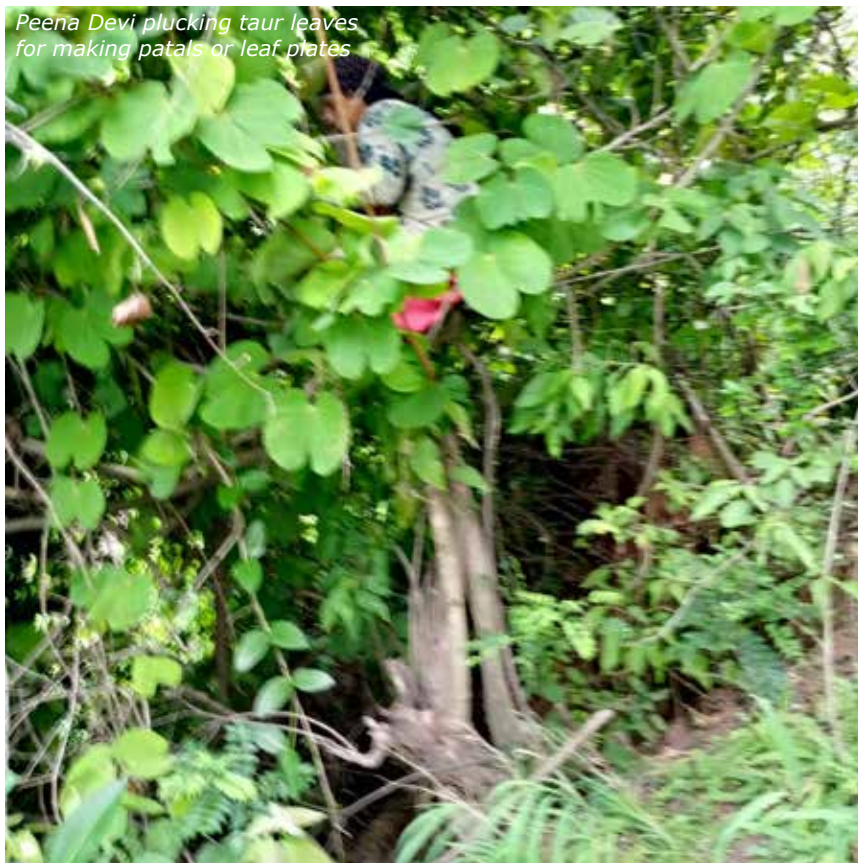
Adept at this art, Peena Devi takes just a minute or so to make a leaf plate. She is training other women too. Peena Devi told us that she and her husband have to spend more than five to six hours to pluck leaves from taur vines from a place some distance away from her village. In the evening, she makes bundles of these leaves and packs them in a sack. She then carries the load of around 12 kg next day, walking 4 to 5 kilometres and then taking a bus to Basantpur from her village Katli.

On reaching the centre, she along with other women who also bring these leaves first unbundle them; if the leaves are in good size, it takes just 3 or 4 leaves to make one plate and if small, 5 to 6 leaves are required for the purpose. She and other women like her get ₹40 for one kg of leaves and are paid ₹250 as daily wage for making leaf plates.

Pushpa from Juni village about 20 km from Basantpur, who learnt the art of making leaf plates from Peena Devi, has joined the group of women who make a living from this art.

“While plucking taur leaves from the vines that sometimes climb on tall trees is difficult and is time consuming but making leaf plates is much easier and the job is done pretty fast,” says Pushpa. Her husband is a farmer and they are also into selling milk as they own cattle. She,

Peena Devi plucking taur leaves for making patals or leaf plates



like other women, agree that an extra cash in the hand is always welcome.

According to Reema, President of the Cluster Level Federation at Basantpur, 50 to 60 women in Basantpur block and

nearby areas are involved in making these and other products.

The availability of taur leaves in Shimla district is also an issue. The forest department is being asked to include plantation of taur vines in their future campaigns.

Making of leaf plates has not only opened a window of opportunity for women in the area to earn a livelihood but their use can help in preventing environmental hazards caused by the littering of disposable plastic plates and dishes. These used leaf plates are also a source for making manure that can be used for agricultural purposes.

The need is not only to sustain this initiative but also expand the campaign to use leaf plates at temple *langars* and *dhams* in the state especially where these taur vines grow in abundance. ■

Sarita Brara is a Delhi-based senior freelance writer.



Five Scenarios for the Future of Climate Change Adaptation

And the technologies that will deliver benefits

Regardless of the success of climate change mitigation, companies and society must adapt to a changing world. Climate adaptation is complex, with unpredictable impacts, varying consequences, and numerous technologies, making it difficult to plan. To assist with adaptation strategies, Arthur D Little's Blue Shift Institute released *We're Doomed, Now What?*, a report outlining five potential adaptation scenarios and key technologies for businesses to focus on. It highlights "no regret" solutions and vital capabilities for future investment. Based on the IPCC's "+3°C by 2100" climate projection, the report is informed by analysis, interviews with over 40 global experts, and collaboration with the UN's World Intellectual Property Organization (WIPO). Read this article by **Zoe Huczok** and **Dr Albert Meige**.

Whatever the success of climate change mitigation measures, companies and society will need to adapt to a changing world, alongside their efforts to reduce emissions and achieve net zero targets. However, climate change adaptation is complex, with an unpredictable future, highly variable impacts and a myriad of available technologies all making it difficult to plan for. Where should companies start and what should they invest in?

Arthur D Little (ADL)'s Blue Shift Institute report, 'We're doomed, now what?', aims to help businesses navigate this area. It has a triple focus, looking at adaptation, what companies should do, and how technology can help. Deciding where to focus investment and development efforts for adaptation is difficult. The technologies to address adaptation needs are, for the most part, specific, numerous, and fragmented. There is no single technology that meets every need. At the same time, funding

for adaptation tech remains low—it is estimated that less than 10 per cent of all climate technology funding went to adaptation in 2020–2021.

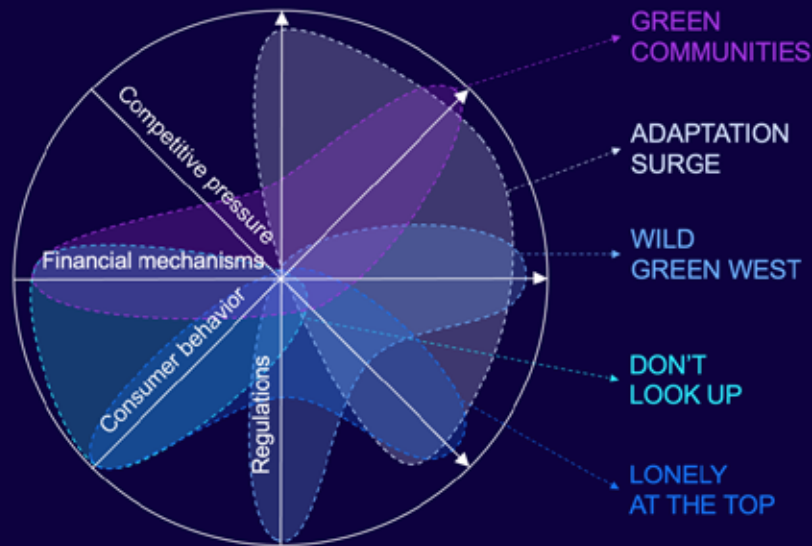
Furthermore, the suitability and viability of adaptation solutions in the future will be greatly affected by a range of uncertainties, such as market dynamics, regulation, consumer behaviour, and financial mechanisms. This complexity often leads to decision paralysis or, at least, an extended "wait and see" philosophy.

Modelling Potential Outcomes

To understand how companies should move forward, we began by modelling the outcomes of a rapidly warming world, based on what is certain and what is uncertain. What is relatively certain are the geophysical and biological impacts of a "+3°C by 2100" increase in temperature. This figure is based on one of the scenarios of the Intergovernmental Panel on Climate Change (IPCC) projection, which outlines major effects from an increase in extreme climate events, scarcer freshwater availability, sea level rise, biodiversity loss, and increased pests. These impacts are widespread



To reduce climate complexity, we laid out all possible combinations of critical uncertainties, generating 24 projections which we then filtered down to **5 projections to emphasise insightful tensions**



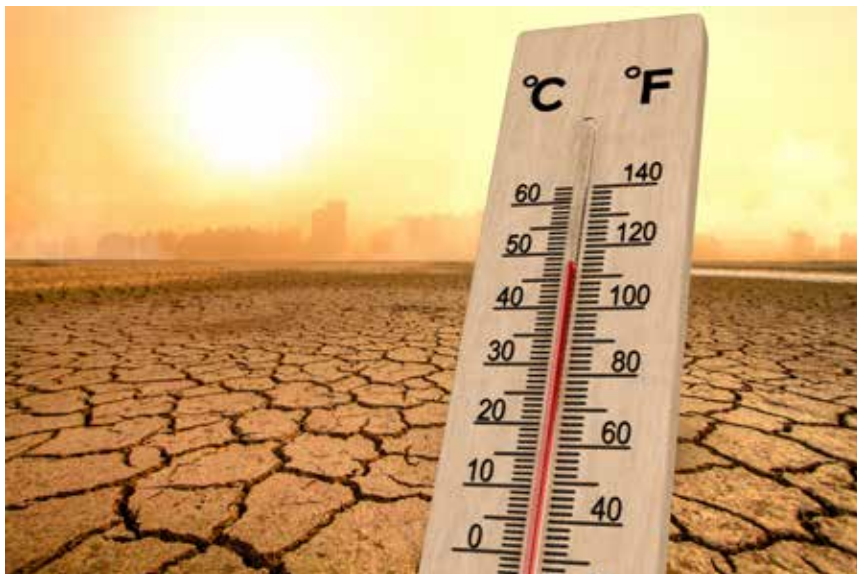
and large-scale, whatever mitigation measures are taken. From this we outline the consequences for businesses across four areas—sourcing raw materials (*source*), manufacturing goods (*make*), protecting their sites and assets (*protect*) and finally selling to customers in a changing world (*sell*). Companies must consider how these four types of

challenges could affect their business operations as they consider their options.

Alongside these certain impacts, businesses need to factor in four critical uncertainties—regulations, consumer behaviour shift, competitive pressure, and the availability of finance. These combine high potential impact and high uncertainty.

By considering each “on/off” combination of these four factors, we generated 24 future projections, of which five are the most plausible, differentiating, and technologically relevant:

- 1. Green Communities:** Strong consumer behaviour shifts but limited finance. This is a resource-scarce world in which grassroots adaptation initiatives flourish, without large-scale projects.
- 2. Lonely at the Top:** No consumer behaviour shift but high competitive pressure. Adaptation is driven by global market leaders targeting affluent customers in a highly unequal, two-speed society.
- 3. Wild Green West:** Strong finance but little regulation. This is characterized as creative chaos in which adaptation initiatives sprout everywhere, fuelled by private capital but lacking any regulatory backbone.
- 4. Don't Look Up:** Limited finance and no consumer behaviour shift. This is a pessimistic future in which neither customers nor financial institutions



have adjusted to the new climate reality.

5. Adaptation Surge: All variables favour adaptation. This is a relative utopia in which adaptation is the norm, resetting expectations and creating new markets and new needs.

Responding with Technology

We then mapped these five projections against the four corporate challenges (*source, make, protect, and sell*). This enabled us to identify both specific technologies that enable adaptation for each projection, and a short list of *no-regret solutions*, enabling technological bricks, and key capabilities that companies should consider. These no-regret moves that will be relevant regardless of the projection, or the industry concerned, include:

- **Solutions:** Early warning systems, thermal comfort systems, geographic information systems (GIS) for site location, aerial drones for imaging,

robots for maintenance and automation of production, and water efficiency and recycling systems

- **Key technological bricks:** Sensing technologies, including Internet of Things (IoT) and remote sensing (including light detection and ranging, or LiDAR); digital twins and generative AI (GenAI) for simulation; and neural networks for prediction
- **Underlying capabilities:** Data science, complex systems modelling, design for scarcity, responsive risk assessment, and strong local partnerships

Ultimately, climate is a complex system, which means it exhibits hard-to-predict, emergent effects. While the likely scale of climate change impacts is well evidenced, generally the sequence and speed of development of individual events are hard to predict. The capability to model complex systems and their impacts at a local scale will be key to developing comprehensive and nuanced approaches to successful adaptation.

Taking Action

A survey conducted as part of our study confirmed that a lack of knowledge of the best course of action is the biggest hurdle to business adaptation. To move forward, companies should focus on understanding their climate change issues and risks, putting suitable governance in place, establishing means of financing, and developing local partner ecosystems. To take effective action, companies must consider four key questions:

- 1. How to predict?** Decision makers should begin by creating their own global warming trajectory assumptions and identifying the shaping factors most critical for their industry and global footprint. They need to conduct site-by-site assessments of potential risks, both acute and chronic, and pilot improved risk-monitoring and modelling approaches, leveraging digital technologies, such as digital twinning and AI.





- 2. How to decide?** Businesses will need a suitable governance approach to oversee the adaptation agenda, which often stretches across several functions. New metrics are likely to be required. Approaches such as heat maps can help allocate priorities. Abilities to “think global, act local” and enhance customer listening are key.
- 3. How to finance?** Mobilizing funding for adaptation requires updating financial metrics, including pricing climate-risk vulnerabilities in terms of damage to assets, production loss, and possible reputational effects. It may also involve the complex task of pricing positive externalities (productivity gains, employee retention) and potential market opportunities from adaptation (market share gains, or new product-market fit). It also requires working with longer timelines (>15 years) than is customary for most corporate decision-making.

- 4. How to build?** Because adaptation problems require local solutions, it will be essential for businesses to develop local ecosystems of partners. As with any collaborative innovation effort, it is important to set clear ground rules for intellectual property (IP). Finally, companies will have to accept longer timescales for adaptation investments.

The Need to Adapt Rapidly

Technology alone will not solve adaptation challenges. As our future projections illustrate, the effectiveness of adaptation responses will be the result of how governments, businesses, societies, and individuals interact and behave. In particular, it is both very uncertain and very consequential whether consumers change habits, regulation is enacted, financial mechanisms are developed, and funds unlocked, and large companies assume leadership in adaptation.

Ultimately, the effectiveness of

adaptation to climate change will be a function of how all stakeholders can collaborate to meet local, national, and global challenges. Beyond the no-regret solutions, technological bricks, and capabilities outlined in our report, there is no single best approach to solve adaptation challenges. What is needed is a nuanced consideration of the impact of a business’s ecosystem on its operations, and vice versa, to identify the most relevant solutions.

What is clear is that climate change will become an increasingly consequential constraint on corporate forward planning. This means that 100 per cent of tomorrow’s business strategies will be climate adaptation strategies if organizations are to safeguard their own, and society’s future. ■

Zoe Huczok and Dr Albert Meige, Blue Shift, Arthur D Little. To read the full report, visit the Arthur D Little website: < <https://www.adlittle.com/> >

Can Diwali Go Green?

Addressing Smog and Carbon Footprints during the Festival of Lights

In this article, **Tanya Singhal** highlights how several communities have successfully replaced traditional fireworks with stunning laser displays and organized mesmerizing drone shows, blending modern technology with Diwali's core theme of light. These innovative displays create intricate sky patterns without causing pollution. Additionally, lighting sky lanterns made from biodegradable materials and using LED lights instead of fire offers a beautiful, lower-impact alternative to conventional fireworks. Unlike the fleeting joy of a firecracker, each illuminated lantern lingers in the sky far longer. Beyond these eco-friendly alternatives, we can truly embrace the spirit of Diwali by focusing on community-centred celebrations.

Diwali, the Festival of Lights, has been a cornerstone of Indian culture for millennia. Historically, it celebrated the triumph of light over darkness, good over evil, and knowledge over ignorance. Ancient texts describe Diwali as a time of lighting diyas (oil

lamps), creating intricate rangoli designs, and coming together as communities. Notably absent from these descriptions are fireworks or crackers. Over the centuries, however, the essence of Diwali has been gradually diluted. In many places, what was once a festival of inner

illumination and community bonding has devolved into an event marked by excessive fireworks and air pollution. This shift strays from the festival's roots and poses significant environmental and health challenges.

In recent years, the environmental





impact of Diwali celebrations has become alarmingly clear. According to the Central Pollution Control Board of India, $PM_{2.5}$ levels in Delhi during Diwali typically spike 300–600 $\mu\text{g}/\text{m}^3$, far exceeding the World Health Organization's 25 $\mu\text{g}/\text{m}^3$ guideline for a 24-hour mean. These pollutants don't dissipate quickly; they linger for weeks, affecting millions of lives.

We must ask ourselves: Can we realign Diwali with its original spirit while addressing these environmental concerns? The answer is a resounding yes, and the transition has already begun. Multiple innovative alternatives to traditional fireworks are emerging,





like drone light shows, lighting sky lanterns, community laser light shows, augmented reality (AR) fireworks, etc. Several communities have successfully replaced fireworks with dazzling laser displays and have organized spectacular displays using hundreds of drones, combining modern technology with the festival's essence of light, creating intricate patterns in the sky without any pollution. Lighting sky lanterns made from biodegradable materials and using LED lights instead of fire provides a beautiful, lower-impact alternative to traditional fireworks. Each lighted lantern stays much longer in the air than just the momentary pleasure of burning a firecracker. Beyond these alternatives, we can embrace the true spirit of Diwali through community-centric celebrations. Organizing cultural programmes and community feasts reduces individual carbon footprints and strengthens social bonds—a core aspect of the festival.

LED lights offer a sustainable option for those who wish to decorate their homes. Compared to traditional lighting, they can reduce electricity consumption by up to 80 per cent, allowing for festive illumination without the guilt of excessive energy use.

Education and knowing the power of an individual's actions plays a crucial role here. Schools can integrate environmental awareness into their Diwali celebrations, teaching students about the festival's history and the importance of sustainable practices. Encouraging students to take pledges for a green Diwali can create a ripple effect, influencing families and communities. The challenge lies in balancing tradition with environmental responsibility. It requires a shift in mindset, viewing sustainable practices not as a compromise but as an evolution of our cultural heritage. By choosing eco-friendly celebrations, we protect our

environment and rediscover Diwali's true meaning—a festival of light, hope, and renewal.

Imagine a Diwali where the air remains clean, celebrations bring communities together without harming the environment, and the light we kindle symbolizes our commitment to a greener future. The question isn't whether Diwali can go green—it's whether we will make it happen. This Diwali, let's pledge to celebrate responsibly, keeping in mind that the true spirit of the festival lies not in momentary sparkles but in illuminating a path towards a sustainable future. By doing so, we can ensure that the 'Festival of Lights' brightens not just our homes but the prospects of our planet for generations to come. Together, we can transform this Diwali into a Green Diwali. ■

Tanya Singhal, Founder, Mynzo Carbon & SolarArise.

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