

TerraGreen

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VOLUME 16 | ISSUE 2 | May 2023

Brahmapuram Landfill Fire

Points towards the Need for
Decentralized Waste Management

TERRA YOUTH

Stop Food Waste Day

IN CONVERSATION

Dr Pushplata Singh

Senior Fellow, Centre of Excellence
in Agrinotechnology, TERI

SPECIAL HIGHLIGHTS

The Aluminium-Air Battery
Bite into a Peach



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Mycorrhiza News provides a forum for the dissemination of scientific information on mycorrhiza research and activities; publishes state-of-the-art papers from eminent scientists; notes on important breakthroughs; provides brief accounts of new approaches and techniques; publishes papers compiled from its RIZA database; provides information on forthcoming events on mycorrhiza and related subjects; lists important research references published during the quarter; and highlights the activities of the Centre for Mycorrhizal Culture Collection.

Editor: Dr. Mandira Kochar, TERI, New Delhi.

Frequency: Quarterly (4 Issues per year—April, July, October, and January) • **Print ISSN:** 0970-695X • **Print ISSN:** 0970-695X

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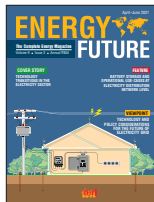
TerraGreen

TerraGreen is India's most respected monthly magazine dedicated to informing and enlightening its readers on issues of environment, energy, and sustainable development. Launched in 2004, TerraGreen has made an indelible impression on the minds of readers, both in India and across the world. Today, it enjoys a readership of over 40,000 and a subscriber base of close to 10,000.

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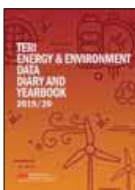
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Energy Future draws from a deep well of expertise at TERI, India's leading research institute on energy and green growth. Knowledge of energy security and development is a critical requirement in the modern global economy, and Energy Future aims to educate and inform you about the wide world of energy; its history, its future, how the energy industry works, how it has affected the world, and how it continues to affect you and me.

Frequency: Quarterly (4 Issues per year) **Print ISSN:** 2278-7186

Subscription rate: Print+Online – ₹800/\$80

(Free access to online archives of over 12 years)



TERI Energy & Environment Data Diary and Yearbook

A TERI Publication

TERI Energy & Environment Data Diary and Yearbook, or TEDDY, is an annual publication brought out by TERI since 1986. TEDDY is often used as a reference in other peer-reviewed books and journals for energy and environment-related data. It gives an annual overview of the developments in the energy supplying and consuming sectors as well as the environment sector. It also provides a review of the government policies that have implications for these sectors of the Indian economy.

402 pages • Hardback • 220mm × 280mm • ₹1995/\$129 (Online only)

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EDITORIAL



“ According to the Solid Waste Management Rules, 2016 only non-recyclable, non-biodegradable, non-combustible wastes should be allowed to come to the landfill; this was not the case in Brahmapuram landfill. ”

The devastating fire at Kochi's Brahmapuram garbage plant in March 2023 has left Kerala's residents breathless. It has turned out to be a major point of concern among people. This incident should be considered an indication of Kerala's lingering waste management problem. Spread across 70 acres, Brahmapuram landfill has been accumulating legacy waste of almost six lakh tonnes. Almost 70–80 per cent of this garbage is not segregated. The mix includes both biodegradable and non-biodegradable waste.

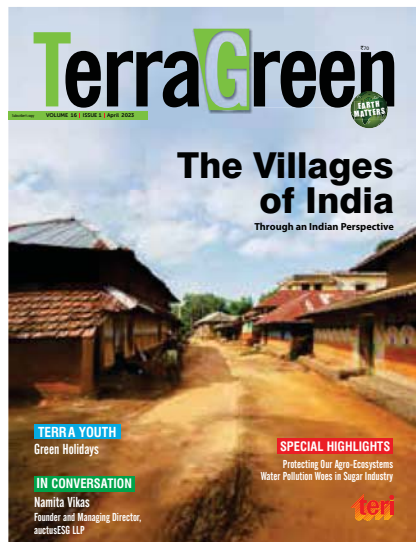
Our cover story on Brahmapuram Landfill Fire this month highlights that a series of flames have been breaking out, year after year, at the Brahmapuram landfill in Kerala. Yet, it was not taken too seriously. This year, the massive uncontrollable fire breakout pressed on the Kochi Corporation to take serious steps to resolve this issue as it impacted the health of people, and the environment. According to the Solid Waste Management Rules, 2016 of the Ministry of Environment, Forest and Climate Change, Government of India, the mixed waste in Brahmapuram was not acceptable. The Rules say that only non-recyclable, non-biodegradable, non-combustible wastes should be allowed to come to the landfill; this was not the case in Brahmapuram.

The cover story shows that there is light at the end of the tunnel as there are some Kochi-based not-for-profit organizations, working on waste management, and other environmental issues. Plan@Earth was one of the earliest NGOs to intervene in the waste collection space in Kerala. They started off by engaging in a clean-up activity with college students in the tourist spots Athirampally and Vazhachal in Kerala. Plan@Earth is currently working in five panchayats and two municipalities, reaching out to almost 30,000 households in the State. They are recycling 60–70 tonnes of plastic waste every month. The NGO is also working with a team of people to offer scientific solution to the issue of waste management. The solid waste management model works well with households, but beyond it, the manufacturers have to take responsibility for the waste generated.

With this cover story and other articles of current interest, we hope that you enjoy reading this issue of *TerraGreen*. We do look forward to receiving your feedback and letters.

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

Vibha Dhawan
Director-General, TERI



I liked reading the April 2023 issue of *TerraGreen*. The cover story on Indian villages is apt indeed. The authors are correct when they say that a new tradition of scholarship must evolve to understand the village systems at the conceptual and theoretical levels. The way 'rural' and 'village' concepts have been historically interpreted and understood needs refinement, and the colonial imprint has distorted the existing fabric of the rural social systems. The credit for constructing the 'immemorial' village community goes to the colonial period. Much later, even for Indian nationalists, the village remained a symbol of 'traditional' India, which the British had sought to sustain for its purposes. Agriculture, peasantry, land use, social systems and infrastructure, and indigenous technical knowledge systems need a more profound understanding of structural-functional and comparative analysis approaches. Furthermore, village and rural society is a

complex issue and has been historically misread and misinterpreted, which has caused a significant loss to the country. Therefore, it is the need of the hour to focus on the village and immerse us in the nation's holistic development.

Sunil Kr Yadav
New Delhi

I liked reading the article on health hazards posed by sanitary pads. They carry BPA and other chemicals which can cause cancer over time and can interfere with the reproductive system as well. The presence of pesticides and herbicides in pads can directly enter your bloodstream to affect your internal organs. To prevent the smell of menstrual blood sanitary napkins are equipped with deodorants and fragrances which can cause infertility. So, do we have an alternative for these? Menstrual cups are a perfect alternative to prevent yourself from the health hazards of sanitary napkins as these are safe, economical, and are recommended by gynaecologists too! The article on water pollution woes in sugar industry is also very interesting to read. All sugar mills/other industries have effluent treatment plants (ETPs) mandated since several years now. Every industry and its ETP outlets are connected to a central monitoring system that regularly reads and sends data to state PCBs and CPCB. If the PCB receives information that the limits have been exceeded, the industry is sent a notice and serious action is taken. However, since the parameters that CPCB monitors are not available to the public, there is a lack of transparency in the system.

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Himachal Pradesh Takes Aim to Lead in Country's Clean Energy Transition

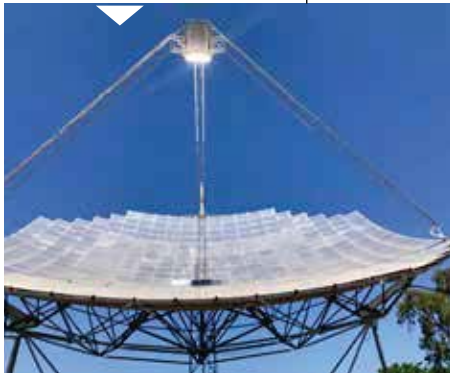
As India aims to become energy independent by the year 2047, Himachal Pradesh is taking a lead in the country's clean energy transition by contemplating a 'Green Hydrogen' policy that would promote the use of green hydrogen and establish the hill state as a leading hub for its production. Increasing renewable energy use across all economic spheres is central to the country's energy transition, and 'green hydrogen' is considered a promising alternative for enabling this transition. Hydrogen can be utilized for long-duration storage of renewable energy, replacement of fossil fuels in industry, clean transportation, and potentially also for decentralized power generation, aviation, and marine transport.

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

Cancer Hospital in Vadodara Gets World's Largest Solar Concentrator

The Kailash Cancer Hospital and Research Centre in Vadodara has added another identity—having the world's largest solar concentrator. It has been developed by the Australia National University and Sunrise CSP Australia, and this solar concentrator will provide steam required for cooking more than 2000 meals every day apart from taking care of the hospital's laundry and sterilization needs. The solar concentrator—Bigdish—has been developed by Sunrise CSP India, a start-up established at the Ashram. "It is highly efficient and capable of providing steam required for cooking for more than 2000 meals daily, besides laundry and sterilization too," said Deepak Gadhia, one of the trustees of Muni Seva Ashram and chairman of Sunrise CSP India.

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



Apple Opens Carbon Neutral Stores in Mumbai and Delhi

When Apple opened its first store in India in April 2023 in Mumbai, it followed its policy of opening only carbon-neutral stores worldwide. Apple's 28,000 sq. ft. store at BKC, Mumbai, is designed to be one of the most energy-efficient Apple Store locations in the world, with a dedicated solar array and zero reliance on fossil fuels for store operations. The store is operationally carbon neutral, running on 100 per cent renewable energy.

Apple's second store opened in Saket in Delhi a few weeks after the first in Mumbai. The Delhi store is located in Select CITYWALK mall. Even this store runs on 100 per cent renewable energy and is carbon neutral. Apple has announced that it is committed to becoming carbon neutral by 2030.

Source: <https://sustainabilitynext.in/>



New Species of Flying Gecko Found in Mizoram; Named After State

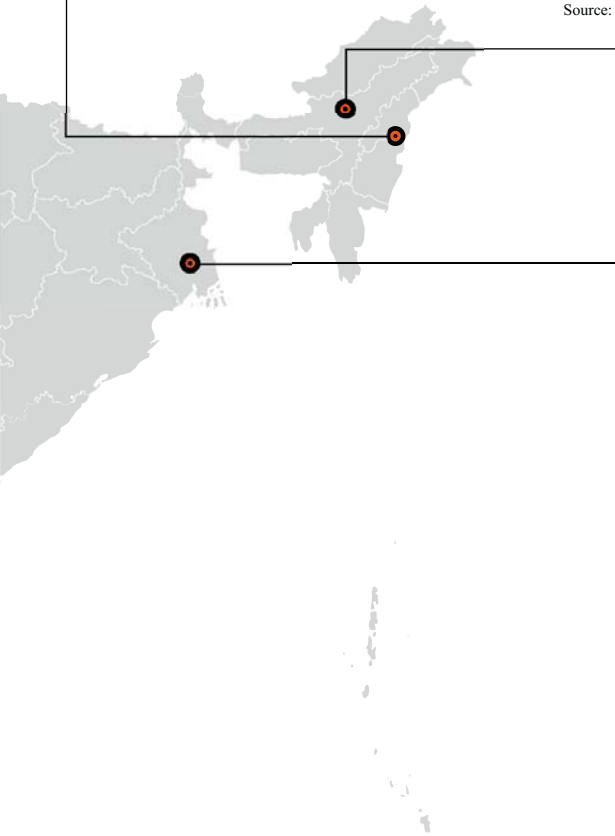
A team of researchers from Mizoram University and Max Planck Institute for Biology in Germany have discovered mainland India's first species of flying geckos in Mizoram. Details of the study on the new species, which is also called gliding or parachute geckos, were published recently in the latest issue of *Salamandra*, a German journal on herpetology. The new species has been named *Gekko mizoramensis* after the northeastern state. The only other flying gecko species in India is *Ptychozoon nicobarensis* or Nicobar gliding gecko found only in the Nicobar Islands.

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

Signify Lights up Majuli Island in Assam with Solar Lighting

Signify (Euronext: LIGHT) has illuminated 43 villages in Majuli Island, Assam, with solar street lighting to enhance the safety of local citizens. The project executed in partnership with Evangelical Social Action Forum (ESAF) is part of the company's Har Gaon Roshan CSR programme, which focuses on sustainable rural development. Majuli is one of the world's largest river islands and is often dubbed the cultural capital of Assam as it is home to many ethnic groups that have lived here for centuries. It is also a natural habitat for rich flora and fauna, harbouring many rare and endangered species, especially migratory birds that make Majuli their home during the cold winters.

Source: Simran.Maheshwari@sixdegrees-bcw.com



Advantages of Super-Cool Materials on Roofs, Pavements, and Walls

A coat of pocket-friendly, super-cool materials on roofs, outer walls of houses and pavements can reduce the peak air temperature in Kolkata by 5.3°C, cut down on the consumption of cooling energy significantly and save people from heat stress, finds a study by a Kolkata-based college teacher Ansar Khan, which was recently published in a peer-reviewed international journal. When super-cool roof materials are used only on the rooftops of buildings in a humid city such as Kolkata, the ambient temperature in the city can fall by up to 1.6°C.

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



Climate Change to Push 30 Per Cent Species over Tipping Points

Climate change is likely to abruptly push up to 30 per cent species over tipping points as their geographic ranges reach unforeseen temperatures, according to a study. The researchers found that if the planet warms by 1.5 degrees Celsius, 15 per cent of species they studied will be at risk of experiencing unfamiliarly hot temperatures across at least 30 per cent of their existing geographic range in a single decade. However, this doubles to 30 per cent of species at 2.5 degrees Celsius of warming, they said. The study, published in the journal *Nature Ecology & Evolution*, analysed data from over 35,000 species of animals—including mammals, amphibians, reptiles, birds, corals, fish, cephalopods and plankton—and seagrasses from every continent and ocean basin, alongside climate projections running up to 2100.

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



Deadly Floods in Italy

Severe flooding and mudslides in the northern Italian region of Emilia Romagna have resulted in the deaths of at least eight people. Over 13,000 residents evacuated their homes. The disaster affected multiple cities. A significant number of people had to be evacuated from Bologna, Faenza, and Ravenna. The flooding has been so severe that in some areas, people have had to escape to their buildings' roofs to avoid the rising waters. Rescue teams, including 600 firefighters, were deployed from across Italy to assist in evacuations and search for missing persons. The situation remains critical, with weather alerts at their highest level and river levels still rising. This extreme weather event follows a period of prolonged drought in the region. Meteorologists suggest the drought may have worsened the floods.

Source: <https://newsqpt.ai/>

More than Half of the World's Large Lakes are Drying Up

More than half of the world's large lakes and reservoirs have shrunk since the early 1990s, chiefly because of climate change, intensifying concerns about water for agriculture, hydropower and human consumption, a study published recently found. A team of international researchers reported that some of the world's most important freshwater sources—from the Caspian Sea between Europe and Asia to South America's Lake Titicaca—lost water at a cumulative rate of around 22 Gigatonnes per year for nearly three decades. That's about 17 times the volume of Lake Mead, the United States' largest reservoir.

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





The UK Government Allocates £77 Million for Zero-Emission Vehicle Projects

The UK government has announced £77 million in funding for a zero-emission vehicle project that will include emergency services vehicles. The project seeks to develop a hydrogen fuel-cell range extender for specialist electric vehicles (EVs) such as fire engines and ambulances. A project focusing on battery-powered buses will also benefit from the scheme. In 2022, nearly 66,000 electric buses and 60,000 medium and heavy-duty trucks were sold worldwide, representing about 4.5 per cent of all bus sales and 1.2 per cent of truck sales. The funding has been awarded through the Advanced Propulsion Centre's (APC) Collaborative Research and Development programme. The government will provide £38.4 million of the investment, backed by a further £38.7 million from the automobile industry.

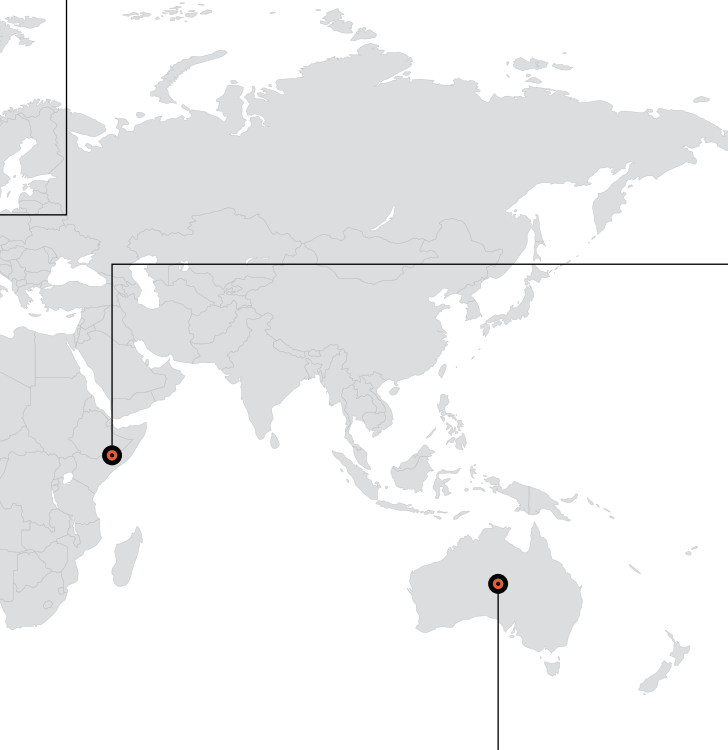
Source: <https://renewablewatch.in/>



UN Lays Out Strategy to Reduce 80 Per Cent of Plastic Waste by 2040

The United Nations Environment Programme (UNEP) released its analysis of policy options to tackle the plastic waste crisis two weeks before countries convene in Paris. Countries can reduce plastic pollution by 80 per cent by 2040 using existing technologies and by making major policy changes, the UNEP said in a new report recently. The Kenya-based UN body released its analysis of policy options to tackle the plastic waste crisis two weeks before countries convene in Paris for a second round of negotiations to craft a global treaty aimed at eliminating plastic waste.

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



Hotspots Globally Vulnerable to Deadly Heatwaves

The effects of climate change are already being felt in many parts of the world, with extreme temperatures ranging from intense heatwaves to severe cold spells depending on the season. Now, a study published in the journal *Nature Communications* recently revealed that specific regions around the world are "most-at risk" of experiencing devastating heatwaves in the coming years. These regions include parts of Russia, Central America, central Europe, China, and Australia, along with Afghanistan, Papua New Guinea, and northwestern Argentina. The study aimed to identify global regions that have been fortunate enough to avoid experiencing extreme heat until now.

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



Hiccups in the Himalayas

Reading the Warning Signs in Uttarakhand

Joshimath, also known as Kartikeyapura named after Kartikeya, the God of Katyuri kings and the son of Lord Shiva, is the ancient and picturesque town in the Chamoli district of Uttarakhand, which has been breaking for some time now, however, the urgent appeals to mend it has been ignored every time. The town lies in seismic zone V, which makes it the most active earthquake prone area in the Indian Himalayan geographical region and is anyway precariously positioned when it comes to frequent as well as high intensity earthquakes. Read on to know more...

The Himalayan biome works in a very complex manner compared to the other biomes on the planet. Further, the geosphere (land), hydrosphere (water) and biosphere (ecology) are all the combined components of the Himalayan mountains and they keep interacting with each other continuously and comprehensively in the young Hindu-Kush Himalayan (HKH) region. Being an active plate tectonic collision zone it adds on to the continuity of geographical

events, majorly disastrous (flash floods, avalanches, landslides, earthquakes, debris flow, etc.) which results in the loss of human lives, flora & fauna and livestock on the third pole of the Earth.

The land subsidence being witnessed in Uttarakhand's Joshimath over the past few days has triggered an ecological and humanitarian crisis, and it arises from the complex mechanism of Himalayan plates active for almost over a century now when the area was formed by debris of a landslide that happened at the time.

It is also to be noted that the hydrogeological cycle never works in silos, instead is always inter-disciplinary in nature. With the majority of the Himalayan states in the country covered under the watershed of the three mighty glacier-fed river water systems, the Ganga, the Brahmaputra and the Indus; springs, which is one of the major natural source of ground water, are the result of the same interactive processes (aids in the formation of karst geomorphology, fractures, and cracks in the rocks) that keeps going on inside-out in the Himalayan mountains. The dynamic weather phenomenon associated with glaciers plays an equally important role in the formation of clouds for rainfall and also in interaction with the forest reservoir.

A recent joint report from the Food and Agriculture Organization (FAO) and United Nations Environment Program published in 2020 underscores the impact of the COVID-19 pandemic on the sustainable management of forests. In the past two years, Uttarakhand has been wrecked by natural calamities—the flash floods in Chamoli in February, 2021; an avalanche above Joshimath town in April the same year; cloud burst in Devprayag





in May, 2021; and most recently, the land subsidence and houses on unsteady ground in Joshimath town. The young and varied rock formation, especially the loamy sand to sandy clay loam, in the Himalayas exacerbates the frequency of the extreme events.

The extreme weather events have resulted in the disappearance of a vast section of vegetation from the state's forested and inhabited areas, including the villages. A sense of fear pervades the villages, especially those perched on the steep, inclined ranges of fragile slopes. The twin combination of deforestation and controlled blasting for large infrastructural projects are the prime anthropogenic activities responsible for frequent devastating events in Uttarakhand being witnessed now. The drying of springs due to dropping water recharge and increased extraction is leading to pores in the soil and rocks and, hence, accelerates the land subsidence. There is an urgent need to focus on

the preventive measures to protect the endangered ecology of Joshimath and nearby areas. Large-scale afforestation plans need to be undertaken to boost soil binding and holding capacity, which will eventually recharge underground aquifers as a portable source of water and will also fill the voids in rocks, enhancing the land resistance. It is high time for the state to rework its policy structures and build strong systems towards big hydropower and infrastructural projects with private partners. It is imperative to have participatory involvement of village communities at the grassroots level since they are the primary stakeholders of the resources. Women in the mountains often undertake responsibilities of farming and run small shops. It is important to involve them to build a sense of ownership and security in the community.

Controlled blasting which generates little tremors in the earthquake-prone Himalayas should be stopped urgently or an alternative to controlled blasting

should be brought in place after proper scientific studies.

Development should not be at the cost of sustainable practices or destruction of the natural habitat. Most importantly 'green tourism' should be the way ahead to reduce the pressure on mountains, while generating employment opportunities and preserving the heritage of Himalayas as much as possible.

It is the need of the hour to keep our mutual and short-term benefits aside if the horrific histories of Kedarnath disaster in 2013, and Rishiganga and Dhauliganga disaster of 2021 is not to be repeated. Another instance of neglect will have us hurtling down a disastrous path which has no return. ■

Article by Priyanka Vadrevu, who is a Research Associate at the Centre for Himalayan Ecology at The Energy and Resources Institute (TERI), New Delhi. This article first appeared online at <https://www.teriin.org/>

Elephant Ecosystems in Decline

Points towards Conflict between Elephants and Humans

Study examining habitats across centuries reveals an urgent need for sustainable land-use and conservation strategies to avoid dangers for wildlife and human communities. Global space for Asian elephant habitats has been in rapid decline since the 1700s, a new report reveals. More than 3 million square kilometres of the Asian elephant's historic habitat range has been lost in just three centuries and may underlie present-day conflicts between elephants and people.

More than 3 million square kilometres of the Asian elephant's historic habitat range has been lost in just three centuries, a new report from an international scientific team led by a University of California San Diego researcher reveals. This dramatic decline may underlie present-day conflicts between elephants and people, the authors argue. Developing new insights from a unique

dataset that models land-use change over 13 centuries, a research team led by new UC San Diego faculty member Shermin de Silva found that habitats suitable for Asian elephants have been cut by nearly two-thirds within the past 300 years.

The largest living land animal in Asia, endangered Asian elephants inhabited grasslands and rainforest ecosystems that once spanned the breadth of the

continent. Analysing land-use data from the years 850 to 2015, the researchers describe in the journal *Scientific Reports* a troubling situation in which they estimate that more than 64 per cent of historic suitable elephant habitats across Asia has been lost. While elephant habitats remained relatively stable prior to the 1700s, colonial-era land-use practices in Asia, including timber extraction, farming and agriculture, cut

Photo courtesy: V Srinivasan on Unsplash



the average habitat patch size more than 80 per cent, from 99,000 to 16,000 square kilometres.

The study also suggests that the remaining elephant populations today may not have adequate habitat areas. While 100 per cent of the area within 100 kilometres of the current elephant range was considered suitable habitat in 1700, the proportion has since declined to less than 50 per cent by 2015. This sets up a high potential for conflicts with people living in those areas as elephant populations alter their behaviour and adjust to more human-dominated spaces.

"In the 1600s and 1700s there is evidence of a dramatic change in land use, not just in Asia, but globally," said de Silva, an assistant professor in the School of Biological Sciences' Department of Ecology, Behavior and Evolution, and founder of the non-profit Trunks & Leaves. "Around the world we see a really dramatic transformation that has consequences that persist even to this day."

Also contributing to the study were researchers from across the globe, including Smithsonian's National Zoo and Conservation Biology Institute, University of Nottingham Malaysia, Frankfurt Zoological Society, Vietnam National University of Forestry, Wild Earth Allies, Zoological Society of London and Colby College. "This study has important implications for our understanding of the history of elephant landscapes in Asia and it lays the groundwork for better understanding and modelling the potential future of elephant landscapes as well," said Philip Nyhus, Professor of Environmental Studies at Colby College and one of the study co-authors.

In addition to Nyhus, three Colby undergraduate students contributed to the study. "This was a collaborative and multi-institutional effort," added Nyhus, "and I was proud that Colby students contributed significantly to the models and analyses used in the study." Beyond the immediate impact on Asian



Photo courtesy:
Pawel dotio on
Unsplash

elephants, the study offers the results as a mechanism to assess land-use practices and much-needed conservation strategies for all of the area's inhabitants.

"We're using elephants as indicators to look at the impact of land-use change on these diverse ecosystems over a longer time scale," said de Silva. Human impacts leading to reductions in the habitat ranges of several land-based mammal species have been well documented in the recent past. Climate change is also thought to have accelerated this decline over the past century. But assessing the impact of such changes on wildlife over the long-term has been difficult to study due to the lack of historical records.

The newly published findings were based on information from the Land-Use Harmonization (LUH) dataset, produced by researchers at the University of Maryland. The dataset provides historical reconstructions of various types of land uses—including forests, crops, pastures and other types—that reach back to the ninth century.

"We used present-day locations where we know there are elephants, together with the corresponding environmental features based on the LUH datasets, to infer where similar habitats existed in the past," said de Silva. "In order for us to build a more just and sustainable society,

we have to understand the history of how we got here. This study is one step towards that understanding."

The research team notes that the historical range of elephants is likely to have extended well beyond protected areas, which are of insufficient size to support elephant populations in Asia. They included lands under traditional systems of management that were altered within the past three centuries. The loss of these traditional practices, the authors suggest, may be a major reason behind the loss of habitat.

Much more work, the authors argue, is needed to understand possible changes facing these habitats in the future. Considering the people—along with wildlife—at the frontiers of elephant-human conflict zones, the researchers caution that attempts at habitat restoration need to be guided under a reckoning of social and environmental justice for historically marginalized communities.

"Exploring the relationship between past land management practices and the distributions of elephant ecosystems would be a useful direction for future studies from the perspectives of both ecological and social policy," they note in the report. ■

Source: www.sciencedaily.com





The Aluminium-Air Battery

The Holy Grail for India's EV Market?

In this article, **Manish Vaid** says aluminium-air (Al-air) batteries offer a promising alternative to lithium-ion batteries for the Indian electric vehicle ecosystem. As India makes strides towards adopting other sustainable mobility options such as green hydrogen as transportation fuel, compressed biogas, and ethanol blending, it has also begun its quest for alternative battery technologies such as sodium-ion and Al-air.

As India focuses on achieving its net zero goals by 2070 to address the pressing need for climate change mitigation, it becomes imperative to rely on sustainable and renewable energy sources. To accomplish this, the transportation industry, a primary contributor to emissions, must be prioritized. Immediate electrification of vehicle fleets is critical to avoiding a significant surge in transport-related emissions by 2050. In this regard, Aluminium-air (Al-air) batteries offer a promising alternative to lithium-ion batteries for the Indian electric vehicle (EV) ecosystem.

Earlier, the Indian government has taken resolute actions to swiftly advance the acceptance of electric mobility within the country. To meet its objective of having 30 per cent electric vehicles on the roads by 2030, a blend of policies has been put in place, encompassing purchase discounts on various vehicle segments, lowered road taxes, as well as incentives for scrapping and retrofitting under its Faster Adoption and Manufacturing of Hybrid & Electric Vehicles (FAME) scheme. India is also developing a policy for battery swapping. This scheme launched in 2015, promotes and accelerates the adoption of electric and hybrid vehicles in the country.

India's recent policies promoting e-mobility reflect the country's



concerns over the growing burden of oil imports, increasing pollution levels, and its commitment to tackling climate change on a global scale. These policies are tailored to pave the way for India to become a leader in sustainable transportation, reduce its carbon footprint, and spur economic growth and innovation in the EV sector.

However, India's EV sector is highly dependent on lithium-ion batteries which are predominantly imported from other countries, mainly China. For instance, India's total imports of lithium-ion have surged to USD 2.31 billion¹ (INR 18,958.75 crore) from April

¹ Details available at <https://economictimes.indiatimes.com/industry/renewables/NITI Aayog mulls EV policy review to reduce dependence on China - The Economic Times>

2022 to January 2023, up from USD 1.83 billion in 2021–22, of which around 75 per cent originates from China. India's heavy reliance on imported lithium-ion batteries presents a significant challenge for the country's EV sector, as it leads to increased EV costs and makes the sector vulnerable to supply chain disruptions.

The Indian government is becoming increasingly alarmed by this development, and there are calls for the country to reduce its dependence on China for lithium-ion and instead explore other sources of renewable energy to fuel future vehicles. Now India has reason to be optimistic after the Geological Survey of India (GSI) discovered an inferred reserve of 5.9 million tonnes² (MT) of lithium in the Salal–Haimana area of the Reasi district of Jammu & Kashmir. This discovery has the potential to wean itself off from lithium-ion imports, particularly from China, and put it among the leading countries having significant lithium reserves.

While it may take some time for India to begin producing lithium from this location, it would be wise for India to not solely depend on these reserves to establish itself as a global player in the lithium market. Instead, India should consider exploring other options in the

² Details available at <https://www.thehindubusinessline.com/news/national/india-discovers-lithium-inferred-resources-in-jammu-and-kashmir/>

Source: <https://e-vehicleinfo.com/>



field of battery technology. This would help India diversify its resources and avoid over-reliance on a single source of energy.

As India makes strides towards adopting other sustainable mobility options such as green hydrogen as transportation fuel, compressed biogas, and ethanol blending, it has also begun its quest for alternative battery technologies such as sodium-ion and Al-air. These technologies are considered promising alternatives to lithium-ion batteries. Therefore, policymakers must delve into innovative and cutting-edge technologies such as Al-air batteries and explore their potential for powering automobiles, particularly EVs.

What is an Al-air Battery?

As the EV market gains momentum, some potential car buyers are still concerned about the range and safety of lithium-ion batteries. In response, substantial investment and efforts are being directed towards the development of new battery technologies that aim to enhance battery range, efficiency, and safety. These advancements will help instil greater confidence in consumers about EVs, which will accelerate their adoption. One promising battery



technology that has gained attention in recent years is Al-air batteries, which have the potential to make a significant impact on the EV industry as it offers solutions to the challenges of lithium-ion batteries.

In general, primary Al-air batteries³ consist of a basic structure that comprises an aluminium alloy plate as an anode, an air cathode, and a non-toxic electrolyte-like water and silver catalyst. Al-air batteries generate electricity by reacting oxygen in the air with aluminium. When oxygen and aluminium react in the air, they produce electricity

³ Details available at <https://link.springer.com/article/10.1007/s41918-020-00065-4>

that can be harnessed, making Al-air batteries the batteries with the highest energy density. The Al-air battery is a promising candidate for EVs due to its high theoretical energy density of up to 8100 Wh kg⁻¹, significantly higher than lithium-ion batteries ranging from ~ 100 to 250 Wh kg⁻¹.

Pioneering Indigenous Battery Technologies

Both Phinergy, an Israeli battery technology company, and Log9 Materials, a Bengaluru-based materials science company, are betting on the commercialization of their Al-Air technology systems this year in India. These companies have developed batteries that use aluminium and oxygen to generate electricity, offering several advantages over traditional lithium-ion batteries, such as longer lifetimes and higher energy densities.

Indian Oil Corporation (IOC) has formed a joint venture with Israel-based start-up Phinergy to develop, manufacture, assemble, and sell aluminium-air batteries. The joint venture, named IOC Phinergy Private Limited, aims to pursue energy independence for India through proprietary Al-air battery solutions. Their technology uses aluminium as an energy carrier, which is fully recyclable and reusable with nearly 100 per cent material recovery. The joint venture





Log9 retrofitted a Mahindra e2o with aluminium air batteries. Source: factordaily.com

represents a significant step towards developing sustainable energy storage solutions and reducing dependence on fossil fuels.

Similarly, Log9 Materials has developed both Al-air batteries and aluminium fuel cells for mobility and stationary energy applications. They have retrofitted⁴ a Mahindra e2o with Al-air batteries at a cost of approximately INR 2.5 lakh. Log9's metal-air batteries can travel up to 1000 km without recharging, with only water needing to be topped up every 300 km. This represents a significant advancement in sustainable energy storage and has the potential to revolutionize the transportation industry.

Indian OEMs are Ready to Embrace Al-air Tech

Tata Motors and Mahindra & Mahindra, two leading original equipment manufacturers (OEMs), have partnered with Phinergy to implement Al-air technology in their vehicles. During the 2023 Auto Expo, Tata Motors showcased a Tigor EV that was fitted with Phinergy's battery pack at their booth. It is expected that these OEMs will adopt Al-air technology in their vehicles within the next 18 months.

⁴ Details available at <https://www.businessworld.in/Electric Vehicles Big Boost For Aluminium Makers - BW Businessworld>

Additionally, Maruti Suzuki and Ashok Leyland have recently signed a Letter of Intent⁵ with IOC Phinergy JV, and their senior representatives are currently involved in the validation process of the technology. As part of the collaboration, Ashok Leyland and Maruti Suzuki are planning to integrate Phinergy's technology into their electric buses and passenger vehicles, respectively. The partnership will include the development of prototypes, field trials, and adaptation of the Al-air battery to suit the expansive Indian market.

Advantages of Using Al-air Batteries in EVs

As mentioned earlier, one of the key advantages of Al-air batteries over lithium-ion batteries is their significantly higher density. This difference in density is considered a game-changer in the field. Other notable advantages of Al-air batteries are as follows:

- **No electricity and charging infrastructure needed:** Since Al-air batteries do not rely on electricity, there is no need for charging facilities. This not only reduces power consumption but also eliminates the need for expensive charging

⁵ Details available at <https://www.carandbike.com/news/indianoil-and-isreals-phinergy-form-jv-to-build-aluminium-air-battery-systems-for-evs-2406372>

infrastructure. Electricity is generated through a chemical reaction by mixing aluminium and oxygen, resulting in zero emissions.

- **The Al-air battery is environmentally friendly:** The beauty of the aluminium battery lies in its clever design. It uses aluminium as the anode and ambient air as the cathode, with water serving as the electrolyte. As the aluminium oxidizes, it liberates electrons that flow through a circuit, producing electricity. This approach yields a battery that is not only economical and lightweight but also eco-friendly⁶ since the primary byproduct of the reaction is aluminium hydroxide, a recyclable material.
- **No range anxiety and long-lasting batteries:** Al-air batteries offer a travel range comparable to that of gasoline-powered cars, estimated at 1600 km per tank,⁷ which is several times greater than lithium-ion batteries, as noted by Trevor Jackson, founder of Métaélectrique. Also, these batteries are projected to sustain a travel distance of roughly 5400 miles,⁸ rendering them a feasible alternative for individuals who frequently embark on long journeys with infrequent access to battery swapping stations (BSS).
- **Battery swapping is the key:** As stated in the NITI Aayog handbook, "battery swapping" refers to the process of replacing a depleted EV battery with a fully charged one. This is made possible by visiting BSS located in the vicinity. However, as compared to swapping up the lithium-ion batteries, swapping Al-air batteries are easier as they are lighter than the former, requiring only one-eighth the

⁶ Details available at <https://e-vehicleinfo.com/aluminum-air-battery-in-electric-vehicles-advantage-and-disadvantages/>

⁷ Details available at <http://www.ececp.eu/en/aluminium-air-batteries-technology-of-the-future/>

⁸ Details available at <https://www.makeuseof.com/what-is-aluminum-air-battery/>

size to achieve the same range per charge, with a swap-time of only 180 seconds. With the growing prevalence of battery-swapping stations, the utilization of Al-air batteries in current EVs may very well gain traction. Métalectrique is currently developing a battery-swapping mechanism that can complete battery replacements in just 90 seconds. This cutting-edge system uses modules weighing less than 5 kg, requiring only basic warehousing and logistics for the battery-swapping infrastructure.

Challenges

Al-air batteries are becoming increasingly popular owing to their exceptional energy density, affordable manufacturing, and unparalleled security. Nevertheless, several hurdles stand in the way of their successful commercialization. Some of these challenges are mentioned below.

- **Non-rechargeable:** The non-rechargeable nature of Al-air batteries poses a significant challenge. Once the aluminium anode undergoes oxidation from atmospheric oxygen, the battery's energy output ceases, and replacement becomes the only viable option by visiting a battery swap station.
- **Untapped bauxite reserves:** Due to the abundance of high-quality metallurgical grade bauxite deposits in India, the manufacturing cost of aluminium-air batteries is expected to be quite low. Unfortunately, India has not fully capitalized on this potential, which has resulted in the continued import of bauxite and a significant loss of foreign exchange of more than \$571 million⁹ in the last six years alone. Currently, India has a low per capita consumption of aluminium at 2.5 kg, which is much lower than the



global average of 11 kg and China's 24 kg. India's goal of promoting Al-air battery technology necessitates a significant increase in bauxite mining to take advantage of its abundant reserves.

- **Lack of green-aluminium push:** Aluminium production is a major contributor to global CO₂ emissions, accounting for 1.1 billion tonnes annually due to its energy-intensive nature. However, increasing the output of "green aluminium" can significantly reduce emissions by 13 million tonnes, or 1.2 per cent, as it has a lower carbon footprint of fewer than 4 tonnes of CO₂ per tonne of metal compared to the global average of 16.6 tonnes. Western countries are leading the charge in producing green aluminium, with the US producing most of its aluminium using hydroelectricity. Moreover, Canada's Rio Tinto smelter in British Columbia is also doing its part, reducing greenhouse gas emissions by 36 per cent using new green smelting technology and hydropower. In contrast, India's carbon footprint in its aluminium value chain is set to increase as its aluminium production grows to meet the demand for products such as Al-air batteries and automobile components. To mitigate this, India should quickly explore alternative sources of aluminium production, as its current method relies solely on coal-fired electricity.

Conclusion

To conclude, the emergence of Al-air battery technology presents a thrilling prospect for India to transform the sustainable energy storage industry and decrease its reliance on imported lithium-ion batteries. With its potential to significantly enhance the range and efficiency of electric vehicles and stationary energy applications, Al-air batteries offer numerous advantages over conventional battery technologies. The mounting interest and investment from prominent corporations like Tata Motors, Mahindra & Mahindra, and Indian Oil Corporation, coupled with the adoption of Al-air technology by Maruti Suzuki and Ashok Leyland, foreshadow a promising future for this innovative technology. Nevertheless, several challenges must be addressed, and governments and industry players need to collaborate in promoting the sustainable development of this technology. With coordinated efforts, Al-air batteries could usher in a cleaner, greener, and more sustainable future, potentially becoming a holy grail for India's EV market. ■

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Disclaimer: Views expressed in this article are those of the author and do not necessarily reflect TERI's views.

⁹ Details available at <https://www.thehindubusinessline.com/opinion/india-must-leverage-its-huge-bauxite-reserves-to-boost-growth/article34720669.ece>

Nano Steps towards Climate Smart Agriculture

Nanotechnology may work at a small scale, but the minuscule size of nanomaterials belies their efficiency. Its deceptively small size is no measure of its impact. Little wonder then that the technology is being increasingly applied in agriculture to enhance efficacy and, importantly, to shrink the adverse impact of conventional chemical fertilizers on the environment and health. The TERI-Deakin Nanobiotechnology Centre has been working to evolve ways of effectively using nanobiotechnology to provide sustainable agriculture solutions.

In this 'In Conversation' section, **Dr Pushplata Singh**, Senior Fellow, Centre of Excellence in Agrinotechnology, TERI, talks to **Palak Khanna** from the Communications Team, TERI, about the incisive role the technology can play in the fields of agriculture and beyond.





What is nanotechnology and what is the principle on which it works?

Nanotechnology, as the name suggests, works at the nanoscale. The difference between a metre and a nanometre is 10^9 . When the size of a material is reduced by such magnitude, there is a huge change at the surface-chemistry level, and the surface area-to-volume ratio increases significantly. The material becomes highly reactive when there is a gain in surface area over the volume. There are two important impacts of it; they become highly reactive and when used as crop macro or micronutrients, it increases the fertilizer uptake efficiency in plants by several folds. The other aspect is that their frequency of interaction with all biological surfaces increases, which influences safety to human health and the environment.

What are the nanotechnologies developed by TERI to help farmers with climate-smart farming techniques?

In TERI, we develop nanomaterials using a biogenic approach. Microbial organisms are tuned as bio-factories for converting bulk material into nanomaterials, which generally make all nanomaterials produced by TERI safe by design for human health and the environment. We are developing nanomaterials primarily for use in agriculture in the form of nano-fertilizers, nano-pesticides, and smart carriers. At the commercial level, TERI aims to launch some of the nanofertilizers in the second and the third quarter of the ongoing fiscal year 2023–24, and it will include nano-urea, nano-di-ammonium phosphate, and nano-phosphorus. At the research level, TERI is working towards fertilizers including nano-NPK, nano-sulphur, nanocomposite of zinc and iron, nano-boron, multiple nano-micronutrients; nano-pesticides including nano-copper and nano-sulphur; and nano-2,4 D as a weedicide.

Besides agriculture, we are also developing nanomaterials for water



Dr Pushplata Singh

treatment and for enhancing the fuel efficiency of non-conventional fuels such as hydrogen. We can also enhance the properties of paints, such as increasing their anti-fouling properties and preventing bacterial and fungal growth, consequently help provide smooth and shiny surfaces which cannot be degraded by harsh environmental conditions using nanotechnology. TERI has been working towards developing paint-based nanomaterials based on zinc, and molybdenum nanoparticles derived from environmental waste materials.

How can nanotechnology be useful in agriculture and allied sectors?

What are the potential benefits and drawbacks of this technology?

The use of nano-fertilizer will reduce the application size of fertilizer in agricultural fields. They are highly efficacious as compared to conventional fertilizers. Since the size of conventional fertilizers tend to be big, their uptake efficiency usually varies between 20 per cent and 40 per cent, which means that depending on the soil type and agroclimatic zone, on the application of 100 kg of conventional fertilizer, a maximum of 40 kg gets used by the plant and, the remaining 60 per cent gets

washed off to different environmental pockets, contaminating the water table. However, with the use of nano-fertilizer, uptake by plant increases significantly and the quantity of fertilizer application gets reduced drastically.

In some cases, the utilization-efficiency of nano-fertilizer goes up to 95 per cent, or even 100 per cent. Additionally, small-sized nanomaterials also impart a quantum effect. In simple language, they act as additional reaction centres in plant leaves and help plants in increasing their photosynthetic rate. In effect, with nano-fertilizers, the utilization efficiency is high, and the application scale is very low. So instead of 50 kg, you may apply only a few grams, this way, application doses reduce by 100–200 times. Moreover, it reduces the burden on the farmer.

It also impacts the supply chain in a positive manner. For instance, at the agriculture ministry level, when 50 kg gets replaced by a few grams, the import and procurement of raw materials for fertilizers will also be proportionately reduced. The fuel required for transportation will also come down, for instead of 50 kg, you only need to spend the energy required for a few grams. Similarly, instead of 20 trucks going from a factory, probably one truck would be enough, or a smaller vehicle would do.

Farmers will incur the same cost as there would not be any subsidy on nano fertilizers as they are specialty fertilizers, and subsidies are only for regular fertilizers like conventional urea. What

farmers would look for instead is a gain in crop yield over conventional fertilizers. We have witnessed a 15 to 20 per cent gain in yield, which ultimately results in increased incomes for farmers when compared to conventional fertilizers.

The use of nanotechnology transforms practice. TERI is developing nanofertilizers using biological agents such as bacteria or fungus, so there are no hazardous chemicals used in the synthesis process of these nanomaterials. The synthesis process reduces the size of large solid fertilizer particles into small ones (nanometres), ensuring the same functional characteristics for each nanoparticle as compared to a conventional fertilizer particle. The methodology tends to be safe and green.

How is nanotechnology applied in agriculture?

When it comes to the application of nanotechnology-based agents, whether it is fertilizer or pesticides, drones are an easy way of application. India now has the required guidelines and policies for drone use in place. Drones would soon become available with local vendors in different cities and villages, and farmers can take them on loan or hire them for a few hours or weeks. All the nanotechnologies that TERI has developed performed well when supported by drones. The use efficiency, which is already at 95 per cent, goes up to 100 per cent when drones are used. In a nutshell, a drone is one mechanism to apply nanotechnology in agriculture.

But small farmers with a landholding of about 2.5 hectares use manual sprayers with the normal nozzle set-ups, and the job is done in a day.

How can nanotechnology help in mitigating the effects of climate change on agriculture?

The agriculture sector has become one of the major contributors to greenhouse gas (GHG) emissions leading to climate change. GHG emission from agriculture mainly comes from the fertilizer industry. When conventional fertilizers are made a lot of fuel and energy are invested in its synthesis and transportation. Also, these fertilizers are required in large amounts due to low-use efficiency (20–40 per cent for N, P, and K). Contrarily, due to their very high-use efficiency, nanofertilizers are required in very small amounts as compared to the conventional fertilizers (1/100 times lesser). By reducing the application rate by 100 times, nanofertilizers can reduce GHG emissions at the source itself.

Furthermore, TERI is developing all the nanofertilizers by using a biological approach instead of a chemical approach. The chemical synthesis of nanofertilizers leads to a generation of chemical waste. However, biological synthesis does not generate any chemical waste and thus are more appropriate for GHG emission reduction.

What are the awareness initiatives needed to enhance the use of nanotechnology among farmers?

I have been attending many commercial meetings where we invite farmers, and their only question is what will be their financial gain and how much will be the enhancement in yield. Nanotechnology benefits them by supporting healthy growth of crop, which significantly increases yield. If the normal practice involves urea application of up to three bags in the field, farmers end up using seven bags to gain the desired yield. And they still fail to gain the yield they expect. With nanotechnology, they are gaining





15 to 20 per cent more by applying a combination of one to two bags of urea along with one bottle of nano-urea.

We have done a battery of tests by using Organisation for Economic Cooperation and Development (OECD) guidelines on multiple environmental organisms and model systems for human blood, skin, eye, and brain. We have also done a Life Cycle Assessment for the behaviour of all nanomaterials developed by TERI in terrestrial and marine environments for the safety assessment of fertilizers, pesticides, and other nano-agri-inputs in 2021. Every farmer is now aware of the health problems prevalent in the families of Punjab and Haryana owing to the use of conventional fertilizers. With our technology, we assure them safety by reducing the use of chemical fertilizers, improving soil health, and reducing toxic build-up in groundwater. To involve farmers in the process of transformation, TERI, in collaboration with several well-known fertilizer companies, is organizing various field demonstrations on farmer's fields, which will help them compare the

results and impacts of nano-fertilizers and that of conventional sources. About 2300 farmers across the country have registered to use our nano-urea and nano di-ammonium phosphate (DAP) and nano phosphorous.

Does nanotechnology have any adverse impact on health or crops?

Nanoparticles interact a lot with biological surfaces. If nanoparticles come in contact with humans and are retained over a period of time, they may start harming the body the same way conventional fertilizers do. So, it is necessary that it goes through all levels of clearance for safety assessments as suggested in the guidelines by the Department of Biotechnology (DBT), and FCO order 2021, Government of India.

There are several stages for the safety assessment of nanomaterials; the material developed is tested in the laboratory, then tested in the greenhouses, upon which it is followed by field trials. The Ministry of Agriculture under the Fertilizer Control Order (FCO), Gol has mandated the trials be done only

at the locations of the Indian Council of Agriculture Research (ICAR). Third-party trials are possible only after we have done trials in-house and completed all toxicity assessments, including phototoxicity on crops by using the standard guidelines. We can go for field trials only after clearing the safety assessment stage. TERI is one of the core institutions that played an integral role in drafting the DBT guidelines for the safety assessment of nano agriculture products. In the safety assessment guidelines, which were released by the Department of Biotechnology India, in 2021, multiple measures are taken to ensure safety. We start with in-vitro testing, followed by tests on multiple model systems, and then on in vivo-systems very close to human systems. In addition to animal-model systems, we also perform pre-clinical trials, and only if a nanomaterial clears all these stages can we take it for registration of the product for commercialization. ■

This interview first appeared at <https://www.teriin.org>



Brahmapuram Landfill Fire

Points towards the Need for Decentralized Waste Management

In this article, **Sharada Balasubramanian** highlights that a series of flames have been breaking out, year after year, at the Brahmapuram landfill in Kerala. Yet, it was not taken seriously. This year, the massive uncontrollable fire breakout urged the Kochi Corporation to take serious steps to resolve this issue as it impacted the health of people, and the environment. Brahmapuram is the only landfill that is a bone of contention in Kerala where solid waste management, otherwise is decentralized and systematic. Plans are underway to solve this crisis that the Kochi Corporation is facing after the Brahmapuram incident.





Kerala, one of the progressive states in India laid out policies of decentralized waste management system to solve the municipal solid waste issue in the state. Centralized waste management was not favoured by the citizens. After 2012, there were mass protests from people on the 13 centralized solid waste management plants in Kerala, primarily because it affected the health of the people living in the vicinity. Waste dumping in areas including Vilappilsala, Lalur and Njeliyanparambu in Kerala was opposed by people, pushing the government to a decentralized model of waste management.

In 2014, Kerala set an example in segregating waste from the source; treating this waste in a decentralized way with a team involving the state-promoted Suchitwa Mission, the Clean Kerala Company, and the Haritha Kerala Mission (Green Kerala mission). Biodegradable waste from houses, communities, and institutions were collected by involving the people working for the green mission. For this initiative, the state received award under the cleanliness tag in 2020. Almost 789 local bodies including 718 gram panchayats, 72 municipalities, and 3 corporations were involved in this initiative.

Fire Breakout in Brahmapuram

In March 2023, the massive fire breakout at Brahmapuram landfill turned to be a major point of concern among people. The Brahmapuram plant is polluting the two rivers, Kadambrayar and Chithrapuzha as the rivers flow through this region. Other than Kochi Corporation, waste from other areas such as Kalamassery, Aluva, Angamali, and some other panchayats are dumped here.



Spread across 70 acres, this landfill has been accumulating legacy waste (a waste that is old, and kept for years in a land; a dumpsite) of almost six lakh tonnes. Almost 70–80 per cent of this garbage is not segregated. The mix includes both biodegradable and non-biodegradable waste. Everyday 390 tonnes of waste are dumped here, of which 64 per cent is biodegradable.

The recent fire breakout in Brahmapuram is not the first time. The first fire happened in 2013. It took six long hours to stop that. The second one happened in 2019, and was much harder to stop. Between 2018 and 2022, seven major fires happened intermittently, posing severe risk of a disaster that could happen anytime. Fire in Brahmapuram is nothing new, say experts.

Mounting garbage woes forced the government to expand the land space from 70 to 110 acres. The land was holding more waste than its capacity. It is also important to note that Kerala has limited land space. The state is filled with lakes, water bodies, and rivers.

‘Own Your Trash’

According to the Solid Waste Management Rules, 2016 from the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, the mixed waste in Brahmapuram was not acceptable. The rules say that only non-recyclable, non-biodegradable, non-combustible wastes should be allowed to come to the landfill; this was not the case in Brahmapuram, the



rules were clearly flouted. The Solid Waste Management Rules, 2016 guidelines include householders, event organizers, street vendors, gated communities, restaurants and hotels as entities that should take responsibility for segregating the waste at source and handing over to the municipal authorities.

The usual statement from householders is ‘not in my backyard’. Everything begins at source point. At this juncture, when the world talks about sustainability, perhaps a fraction of population can pursue this—also experts say that asking people to switch away from plastic without availability of an alternative resource at the same cost is challenging.

However, why citizens are not, in the least segregating their waste is a question to moot. Also, with no incentive or action against non-segregation, mixing of waste, individuals are contributing to this mounting problem. The shift of blame is passed entirely on the corporation and government, when the solid waste management rules clearly elucidate the need for citizens to take ownership of the trash they generate, segregate it, so that it can be recycled or composted.

National Green Tribunal Slaps Fine

According to the Swachh Bharat Report (2020), India loses over 1250 hectares of useful land every year to dispose of municipal solid waste. Further, the National Green Tribunal stated that more than 10,000 hectares of usable urban land is locked up under 3159 legacy waste dumpsites in the country,

A fine of INR 100 crore was slapped on the Kochi Corporation for the Brahmapuram fire incident. A report from Livelaw mentioned that in 2018, lapses from the corporation were fined; however, the high court stayed the order.

Kerala has a Solid Waste Management Policy, which emphasizes decentralized waste treatment. The policy emphasizes on reduction, reuse, recycling, and recovery—a zero waste state phase by phase.

“Any centralized mode of waste treatment is against this policy,” experts said. Sooraj Abraham, Secretary, Planatearth (Plan@Earth), a Kochi-based not for profit, working on waste management, and other environmental issues says: “Brahmapuram is the only case of contention. Nowhere else in Kerala there is a

problem of solid waste management as everything is decentralized.”

Decentralized Waste Collection in Paravur

Planatearth was one of the earliest NGOs to intervene in the waste collection space in Kerala. They started off by engaging in a clean-up activity with college students in the tourist spot Athirampally and Vazhachal in Kerala. After collecting a heap of plastic bottles, and bags, they were clueless on how and where to dispose this. “We started contacting people for collection, but no one came forth.” Realizing the magnanimity of this issue, they started campaigns such as street plays, approaching schools, and talking about this issue, but no one cared. “We realized people knew it is plastic and non-biodegradable, yet they did not bother about this issue, so we decided to take it on our shoulders,” says Sooraj.

Initially, they started with a small community. People had no idea what they were talking about; there was no concept of waste segregation at source. Plastic and food waste were mixed together. They started off



with the implementation of the ITC's wealth-to-waste programme in the Paravur municipality. Under this, however, only paper waste was handed over to ITC. Most of the generated waste, almost 60–70 per cent of it was plastic. The people were paid INR 2 for a kilo of paper waste per household. This could not sustain as most of the waste was plastic. Initially, the NGO suffered losses in lakhs.

However, on the brighter side, by now, people in that municipality had practised waste segregation. So, the NGO came up with a new model that will be in tune to the new practices the people had adopted.

Success Story

Paravur, a municipality in Kerala, is full of canals and water bodies and it was common for people to dump their waste into water. This changed, after Planatearth came into picture. Since the waste-to-wealth programme was initiated, people were used to the idea of segregation. They had already unlearned their old habits of mixing waste. "These are tiny municipalities with a population of 6000. We started free waste collection through resident associations with 2–3 collection points. People had to just keep the garbage clean, and we would pick it for them," says Sooraj.

The waterways and canals were clean in Paravur. "In 2011–12, at Paravur, the municipal chairperson Valsala Prasannakumar was responsible for bringing a radical change and implementation of this model," said Sooraj. Valsala told the NGO they could now charge a collection fee of INR 10 per month per household for collecting garbage. Though the other local councillors were not in favour, she said she would do this in her ward. The public caught on the idea; INR 10 was a minimal fee too.

The activities at Paravur municipality continued for 2–3 years. Then, the NGO was approached by Apollo Tyres to implement the same model in and around the areas they were located in under corporate social responsibility (CSR) model.

In 2014, when Planatearth received these CSR funds, they implemented this project in Kottakara, where Apollo tyres was located. In the first year, five wards were covered, this increased to 11 wards in the second year, 14 wards in the third year, and finally in the fourth year, they completed all wards. The word of success started spreading soon.

This successful model was noticed by Dr K Vasuki, an IAS officer in 2016–17. She took charge of the Suchitwa Mission in Kerala as executive director. She invited proposals from all over Kerala to tackle waste



Sooraj Abraham, Secretary, Planatearth

management, and the NGO's model was documented. Vasuki's efforts to make the state waste free was much talked about. In 2016, at a swearing-in ceremony of cabinet members of the Left Democratic Front (LDF), green protocols were followed. This was the first time that minimizing waste generation was a priority at a government swearing-in ceremony. The efforts from Planatearth, their model was talked about far and wide, not just in Kerala, but also in states like Himachal Pradesh. "Vasuki gave us the space to talk about our model and invited us to many places," said Sooraj.

There is a card system in waste collection, just like cards for LPG. Whenever the garbage is picked, it is marked with a date, along with the money collected. Further, an SMS alert goes to the people as reminders, so that they know the collectors will be coming to pick up the garbage. Everything was systematic.

Bottlenecks, Challenges

Though the collection was streamlined efficiently, there was a question—how and where could the plastic recycling be done? The team travelled across from Kerala to Coimbatore to Karnataka to meet recyclers. They carried a few sacks of the plastic waste they collected so that recyclers can get an idea. "This was not profitable, but there were takers for this plastic, only if the plastic was categorized and graded properly. When we sat with the recyclers, we were able to categorize the plastic into 32 grades. After doing that, we found takers, and then people wanted us," said Sooraj.

When the team spoke to Vasuki, there were two strong solutions that emerged from the model that could be viable for implementation. The first was collection of fee, second, the recyclers who pay for recycling. Vasuki included this model as a plan that



Planatearth upcycling

needs to be followed in every panchayat of Kerala. This was the master plan for the state waste management in Kerala.

Things took a different shape after that. Some parts of the plan developed by Vasuki were implemented. Haritha Kerala Mission was initiated in the state. "Every corporation has waste management plan but it is not completely scientific," says Sooraj. A directive from the state mandates collection of INR 50 as user fee to collect garbage every month. Irrespective of whether people hand over garbage or not this is a mandatory mechanism. The NGO is following the same model.

The money is used to give income for women who collect waste. Planatearth is currently working in five panchayats and two municipalities, reaching out to almost 30,000 households in the state. They are recycling 60–70 tonnes of plastic waste every month. Along with this, their operations with Apollo tyres is running into its 8th year. From recycling, the NGO also started upcycling in 2016. They made quality shopping bags from plastic, toothpaste tubes, etc.

Other Issues in Brahmapuram

Kochi Corporation has permitted other panchayats and municipalities to dump waste in Brahmapuram, and the land could not take this overload. A lot of plastic that enters the landfill cannot be managed. To add to the garbage woes, there are human health issues too. Migrant labourers from northern parts of the country and elsewhere are engaged in unorganized work, picking garbage from this landfill. They are usually engaged by a contractor.

They pick up garbage without any safety measures. The migrant labourers recover whatever they can sell

immediately, such as PET bottles and broken buckets. The other waste is left on the site.

According to estimates from Planatearth, 4300 tonnes of unwanted unrecyclable plastic is left in Brahmapuram, after recovery by unorganized labour. It is 4300 tonnes per month, and by end of the year, it is a mountain of non-recyclable plastic, which cannot be recovered just by picking it up.

"One aerosol can is all that it takes to explode and make the entire landfill burn. Spontaneous combustion can happen anytime," says Sooraj. He added that when people are working in unorganized sector, someone could leave behind a blowing beedi and that could catch fire.

The NGO is also working with a team of people to offer scientific solution to this issue. The solid waste management model works well with households, but beyond it, the manufacturers have to take responsibility for the waste generated. Very little has been done on that front. The fast moving consumer goods (FMCG) companies seem to be the biggest offenders, say experts. They need to take responsibility for the waste generation, for instance, companies that manufacture diapers. Extended producer responsibility (EPR) is strict for e-waste, says Sooraj; however, that comprises just 3 per cent of the waste.

Experts say that at an industry level, nothing has been done with respect of FMCGs. However, at an individual level, there are changes in sustainable lifestyle. Sooraj says, "Many strong people have been outspoken about shifting to menstrual cups in their talks at schools and colleges. Such mass campaigns and outreach has brought a change in Kerala. The usage of sanitary napkins has drastically reduced; it is no more a taboo," says Sooraj.

At the end of the day, when it comes to municipal solid waste management, only decentralized system works. Sooraj says, "In the last 14–15 years having worked in this area, we know that nothing more than 10 tonnes can be managed by a centralized hub. Beyond 10 tonnes, waste becomes unmanageable. In houses, people can do onsite composting. Lot of people are doing this in cities like Bangalore. If the solution is given to the local people, they will take it up easily, but if it is delayed too much, they tend to lose interest", says Sooraj. ■

Sharada Balasubramanian is Winner: Asian Environmental Journalism Award 2019; Environmental Journalist of the Year; Environmental Story of the Year; and Prem Bhatia Award for Excellence in Environmental Reporting 2019. She is Earth Journalism Network grantee and Fellow: UN Water, IUCN, Asia Europe Foundation. She is also DW Climate Change Reporting Fellow South Asia. She regularly contributes articles in TerraGreen.



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Bite into a Peach

While You are in South Carolina

In this article, **Dr Marianne Furtado de Nazareth** recollects her wonderful experience of eating ripe South Carolina peaches. She realizes that South Carolina averages more than three times the amount (in pounds) of peaches harvested in Georgia in a typical season. Peaches do have many health benefits also as one large, juicy globe of peach delivers an impressive quantity of vitamin C and is a good source of vitamins A and B. It also offers three grams of fibre.

Enjoying eating peaches has been part of my growing years in New Delhi. My father always took us to Gupta market, every Sunday to buy whatever fruit our heart desired. And in those days fruit was bought by the basket and not by the kilo like today! But, it was only when I went to the USA and stayed with my son in South Carolina did the wonder of the fruit that the peach is, come back to me. The soft and furry fruit took on a whole new meaning after

I bit into a completely ripe, orangey red peach, which was larger than my fist size. Standing over the sink I slurped my way through its goldy yellow flesh with its juice running down my chin! That has been an experience I can replicate a hundred times over and never tire of the wonder of eating a ripe South Carolina peach.

Peaches can be enjoyed at any stage of ripening. Depending on your preference for firm, soft or somewhere

in-between fruit. The softer the fruit becomes, the sweeter and juicier it will be when eaten. Peaches are always very fragrant when they are ripe. The red blush of a peach is beautiful, but it doesn't indicate ripeness, just like in a Cardozo mango. A uniform yellow background colour with no green around the stem and a fragrant aroma are the qualities to look for when judging ripeness in peaches. Peaches need to ripen at room temperature. Do not refrigerate firm



fruit—the low temperature will stop these fruits from ripening. Store peaches on the kitchen counter so they will reach your optimum preference for firmness. When the peaches are fully ripened or past maturity, then they may be placed in the refrigerator or even frozen for later use.

There are two varieties of peaches—they are either clingstone or freestone. This term refers to how easily the flesh separates from the pit or stone. Freestone peaches are available starting in mid-June in South Carolina and all mid and late season peach varieties harvested in South Carolina are freestone peaches.

Earlier I believed Georgia was the “peach” state as per tourist information. The huge peach installation as you go past on a National Highway never failed to draw our collective attention in the car. But once my son moved to South Carolina we realized that South Carolina averages more than three times the amount (in pounds) of peaches harvested in Georgia in a typical season. As you go back in history, of course Georgia is known as the peach state because commercial peach production began in Georgia, and many known varieties were hybridized there, including



the famed and much coveted ‘Elberta’ variety.

But, over the years, summers are peachy in South Carolina—literally with enormous peach farms abounding and thriving in the state. Second only to California in production, the Palmetto State is a peach heavyweight with more than 50,000 tonnes of the fruit harvested annually. And, yes, that’s more than Georgia harvests and produces. In fact,

the peach was named the official state fruit in 1984.

Digging up the history of the peach, historians say peaches were first grown in China before finding their way to Europe. They were introduced to the USA by the Spanish in the 1600s, but it took more than a century for the South Carolinians to try their hand at cultivation. In the 1850s, South Carolina-grown peaches debuted outside the state when grower Henry William Ravenel of Aiken made his first commercial peach shipment. Lots of farmers jumped on the peach fruit wagon following the Civil War, and is said, a South Carolina agricultural tradition was born. It is amazing to see acres and acres of peach trees, loaded with the sweet smelling fruit just a few kilometres out of the main city of Greenville in South Carolina.

Today, farm stand vendors hawking baskets of the rosy fruit are fixtures along the state’s highways and byways during the season. We stopped at Fishers Farm, which had a large shed like shop selling all sorts of vegetables besides of course a massive variety of peaches. Each variety was named and placed out in cane baskets for sale. Go ahead and make a pit stop for some of the juiciest, sweetest peaches you’ll ever taste if you happen to



be in the vicinity.

Here are some interesting facts you might be surprised to discover about peaches. They have some familiar relatives, which are also stone fruit.

- Peaches belong to the genus *prunus*, which means they are part of the rose family, as are apricots, almonds, plums, and cherries.
- Try breaking open and eating the inside of the peach pit. You would have been reminded of an almond. That's because the two are closely related.
- Nectarines are peaches too, minus the fuzz and smooth skinned, but to me don't taste as good.

When I called up to ask if we could come and pick some peaches and pay for the picked produce we were welcomed by the farmer and his family. We were told that there are three types of peaches which appear at different points in the season: clingstone, semi-freestone, and freestone.

- **Clingstone:** The flesh of the peach "clings" to the pit; available mid-May to mid-June
- **Semi-freestone:** It is a hybrid variety

in which the flesh clings, but becomes easier to pull away as the peach ripens; these are available mid-June to mid-July

- **Freestone:** The peach flesh cleanly separates from the pit, making it the preference of home makers who can the fruit; these are available late July to mid-August or early September.
South Carolina farmers grow a mind boggling 40 varieties of peaches. The differences in these two kinds of fruits go beyond colour and size.
- Yellow-fleshed peaches have a longer shelf life; these are the ones commonly seen in grocery stores.
- White peaches tend to be sweeter and less acidic, but have a much shorter shelf life.

Varieties of Peaches

South Carolina farmers grow about 40 varieties of peaches. Some of the most common include: Gold Prince (cling); Gala (cling); Blaze Prince (semi-freestone); Summer Gold (freestone); Cresthaven (freestone); Winblo (freestone); O'Henry (freestone); Big Red (freestone); Donut

peaches are small, squished-looking fruits that some people consider the sweetest of all. They come in white-fleshed varieties that are soft, juicy, and very sweet.

Choose a "firm-ripe" peach for the perfect summer treat. To find the South Carolina peaches of your dreams, rely upon sight, touch, and smell.

- Don't judge a peach by its reddish colour as the pretty blush is nothing more than that—pretty. According to the South Carolina Peach Council, look for skin that has a soft, yellowish hue; any green areas indicate the peach is not yet ripe.
- You want to choose a peach that is "firm-ripe," that is, one that is firm, but gives slightly when you gently press it.
- While you can eat a firm-ripe peach, allowing it to sit on the kitchen counter until it is softer, or "dead-ripe," ensures the ultimate flavour. Only refrigerate after the peach has achieved "dead-ripe" status.
- Follow your nose to flesh out peaches at the peak of goodness. That irresistible sweet fragrance is a strong clue that the fruit you're considering is





June Gold peach: One of the earliest ripening peaches and a long-time favourite, June Gold peach bears large, firm and juicy yellow-fleshed peaches that are freestone once fully ripe. It is a top selection for fresh markets and also a good choice for cold climates or places with late freezes due to its frost hardy blossoms.

White peaches: These are similar in flavour to yellow peaches, however, they are said to be slightly sweeter due to their low acidity. They have a pale pink hue on the outside and a pale yellow flesh. Because white peaches are softer than yellow peaches, they don't hold up as well when baked.

ready for eating.

- Other contenders for the sweetest peach are Redhaven, Red Globe, Polly, and Elberta varieties.
- Finally, I am rooting for South Carolina grown peaches. I have found they are the freshest, sweetest, juiciest peaches I have eaten anywhere in Europe or the USA.

Which is sweeter; apple or peach? If you are looking at 210 milligrams peach, it is low in sodium, has no fat, about 3.3 grams of fibre, lots of fructose and is sweeter-tasting than a plum or apple. Peaches are 80 per cent water by weight and juicier than apples.

What nutrition do you get from peaches? Eat up! This is one food that not only tastes good, but is good for you too. One large, juicy globe delivers

an impressive shot of vitamin C and is a good source of vitamins A and B. It also offers three grams of fibre. You get all that for just 70 calories—that's a nutritional bargain!

So, the final question in my head was—are South Carolina peaches as good as Georgia peaches? Which peach tasted better to me you might ask? The larger South Carolina peach was plump and drippy when I bit into the flesh. The floral aroma tickled my tongue and I tasted hints of nectar and honey. The Georgia peach had a less pronounced flavour and was less juicy. Now you decide! ■

Dr Marianne Furtado de Nazareth is freelance Science and Environment Journalist.

Drought and Desertification in the Horn of Africa

History Same as India?

The Horn of Africa is one of the world's most conflict-prone and fragile regions. Countries such as Kenya, Somalia, Ethiopia, Djibouti, and Eritrea (along with some other countries) form the Horn of Africa. In this thought-provoking article, **Faiza Mustafa** says Africa contributes 3–4 per cent of global emissions and 17 per cent of the world's population. So, it is not responsible for the drastic climate events and yet faces the worst consequences of natural disasters such as droughts. She also addresses the vital question that how India after facing the same situation during the colonial era was able to overcome these challenges.

Years of insufficient rainfall, COVID-19 pandemic, internal conflicts, political instability and soaring food and oil prices by the ongoing Russia–Ukraine war result in an entrenched drought crisis across Kenya, Somalia, Ethiopia, Djibouti, and Eritrea.

UN humanitarian chief warns of famine and a disaster-like situation in Somalia. Regional Director of Eastern Africa UN WFP Michael Dunford explains—“This is the worst drought, the driest it's ever been in 40 years. So, we are entering a whole new phase in climate change.”

The last major drought in the region occurred in 2011, which led to the deaths of almost 250,000 Somalis. Droughts are frequent and more intense now and are disastrous for the economy of these nations and the livelihoods of people. Data by the government indicates that 950,000 children under five years of age and 134,000 pregnant and breastfeeding mothers in Kenya's north arid region are acutely malnourished. And around 3.9 million children are severely malnourished in Ethiopia alone—“What we're witnessing is a threefold increase in the number of malnutrition cases. There's an urgent need to invest in interventions to prevent malnutrition so that we don't lose an entire generation to the drought,” adds Dunford.

Open water sources run dry and those which are left only have 20–40 per cent of their capacity. Agriculture, livestock and animal husbandry production have been blocked and people have lost their sources of income. Extreme food and water scarcity have killed around 7 million livestock across the Horn. Pastoralists in the southern and eastern



lowlands of the country have powerlessly watched another predator—drought—reduce their livestock to skin and bones. As per the UN report, more than 20 million people are marching towards starvation—the figure is just doubled of what it was six months before and almost 66 million are experiencing acute food shortages.

Over and above that, it's not just only about lack of water and farming challenges but it also triggers an array of unprecedented emergency situations for communities, which includes gender-based violence, people vulnerable to disease, sexual exploitation, child marriage, children's education, and many more. Agriculturists are now looking for better alternatives to be able to survive. Kenyans are now shifting to suitable seeds and crops that can endure severe heat waves. Shem Wandiga (founder of Climate Change Institute, Kenya) believes that traditional seeds and other methods of agriculture are no more useful and appropriate for such conditions and there is a need for innovations that are more climate resilient. By using weather forecasts and other approaches, WFP has set up early-warning systems in Ethiopia and Somalia, by which people receive life-saving information. They are also investing in sustainable solutions to make communities resilient to disasters by building irrigation canals and culverts and establishing community and household gardens, which helps them to become more self-sufficient. No doubt these hazards and other atmospheric disturbances are the consequences of global warming and greenhouse gas emissions, of which 95 per cent come from countries such as China, the US and the European Union. This specifically impacted The Sahel Belt, Middle East and North Africa (MENA) region and The Horn of Africa in the form of droughts, which combined with no rainfall led to the food insecurity and starvation. It is unlike Europe, which experiences heavy floods as a result of the climate crisis. Africa contributes 3–4 per cent of global



emissions and 17 per cent of the world's population. So, it is not responsible for the drastic climate events and yet faces the worst consequences. The fact that despite losing lives and infrastructure Europe has the ability to build much faster, while Africa suffers more because it doesn't have the resources and capital for such reconstruction. According to some estimates, Africa needs USD 1.4 trillion in green financing within a decade to vanquish these problems.

Moreover, the Afro-centric and Anti-colonial historians have been on record stating that, the exploitation of the Third World countries accelerated the economic development of the West. Their idea revolves around imperialism, colonial exploitation and to be more precise commercialization of agriculture. Extractivism remains the most enduring economic model in Africa, where on the one hand the continent had free workforces along with the existing institution of slavery and vast availability of natural resources such as copper, cobalt, oil, gas, diamonds, and gold.

And on the other, it acts as an open market for European industrial goods. In addition to that a new generation of historians is trying to break out of the ideological chains of neo-Marxist history, and the Eurocentric explanations of African history, by simply acknowledging that the experiences of the Kuba (also called Bakuba, a community of 16 Bantu-speaking groups in southeastern Congo) in the Congo Free State during the rubber terror in the 1890s contrasted sharply with those of the Asante cocoa farmers in the Gold Coast during the 1920s. Coffee in Kenya, cotton in Mali, and cacao around Côte d'Ivoire and Ghana were some of the major crops produced under commercialization. In the Gold Coast, which is now Ghana, cacao accounted for over 60 per cent of exports, which was essential to the economy of the British. This model not only drained resources but also blocked Africa's capacity to create, produce, and develop. This pushed Africans away from subsistence farming and the production of food for the local market, to the

cultivation of commodity crops needed to fuel European industrialization and economic expansion.

Scholars are of the view that this momentum pushed Asian governments after independence into such a proactive role specifically during the Cold War Era that it ultimately helped them to overcome such consequences. Leaders such as Marcos, Suharto and Indira Gandhi came to see 'rice, roads and schools' as crucial components of their attempt to centralize power and raise popular support. The exactly same extract mechanism happened in India during the first half of the 19th century but with crops such as cotton, opium, jute, sugarcane, groundnuts and tobacco along with the beginning of the plantation crops like tea, coffee, rubber, indigo, which heralded a new era in agricultural practices in India. The commercialization of Indian agriculture started post 1813 when Industrial Revolution in England gained pace and it became prominent around 1860 AD (during American Civil War, which boosted demand of Cotton from India to Britain as America was not able to export cotton). This resulted in reduction of area under cultivation of food crops due to the substitution of commercial

non-food grains in place of food grains. As per some estimates from 1893–94 to 1945–46, the production of commercial crops increased by 85 per cent and that of food crops fell by 7 per cent. This affects the rural economy negatively and India experienced a series of ferocious famines, impoverishment of people, and food shortage. The fact that these crops implanted a devastating impact on the soil, as it not only degraded its fertility but also led to soil contamination and herbicide resistance. The upper Doab famine of 1860–61, Rajasthan famine of 1869, famine in Bengal between 1873 and 1874, The Great Famine of 1876–1878 which impacted Madras, Bombay Deccan, Bengal, United Provinces and Central Provinces, Indian famine of 1896–97 in Bengal where around 1.5 million people lost their lives from starvation and epidemics. Such famine saga continued even several decades after independence. Now, the question arises that why India after facing the same situation during the colonial era was able to overcome these challenges. The answer has several reasons—first, India is geographically advantageous, as a tropical country it experiences a good monsoon each year, which helps in maintaining the

fertility of soil, unlike Africa's hyper-arid catastrophe. The second reason is political stability and farsighted approach since independence. Africa experiences major political conflicts between the government and armed groups, which significantly affected the economic development. The farsighted approach of the Indian government 1950 onwards put India on a stabilized front as far as international politics and food security is concern. Since independence the aim is sustainability and to make people self-reliant to earn their livelihood by further backing with reforms in agriculture and food security. The public distribution system, the Green Revolution (1960s), introduction of MSP and founding of organizations such as the Central Rice Institute and The National Bank for Agriculture and Rural Development and the Kisan Credit Card schemes empower farmers and prevent their economic exploitation.

Therefore, in the waning hours of the biggest climate change conference in 2022, that is, COP27, we learned a deal to create a 'loss and damage' fund, a source of finance to compensate poor countries for the challenges they are facing because of climate change. Addressing loss and damage is an excellent way to provide climate justice, as developing and underdeveloped countries bear the brunt of the impacts and yet do the least to cause it. This loss and damage can be averted and minimized by curbing greenhouse gas emissions, that is, mitigation and taking preemptive action to protect communities from the consequences of climate change, i.e., adaptation. Hence, greater efforts and collaboration are needed to achieve SDG2. ■

Faiza Mustafa is currently pursuing Post Graduate courses like "Giza, Ancient Egyptian Art and Architecture" from Harvard University and "Gandhi and Peace Studies" from Indira Gandhi National Open University. Her works have been published in international journals and being an art enthusiast her art pieces were also published in The Hindu.





Terra Youth

Joining Hands
for a Greener
Tomorrow

Stop Food Waste Day

The Fight against Food Waste is More Important than Ever

To mark the seventh annual Stop Food Waste Day, an International Day of Action in the fight against food waste, Compass Group led a global campaign to raise awareness of the environmental and social benefits of reducing food waste.

“With food waste contributing to around 8–10 per cent of the world’s greenhouse gas emissions each year, and with global food inflation and cost of living pressures, the need for action to reduce food waste has never been more important,” says Compass Group PLC, the world’s largest food services company. To mark the seventh annual Stop Food Waste Day, an International Day of Action in the fight against food waste, Compass Group led a global campaign to raise awareness of the environmental and social benefits of reducing food waste. By bringing together clients, colleagues, suppliers, and charity partners across nearly 40 countries, Compass hopes to take a lead in the global movement focused on

preventing food waste. Compass Group PLC is a world leading food and support services company, which serves meals to millions of people in c.40 countries and employs and engages more than 500,000 people globally. The Company specializes in providing food and a range of support services across the core sectors of Business & Industry, Healthcare & Senior Living, Education, Sports & Leisure and Defence, Offshore & Remote, with an established brand portfolio.

Launched in 2017 by Compass Group USA, Stop Food Waste Day is an International Day of Action in the fight against food waste. On April 26, 2023, Compass Group, along with its suppliers, clients, colleagues, and customers globally, worked together to raise

awareness and inspire change around the critical issue of food waste.

Food Waste Prevention

In April 2023, Compass launched ‘Chefs Creating Change’, its first Global Culinary Forum convening over 1500 Compass chefs from around the world to share their best food waste insights, tips, and tools they use to attack food waste at the source. On Stop Food Waste Day 2022, Compass Group North America committed to rolling out its proprietary, tablet-based food waste tracking system, Waste Not 2.0, across thousands of kitchens throughout the US.

Since then, this technology has been deployed to nearly 2500 kitchens across



North America, leading to a 31 per cent reduction in waste at participating cafes. The programme has now been expanded globally with four Compass markets outside of North America. As a Group, Compass recorded a 28 per cent reduction in 2022 in its own food waste across 28 countries and remains on track to achieve its target to halve food waste within its global operations by 2030.

At Compass India, their culinary team has curated over 150 recipes using things which would otherwise land in the garbage bin. For one of the world's largest semiconductor chip manufacturers, they saved over 1776 kg of waste through their repurpose programme.

Surplus Food Redistribution

- To ensure perfectly good surplus food does not go to waste, Compass works with multiple charity partners and social enterprises around the world, such as FoodCycle, FareShare, Olio and Too Good To Go, to pass surplus meals on to people in their communities who need it most.
- Last year, across Compass' largest international markets, the Group donated more than 1.3 million meals to local communities.

Inspiring Positive Change

Following the success of the first Stop Food Waste Day Cookbook in 2022, Compass has created an extended edition of the digital cookbook, featuring recipes from over 50 Compass chefs across nearly 40 countries. The cookbook makes it easy to create meals, which give a second life to ingredients that most commonly go to waste. New recipes in 2023 include leftover bread casserole from Austria, wonky vegetable enchiladas from Mexico, and stuffed potatoes with vegan Bolognese from Spain. In 2022, Compass Group joined



the Board of the International Food Waste Coalition (IFWC) to strengthen the global fight against food waste. Meanwhile, Compass Group Australia and Foodbuy Australia proudly became signatories to the Australian Food Waste Pact, a voluntary agreement which brings organizations together to create and share solutions and strategies dedicated to food waste prevention.

At Compass India, they work extensively with their clients to encourage food waste reduction internally and externally. In this they work closely with their BOH teams to reduce kitchen wastage through technology intervention in menu planning and more efficient execution. They also promote reducing plate waste through continued communication to consumers.

Dominic Blakemore, Group Chief Executive Officer of Compass Group PLC, said: "In a world gripped by conflict, climate change and cost of living pressures, the need for action to reduce food waste has never been more important. Every item we throw away is a waste of the energy used to grow, harvest, process and cook it."

"Minimizing food waste is an essential part of Compass' purpose and commitment to a sustainable future

for all. Managing waste also helps us manage costs for client and consumers. I'm extremely proud of the significant efforts our chefs and frontline teams make every day and I hope their actions and enthusiasm will inspire everyone to get involved in Stop Food Waste Day."

Amy Keister, Global Director of Sustainability at Compass Group, added: "Now in its seventh year, Stop Food Waste Day has expanded beyond just an annual event held on the last Wednesday of April. It's become a global movement, and a core part of our culture at Compass Group. Our chefs and frontline teams understand the opportunity that we have to empower the communities we serve with knowledge, tips, and tricks to reduce food waste; not only in our cafes but in their homes and beyond.

"No one ever has the intention to waste food, which is why at Compass we strive to make everyday #StopFoodWasteDay. By shining a light on this issue, and tackling it together, we can make such a meaningful impact on our global food system." ■

Visit the Stop Food Waste Day website for more information: <https://www.stopfoodwasteday.com>

Bizarre Facts



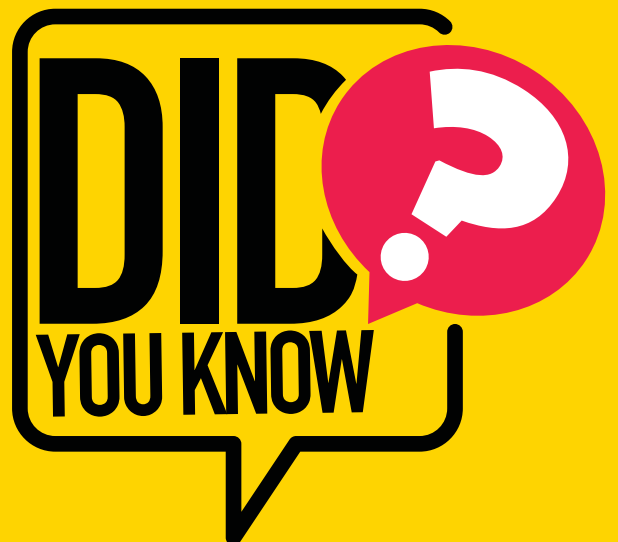
1. There is a town called Calama in Chile that has never experienced rain.
2. Lightning strikes the earth 100 times each second.
3. Ancient Egyptians slept on stone pillows.
4. Ketchup was once used as medicine.
5. Ripe cranberries can bounce.
6. Your eyebrow shapes can predict your personality.
7. A plant that consumes rats can be found in the Philippines.
8. The webs of spiders were once used as bandages.
9. Male rabbits are called bucks.
10. The tooth of an elephant weighs around 9 pounds.



Did You Know?

- There are constantly around 1800 thunderstorms that occur somewhere on the planet.
- The longest recorded tennis match lasted for 11 hours.
- All swans in England belong to the Queen.
- A person is unable to detect smells when they suffer from anosmia.
- Peas are the oldest vegetables.
- Redwoods are the tallest trees.
- Strawberries are the only known fruit to grow their seeds externally.
- A rare pink dolphin resides in Louisiana.
- Eating too many onions can cause sleepiness.
- The smell of freshly cut grass is noted to be the grass screaming in distress.

Source: <https://facts.net/weird-facts/>



Hindustan Zinc Nurturing Biodiversity with Miyawaki Plantation

On this Biodiversity Day, Miyawaki Plantation delved into the ingenious technique that is transforming barren land into thriving green havens. Revolutionary reforestation technique restores nature's balance as Hindustan Zinc has planted 32,500 saplings of 65 diverse species in Debari, Dariba, and Chanderiya in Rajasthan.

In midst of rapid urbanization and its impact on the environment, Miyawaki Plantation has emerged as a beacon of hope. On this Biodiversity Day, Miyawaki Plantation delved into the ingenious technique that is transforming barren land into thriving green havens. Through the implementation of the Miyawaki Plantation, Hindustan Zinc has successfully transformed 2.4 hectares across its operational units in Debari, Dariba and Chanderiya in Rajasthan. The company has planted 32,500 saplings of 65 diverse species in its operational units through a chemical-free approach.

Miyawaki Plantation, pioneered by Japanese botanist Akira Miyawaki, revolutionized reforestation efforts by establishing dense, diverse and rapidly

growing forests in a short span of time. By emulating the natural processes of a forest ecosystem, this technique results in self-sustaining forests that enrich biodiversity, restore degraded lands, enhance air quality, mitigate climate change, and create green spaces.

Hindustan Zinc, India's largest and only integrated producer of zinc, lead and silver, has enriched its surroundings with canopy layers, tree layers, small bushes, and other flora. The technique helps plants to grow ten times faster than conventional methods, which results in a thirty-fold increase in plantation density. Consequently, the carbon sequestration potential is significantly enhanced, contributing to a more sustainable future. This has brought about a positive impact by lowering the ambient temperature,

improved soil nutrition, and creating of safe havens for wildlife.

To mitigate climate risk, Hindustan Zinc has joined the Taskforce on Nature-Related Financial Disclosures (TNFD) forum, underlining their dedication to preserving Earth's rich biodiversity. Additionally, the company has signed a significant three-year collaboration with International Union for Conservation of Nature (IUCN). These strategic endeavours solidify the company's commitment to sustainability and has resulted them to rank 3rd globally and 1st in Asia Pacific Region in S&P Global Corporate Sustainability Assessment under metal and mining sector. ■

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Inspiring and Nurturing Young Minds

Dr Kalam's Exceptional Story-Telling Skills

Children who visited **Dr APJ Abdul Kalam** witnessed the absolute power of his story-telling. His anecdotes caught them in rapt attention. Almost everything a child heard and saw in Rashtrapati Bhavan is preserved in their memories, waiting to resurface exactly as it was experienced—just as the heart desires. He was probably the only Indian President who really knew how to tell a story. The more they listened to him, the better they connected with him. Like the stories he told, his life too was filled with extraordinary twists and turns. An article by Dr Elsa Lycias Joel.

Spinning magic with words, Dr Kalam taught children to look for miracles even in unlikely places. Children are believers because their world is still full of possibilities, miracles, and magic. Throughout his life, Dr Kalam had awakened in children and youth, a curiosity and love for the world around them and in return children touched his heart with their innocence and enthusiasm. Dr Kalam called his interactions with youth as 'wonders of life'. As a scientist and teacher for more than four decades, Dr Kalam shaped thousands of youngsters, many of whom became women and men of substance.

Dr Kalam knew how to handle children perfectly because at heart, he was a child himself. Even at the age of 83, his zest for life remained unwavering. He read to them, told them stories, accompanied them on garden tours and spent hours listening to them. In the presence of kids, nothing else seemed to matter because he was completely occupied by them.

"I honour my debt to my parents by giving abundant love to children," Dr Kalam told Harry Sheridan,¹ in a tone that had a minor triumph in itself.

Few people close to Dr APJ Abdul Kalam wondered his objective behind addressing students and questioned him if his talks on dreams will really make an impact. That's when he would answer in a confident tone with his unassuming smile, "Many aren't blessed with optimal situations, you know. The fire in them needs kindling at regular intervals."

In a country like ours where the advancement of education is a

continuing challenge, Dr Kalam's was a massive effort in consolidating moral visions. He was keen on retaining the very fibre of our country. To him, addressing kids and youth was more than a job. His conversations with parents, teachers and children were about forging a covenant that will strengthen bonds.

"If I don't trigger them to reach as far as their talents and determination can take them, I fail in my duty," Dr Kalam



¹ Harry Sheridan was Dr Kalam's private secretary for over two decades.



would say, his voice full of conviction.

Once, on a flight to Chennai from Delhi, a youngster pursuing a postgraduate medical degree told Dr Kalam, "Sir, but for your lecture on perseverance that I listened to as a school kid in Dehradun, I wouldn't have persevered to come this far." That boy's happiness knew no bounds when Dr Kalam responded with the same vigour and told him, "How well you do depends on how hard you work."

Along with Dr Kalam, kids seemed bright with promises and eager for instructions. The twinkle in their eyes as they discovered questions and answers demanded Dr Kalam's whole self. Occasionally, when teachers tried to shush students from asking certain questions, Dr Kalam politely requested

that they don't meddle or intimidate kids. Thus, their conversations revolved around Dr Kalam's hairstyle, his decision to stay back in India, bachelor status, school days, food habits, and disappointments. His anecdotes were laced with messages, about opportunities that need to be grabbed and duties that have to be fulfilled. With his stories, Dr Kalam taught life lessons to kids helping them recognize their obligation to their country and to mankind. By interacting with children, media and youth in an uninhibited manner, Dr Kalam demonstrated to all leaders a sense of purpose which also brought him love and respect.

There were instances when kids were accompanied by parents, enthusiastic and keen enough to answer questions

posed by Dr Kalam to kids. Then Dr Kalam would make small noises of dissent, tell parents to let the kids take their own time and that he was in no hurry to wind up. "The question was to the child, I say," Dr Kalam would chuckle trying hard to conceal his disappointment. "Please let him/her think."

Once while relaxing in the airport lounge, Harry Sheridan saw a girl talking to the security personnel. Frustration was written all over her face. Going by her gestures he understood she wanted to meet Dr Kalam. So, he asked Dr Kalam his convenience and the girl was let in. She humbly requested Dr Kalam to bless her. Unlike others, Sheridan wasn't surprised, as it wasn't the first time he was witnessing something like that. Many others in the vicinity were amazed



because, until then they haven't seen children wanting to be blessed by great people.

The most exciting gardening project of Dr Kalam was the tactile garden he created in April 2004 at Rashtrapati Bhavan. It had herbs of many kinds for year round flavour and fragrance. He earnestly wished this garden served as a template, worthy of replication. When the project was taking shape, he always spoke of visually impaired kids and how he sees their challenges. We do know that the visually impaired who are unable to sense all experiences in daily life as normal people are more likely to lose the sense of happiness. So, developing their sense of smell can compensate their visual loss to a certain extent. Our experience at the sensory garden was beautiful. We could see how people connected well with the environment through perceived smells. According to Sheridan, Dr Kalam's idea of taking the children on a personal tour was to just

to soak in the contentment of enabling them to recognize the world through smell and touch. It seems Dr Kalam never looked anywhere while interacting with kids in this garden but their eyes. He was intent on what they said and how they responded. In the garden, they appeared like arming one another with a constant dose of truth, love, comforting scents and words. Back from the garden tour, he told Sheridan, 'Come here, I've got something that might interest you' and placed some fresh mint leaves in his hand. At that moment, the scent acted like a time portal, instantly sweeping Sheridan from wherever he was to his grandmother's tiny kitchen. Sheridan was astounded when Dr Kalam told him that scents are unique because they always trigger emotions and memories.

"Well," said Dr Kalam clasping his hands together, "Kids went on a memory tour. Many were reminded of their moms' recipes, their grandmothers' garden and what not!" He wasn't looking at Sheridan

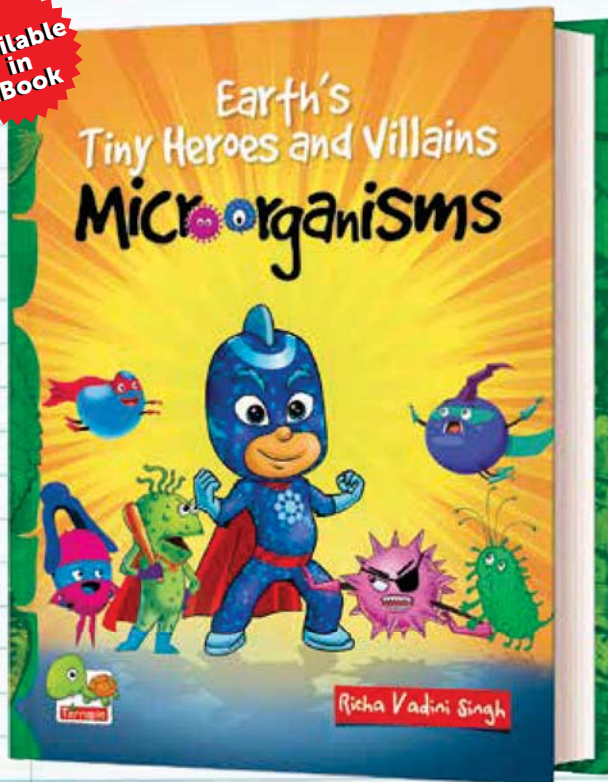
when he said this. He seemed intensely satisfied and proud about the remarkable garden he created with his dedicated team. After garden tours, Dr Kalam read up on amazing visually challenged people so that they can have their choice of heroes. In every manner, Dr Kalam tried his best to give kids a wonderful childhood. -

By all means, he got children to believe in themselves and treated everyone like they were amazing. As a paragon of success, Dr Kalam taught children that winners need not race against others but against themselves to conquer their wills, to transcend their weakness, and destroy their nightmares. Young visitors saw the President of India as a man on a mission both infinitely greater than yet remarkably similar to their own, to show them what they are made of. ■

Dr Elsa Lycias Joel regularly contributes articles in TerraGreen.

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Electrocution of Animals

Can We Reduce Domestic Power Supply Volts?

In this article, **Nava Thakuria** says that today electrocution has emerged as a major cause of death of wildlife such as elephants. Various government sources confirm that India lost over 470 elephants (along with more than 220 flamingos, 150 leopards, 45 tigers, etc.) to electrocution injuries during 2014 to 2020 fiscal years.

To prevent such fatalities in the future, the decrease of domestic supply voltage will definitely be a major policy shift for the vast country with the high population as it would need a huge volume of resources with adequate preparedness and public awareness. A long-term plan will be needed with a strong political will from both the Centre and State governments.

The recent incident of electrocution death of a 16-year-old boy at Bhupen Hazarika Samadhi Kshetra in Jalukbari is heart breaking. Subham Kumar Roy from Pandu locality of Guwahati accidentally touched the fountain water inside the campus and sustained severe electric jerks (as the water was unfortunately connected to the live power supply). The

high school student was taken to the hospital where he succumbed to injuries.

No doubt, the incident should (could) have been avoided and Subham been saved if some basic safety measures endorsed by the central electricity authority were taken while using electric supply lines to any appliance (in private or public places). But Subham is neither the first case of electrocution death

nor it would be the last in India, as the country annually loses over 11,000 people to similar incidents (as revealed by the national crime records bureau). Accidental electrocution (including few suicidal) cases are reportedly high in Madhya Pradesh, Maharashtra, Uttar Pradesh, Rajasthan, Gujarat, Chhattisgarh, Andhra Pradesh, Telangana, Tamil Nadu, Karnataka, Jharkhand, Kerala,



Odisha, Uttarakhand, etc. Though low in numbers, Assam loses 50 to 100 people annually because of electrocution deaths (as stated by Assam Power Development Corporation Limited).

The State lost nearly 400 people to electrocution incidents between financial years 2019 and 2022. It recorded 78 incidents of electrocution where 82 people died and three were injured in 2019. Next year, 112 cases were reported with 112 casualties with injury to one. In 2021, it recorded 91 cases with 89 deaths and wounds to four people. Next year, it recorded 91 cases with 89 casualties and injuries to four individuals.

Assam also witnesses the killing of wild animals due to electrocution at a higher rate than other States. Various government responses confirm that India as a whole lost over 470 elephants (along with more than 220 flamingos, 150 leopards, 45 tigers, etc.) to electrocution injuries during 2014 to 2020 fiscal years. Assam remained at the top with 90 elephant casualties followed by Odisha (73), Tamil Nadu (68), Karnataka (65), Kerala (24), etc.

India today gives shelter to around 30,000 Asian elephants (almost 50 per cent of its global population). Lately, the electrocution (often planned by human beings) has emerged as a major cause of death for the gigantic animal, which is listed as endangered by The International Union for Conservation of Nature (IUCN). The Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, also admitted that the electrocution now kills more elephants than even the poachers. Expressing concerns over electrocution deaths, The High Court of Jammu & Kashmir and Ladakh emphasized on implementing all safety measures to prevent the casualties and also injuries to individuals. All Assam Engineer's Association lauded the court order and commented that often such incidents are ignored by the administration and electricity authority as mere accidents. The forum of graduate engineers supported the move to ensure

timely implementation of statutory safety measures and regulations endorsed by the central electricity authority. The forum also emphasized on a pragmatic action plan for laying high voltage live wires with timely maintenance, transformers under protectors, adequate public awareness and monitoring of electrical appliances by the common people. It pointed out that often the bamboo poles (or other living trees) are temporarily used to carry out the electrical wires, which must be stopped. Moreover, the proper use of fuse wires (or other protective systems) in all electrical systems should be encouraged.

At the same time, the forum argues that India must aggressively look for alternate (green/renewable) sources such as solar and wind power to deal with negative impacts on the environment and public health. For the north-eastern region with abundant water bodies, hilly terrains, forest covers supporting wildlife (where laying of high voltage wires are difficult) including the tendency of natural disasters (floods and earthquakes), the localized power generation units become need of the hour, it asserted.

Days back, a debate was also engineered by Patriotic People's Front Assam, if the domestic supply voltages of 240 (in alternate current with 50 hertz) can be reduced up to 120 (or even lower in volt differences) with multi-phase supply facilities across India to reduce the fatality to some extent. The forum of nationalist citizens cited that the low supply volt system remains popular in many developed countries such as the USA, UK, Japan, etc. Those countries adopt a unique system to deliver the domestic electrical power in split phase arrangement, where it has two or more 120-volt alternate current phases with one neutral. The consumers use any one of the available independent phase lines with the neutral one for their low power domestic appliances. The families with heavy electrical appliances such as air conditioners, electric oven-dryer-cookers,



go for multi-phase supply lines. Same arrangements may be applied in India with two independent live/phases (each of 120 volt) with one neutral wire, where the customers may opt for single phase line only to use in lighting (preferably with LED bulbs), digital screening of television, computer, charging mobile phones as well as low energy consuming fans and other appliances. Needless to mention that these utilities run with lower volts, which are generated with step-down adaptors. The decrease of domestic supply voltage will definitely be a major policy shift for the vast country with the high population as it would need a huge volume of resources with adequate preparedness and public awareness. A long-term plan will be needed with a strong political will from both the Centre and State governments. The qualified and practising electrical engineers should come forward with pragmatic resolutions. After all, if the precious lives are recognized, a national debate with follow-up actions becomes inevitable. ■

Nava Thakuria is a professional journalist with the academic qualification of engineering (mechanical/automobile), and is based in northeast India.

Sustainability Version 2.0

Revisiting ESG

In light of recent changes and AI-augmented awareness of society, the ESG-oriented approach has an indispensable role to play in its applied linkage to sustainability revisited in the contemporary version. As per India Finance Corporation's definition, sustainability is an approach that ensures long-term business success along with socioeconomic development and a healthy environment. Keep reading to know more...

The ESG framework, in general, operates through three buckets, that is, Environmental, Social, and Governance, each of which is measured by metrics. The environmental bucket typically includes parameters related to the state of the environment, climate, and natural ecosystems. The social bucket includes parameters that look at the relationship of the business with various stakeholders. The governance bucket covers parameters related to fair conduct and accountability of the business. While each bucket has

several parameters under them, their importance would vary from sector to sector, and company to company.

Alternatively, a holistic approach to achieve this sustainability lies in the identification of non-financial risks and opportunities with respect to issues related to Environmental, Social, and Governance, respectively. Gone are the days when ESG used to find its relevance only in terms of qualitative mapping of activities under green/sustainability space by most organizations. Especially, on E parameter of ESG that connects it

to the applied sustainability landscape is 'Sustainalytics'. This is one of the most popular themes that contain the aim of decarbonization to reach net-zero goals ultimately. Internationally, ESG themes are picking up, such as clean energy, e-mobility, gender, diversity and inclusion, business and human rights, and sustainable supply chains.

Initially, ESG used to be considered a qualitative practice with lesser significance than its quantitative counterpart. However, an ESG-oriented sustainability approach needs to be precise in terms of specific issues to examine under the Environmental, Social, and Governance perspective, typically categorizing them as high risk, medium risk, and low risk. It needs to be measurable in terms of quantitative and semi-quantitative parameters on qualitative data to which scoring can be allotted. Also, it needs to be holistic and integrated, covering financial and non-financial variables that may impact business performance. ESG integration refers to the inclusion of qualitative and quantitative information on ESG-related issues into financial analysis and business value drivers, to gauge their impact on the company's financial performance.

Broadly, ESG integration across activities involves two things. One is to





incorporate ESG issues into the financial institution's own risk management, governance, disclosure, business strategy, branch network, training, capacity building, and updation of data systems such that it leverages KYC and due diligence processes to collect more information on ESG issues. The second is to assess the underlying counterparty's business value drivers such as competitive position, growth prospects, ability to sustain in the long run, and financial condition so that the resultant financial analysis on the counterparty reflects the impact of non-financial risks and opportunities.

Only such an ESG-oriented approach can tangibly assist investment and lending decisions for a bank or any financial institution. To gauge which are the most critical parameters for a bank within an ESG-oriented approach, the materiality mapping exercise is a good place to start. Materiality mapping would typically form part of any bank's sustainability disclosure activity as well. This exercise identifies the key issues affecting a bank, as per their

importance to stakeholders and the business. However, while an approach that considers ESG issues in lending and investing decisions can improve the company's long-term social license to operate, there are several challenges to mainstream ESG adoption. For example, there remains a lack of a uniform definition of what is green, or sustainable.

What is ESG for one may vary for another, and this heterogeneity in the absence of specific regulations may lead to inadvertent greenwashing, as everyone makes varying interpretations of the ESG framework. This uplifts the lack of regulations as another related challenge. Nonetheless, corporates have started realizing the ESG approach amidst consideration of issues in lending and investing decisions that could improve the company's long-term social license to operate. Much said and done, several challenges still exist to mainstream ESG adoption.

To conclude, the consideration of ESG issues within lending decisions is still evolving and varies from institution to institution, and this framework only

serves as a rough guide. ESG and climate change are not just about the risks that they pose; rather, it is also about the new opportunities they offer. For business-as-usual (BAU) scenarios, opportunities are changing, and hence, it is extremely important that corporates and financial institutions remain agile and tap these ensuing opportunities to build a first-mover advantage over competitors. Nevertheless, with the growing awareness of regulators, investors, and customers on these issues, financial institutions that do not start factoring ESG within their decisions may face higher credit risks and unfavorable terms of funding. ■

Article contributed by Dr Megha Jain, Assistant Professor, Shyam Lal College (M), University of Delhi; Dr Palakh Jain, Senior Fellow/Associate Professor, Pahle India Foundation/Bennett University, Delhi/UP; and Dr Mukta Rohatgi, Associate Professor, Shyam Lal College (M), University of Delhi.

Disclaimer: This article is authors' own opinion without any affiliation to any specific organization or academic institution.

Manipur Black Rice

Nutritious and Exotic

In this article, **Onam Vaid** highlights that aromatic black rice is dense in nutrients and contains powerful antioxidants called anthocyanins. The nutrients present in the black rice help to flush out toxins from the body. It also aids in the functioning of the brain. Aromatic black rice helps in body metabolism. It also has low glycaemic index; hence it is beneficial for diabetic and heart patients. In comparison with other types of rice, black rice is the lowest in calories and highest in protein. It is expected that the GI tag and the renewed interest in the healthy properties of this rice variety will encourage commercial cultivation and marketing across the world.

Black rice or forbidden rice is a rare and very old variety of rice. In India, it is cultivated in Manipur and traditionally known as 'Chak hao amubi' where 'chak hao' means delicious and 'amubi' means black. The scientific name of black rice is *Oryza sativa L.* It is

the cultivated form of wild rice and has been part of Asian culinary culture for the last 7000 to 9000 years. The black rice is glutinous in nature and is also sticky, which has a slightly nutty flavour. Upon being cooked, this black rice turns deep purple in colour due to the high content

of anthocyanin. Thus, it is also known as purple rice. It is a rich source of Vitamin E and thus good for the skin and hair. Aromatic black rice is dense in nutrients and contains powerful antioxidants called anthocyanins. The nutrients present in the black rice help to flush out toxins from the body. It also aids in the functioning of the brain. The rich fibre content not only helps to regulate bowel movements, diarrhoea and bloating but also helps to prevent obesity. Aromatic black rice helps in body metabolism. It also has low glycaemic index; hence it is beneficial for diabetic and heart patients.

Black rice is used to prepare desserts, *idli*, *dosa*, noodles, risotto, porridge, and bread. Black rice is usually grown in warm climate and requires at least 3–6 months to grow fully. Black rice requires full sunlight with enormous watering. The germination of seeds requires sustainable temperature of approximately 21°C.

'Chak hao amubi' bagged the geographical indication (GI) tag in May 2020. GI status is an indication that identifies goods as produced from a particular area which has special quality attributable to its geographical origin.



Source: dhanyam.in

GI has great potential to play a major role in trade and there is a possibility of preserving many traditional skills. “Now we can sell seeds as well as grains to any parts of the globe. We will get loyalty if anyone wants to do trading,” said M S Khaidem, Project Coordinator of Manipur Small Farmer’s Agri-business Consortium.

‘Chak hao amubi’, a scented glutinous rice which has been in cultivation in Manipur over centuries and is spread over 4500 hectares is characterized by its special aroma. It is normally consumed during community feasts and also served as Chak hao kheer. ‘Chak hao amubi’ has also been used by traditional medicinal practitioners as part of traditional medicine. It is sold at INR 100–120 per kilogram on an average in Imphal market.

There are very limited research studies on black rice. The demand of black rice is rising steeply due to the presence of several antioxidants and phenolic compounds which help in curing numerous chronic diseases, such as cardiovascular diseases, heart-related ailments, cancer, etc. In comparison with other types of rice, black rice is the lowest in calories and highest in protein. Hundred grams of black rice contains approximately 9 grams of protein compared with 7 grams of brown rice. The outer covering of the black rice is black due to the presence of the black colour pigment called anthocyanin. Anthocyanin is also found in blueberries, eggplants and purple sweet potatoes. Studies revealed that anthocyanins have strong anti-inflammatory, antioxidant and anti-cancer effects. Furthermore, eating foods high in anthocyanins may protect against several chronic diseases such as heart disease, obesity, and cancer. Therefore, adding black rice to diet could help in curbing severe ailments.

Enumerating the benefits of black rice, Shilpa Arora, Macrobiotic Nutritionist and Health Practitioner says, “It is loaded with antioxidants especially anthocyanin, which is great for diabetes, heart patients and helps brain activity. It is great for skin and hair due to its Vitamin E content. It is



Source: www.agrifarming.in



also loaded with fibre so it does not spike blood sugar levels. It is rich in iron, hence a good source of iron for vegetarians.”

The ‘forbidden rice’—the secret of this intriguing nomenclature goes back to Ancient China where a black variant of rice was consumed by a host of Chinese kinsmen for betterment of kidneys, stomach and liver until a handful of noble Chinese men took possession of every grain and withheld it from public consumption. Black rice then became a property for the royalty and the wealthy only in Ancient China. Black rice continued to be cultivated but only for

the elite classes in limited quantities and under strict surveillance. The common folk were prohibited from growing or consuming it and since then it earned its much renowned label, that is, the forbidden rice.

Black rice also works as antioxidants which protects eyes. Studies suggest that the antioxidants present in black rice may play a vital role in protecting against age-related degeneration, which is the leading cause of blindness worldwide. Regular intake of black rice may also decrease the risk of cataracts and diabetes-related ailments.



Research on black rice's effects on heart is very limited. Some of the research studies suggest that anthocyanins may help improve cholesterol and triglyceride levels. However, more research is needed to understand black rice's effects on heart diseases.

Anthocyanins from black rice may also have potent anti-cancer properties. A review of population-based studies found that higher intake of anthocyanin-rich foods was associated with a lower risk of colorectal cancer. Furthermore, a test-tube study unravelled that anthocyanins from black rice reduced the number of human breast cancer cells as well as slowed their growth and ability to spread but more research is required to fully understand the ability of the anthocyanins in black rice to reduce the risk and spread of certain types of cancer.

Black rice is unpolished and comprises of protein and fibre, which helps in

reducing weight by reducing appetite and increasing the satiatedness. The research on black rice's role in weight loss in humans is limited; more research studies are needed to vividly understand how the black rice aids in controlling obesity in humans.

Black rice is naturally gluten-free and extremely beneficial to combat celiac disease or gluten sensitivity. People suffering with celiac disease need to avoid gluten as it affects an immune system that damages the small intestine. Gluten can also cause gastrointestinal problems such as bloating and abdominal pain. So, black rice helps in detoxification as the fibre present in black rice helps in easy bowel movements.

Black rice also protects liver and kidney from injuries because of its antioxidant and anti-inflammatory properties. Black rice also possesses anticarcinogenic properties, which is

traditionally served to pregnant women to reduce complexity during childbirth.

Japanese researchers found that a change in a gene that controls anthocyanin was rearranged to create black rice; this mutation occurred in a sub-species of rice. Since then, the rice has been replicated and transferred to other rice species through cross-breeding.

Black rice when cooked, its deep purple colour can turn even the most basic meal into a visually appealing cuisine. It is expected that the GI tag and the renewed interest in the healthy properties of this rice variety will encourage commercial cultivation and marketing across the world. ■

Onam Vaid is a writer at India International Centre, New Delhi. Previously, she has worked as German Lecturer at prominent institutions, including University of Delhi. She was also Visiting German Faculty at various schools in Delhi, such as Modern School, Vasant Vihar.

Nature is Changing

As Land Abandonment Increases

When people leave their rural lives behind to seek their fortunes in the city or agriculture is no longer profitable, the lands they toiled on are often left unused. A new perspective piece in *Science* shows that these abandoned lands could be both an opportunity and a threat for biodiversity, and highlights why abandoned lands are critical in the assessment of global restoration and conservation targets.

The past 50 years have seen an increased exodus of populations from rural to urban areas. Today, 55 per cent of the world's population lives in or around cities and this proportion is expected to expand to up to 68 per cent by 2050. There are of course a multitude of reasons for people to leave their rural lives behind and move to urban areas, including socioeconomic and political change, declining subsistence farming, and environmental factors. One effect

of this continuous decrease in rural populations is that the land they leave behind leads to a rise in the number of abandoned fields and pastures, forestry areas, mines, factories, and even entire human settlements.

IIASA researcher Gergana Daskalova and Johannes Kamp, a researcher at the University of Göttingen in Germany, took a closer look at abandoned land—in other words land on which human activities have ceased—to explore how

biodiversity is influenced, and what this means for ecology and conservation.

“The factors that drive depopulation and consequently also land abandonment are intensifying due to issues such as climate change and the rapidly changing geopolitical landscape. The Russian invasion of Ukraine, for example, has already created new abandonment hotspots. Abandonment is a globally important process. The scale at which this is happening around the



Photo courtesy: Theo Bickel on Unsplash

world urged us to put the spotlight on the places people have left behind as a potential source of future solutions for conservation, while also protecting human livelihoods," Daskalova explains.

According to the authors, the exact amount of abandoned land around the world is unknown, but it is estimated that it could comprise up to 400 million ha globally, which is an area roughly half the size of Australia. Most of this abandoned land is in the Northern Hemisphere, of which around 117 million ha falls within the former Soviet Union.

The effect that abandoned areas have on biodiversity can be both positive and negative. The biggest wins are likely to be achieved where areas that were previously intensively farmed and where biodiversity was low, are abandoned. The first changes that will probably be observed in these areas would be the return of plant life, birds, and invertebrates that can survive in recently disturbed ecosystems. If the abandonment of these crop fields is coupled with people leaving the area or with wildlife reintroductions, this can lead to rewilding with the possible return of large herbivores and even carnivores. The authors, however, point out that not all abandoned land will recover without help, and that some of the land that was previously intensively farmed will never

return to what it once was.

Land abandonment can also have negative impacts in terms of biodiversity, as well as for human culture and tradition. In areas that have traditionally been used for low-intensity, or subsistence farming over a long period of time, for instance, the close ties between the people and the land have created interdependent ecosystems that break down after people move away, thus leading to the loss of locally rare species or the proliferation of only one or two dominant species at the expense of others.

"Because abandonment usually happens out of sight, there is still so much we do not know about its imprint on the planet. We are currently working in Bulgaria, the quickest depopulating country in the world, to determine what types of plants, birds, and other biodiversity return to villages long after the last house lights have been turned off," Daskalova notes.

Any gains in biodiversity on abandoned land can unfortunately be very quickly undone when land is recultivated or repurposed and, according to the authors, there is growing pressure to find new industrial uses for abandoned land, such as large-scale bioenergy, wind-, and solar energy production, often in just over a



Photo courtesy:
Annie Spratt on Unsplash

decade after abandonment. The authors further highlight that finding the best use for abandoned land will involve balancing benefits for conservation, human livelihoods, and sustainability. It is therefore crucial that biodiversity change on abandoned land be included in regional and global assessments, policies, and scenarios and where abandoned land is reused, care should be taken to ensure that economic needs are balanced with restoration and conservation goals.

"It is important for future models and scenarios aimed at predicting the positive versus negative effects of abandonment on biodiversity to take into account whether the land is likely to remain abandoned and what the feedbacks between abandonment, biodiversity, human values, and livelihoods entail. As global conversations around this topic continue, we can look to abandoned lands as the product of centuries of interactions between people and nature, and create incentives not just for conservation, but also for land stewardship and the preservation of both social and ecological values," Daskalova concludes. ■

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



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