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The Alpha Myth

What Animal Societies Can Teach Us about Dominance and Leadership

IN CONVERSATION

Prashant Singh,
CEO & Founder of Blue Planet Environmental Solutions

SPECIAL HIGHLIGHTS

India's Energy Security

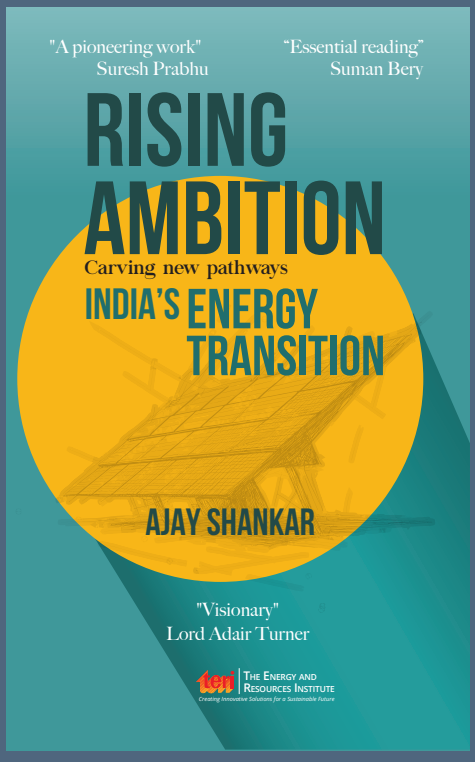
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Rising Ambition Carving New Pathways India's Energy Transition

Ajay Shankar
Distinguished Fellow
The Energy and Resources Institute (TERI)

India aims to become net zero by 2070. This book sets out the pathways to net zero with key milestones. It suggests policy choices and ways to minimize the cost of this fundamental transition deriving lessons from the remarkable success that has been achieved in renewables. It makes the case that moving away from fossil fuels would also help India become a developed country with a competitive green economy.

Year: 2025
Size: 5 inch x 8 inch
Pages: 244
ISBN: 978-93-94657-19-9
Price: ₹495.00

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EDITORIAL



> As climate-related risks become more common across many regions, strengthening our understanding of environmental processes, climate risks and investing proactively in practical solutions will be an imperative.

The natural world has long fascinated humanity from time immemorial. From observing animal behaviour to studying ecosystems and evolutionary processes, science has helped us uncover valuable insights into how living organisms survive, adapt, and interact with one another. At the same time, these discoveries remind us that nature is often far more complex than our simplified interpretations of it.

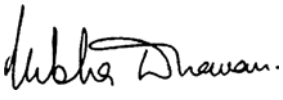
Over the years, certain scientific ideas have moved beyond academic circles and entered popular culture. While this can help increase public interest in science, it can also lead to misunderstandings when findings are taken out of context. Concepts that were once based on limited observations are sometimes repeated for decades as beliefs and perceptions crystallize over time, even after new research presents a more complete picture.

The cover story in this issue explores one such example: the enduring belief in the "alpha male." Drawing on studies of wolves, chimpanzees, bonobos, and other social animals, the article examines how early observations shaped popular ideas about dominance and leadership. It also highlights how later research revealed that animal societies are often built on cooperation, social bonds, adaptability, and shared responsibilities rather than constant competition and aggression. The story encourages readers to look beyond popular stereotypes and appreciate the complexity, interdependence and reciprocity of both animal and human societies as interspecies interactions.

The importance of informed understanding extends well beyond discussions of behaviour. Recent floods in Nepal and Assam in India have once again highlighted the growing challenges posed by extreme weather events. These incidents have affected communities, infrastructure, and livelihoods, while also reminding us of the importance of preparedness, ecosystem conservation, early warning systems, and resilient development. As climate-related risks become more common across many regions, strengthening our understanding of environmental processes, climate risks and investing proactively in practical solutions will be an imperative. In other words, a holistic understanding and comprehension of the changing ground reality help in making informed choices.

Whether we are examining wildlife behaviour, addressing environmental challenges, or planning for a changing future, science offers valuable guidance. It encourages curiosity, critical thinking, and a willingness to revisit old assumptions in the light of new evidence.

We hope this issue inspires readers to engage more deeply with the natural world and the scientific process itself. By approaching knowledge with openness and scientific perspective, we can build a society that is not only adequately informed but also well equipped to respond to the opportunities and challenges of the future.



Vibha Dhawan
Director-General, TERI



The cover story of the July 2026 issue of TerraGreen, "Data Centre Boom: Implications for Power and Environment", is a timely and thought-provoking exploration of an increasingly important aspect of India's digital transformation. As data centres expand to support cloud computing, artificial intelligence, e-commerce and other digital services, their growing requirements for electricity and water deserve greater public attention. What makes the article particularly relevant is its emphasis on the environmental implications of this rapid expansion. The increasing demand for reliable power, cooling and water resources raises important questions about how India can balance digital growth with its sustainability objectives. The story also highlights the need to look beyond the construction of data centres themselves and consider their wider implications for power systems, natural resources and local communities. Integrating renewable energy, improving energy efficiency, adopting innovative cooling technologies and promoting responsible water management could help reduce the environmental footprint of this emerging infrastructure. The cover story successfully brings together technology, energy and environmental concerns and encourages readers to think about how India's digital future can be made more resource-efficient and sustainable.

Prakash Singh
New Delhi

The Special Report in the July 2026 issue of *TerraGreen*, "Sustainability Meets Infrastructure: Why India's Growth Story Must Be Built Differently," provides a timely perspective on one of the most important challenges facing a rapidly developing India. As the country invests in roads, buildings, transport systems, energy networks and other infrastructure, the choices made today will have environmental and economic consequences for decades. The report rightly draws attention to the need to integrate sustainability into infrastructure planning from the very beginning, rather than treating it as an additional consideration after projects have been designed. The emphasis on low-carbon materials, climate-resilient design, resource efficiency and digital technologies is particularly relevant as India seeks to expand its infrastructure while addressing climate-related risks.

Suman Bhattacharya
Kolkata, West Bengal

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

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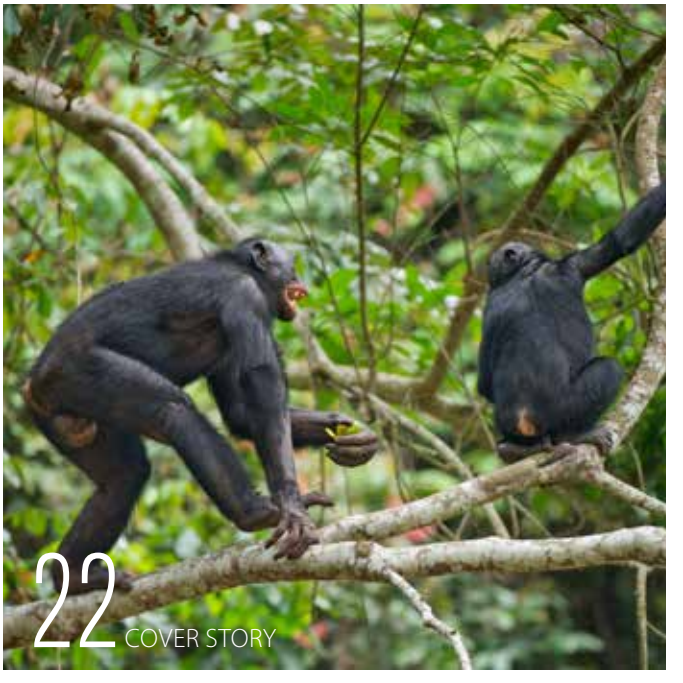
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India Supports Nepal after Devastating Himalayan Flood

India has approved electricity exports of up to 654 MW to Nepal following a devastating flood triggered by a glacier collapse in the Himalayas. The disaster damaged hydropower plants and other infrastructure and severely disrupted Nepal's electricity system. Since hydropower supplies most of Nepal's electricity, the destruction created an immediate energy shortage. India's decision will allow Nepal to import electricity for up to 18 hours a day until the end of 2026. The disaster has also renewed attention on the vulnerability of Himalayan communities and infrastructure to climate-related hazards. For India and other countries in the region, it underlines the importance of stronger early-warning systems, climate-resilient infrastructure and cooperation on Himalayan disaster preparedness.

Source: https://www.reuters.com/

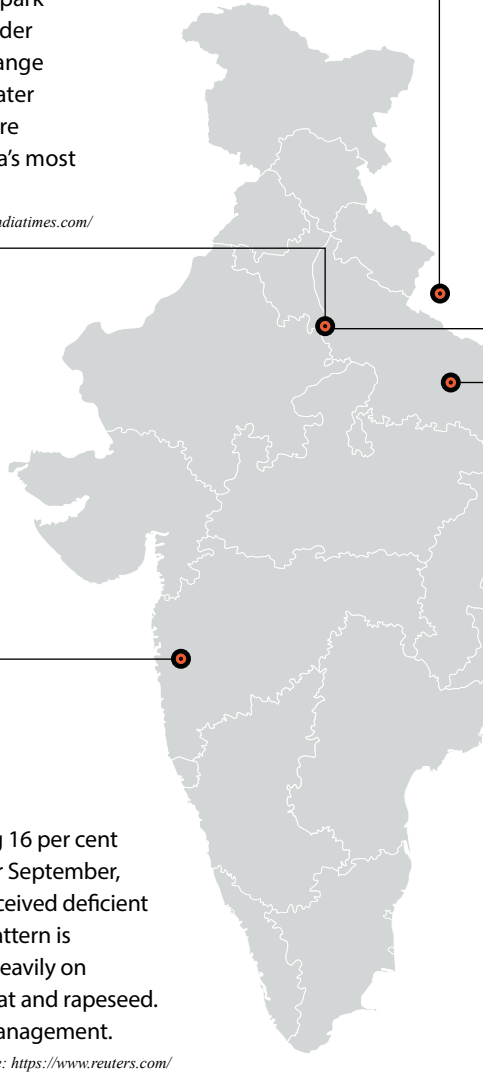
Aravalis Face Renewed Scrutiny over Conservation Boundaries

The ecological future of the Aravalli landscape has come under renewed attention as a Supreme Court-appointed committee examines how the mountain range should be defined and protected. The field exercise includes ecologically important areas such as Asola, Mangar Bani and the biodiversity park in the Delhi-NCR region before extending to Rajasthan. Conservation groups have called for wider consultation with communities living across the Aravallis. The issue is significant because the range performs several ecological functions, including supporting biodiversity, influencing groundwater recharge and helping regulate local climate. Establishing clear ecological boundaries is therefore important for balancing conservation with development pressures across one of northern India's most environmentally significant landscapes.

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







Weak Monsoon Raises Concerns for Indian Agriculture

India is facing growing concerns over a weak and uneven monsoon, with rainfall in August falling 16 per cent below normal. The India Meteorological Department (IMD) also forecast below-normal rainfall for September, partly because of strengthening El Niño conditions. By the end of August, several districts had received deficient rainfall, while others experienced intense spells followed by prolonged dry periods. The erratic pattern is particularly significant for crops such as cotton, soybean, rice, maize, and pulses, which depend heavily on monsoon moisture. Lower soil moisture could also affect the sowing of winter crops such as wheat and rapeseed. The situation highlights the growing importance of climate-resilient farming and better water management.

Source: https://www.reuters.com/



BRICS Countries Highlight Sustainability and Energy Transition

The 18th BRICS Summit, held in New Delhi on September 11–13, 2026, placed sustainability among the grouping's areas of cooperation. The New Delhi Declaration emphasized resilience, energy security, clean-energy technologies, critical minerals and disaster early-warning systems. It also recognized the importance of a fair and nationally determined transition towards lower-carbon energy systems. At the same time, the declaration acknowledged the continuing role of fossil fuels, particularly for developing economies concerned about energy security and development. The discussions reflect the complexity of the global energy transition, where countries are attempting to expand renewable energy while managing growing electricity demand and existing dependence on conventional fuels.

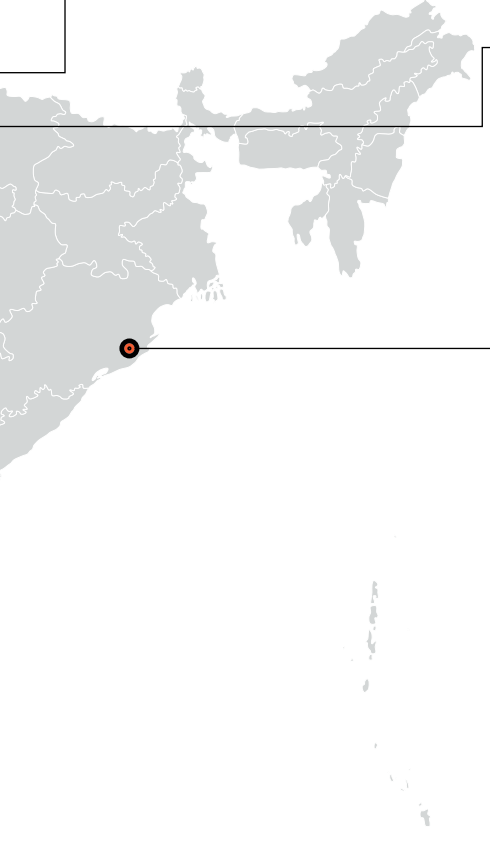
Source: https://indianexpress.com/

Lucknow Leads National Clean-Air Survey



Lucknow emerged as the top-performing city among Indian urban centres with populations exceeding one million in the 2026 Swachh Vayu Sarvekshan. Indore and Jabalpur followed in the same category. The annual assessment evaluates measures undertaken by cities to improve air quality under the National Clean Air Programme. Lucknow has introduced initiatives such as electric vehicles for waste collection, mechanized road sweeping and improved management of legacy waste. However, the city still recorded PM^{10} concentrations above the national standard, showing that progress in pollution management does not necessarily mean that air-quality targets have already been achieved. The survey illustrates the importance of combining emission reduction, waste management, monitoring, and sustained local action.

Source: https://indianexpress.com/





Five Young Orangutans Found in Odisha Forest

The discovery of five baby orangutans in a forest in Balasore, Odisha, has triggered an investigation into possible wildlife trafficking. Odisha's environment minister, Shri Ram Singh Khuntia, said wildlife investigators were trying to establish how the rare apes reached India. Orangutans are native to the forests of Borneo and Sumatra and do not naturally occur in India. Authorities have placed the animals in quarantine while investigating how they reached the country. International trade in orangutans is prohibited under CITES, reflecting the severe conservation pressures faced by the species. The incident highlights the international nature of wildlife trafficking, in which animals can be moved far beyond their native habitats.

Source: https://www.theguardian.com/



European Seas Experience Extreme Marine Heat

European seas experienced an exceptional marine heatwave during the summer of 2026, with sea temperatures in some areas rising several degrees above normal. A World Weather Attribution study found that human-caused climate change contributed substantially to the unusually high ocean temperatures. The warming affected the Mediterranean, Bay of Biscay and Celtic Sea regions and placed additional pressure on marine ecosystems. Fish, seabirds and other organisms can be particularly vulnerable when water temperatures remain elevated for prolonged periods. Marine heatwaves can also influence rainfall and weather patterns over land. The event illustrates that climate change is not simply a problem of rising air temperatures; increasingly, the world's oceans are absorbing and redistributing enormous amounts of excess heat.

Source: https://www.theguardian.com/





August 2026 among the Hottest Months Ever Recorded

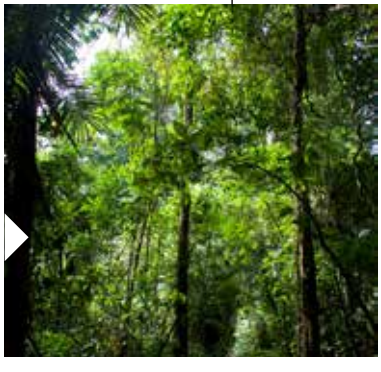
August 2026 was recorded as the joint-hottest month globally since modern temperature records began, according to the European Union's Copernicus Climate Change Service. The global average surface air temperature reached 16.96°C, or about 1.65°C above the pre-industrial average. The month matched the record set in July 2023. Scientists attributed the exceptional warmth primarily to long-term human-driven climate change, with a strengthening El Niño adding to the heat. Ocean temperatures also remained exceptionally high. The figures do not mean that the Paris Agreement's 1.5°C goal has been permanently exceeded, since that target refers to a long-term average. However, the data underline the continued acceleration of global warming.

Source: https://www.reuters.com/

Amazon Faces Growing Pressure from a Strong El Niño

The Amazon rainforest is entering a potentially difficult period as a strong El Niño is expected to peak towards the end of 2026. The climate phenomenon can reduce rainfall and increase temperatures in parts of the Amazon, raising the risk of drought and forest fires. Scientists are particularly concerned because large areas of the rainforest have already experienced degradation caused by deforestation, agriculture, and other human activities. Lower river levels could also affect communities, transport, and agriculture. The Amazon plays a major role in regulating regional rainfall and storing carbon, making its condition important well beyond South America. The developments highlight the interaction between natural climate variability and long-term human-driven warming.

Source: https://www.theguardian.com/





Himalayan Glacier Collapse Causes Catastrophic Flooding

A major flash flood in the Himalayas in late August devastated parts of Nepal and China's Tibet region after a glacier-related collapse sent enormous quantities of water, rock and debris downstream. Hundreds of people were killed and thousands were reported missing, while hydropower plants, roads and settlements were severely damaged. The disaster also affected international pilgrims travelling towards Mount Kailash, including many Indians. Scientists and authorities are examining the role of warming conditions in increasing risks associated with unstable glaciers and high-altitude lakes. The event highlights the vulnerability of Himalayan communities and infrastructure and the need for stronger monitoring of glaciers, glacial lakes, river systems and potential downstream hazards.

Source: https://www.reuters.com/





Global Forest Loss Raises Concerns over Future Timber Demand

Growing global demand for wood is intensifying concerns about forests, with consumption projected to rise substantially by 2050. Forest loss continues to be driven by agriculture, logging and wildfires, even as countries have pledged to halt and reverse deforestation by 2030. The European Union's Deforestation Regulation, scheduled to take effect at the end of 2026, will require companies importing several forest-linked commodities to demonstrate that products are not associated with recent deforestation. However, implementation will depend on reliable supply-chain tracking and enforcement. The debate illustrates the challenge of meeting demand for timber while protecting forests that store carbon, support biodiversity and provide livelihoods to millions of people.

Source: https://www.reuters.com/

Indonesia's Wildfires Drive a Surge in Emissions

Wildfires in Indonesia caused a sharp rise in carbon emissions during the first week of September, with satellite-based monitoring showing emissions of around 19.7 million tonnes of carbon dioxide between September 1 and 7. According to the EU's Copernicus monitoring service, this represented more than one-third of global wildfire emissions during the period. Fires have been particularly severe in Kalimantan and Sumatra, where drought and extreme heat have been intensified by a strong El Niño. Smoke has also affected air quality across parts of Southeast Asia. The episode demonstrates how drought, land clearing and peatland fires can combine to produce environmental impacts extending far beyond national borders.

Source: https://www.reuters.com/



When Risk Stops Looking Normal

Lessons from the Nepal Floods

The Nepal floods are a reminder that the world we are designing for is becoming less comfortable with our assumptions of normality. We should continue improving our ability to observe and model glaciers, slopes, rivers, and weather, says **Shiren Pandita** in this article.

The devastating floods in Nepal on August 26 are still unfolding. Hundreds of lives have been lost, many more people remain missing and entire stretches of the Rasuwa-Bhote Koshi-Trishuli corridor have been transformed. Roads, bridges and hydropower infrastructure have been destroyed, while some of the very monitoring stations intended to warn us of flooding were themselves swept away.

What makes the disaster particularly unsettling, however, is not simply its scale. It is the nature of the event itself. The current scientific assessment points to a glacial collapse at Langtang Lirung, which then developed into a debris flow and flood that travelled almost 100 kilometres downstream. It was not a conventional flood with a single, easily identifiable cause. A disturbance in one part of a mountain system interacted with ice, rock, water, sediment, slopes and rivers, producing consequences far beyond the location where it began.

And this was not even the first time this corridor had experienced such a shock. Just fourteen months earlier, in July 2025, the same broad Lhende-Bhote Koshi system was hit by a devastating flood, although the initiating mechanism was different: the drainage of a supraglacial lake in Tibet. The trigger changed; the downstream vulnerability did not.

We tend to organize risk into categories: glacial lake outburst floods, landslides, floods, avalanches, earthquakes, extreme rainfall. We build monitoring systems around these categories and develop response protocols for each. But mountains do not experience risk in categories. An ice collapse can become a debris flow; a debris flow can alter a river; a temporary blockage can create a new lake and another flood. By the time the disturbance reaches people and infrastructure downstream, it may bear little to no resemblance to the event that initiated it.

Perhaps, we are looking at the problem through the wrong statistical lens.



Designing Around the Mean

For much of modern planning, we have designed around the mean. We calculate average rainfall, river discharge, temperature, and traffic. We then design infrastructure to perform reliably around those expected conditions, with some allowance for an extreme event.

There was a logic to this. The assumption was that the underlying system was sufficiently stable for the mean to be a useful representation of what we could expect. Deviations were exceptions. But what happens when deviations stop behaving like exceptions?

This is where ecological overshoot becomes important. We have progressively increased our demands on ecological systems while reducing their capacity to absorb disturbance. In doing so, we are losing the buffers that once

made variability manageable. Glaciers, forests, wetlands, watersheds and diverse ecosystems perform functions that absorb shocks and prevent disturbances from becoming catastrophes. When those buffers weaken, the same hazard can produce a very different outcome. Risk begins to look like danger.

Danger of Aggressive Optimization

As a planner, one of the first things we are taught is that urban planning is fundamentally about optimizing resources and using them in the most efficient way possible. The problem begins when optimization becomes the dominant objective.

Modern infrastructure and urban systems are designed to minimize waste and maximize performance under expected conditions. But aggressive optimization often removes what appears unnecessary: spare capacity, redundant routes or undeveloped land. These are precisely the things that provide resilience when conditions move beyond normal.

A system optimized for average conditions can become extremely fragile when conditions become more variable. What looks like inefficiency from the perspective of optimization can, in fact, be resilience from the perspective of a system exposed to uncertainty. This is the paradox of efficiency.

Let us return to Nepal. The question is not simply whether we could have predicted the exact glacial collapse at Langtang Lirung. It is: why was a disturbance in one part of the mountain system capable of producing such catastrophic consequences nearly 100 kilometres downstream? Part of the answer lies in the buffers between the initiating hazard and the people and infrastructure downstream.

Designing for Deviation

The Nepal experience also challenges another assumption: that once we have



mapped a hazard, we have understood the risk. We haven't. The same corridor experienced two major events in fourteen months, triggered by different mechanisms. The unit of analysis therefore cannot simply be the hazard; it has to be the system.

Risk cannot be treated as static. A changing glacier, expanding lake, destabilizing slope or new development downstream can alter the risk landscape. And after a major event, the landscape itself may have changed. In Rasuwa, debris from the collapse has already created new barrier lakes, introducing another potential source of flooding.

Risk Assessment Needs to Become a Living Understanding of a Changing System

This also changes how we think about early warning.

The Nepal disaster showed that information can reach a forecasting system within minutes and still be of limited value to communities closest to the source. The automatic monitoring stations in the upper Bhote Koshi were themselves destroyed, while downstream warnings may nevertheless have helped people farther south reach safety.

So the measure of an early-warning system should not simply be whether it detected an event. It should be whether it created actionable decision time. Could someone evacuate? Could a road be closed? Could critical infrastructure be protected? Could emergency teams be moved before access was lost?

The goal is enough understanding, early enough, to change the outcome.

The Nepal floods are a reminder that the world we are designing for is becoming less comfortable with our assumptions of normality. We should continue improving our ability to observe and model glaciers, slopes, rivers, and weather. But observation alone cannot make a system resilient if the ecological and spatial buffers around it have already been eroded.

The deeper challenge, therefore, is not simply climate change. It is the erosion of the buffers that once made climatic and ecological variability manageable.

This is why I think we need to move from designing for the mean to designing for the deviation. Not by trying to predict every extreme event, but by asking whether our systems have enough room to absorb what we cannot predict. Because perhaps the most dangerous system is not the one that cannot predict the future. It is the one that has been so perfectly optimized for the expected future that it has no room left for anything else.■

Shiren Pandita serves as an Associate Fellow in the Transport and Urban Governance Division at TERI. This article was originally published on the TERI website.

How Artificial Intelligence Is Transforming Environmental Monitoring

Artificial Intelligence (AI) is no longer just shaping the future of technology—it is becoming one of the world's most powerful tools for protecting the environment, says **Bindu Parthasarathy** in this article.

The 21st century has witnessed remarkable advances in Artificial Intelligence (AI), transforming industries ranging from healthcare and education to finance and transportation. Today, AI is also emerging as a powerful ally in addressing some of the world's most urgent environmental challenges.

Climate change, biodiversity loss, deforestation, pollution, and unsustainable resource use demand faster and more accurate decision-making than ever before. By analysing vast amounts of environmental data, AI enables scientists, governments, and conservation organizations to monitor ecosystems, predict environmental changes, and develop more sustainable solutions.

While AI is not a substitute for sound environmental policies or human expertise, it is becoming an essential tool for environmental monitoring and sustainable development.

Climate and Environmental Monitoring

One of AI's greatest strengths lies in its ability to process enormous volumes of environmental data quickly and accurately. Satellite imagery, weather observations, remote sensing data, and ground-based sensors continuously generate information about Earth's atmosphere, oceans, forests, and land surfaces. AI helps transform these complex datasets into meaningful insights.

Researchers use AI to monitor changing weather patterns, detect greenhouse gas emissions, assess ecosystem health, predict natural hazards, and identify long-term climate trends. Organizations such as NASA and the European Space Agency rely on advanced data analytics to interpret Earth observation data, while the Intergovernmental Panel on Climate Change (IPCC) recognizes digital technologies as valuable tools for strengthening climate science and supporting evidence-based decision-making.

Forest Conservation and Biodiversity Protection

Forests are among the planet's most valuable natural resources, playing a crucial role in regulating climate and supporting biodiversity. AI is helping conservationists protect these ecosystems by detecting illegal logging, monitoring land-use changes, and identifying areas at risk of deforestation through satellite imagery and drone technology.

AI also supports wildlife conservation through camera traps, acoustic sensors, and image recognition systems that automatically identify species and monitor animal populations. These technologies reduce the time required to analyse large volumes of ecological data, allowing conservation teams to respond more rapidly to environmental threats. Some real world examples include AI-assisted wildfire detection, harmful algal bloom prediction, or biodiversity monitoring.

According to the United Nations Environment Programme (UNEP), AI has significant potential to strengthen biodiversity conservation and improve ecosystem monitoring when applied responsibly.



Smart Waste Management

Rapid urbanization has made waste management one of the greatest environmental challenges facing modern cities. AI is helping address this problem by improving waste collection, automating recycling processes, and supporting smarter resource management.

Computer vision and robotic systems can identify recyclable materials with greater consistency than manual sorting alone, reducing contamination and improving recycling efficiency. AI-powered waste management systems also assist municipalities in optimizing collection routes, lowering fuel consumption, and reducing greenhouse gas emissions associated with waste transportation. These innovations contribute to the development of a more circular economy, where materials are reused and recycled instead of being discarded.

Precision Agriculture for Sustainable Resource Management

Agriculture must produce enough food for a growing global population while minimizing its environmental footprint. AI-powered precision agriculture offers an effective solution by helping farmers make informed decisions based on real-time data.

Using satellite imagery, drones, soil sensors, and weather forecasts, AI can recommend optimal irrigation schedules, monitor crop health, identify pest outbreaks, and improve nutrient management. These technologies help conserve water, reduce unnecessary fertilizer use, improve crop productivity, and promote more sustainable farming practices. The Food and Agriculture Organization (FAO) recognizes digital agriculture and AI as important tools for increasing agricultural productivity while improving environmental sustainability and climate resilience.

Challenges and Ethical Considerations

Despite its enormous potential, AI also presents environmental and ethical challenges. Developing and operating advanced AI systems requires substantial computational resources, increasing energy demand and placing pressure on data centre infrastructure. Responsible AI development should therefore prioritize energy efficiency and renewable energy sources.

Ethical concerns, including transparency, data governance, privacy, and equitable access to AI technologies, must also be addressed. Ensuring that AI benefits all communities while minimizing unintended environmental impacts will require collaboration among governments, researchers, industry, and civil society.

AI and the Sustainable Development Goals

The environmental applications of AI directly contribute to several United Nations Sustainable Development Goals (SDGs), including:

- SDG 7: Affordable and Clean Energy
- SDG 9: Industry, Innovation and Infrastructure
- SDG 12: Responsible Consumption and Production
- SDG 13: Climate Action
- SDG 15: Life on Land

By supporting environmental monitoring, sustainable agriculture, biodiversity conservation, and resource efficiency, AI can accelerate global progress towards these goals.

Conclusion

Artificial Intelligence is transforming environmental monitoring by providing faster, more accurate, and data-driven insights into the health of our planet. From climate observation and forest conservation to waste management and sustainable agriculture, AI is enabling innovative solutions that support environmental protection and informed decision-making.

However, technology alone cannot solve environmental challenges. AI must be developed and applied responsibly, alongside strong environmental policies, scientific research, and international cooperation. When combined with human expertise and sustainable governance, AI has the potential to become one of the most valuable tools in building a resilient, sustainable, and environmentally responsible future.

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Article contributed by Bindu Parthasarathy, who holds a Master's degree in Ecology and Environmental Science, along with a Bachelor's degree in Chemistry and a Bachelor of Education. Bindu's interests include environmental sustainability, climate change, environmental policy, and science communication. She is committed to promoting environmental awareness through evidence-based writing.

Life forms, Art forms and Formations

Discovering Nature's Artistry through Wildlife, Beauty, and Behaviour

In an attempt to show that it is the holistic approach to life and all that makes up life that is meaningful and positively oriented towards our environment, its conservation and sustainability on the whole, **N Kalyani** has been bringing together seemingly disparate subjects on the same platform to explain the interconnectedness of life and the spectrum of life forms. Here she takes us into the animal world to discover the many genres of art that we are familiar with. Art appreciation can thus also be a route to wildlife protection and habitat and environment conservation.





When we talk of the arts we discover many different genres. From the different kinds of visual arts to the many different forms of performing arts. Also included are architecture and designing. Then there are the various crafts. This would also include the different kinds of weaving, and the varied styles of sewing and embroidery. Also finding their place in the category of arts are the different forms of activities that foster physical and bodily strength, flexibility, elegance and beauty. And this has a wide range from aerobics to yogic asanas whether done individually or in groups small or large. Then in parades and in structured group exercise regimens as also in dance troupes we find interesting and fascinating formations. These too are a form of art.

When we go into the animal world we discover so many of these art forms in the mammals, amphibians, reptiles, fish, birds, insects and other classes of animals. Just as every element in a food chain or habitat is vital to maintaining ecological balance, every species on Earth possesses its own unique beauty. This beauty is reflected in the elegance of their forms, the remarkable engineering of their physiology, the intricacies of their life cycles, the diverse defence mechanisms they employ, and the extraordinary skills they demonstrate, from building homes and nests to performing elaborate courtship displays.

Most immediate to observe is visual art as we see the enormous variety in the spectrum of life forms. Whether it is the colour of the coat; the patterns on the coat whether it is stripes or rosettes; horns, antlers and tusks; manes and furs; the colours in the plumage of birds; the iridescent and colourful patterns on the frail wings of butterflies; the patterns on the skin of reptiles. This is just a sampler.

As we marvel at the beauty of the world's diverse species, we also come to appreciate the uniqueness of every individual within them. Just as human fingerprints are used for biometric identification because no two people share the same pattern, every animal possesses distinctive characteristics that set it apart from others of its species. These identifying features may be found in the patterns on their coats, the shape and structure of their antlers, the markings on their skin, or even the size and form of their paws. Such individuality makes each animal both distinguishable and identifiable, underscoring the remarkable diversity that exists within nature itself.

Take the case of the royal Bengal tiger, for instance. The stripe set on its coat is unique to each individual tiger. A casual look would make us see the tigers as indistinguishable. The tiger that we see walking past us, when we are, for instance, visiting a national park, and then gets hidden behind a thicket seems to be the same one that again crosess our path after a distance. Need not be. A close examination of the stripe pattern, with the help of photographs of the tigers, will tell us if they were two



different tigers or it was the same one. In fact, this is how tiger census is made possible. Cameras are installed, and the photographs help in estimating the tiger numbers.

The spectrum of life forms indeed makes for fascinating and awe-inspiring visual art. From the carnivorous big cats to the majestic elephant to the arboreal cute red panda to the aquatic whales. All these mammals appear stunning.

Let us now go into the world of the aves. If the Indian little brown dove has the chess board pattern on its neck, the scaly-breasted munia displays the scale-like pattern on its breast and belly. Beaks of birds of different shapes are also remarkable and are actually based on need. For instance, the sunbird, also known as the honeysucker, has a beak to facilitate this. Likewise, the frugivore barbet, when seen on a papaya tree digging into some luscious yellow fruit of the tree, justifies the shape of its beak. We have also noticed the characteristic shape of the parakeet's beak, and the casque which is part of the hornbill's bill. These show the artistic and utilitarian bases of the creation of beaks in birds. All this makes for great visual art.

And what about the splendid plumage of birds? Brilliant, multi-coloured, and shimmering in the



light, their feathers represent some of nature's finest artistry. Every bird species showcases a unique play of colours, patterns, and textures, transforming forests, grasslands, wetlands, and skies into living galleries of beauty. Their vibrant plumage is both a celebration of nature's creativity and a source of endless wonder for humankind. Name the avian species and this is true. Whether it is the shimmering purple sunbird or then the peacock with its fanned out feathers that otherwise trail like a bride's train. And whether it is the bee eater or the kingfisher. Or then the Asian paradise flycatcher.



Then what about the performing arts that one gets to witness in the animal world? The elephant blows its own trumpet! And the lion roars in its pride! And bird calls and bird songs are nothing short of the different elements of a symphony, soprano included. Whether it is the metallic jingling sound of the treepie, the mellifluous song of the koel (cuckoo), the call of the kite from the topmost branch of a tree, or the repetitive chirp of the house sparrow.

When a group of the beautiful and elegant flamingos, with their pink plumes, walk on their slim and long legs, it appears like, as Shekar Dattatri, the acclaimed wildlife filmmaker, notes, in one of his films, a ballet. Very true!

Birds also display great art and skill in nest creation. It is architecture, designing, weaving and sewing at play. Birds source materials for their homes in different degrees of hardness and softness to ensure stability and durability as also comfort for the tender hatchlings and fledglings. Birds build their nests with hardy twigs on the outside that gives sturdiness and also helps keep intruders away, and silky and soft material on the inside so that the female bird can lay her eggs and incubate them and the young ones can be comfortable.

The tailor bird which sews with fine twigs and grasses to build its nest has acquired its name from this activity



of nest building. One morning after a night of rain came a bright sun. When one went to check on the safety of a chick of the little sunbird in the nearby parijat tree one was happy to find the chick secure. Because the little nest, one discovered, was sewn under a leaf, and thus was between two leaves. It was a secluded place sheltered by the leaves; the leaf above had really played umbrella to this little soul through the rainy night. Also, the two rather oily leaves had not allowed any water to destroy the tiny nest and its inhabitant. Industrious birds with a skill and an art to admire.

The weaver bird has been so christened due to the weaving activity it engages in while building its secure, foolproof, well-woven nest. It would seem anti-gravity as the pendulous nest hanging from a sturdy tree branch has its entrance door down below with the entire nest space above.

What about the formations mentioned at the outset? We observe these among sociable and gregarious wildlife species. A herd of elephants, for instance, moves with its calves and young ones positioned at the centre of the group to ensure their protection. We can also see flocks of birds flying in the twilight sky homeward bound. They fly in a particular formation for quite a distance. Group behaviour is also observed in a congregation of birds such as water birds on a beach or a coast. For instance, a multitude of birds in their fine plumage lands on a sandy beach, and, likewise, a group of birds takes off together. It is quite akin to a group of students going into formations with, for example, an open paper fan in a riot of colour on their school ground for a PT (physical training) and dance presentation. We also notice that sociable animals interact with each other amicably with congeniality. For instance, a bunch of the gregarious house sparrows will merrily chirp, hop, and peck at the available morsels in their midst among themselves. And when they sense any threat, they will, in





utter synchronicity, fly off.

It is also common to see ants walking, most industriously, in single file, marching like an army battalion, seemingly to an unuttered instruction, none falling off the path. It appears as quite an art.

Another interesting group phenomenon that occurs in the animal world is the arribada (Spanish for arrival). It is the mass nesting phenomenon observed among the female olive ridley sea turtles. Thousands of the female turtles arrive on the beach and lay their eggs. They dig into the sand, lay their eggs, and go back into the waters. This event generally occurs, for instance, on the Rushikulya and Gahirmatha beaches in the state of Odisha, in the months roughly between December and April.

At the very start to this run of ideas was also suggested that yogic asanas are an art form. Indeed. Now how is that related to the animal world? Interestingly, many yogic asanas are named after certain animals. These asanas are poses that resemble the trademark or easily identifiable postures of these animals. From *ushtrasana* that resembles the posture of the camel to *marjariasana* that is akin to the pose of the cat to *bhujangasana* that is named after the posture of the cobra to *supta kapotasana* which refers to the supine pigeon pose. Asanas such as the *mayurasana*, the peacock pose, and *vrishchikasana,* resembling the scorpion ready to strike, are in fact quite challenging for yoga practitioners to perform. These postures and poses of the animals are natural to them. And that is the art to their postures.

The appearance, form and activities of life forms in their life and in the course of their life cycle is awesome and fascinating. It is an appreciation and respect of this diversity that translates into nature conservation and protection of the entire spectrum of life forms that inhabits the varied habitats on our beautiful Planet Earth. ■

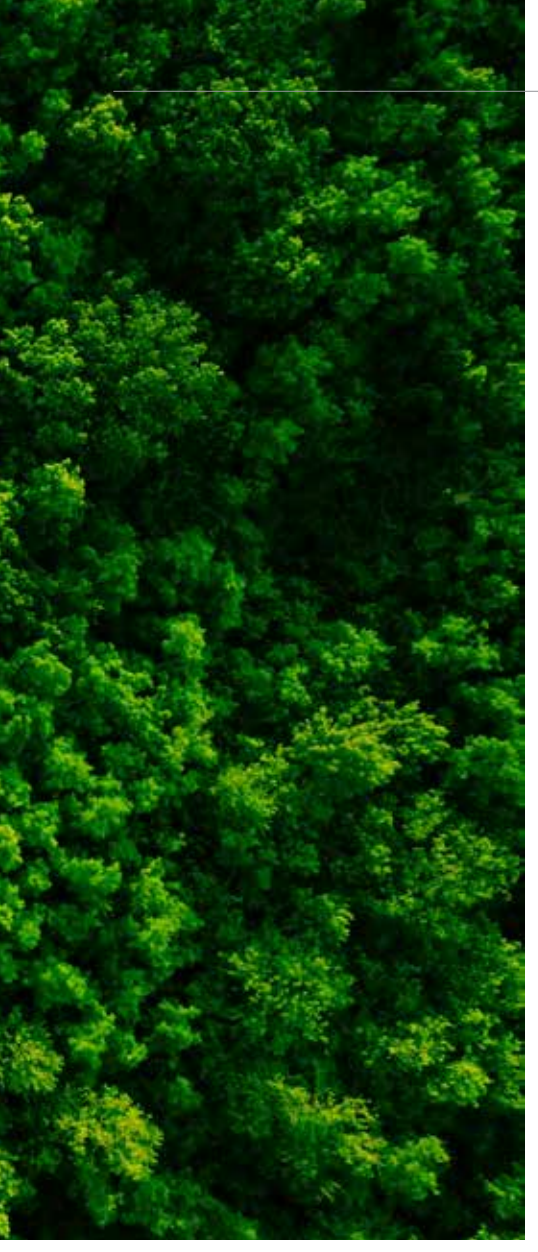
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Turning Waste into Value

Advancing Circularity through Recycling, Remediation, Emissions Reduction, and ESG

Founded in 2017 and headquartered in Singapore, Blue Planet has emerged as one of Asia's fastest-growing integrated waste management companies, enabling organizations around the world to accelerate the transition to a circular economy through innovative and sustainable solutions. In this exclusive email interview with *TerraGreen*, **Prashant Singh**, CEO & Founder of Blue Planet Environmental Solutions discusses Blue Planet's sustainability milestones, waste valorization strategies, and its vision for a more resource-efficient future.



Blue Planet's first Annual Sustainability Report establishes a formal ESG baseline across operations in 13 countries. What prompted the company to undertake this exercise at this stage, and what did the process reveal about the gaps between sustainability ambitions and actual performance?

As Blue Planet has grown across markets and expanded the scale and complexity of its operations, we felt it was important to move from a broad sustainability commitment to a more structured, measurable and transparent framework for performance. The first Annual Sustainability Report is therefore less about presenting a finished picture and more about establishing a credible baseline from which we can continuously improve.

The exercise helped us recognize that sustainability performance cannot be managed through ambition alone. It requires consistent data, clear accountability, common standards across geographies and stronger integration of ESG considerations into everyday operations. One of the key learnings has been the importance of strengthening data governance and ensuring that sustainability practices are consistently embedded across our businesses.

For us, this report creates that foundation. It gives our stakeholders greater visibility into where we stand today and gives us a clearer framework to measure progress going forward.

The report states that 8.92 million tonnes of waste were processed across two reporting years, with an estimated 1.24 million tCO_2e of avoided emissions. How does Blue Planet calculate and validate these impact figures, and how important is independent assurance in building credibility around such claims?

The impact figures are derived from the activities and waste streams managed across our operations, with the objective of translating operational outcomes into measurable environmental impact. This includes activities such as landfill biomining, e-waste recycling, and biofuel operations.



Importantly, we distinguish between operational data and impact estimates. Waste volumes are tracked through our operating systems and ESG data processes, while avoided-emissions figures represent estimated environmental benefits associated with the interventions we undertake.

That distinction is important because sustainability reporting has to be transparent about what is directly measured and what is calculated or estimated. Our ESG reporting is supported by a digital data management platform that improves consistency, traceability and review of information. We have also undertaken independent third-party audits across multiple operations, with 100% compliance



reported against 103 Environmental and Social Action Plan items. Selected ESG indicators have undergone independent limited assurance in accordance with ISAE 3000 (Revised).

Independent assurance is important because credibility is ultimately built through transparency and external scrutiny. As the sustainability ecosystem matures, stakeholders will increasingly expect companies not only to make impact claims, but also to demonstrate how those claims are measured, governed, and independently assessed.

Legacy waste remains one of India's and the developing world's major environmental challenges. With 5.10 million tonnes of legacy waste processed in FY26, what are the biggest technical, economic, and regulatory barriers to scaling up remediation, and where do you see the greatest opportunities?

Legacy waste remediation is fundamentally different from conventional waste management because the problem has accumulated over decades. The material is heterogeneous, often compacted and contaminated, and every site has its own technical characteristics.

One of the biggest challenges is therefore developing site-specific solutions while maintaining economic viability at scale. There are also challenges around land availability, the quality of legacy material, end-use markets for recovered resources, project financing and the need for coordinated decision-making between multiple stakeholders.

The opportunity, however, is equally significant. Legacy waste should not be viewed simply as a disposal problem; it is a resource-recovery opportunity. Through biomining, segregation and processing, materials can be recovered, land can be reclaimed and the environmental burden of unmanaged dumpsites can be reduced.

At Blue Planet, we see the future of remediation increasingly moving towards integrated models where environmental restoration, resource recovery and commercial viability are considered together. Our legacy waste processing increased from 3.49 million tonnes in FY25 to 5.10 million tonnes in FY26, demonstrating the potential to scale such interventions.

The company processed 20,060 tonnes of e-waste in FY26. As electronic waste continues to grow rapidly, what changes are needed across product design, collection systems, recycling infrastructure and producer responsibility to make e-waste management genuinely circular?

E-waste is one of the clearest examples of why circularity has to begin much earlier than the recycling stage.

The first requirement is better product design. Products need to be designed with repairability, durability, modularity and eventual recovery of materials in mind. The second is collection. Even the most advanced recycling infrastructure cannot deliver circularity if end-of-life electronics do not enter formal collection and processing systems.

We also need stronger traceability across the value chain. Producers, consumers, collection partners, recyclers and regulators need greater visibility into where devices go after their useful life and how materials are ultimately recovered.

Producer responsibility frameworks can play an important role in creating this accountability, but they need to be supported by credible collection networks and technologically capable recycling infrastructure.

Our own focus is on building a more transparent and data-driven recycling ecosystem. The launch of Blue Planet E-waste Solutions has strengthened our organized-sector recycling capabilities, with facilities in Binola and Hoskote designed to support scalable and compliant resource recovery.

Ultimately, the objective should not simply be to process more tonnes of e-waste. It should be to recover a greater proportion of valuable materials and return them to productive use.



With more than 4,000 employees and workers across its operations, occupational health and safety becomes a critical component of environmental services. What measures is Blue Planet taking to improve safety standards, particularly for workers involved in waste collection, processing and remediation?

Occupational health and safety is fundamental to the sustainability of an environmental services company. The people working on collection, processing and remediation are often operating in environments that involve heavy

machinery, traffic, hazardous materials and other occupational risks.

Our approach is therefore centred on strengthening safety systems, training, risk awareness and operational discipline. We are also working towards greater consistency in ESG and safety practices across our different businesses and geographies.

Training is an important part of this. During the reporting period, employee participation in training increased from 7,706 in FY25 to 14,318 in FY26. The objective is not simply to increase training hours, but to ensure that people have the knowledge and tools required to identify risks and work safely.

Going forward, occupational health and safety will remain one of our priority areas as we continue to strengthen our ESG framework. For us, environmental impact cannot come at the expense of worker well-being.

Climate action is increasingly moving beyond carbon accounting towards actual decarbonization. What are the key areas where Blue Planet intends to reduce its own emissions, and how do you see waste management and resource recovery contributing to the broader climate transition?

For the Blue Planet, climate action has two dimensions. The first is reducing the environmental footprint of our own operations; the second, and equally important, is enabling emissions reductions through the services and infrastructure we provide.

On our own footprint, we are focusing on areas such as energy and resource efficiency, operational optimization and strengthening the quality of our emissions data so that reduction opportunities can be identified more systematically. The sustainability report gives us a baseline against which future progress can be measured.

At the broader system level, waste management has a significant role to play in the climate transition. Diverting waste from landfills, recovering materials,



producing renewable fuels and reducing the need for virgin resource extraction can all contribute to a more resource-efficient economy.

This is why we believe the future of waste management is not simply about managing waste better. It is about redesigning how resources move through the economy. Our focus on waste valorization, recycling, landfill remediation and circular-economy solutions is intended to support that transition.

Looking ahead, what would success look like for Blue Planet over the next five years—not just in terms of tonnes of waste processed, but in terms of circularity, emissions reduction, resource recovery, worker well-being and the wider environmental impact of its operations?

Over the next five years, success for us cannot be defined by tonnes processed alone. Scale is important, but the quality of the impact matters just as much.

We want to see a greater proportion of waste moving from disposal towards recovery and productive reuse. That means higher resource recovery, stronger recycling outcomes, greater diversion from landfills and more effective remediation of legacy waste.

We also want to strengthen the climate dimension of our business—both by improving the efficiency of our own operations and by expanding solutions that enable emissions avoidance and resource efficiency. Equally, success must include the people's dimension. A sustainable business needs safe workplaces, skilled workers, stronger training systems and responsible practices across its supply chain.

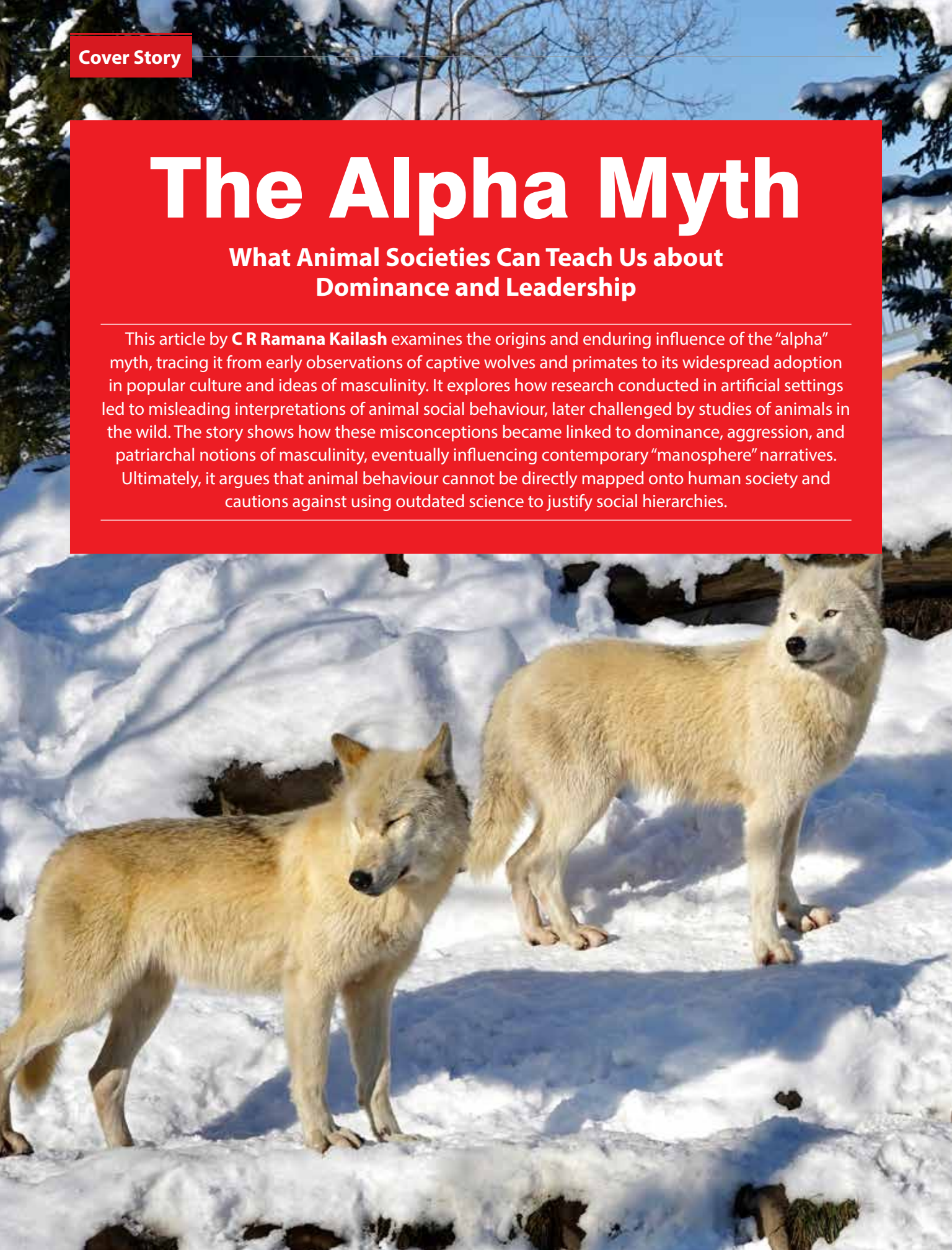
Most importantly, we want to build a business where environmental impact is measurable, transparent and continuously improving. The first Sustainability Report establishes our baseline. The next phase is about using that baseline to set stronger targets, improve performance and demonstrate that growth and environmental responsibility can reinforce each other.

Our long-term ambition remains to help accelerate the transition from a linear waste economy towards a circular one where waste is increasingly seen not as an endpoint, but as a source of resources, energy and economic value. ■

The Alpha Myth

What Animal Societies Can Teach Us about Dominance and Leadership

This article by **C R Ramana Kailash** examines the origins and enduring influence of the "alpha" myth, tracing it from early observations of captive wolves and primates to its widespread adoption in popular culture and ideas of masculinity. It explores how research conducted in artificial settings led to misleading interpretations of animal social behaviour, later challenged by studies of animals in the wild. The story shows how these misconceptions became linked to dominance, aggression, and patriarchal notions of masculinity, eventually influencing contemporary "manosphere" narratives. Ultimately, it argues that animal behaviour cannot be directly mapped onto human society and cautions against using outdated science to justify social hierarchies.







In 1947, Rudolf Schenkel, a Swiss animal behaviourist, submitted his decade-long observations on wolf behaviour and societal structure. Under the name "Expressions Studies on Wolf," Schenkel's work was primarily based on his intensive studies of two captive packs in the Basle Zoological Park, Switzerland. While observing the societal aspects of the wolves, Schenkel found out that there was a dominant pair, a male and a female, who were "respected" and "exempted" in the pack hierarchy. The rank as the "leaders" of the pack was maintained by constant conflicts and controlling activities by these pairs. These dominant pairs were labelled 'Alpha animals' by Schenkel.

Nearly a decade before Schenkel's work, the London Zoo's Monkey Hill exhibit was experiencing frequent, often bloody conflicts among its baboon inhabitants. The fatalities started to rise so high that the exhibit was closed down in 1930. One of the news reports around this period said that "George, a young member of the baboon colony, had stolen a female belonging to the 'king,' the oldest, largest baboon of Monkey Hill. And after a tense siege, the young male killed the female". To the visitors of one of the most famous zoological parks in the world, this cemented the idea that the natural world is inherently violent and patriarchal, with the hierarchy maintained by constant violence.

Later, in the 1970s, wildlife biologist David Mech authored *The Wolf: The Ecology and Behavior of an Endangered Species*. This book drew many of its ideas from Schenkel's work, including the term 'alpha animal'. Being one of the most comprehensive studies of wolves at the time, Mech's book became an instant hit with the public, and its sales helped popularize the word "Alpha" in the public vocabulary.

Another noteworthy and influential scientific study that reinforced the idea of alpha animals is Frans De Waal's book *Chimpanzee Politics: Power and Sex among Apes*. De Waal argued that to study hierarchies in animal societies and apply those ideas to human social structures properly, chimpanzees were the ideal candidates because of their evolutionary closeness to humans. The book highlights that chimpanzee society is driven by calculated, shifting alliances, manipulation, and reconciliation among males vying for alpha status, rather than by physical strength alone. However, societal interpretations of these observations were quickly filtered through a misogynistic and patriarchal lens, portraying influential individuals in animal societies as hyper-aggressive and excessively dominant figures.

Unbeknownst to them, the works of de Waal and Mech would eventually help perpetuate an outdated

theory, one that would go on to negatively influence generations of men.

The Methodological Mistakes

Later research on animal societies in their natural habitat has shed light on fundamental flaws in earlier interpretations. For instance, a typical wolf pack in the wild consists of the breeding pair (the parents) and different litters of variable ages; the individuals from the litters usually disperse from their natal pack and form their own family units. These individuals are related to one another (outsiders are occasionally adopted into the pack, but this does not visibly affect existing relationships). Unlike previous observations in captivity, wolf packs in the wild are more of a family unit and do not follow a rigid social order. Thus, calling a wolf an alpha is usually no more appropriate than referring to a human parent or a doe deer as an alpha (Mech 1975). Moreover, in many cases, the dominant position within the pack is situational and environmentally dictated.

Similarly, our understanding of chimpanzees in the wild has increased considerably and has challenged our idea of social hierarchy in the conventional sense. In a chimpanzee community, male individuals tend to stay in their natal troop, while females disperse to new troops, where they live for most of their lives. Adult males in a chimp community certainly exhibit a degree of social hierarchy relative to one another, however, it is far more fluid than earlier observations. Chimpanzee males do tend to use physical threat displays to show their dominance, but they are rarely violent within the community. The high-ranking males in the community seem to mate more and father more children, but a high-ranking male in reproduction does not necessarily need to be the leader. Several other forms of hierarchy and status exist within a chimpanzee community, such as food and sleeping privileges. Just like wolves, the dominant status in the chimp community is more situational and variable than the rigid human social system.

In some cases, physical prowess and aggression are even detrimental qualities for a dominant individual in a chimp community. A chimp's status in its society is determined by the influence and support it holds; this is achieved by forming deeply emotional bonds with other individuals in the community. In many instances, rank and physical prowess are not the only qualities that make a chimp influential within its community. Rather, generosity, empathy, and the ability to form deep and enduring relationships with other members play a more important role. This social dynamic is far more complex—and perhaps less problematic—than the human notion of a dominant individual.

Similarly, bonobos, the other ape species closely related to humans, possess highly influential females as the dominant members of the community. Unlike





chimpanzees, bonobos are matriarchal and very rarely resolve conflicts through violence; bonobo conflicts are mostly resolved through sexual alliances. Bonobos are known to have almost no lethal conflict and are often used as poster species for anti-war rhetoric. However, De Waal has warned of the danger of romanticizing bonobos: "All animals are competitive by nature and cooperative only under specific circumstances," and that "when first writing about their behaviour, I spoke of 'sex for peace' precisely because bonobos had plenty of conflicts. There would obviously be no need for peacemaking if they lived in perfect harmony."

The fundamental flaw in the earlier observations was the living conditions of the research subjects and bias; Rudolf Schenkel's observation of wolf packs in Basle Zoo consisted of unrelated adults in a captive setting.

'Attempting to apply information about the behaviour of assemblages of unrelated captive wolves to the familial structure of natural packs has resulted in considerable confusion. Such an approach is analogous to trying to draw inferences about human family dynamics by studying humans in refugee camps (Mech, L David, 1999).'

Similarly, De Waal's studies for *Chimpanzee Politics* were primarily based on a captive colony in Arnhem zoo, which clearly affected observing their natural behaviours. Both Frans De Waal and David Mech later acknowledged the issues in their studies, with Mech advocating for the stopping of publication of his book to prevent the spread of outdated information (which was denied). Nevertheless, the publicity and the sensational nature of the study have made it nearly impossible to stop the cultural diffusion, and have since been churning out new age misogyny and patriarchy.

The Appeal to Be Monstrous

To understand the incorporation of such a scientific discourse into popular culture, it is necessary to examine the socio-political conditions of the late twentieth century. This period was marked by profound ideological shifts, shaped both by the rise of progressive social movements and by the enduring impact of the World Wars. The persistent threat of nuclear conflict during the Cold War fostered a climate of uncertainty, while expanding industrial economies concentrated power within large corporations and state institutions. At the same time, younger generations and political actors increasingly questioned established hierarchies and the legitimacy of existing social orders.

In this context, science assumed a position of authority. Its methods and language, perceived as empirical, were frequently invoked to legitimize competing ideological claims. Scientific ideas began to circulate beyond academic settings, entering political and cultural discourse. A notable example is Frans de Waal's *Chimpanzee Politics*, which was distributed among members of the United States Congress in the 1980s, reflecting an effort to draw parallels between primate behaviour and human political organization.

Since then, the idea of dominant individuals or 'alpha males' is cemented as a personality trait immersed in aggression and violence. In a human context, an 'alpha male' is typically defined as a man who is dominant, assertive, and holds a high social or professional status over his subordinates, who are less traditionally masculine and have lower social standing. The dominant social status is often interpreted as maintained through strong repression and violence, which, in turn, grants access to power and partnerships. The term 'alpha male' is often applied to dominating and destructive men, especially bullies.

By the late twentieth century, claims about women being "hard-wired" to desire dominant individuals started to appear as well. Immersed in misogyny and hateful patriarchy, these claims would eventually cement the foundations of the present day "manosphere," an online collection of forums and communities focused on masculinity and often characterized by misogyny and opposition to feminism. While these forums and organizations might seem to reside in the fringes of our society, a large crowd of impressionable young men do believe in these baseless and harmful claims.

Even though wolves are popularly demonized by Western media, and many of the traits attached to being a stereotypical dominator are negative, the appeal for men to be "animalistic" (in a stereotypical sense) reflects a specific and identifiable psychological pattern. The identification of traits such as aggression, emotional detachment, and dominance—as markers of "natural" masculinity.



At its core, this framing relies on a false dichotomy between the "civilized" and the "primitive." The "animalistic" is presented as a return to an imagined origin, a state unburdened by social expectations or moral constraints. The elevation of aggression as the defining feature of the "natural" represents a reduction of natural behaviour in reality. The psychological appeal of this idea lies partly in its promise of release from social norms. The notion of reverting to instinct offers a simplified model of behaviour. It removes the need for negotiation, emotional articulation, or self-reflection, replacing them with a fixed script centred on dominance and control. For individuals experiencing frustration or uncertainty (especially during the exploratory phase of teenage), this can function as a coping mechanism.



However, this appeal is also reinforced through external validation. Media representations, online communities, and certain strands of popular discourse reward displays of exaggerated "animalistic" behaviour, often framing them as signs of confidence or superiority. Over time, this creates a feedback loop in which such traits are not only normalized but actively encouraged, despite their negative social consequences.

It Does Not Matter

Every organism on this planet is shaped by evolutionary pressures. These forces influence not only physical traits, but also behaviour and social structures. In many cases, a species behaves the way it does because those behaviours helped it survive or reproduce in a particular environment. This is the exact reason why applying animal behaviour directly to humans does not work. Evolution does not produce a single, universal model for behaviour—it produces many different strategies, each suited to a specific context.

Human beings are not governed by survival alone. Our societies are shaped by culture, ethics, language, and history—factors that go far beyond basic biological drives. Because of this, human behaviour must not be reduced to paralleling our distant cousins.

For example, our close relatives, chimpanzees, have been observed engaging in violent conflict with rival groups, sometimes even cannibalism. These behaviours



are natural within their ecological setting, just as natural as playing with their young or grooming with their friends. But their existence in nature does not make them acceptable or relevant to human society. Simply put, for human societies, "natural" does not equal "justified."

The idea of the "alpha male" shows what happens when this distinction is ignored. It is based on selective and often outdated interpretations of animal behaviour, which are then used to justify dominance, aggression, and rigid hierarchies among humans, decades after these ideas were discarded. Through media and online spaces, these ideas are repeated so often that they begin to seem factual, even though they lack any scientific support. What results is a simplified and misleading view of both human and animal social relationships.

In the end, the persistence of these ideas reveals a larger problem: the tendency to accept simple explanations for complex human realities. When scientific concepts are taken out of context and used to support existing biases, they stop being tools for understanding and become tools for justification. A more careful and critical approach to science is necessary—one that recognizes its limits and resists turning observation into prescription. Because some of the worst atrocities committed by humanity in modern times are often the result of biased and misinterpreted view of outdated science.

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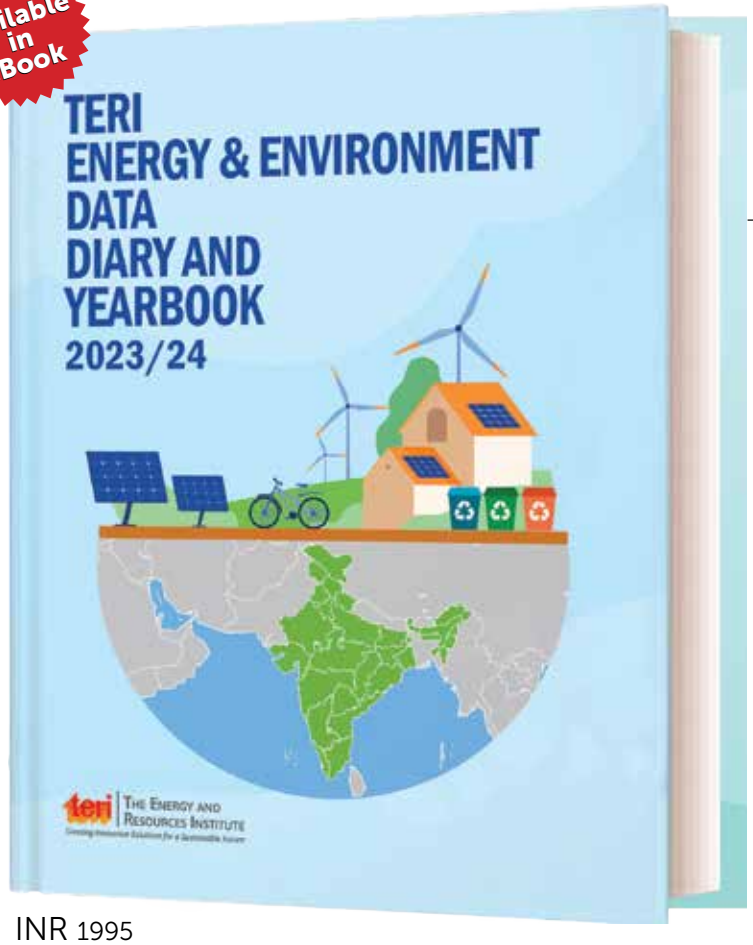
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India's Energy Security

In an Era of Climate Change

In this article, **Manjot Kaur** examines India's energy security in the context of rising energy demand, geopolitical uncertainties, and climate change. She highlights India's continued dependence on imported fossil fuels, particularly crude oil, and the vulnerabilities associated with global market disruptions. The article argues that energy security now extends beyond fuel availability to include affordability, resilience, sustainability, and climate adaptation. It discusses India's transition towards renewable energy, green hydrogen, and domestic manufacturing, while emphasizing the importance of international cooperation. Ultimately, the article advocates greater energy self-reliance to support sustainable economic growth.



Energy has always been essential for economic growth and national development. It powers industries, transport systems, agriculture, healthcare, digital infrastructure, and households. However, in today's interconnected world, energy is no longer just an economic resource. It has become a strategic asset that affects economic stability, national resilience, and foreign policy decisions.

The International Energy Agency (IEA) defines energy security as the "uninterrupted availability of energy sources at an affordable price." Yet, energy security today means much more than simply having enough fuel. It includes affordability, reliability, resilience, sustainability, and the ability to deal with disruptions caused by geopolitical tensions, market volatility, and climate-related events.[1] For India, energy security is therefore not only about meeting domestic demand. It is also about reducing external vulnerabilities, supporting long-term economic growth, and building a more self-reliant and sustainable energy system.

Energy and Global Politics

Energy has been closely linked to international politics for over a century. While coal powered the first phase of industrialization, oil gradually became the world's most important strategic fuel. As countries became increasingly dependent on imported oil, access to energy became a matter of national security.

This connection became clear during the 1973 oil crisis when Arab members of the Organization of Petroleum Exporting Countries (OPEC) imposed an oil embargo. The resulting supply shortages and price shocks affected economies across the world. The crisis showed how energy could be used as a political tool and exposed the risks of relying heavily on imported fuel. The oil shocks of the 1970s also influenced India's energy policies. As Bardhan notes, India's focus gradually shifted towards energy conservation, supply diversification, and long-term energy security planning after this period.[2]

Recent developments have reinforced these concerns. The Russia–Ukraine

[1] International Energy Agency. (2026a). Energy security. International Energy Agency. Details available at <https://www.iea.org/topics/energy-security>

[2] Bardhan, R., Debnath, R., & Jana, A. (2019). Evolution of sustainable energy policies in India since 1947: A review. WIREs Energy and Environment, 8(5), e340. Details available at <https://doi.org/10.1002/wene.340>

conflict disrupted global energy markets and altered trade flows, while tensions in the Middle East such as the recent Iran–Israel crisis continue to create uncertainty in oil markets. In response, many countries have diversified both their energy sources and suppliers, expanded strategic reserves, and accelerated investments in domestic energy production. Today, energy security is not simply about securing fuel supplies. It is about reducing vulnerability to external shocks and ensuring stability in an uncertain global environment.

India's Energy Challenge

India's economy has grown rapidly over the past few decades, and energy demand has increased alongside it. India's energy demand has almost doubled since 2000. Despite significant growth in domestic energy production, fossil fuels continue to dominate the country's energy system. According to *Energy Statistics India 2026*, India's total primary energy consumption reached 39,847 PJ in FY 2024–25 (P).[3] Total primary energy consumption increased from 29,063 PJ in 2015–16 to 39,847 PJ in 2024–2025, reflecting the country's steadily rising energy demand.[4] Coal accounted for approximately 60 per cent of total primary energy consumption, followed by crude oil (29%), natural gas (7%), electricity from hydro, nuclear and other renewable sources (3%), and lignite (1%).[5]

Table 1 shows that out of total consumption, 81.25 per cent of coal is produced domestically and 19 per cent is imported. For crude oil, 10.9 per cent is produced domestically and 90.4 per cent is imported, while natural gas is almost equally supplied through domestic production (50%) and imports (50.3%). These figures show that coal remains the backbone of India's energy system, while heavy dependence on imported oil, coal, and natural gas remains a major energy security challenge. This highlights the need to diversify energy sources and expand cleaner energy.

Table 1: Production, import and consumption of energy resources for India in FY 2024–25

Energy Resource	Production		Import		Consumption	
	Volume	%	Volume	%	Volume	%
Coal	1047.52 MT	81.25	241.71 MT	18.75	1289.23 MT	100
Crude Oil	28.70 MT	10.55	243.22 MT	89.45	271.92 MT	100
Natural Gas	36.11 BCM	50.27	35.72 BCM	49.73	71.83 BCM	100

Source: Based on Ministry of Statistics and Programme Implementation (2026). Provisional statistics used.

Imports and Energy Security

Although India has increased domestic energy production, it still depends heavily on imported fossil fuels to meet growing demand. According to the UN Comtrade Database, India imported US$114 billion worth of crude petroleum in 2024. Russia was the largest supplier (US$42.2 billion), followed by Iraq (US$22.8 billion), Saudi Arabia (US$13.4 billion), and the United Arab Emirates (US$11.1 billion) (United Nations Statistics Division, 2025).[6]

Coal imports were valued at US$27 billion, with Australia (US$11.1 billion) and Indonesia (US$5.99 billion) being the main suppliers.[7] India also imported US$8.6 billion worth of liquefied natural gas (LNG), mainly from Qatar (US$2.71 billion), the UAE (US$1.42 billion), and the United States (US$1.35 billion).[8]

These figures show how closely India's energy security is linked to global energy markets. Conflicts, supply disruptions, or rising fuel prices can quickly affect India. While diversifying suppliers reduces dependence on any one country, increasing domestic production, improving energy efficiency, and expanding cleaner energy remain essential for India's long-term energy security.[9]

Clean Energy and Diplomacy

This relationship between energy security and clean energy can be seen in India's policy evolution. India's energy transition policies have gradually shifted from only focusing on energy access and supply towards diversification, energy security, and climate-responsive planning. India's clean-energy policies are aimed at making the country's energy system more diverse, resilient, and self-reliant. The National Solar Mission has encouraged rapid growth in solar power across the country. More recently, the PM Surya Ghar: Muft Bijli Yojana has promoted rooftop solar

3 Ministry of Statistics and Programme Implementation. (2026). Energy Statistics India 2026. Government of India. Details available at <https://www.mospi.gov.in/publications-reports/innerpage/2817>

4 ibid.

5 ibid.

6 United Nations Statistics Division. (2025). UN Comtrade Database. Department of Economic and Social Affairs. Details available at <https://comtradeplus.un.org/>

7 Ibid.

8 Ibid.

9 International Energy Agency. (2026b). India energy outlook 2021. International Energy Agency. Details available at <https://www.iea.org/reports/india-energy-outlook-2021>



installations and enabled households to generate their own electricity. The National Green Hydrogen Mission aims to position India as a major producer of green hydrogen, while the Production Linked Incentive (PLI) Scheme supports domestic manufacturing of solar photovoltaic modules and reduces import dependence.[10]

India has also strengthened its role as global norm leader through international institutions. The International Solar Alliance (ISA), launched jointly by India and France, promotes solar-energy cooperation among developing countries through technology sharing, investment support, and capacity building.[11]

These initiatives show that clean energy is not only about reducing emissions. It is also about strengthening domestic manufacturing, reducing import dependence, creating jobs, and increasing India's role in global energy governance.

Climate Change and Energy

Climate change is increasingly affecting energy systems across the world. As a result, energy security and climate security are becoming closely connected. In India, heatwaves increase electricity demand as households, businesses, hospitals, and industries rely more heavily on cooling. At the same time, high temperatures can reduce the efficiency of thermal power plants.[12]

Water availability presents another challenge. Thermal power plants require large amounts of water for cooling, while hydropower projects depend on stable river flows. Changes in rainfall patterns, droughts, glacier melt, and extreme weather events can all affect electricity generation.[13] Floods and cyclones can also damage transmission lines, substations, ports, and transportation networks, disrupting both fuel supplies and electricity distribution.

A secure energy system today is therefore not just one that produces enough energy. It must also be able to withstand and recover from climate-related disruptions. Climate resilience has become an essential part of energy security.

India's position in international climate negotiations has focused on balancing economic development,

[10] Ministry of New and Renewable Energy. (2026). Annual report 2025-26. Government of India. Details available at <https://mnre.gov.in/>

[11] International Solar Alliance. (2026). Annual report 2026. International Solar Alliance. Details available at <https://isa.int/>

[12] Intergovernmental Panel on Climate Change. (2023). Climate change 2023: Synthesis report. IPCC. Details available at <https://www.ipcc.ch/report/ar6/syr/>

[13] Ibid.





energy security, and environmental protection. India believes that developed countries, which have contributed more to greenhouse gas emissions in the past, should provide climate finance, technology, and capacity-building support to developing countries. This position is reflected in India's support for the principle of Common but Differentiated Responsibilities (CBDR). India has maintained that climate action should be fair and should not limit the development prospects of countries that are still expanding energy access and industrial capacity. Today, India's climate diplomacy focuses on promoting renewable energy, strengthening clean-energy partnerships, and expanding access to sustainable technologies while ensuring that climate action remains compatible with development goals.

Towards Energy Self-Reliance

Energy self-reliance has become a central part of India's long-term development vision. In his Independence Day speech on August 15, 2021, Prime Minister Shri Narendra Modi stated:

"India's energy independence is the need of the hour! Therefore today, India has to make a resolution to make India energy independent before the completion of 100 years of independence and our roadmap is very clear for the same."[14]

This vision is closely linked to India's goal of becoming a developed country by 2047.

Achieving greater energy self-reliance will require sustained investment in renewable energy, stronger electricity grids, better energy efficiency, green hydrogen, domestic manufacturing, and secure supply chains for critical minerals.[10]

Complete energy independence may not be possible for any major economy. However, reducing reliance on imported fuels can strengthen resilience, improve strategic flexibility, and protect the economy from external shocks. In this sense, energy self-reliance is not about isolation. It is about reducing vulnerabilities while maintaining strong engagement with global energy markets.

Conclusion

India's energy future lies at the intersection of energy security, energy transition, clean energy, and climate action. The traditional idea of energy security as simply ensuring fuel supplies is no longer sufficient. Today, energy security also requires resilience to geopolitical shocks, diversified energy sources, reliable infrastructure, and the ability to adapt to climate-related risks.

India's continued dependence on imported fossil fuels highlights the importance of diversification, domestic production, and strategic international partnerships. At the same time, renewable energy, green hydrogen, domestic manufacturing, and initiatives such as the International Solar Alliance are creating new opportunities to strengthen long-term energy security.

Ultimately, India's energy transition is not only about reducing emissions. It is equally about strengthening resilience, reducing external vulnerabilities, supporting economic growth, and moving towards greater energy self-reliance. As India's energy demand continues to grow, balancing energy security, climate responsibility, and sustainable development will remain one of the country's most important policy priorities. ■

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[14] Prime Minister's Office. (2021, August 15). PM's address from the Red Fort on 75th Independence Day. Government of India. Details available at <https://www.pmindia.gov.in/en/news_updates/pms-address-from-the-red-fort-on-75th-independence-day/>

When Accurate Isn't Enough

Building Consumer Confidence in the Age of Smart Electricity Metering

As India rapidly expands smart-meter deployment under the RDSS, consumer concerns over higher electricity bills highlight a critical distinction between meter accuracy and consumer trust. In this article, **Mayuri Singh** and **Nishant Saxena** argue that while smart meters may accurately record consumption, consumers often struggle to understand billing changes, tariff calculations, deductions, or grievance mechanisms. Drawing on examples from states such as Uttar Pradesh and Maharashtra, the authors emphasize that effective communication, transparency, and accessible redressal systems are as important as technical reliability. Ultimately, the success of smart-meter reforms depends not only on smarter technology but also on empowering consumers with greater understanding and confidence.

A consumer receives a sharply higher electricity bill after a smart meter is installed. The distribution utility says the meter is accurate. The consumer remains unconvinced. There is no contradiction in those two positions. A meter can measure consumption correctly, while the system around it leaves the consumer confused about the bill, uncertain about what has changed, or unsure how to challenge it.

That distinction is becoming important as India accelerates its smart-meter rollout. Just a few days ago, the Ministry of Power asked States and Union Territories to expedite installation of smart meters across consumer categories, clarifying that deployment should not be delayed on the question of whether billing is prepaid or postpaid.

In fact, the latest parliamentary answer on consumer concerns, answered in August 2026, records 5.73 crore smart meters installed under the Revamped Distribution Sector Scheme (RDSS) by June 2026 and 7.24 crore across the country under various schemes. RDSS has sanctioned smart metering for 19.79 crore consumers, 2.05 lakh feeders and 52.53 lakh distribution transformers.



The rollout is large and its policy objective is clear: better billing and collection, improved energy accounting, and a more efficient distribution system. The consumer experience now needs to keep pace.

A Higher Bill Does Not Prove a Faulty Meter

Several reports from Maharashtra, Uttar Pradesh, Chhattisgarh, Himachal Pradesh and elsewhere have described consumers alleging sharply higher bills after smart-meter installation. Other complaints have involved prepaid deductions, unexpected disconnections, technical glitches, and difficulties obtaining explanations. None of this, by itself, establishes that smart meters are inaccurate.

Electricity consumption may have increased. Summer demand can push households into higher tariff slabs. Earlier consumption may have been estimated or under-recorded. Arrears, billing-cycle changes or other billing factors can also affect the amount payable. Maharashtra's Energy Minister has attributed many complaints to higher summer consumption and misunderstandings about billing.

But repeated complaints still tell us something worth examining. The consumer is asking a question that is different from the utility's technical question.

The utility asks: *Is the meter recording electricity correctly?*

The consumer asks: *Why has my bill changed, and can you show me why?*

Both questions deserve an answer.

Accuracy Needs to be Accompanied by Explanation

On the issue of consumer complaints on smart meters, the Government's response records a substantial technical and consumer-protection framework. Smart meters must meet relevant BIS standards. Factory Acceptance Tests are undertaken, samples are sent to third-party NABL laboratories, and check meters are to be installed when consumers complain, providing a route for independent verification.

There are also mobile applications, low-balance alerts, emergency credit, multiple recharge options and complaint-resolution mechanisms. Consumers can escalate unresolved complaints through the Consumer Grievance Redressal Forum and, thereafter, the Electricity Ombudsman.

The value of these safeguards, however, depends partly on whether the consumer can find them, understand them, and use them. A check-meter provision is little comfort to someone who does not know that it exists. A consumption graph does not explain a higher bill if the consumer cannot connect the data to the tariff applied. An alert is less useful if the consumer does not understand what action is expected.

That is where the smart-meter debate becomes a question of communication, although not just in the conventional sense of issuing more advisories or running another awareness campaign. The system itself has to communicate. The bill, the app, the meter, the tariff information, the recharge balance, and the grievance process should tell a coherent story about what has happened to the consumer's electricity account.



The Consumer Interface Is Becoming Part of the Infrastructure

Smart metering changes the relationship between the consumer and the distribution utility.

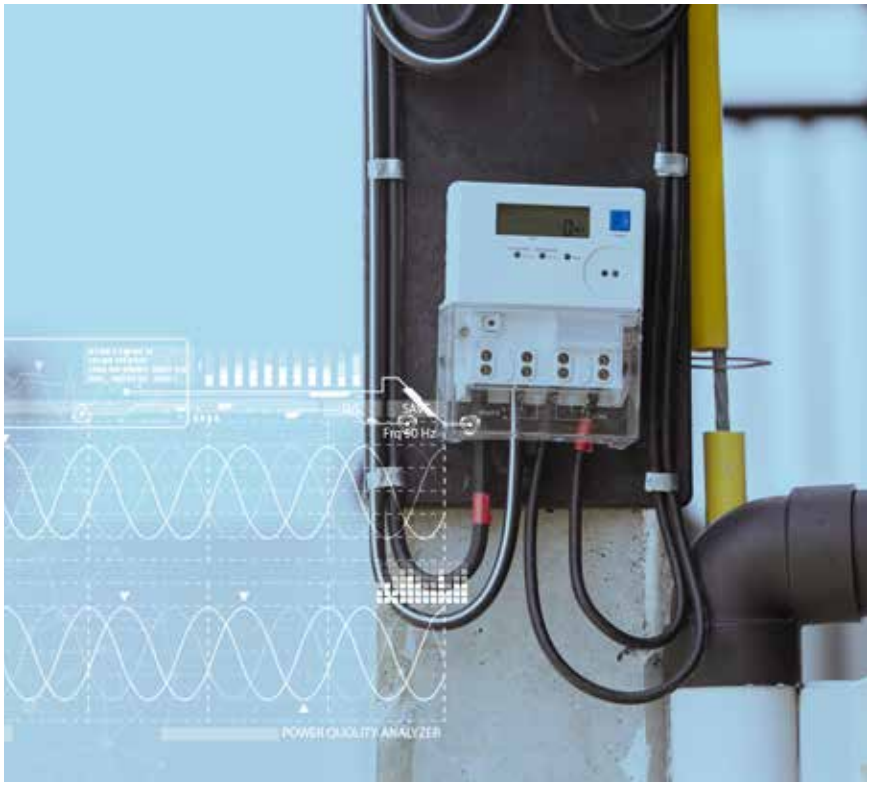
The traditional meter largely sat in the background. The smart-meter ecosystem introduces automated readings, consumption data, digital payments, prepaid balances, alerts, and remote processes into the consumer's everyday interaction with electricity. This creates a different expectation. Consumers need to understand what has changed before they are confronted with the consequences.

Uttar Pradesh offers a useful illustration of why this is significant. Earlier this year, complaints around prepaid smart meters included sudden disconnections, technical glitches, unclear deductions and cases in which consumers reported losing supply despite a positive balance on the app. In May 2026, the State government responded by ordering smart meters to operate in postpaid mode, citing technical difficulties and consumer concerns.

The issue has also moved into the regulatory domain. The Uttar Pradesh Electricity Regulatory Commission (UPERC) had already taken suo motu cognizance of delays in reconnection following prepaid smart meter recharges and, in June, imposed a penalty of

₹7.18 lakh on the Uttar Pradesh Power Corporation Limited (UPPCL) after determining that delays exceeding two hours were in violation of the applicable regulations. The Commission also ordered a root-cause analysis and corrective measures, noting that such failures can undermine consumer faith in smart metering.

Then came another signal from the State. In August 2026, UP Power Minister Shri A K Sharma said wider smart-meter



installation would follow a consumer-awareness drive, with consumers given time to understand the technology and its benefits before the rollout expands.

The sequence is instructive. A technology intended to make electricity systems more efficient can encounter resistance when consumers do not understand how it changes their interaction with the utility. Technical issues, billing questions, and communication gaps can then become questions of regulatory accountability and institutional trust. The lesson is straightforward for digital utility reform: automation increases the importance of clarity at every point where the consumer interacts with the system.

Trust Is Built in the Moments of Friction

This is where communication and regulation meet. A consumer who receives a higher bill needs more than an assurance that the meter is accurate. They need to understand the consumption recorded, the tariff applied, the treatment of arrears and the route available if something appears wrong.

A consumer whose prepaid balance is exhausted needs to know when that will happen, what warnings were issued, what emergency protection exists, and how a technical or payment failure will be handled. A consumer challenging a meter needs to know who will verify it, how the verification will be conducted, and when an answer can be expected.

These are consumer-experience questions, but they also shape institutional credibility.

The Government's framework already provides formal avenues for testing and grievance redressal. Now the challenge is making those protections feel as real to the consumer as the meter itself.

The Measure of Success Needs to Widen

RDSS is designed to improve the operational efficiency and financial sustainability of distribution utilities. Smart metering is central to that objective. The Government has sanctioned ₹1.31 lakh crore for smart-metering works under the RDSS, alongside ₹1.53 lakh crore for loss-reduction infrastructure.

The scale of investment makes installation numbers an obvious measure of progress. But they cannot be the only one. A utility can know how many meters have been installed, how many readings have been collected, and how billing efficiency has changed. At the same time, the consumer experiences something else entirely. Can I understand my bill? Can I question an unusual reading? Can someone independently verify it? Will I receive a clear explanation? What happens while my complaint is being examined? These questions go to the credibility of the reform itself.

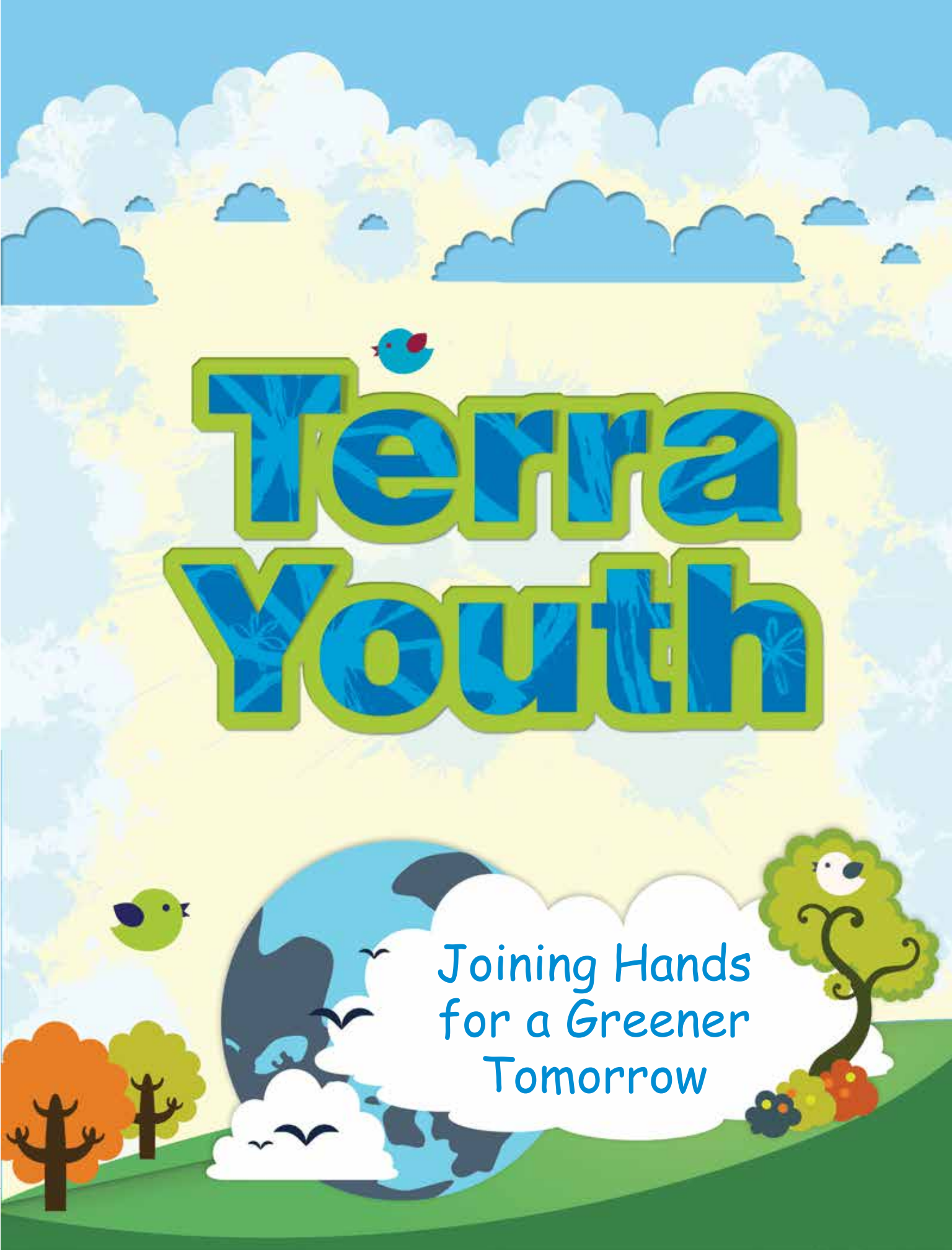
India does not have to choose between smarter metering and stronger consumer protection. The two should reinforce each other.

Parting Thoughts

The technical architecture for smart metering is being built at speed. The consumer architecture needs the same attention. A smart meter can make electricity consumption more visible to a utility. But its success will ultimately depend on whether that visibility also gives the consumer greater understanding and control. Making the meter smarter is a technology project. Making the system understandable is a trust project. India needs both. ■

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Terra Youth
Joining Hands for a Greener Tomorrow

Delhi Youth Develop Affordable Air Purifiers

for Vulnerable Communities

A youth-led initiative by the Global Shapers New Delhi Hub is making clean indoor air more accessible to vulnerable communities. The Accessible Clean Air Initiative developed a compact, energy-efficient air purifier costing about ₹1,450—nearly 90 per cent less than many commercial alternatives. Developed from a simple bathroom experiment using a fan and HEPA filter, the purifier underwent independent testing at an NABL-certified laboratory and achieved approximately 80 per cent removal efficiency for $PM_{2.5}$ and $PM_{10.}$ The initiative has deployed 25 purifiers across schools, hospitals, old-age homes and community institutions, benefiting more than 250 people. Its women-led assembly model also creates local livelihood opportunities.

The Global Shapers Community is an initiative of the World Economic Forum (WEF) that brings together young leaders under the age of 30 to create positive change in their local communities. Today, the community spans more than 500 city hubs across over 150 countries, empowering young people to tackle pressing social, environmental and economic challenges through locally driven solutions.

The New Delhi Hub has been actively working across climate action, public health, education and civic engagement. One of its flagship initiatives is the Accessible Clean Air Initiative, developed under its Climate Emergency Action Project (CEAP).



Global Recognition

In July 2026, the New Delhi Hub represented India at the World Economic Forum's Global Shapers Annual Summit in Geneva, where its Accessible Clean Air Initiative was awarded the Innovation Prize 2026 and a grant of 10,000 Swiss Francs, presented in alliance with Accenture and the Global Alliance for YOUth.

The Innovation Prize recognizes one of the most impactful and scalable community-led innovations from among hundreds of Global Shapers Hubs worldwide. The recognition comes with grant funding that will enable the team to significantly expand the initiative across Delhi.

The Problem: Clean Air Shouldn't Be a Luxury

Globally, clean air has become a privilege. Every year, air pollution claims nearly 7 million lives worldwide, including more than 1.6 million deaths in India. Delhi consistently ranks among the world's most polluted cities, with residents losing an estimated 6–7 years of life expectancy due to prolonged exposure to polluted air. Nearly 40 per cent of Delhi's residents show impaired lung function, making air pollution one of the city's most urgent public health crises.

We take over 20,000 breaths every single day. Imagine if every one of those



breaths carried harmful particulate matter.

While air purifiers have become an essential tool for protecting indoor air quality, they remain inaccessible for millions. Commercial air purifiers typically cost between ₹6,000 and

₹15,000, placing them well beyond the reach of many schools, shelter homes, old-age homes and low-income households that need them the most.

This inequality inspired one question: **Can clean air be made affordable for everyone?**

From a Bathroom Experiment to the World Economic Forum

The idea began in August 2025, not in a laboratory, but in a bathroom.

Armed with a household table fan, a rectangular HEPA filter and a few stretchable hair ties, the team assembled its first prototype simply to answer one question—would such a basic set-up actually filter polluted air?

To test it, incense sticks were lit inside the bathroom to generate smoke. Within minutes, the filter had visibly trapped black particulate matter. It was a simple experiment, but it proved one thing: the concept worked.

That first experiment sparked months of research. The team studied how commercial air purifiers functioned, listing every single component used in existing products. Using a first principles approach, each component was challenged with a simple question:

"Is this truly necessary for air purification, or is it simply increasing cost?" By stripping away everything non-essential, the team redesigned the purifier from scratch. One of the biggest breakthroughs came when the team replaced the original rectangular filter with a cylindrical one. The cylindrical design allowed for a much smaller enclosure, making the purifier significantly more compact, lighter and more affordable. The first casing was manufactured using 3D printing. Although effective, it proved too expensive for large-scale deployment.

The team then redesigned the housing using laser-cut acrylic sheets held together with threaded rods and fasteners. Even the acrylic sheets themselves were optimized repeatedly, experimenting with different cutting layouts to maximize the number of components produced from a single

sheet and minimize manufacturing waste. After dozens of design iterations, the team arrived at a purifier that is compact, lightweight, durable and costs a fraction of commercially available alternatives.

As production began, another realization emerged. Building every purifier by hand would never allow the project to reach the communities that needed it most. Instead of creating a factory, the team chose to create livelihoods. The project has now partnered with a Women's Self-Help Group (SHG), where trained women assemble the purifiers locally, generating income while simultaneously helping deliver clean air to vulnerable communities.

About the Accessible Clean Air Initiative

Accessible Clean Air is a low-cost air purification initiative designed specifically for underserved communities. Each purifier is:

- Built for approximately ₹1,450, making it nearly 90 per cent cheaper than most commercially available alternatives
- Lightweight and portable
- Energy-efficient, consuming less than 24 W of power
- Modular, allowing individual components to be replaced rather than replacing the entire device
- Designed for simple assembly, enabling local production through community-based manufacturing models.

The initiative combines environmental innovation with social impact by creating employment opportunities for women while improving access to cleaner indoor air.

Independent Testing and Validation

To validate its performance, the purifier underwent independent testing at an NABL-certified laboratory. Independent testing conducted by an NABL-certified laboratory found the purifier to achieve an overall removal efficiency of approximately 80 per cent for $PM_{2.5}$ and PM_{10}, validating its effectiveness in improving indoor air quality.

Impact So Far

The project is currently in its pilot phase. To date, the initiative has:

- Deployed 25 air purifiers across community institutions
- Benefited more than 250 people, including children, elderly residents, and immuno compromised individuals
- Installed units at organizations including Deepalaya School, Sheows Old Age Care Centre, Rojavanam Old Age Home and Ghaziabad District Hospital, alongside deployments in orphanages, Anganwadis, shelters, and community spaces
- Conducted community awareness sessions on air pollution and indoor air quality
- Built partnerships with VMTC, Genus Power, TVS Sundaram Textiles, manufacturing partners and implementation organizations supporting the project.



Looking Ahead

Following the Innovation Prize, the initiative is entering its next phase of growth. The immediate goal is to deploy 410 additional air purifiers across Delhi, reaching more than 2,000 people in schools, Anganwadis, shelter homes, hospitals and community centres. The project will continue expanding its women-led assembly model through Self-Help Groups, creating sustainable livelihood opportunities while increasing access to affordable clean air.

The team also aims to build a decentralized model that can be replicated by other Global Shapers Hubs across India, enabling communities to manufacture, assemble and deploy affordable air purifiers locally. In the long term, the initiative seeks to establish a financially sustainable cross-subsidy model where every five paid units help fund one purifier for underserved communities, ensuring that access to clean air is never determined by income.■

Aditi Agarwal, Curator, Global Shapers New Delhi Hub, Project Lead – Accessible Clean Air Initiative.

RiverSoft

RiverSoft's Society Activation Programme reaches 50,000 household across Bengaluru, Hyderabad, and Noida

For millions of urban households, hard water is a daily reality. Even then, awareness of its long-term effects and solutions to tackle it remains surprisingly low. RiverSoft, a trusted hard water solutions brand, is bridging this gap between hard water problems and their impact on overall lifestyle with a vision of making soft water accessible to every household. In line with this, the brand has introduced the RiverSoft Society Activation Programme—a grassroots-level initiative to raise awareness about hard-water and solutions directly amongst residential communities and neighbourhood retail stores.

The programme is built around three simple pillars: consumer education, hands-on product demonstrations, and genuine on-ground conversations. Every weekend, RiverSoft teams set up activations in societies, helping residents understand their unique water-quality challenges and explore solutions best suited to their needs. These interactions give RiverSoft a direct line to consumer sentiment, bring up real concerns, purchase barriers, and evolving expectations around hard-water solutions that shape the brand's future innovation.

Through this awareness campaign, RiverSoft has reached 100+ societies in Bengaluru and 30+ societies in Noida and Hyderabad, translating into 50,000 households. Speaking on the initiative, Ashutosh Kedawat, Founder & CEO, RiverSoft, said, "Our Society Activation Programme grew out of a simple belief: meaningful change starts with having real conversations, not just marketing messages. We wanted to help people connect the dots between the hard water flowing into their homes and the problems they'd long assumed were just part of life—such as hair fall, skin issues or appliance damage. By meeting consumers where they live, we're not only creating awareness of these everyday struggles but also listening and learning from them directly. Crossing 50,000 households is a proud milestone, but this is just the beginning of a much larger movement to make water care a mainstream, everyday priority for urban India."

Looking ahead, building on this momentum, RiverSoft plans to deepen its presence in existing markets while expanding the Society Activation Programme into new cities, reinforcing its commitment to making water quality an accessible, everyday conversation for consumers.■



Let Us Hear the Silent Side

Coexisting with Barn Owls in Our Cities

A conflict between residents and a family of barn owls in Greater Noida raises important questions about human–wildlife coexistence in rapidly urbanizing landscapes. Often misunderstood because of their appearance, nocturnal habits and defensive behaviour, barn owls are valuable natural predators of rodents and can provide an important ecological service, particularly in agricultural areas. As cities expand into natural habitats, wildlife is increasingly adapting to human settlements. Greater awareness of animal behaviour, responsible management of nesting sites and community participation can help prevent conflict and create space for peaceful coexistence, says **Dr Surya Prakash**.

Two high-voltage incidents in Delhi-NCR have recently attracted considerable attention from both the print and electronic media, and both are deeply disturbing in their own ways.

The first concerns a road-rage incident in which a female biker was struck by a vehicle. Thankfully, by the grace of God, she survived and is now fighting for her legitimate rights under the Bharatiya Nyaya Sanhita. We can only hope and pray that justice ultimately prevails.

The second incident, however, raises an entirely different yet equally thought-provoking issue—the conflict between human residents and a family of barn owls *(Tyto alba)* in a residential society in Greater Noida.

In this case, a family of barn owls reportedly became the subject of complaints following attacks on a few residents between two particular residential towers. What makes the situation particularly unfortunate is that we are dealing with two entirely different species: *Homo sapiens sapiens*, a highly evolved human primate, and *Tyto alba*, an avian species. Neither can understand the language or intentions of the other.

Yet the owls, being incapable of speaking for themselves, effectively had no opportunity to present their side of the story. In legal terminology, one might recall the fundamental principle of *Audi Alteram Partem*—"hear the other side." Sadly, the weaker, mute party in this particular conflict had no voice of its own. Only a handful of naturalists and members of the birding community could speak on their behalf, but before their voices could perhaps be heard, the owls had already been treated as the problem and removed from the premises.

As a student of science, I have always believed that every species possesses powerful instincts to protect and safeguard its offspring. It is therefore entirely possible that the barn owls were simply defending their nests, mates, or young when they reacted to people coming too close to their territory. Such defensive behaviour should not automatically be interpreted as aggression or malice.

There is also a deeper cultural issue that deserves reflection. Owls have, unfortunately, been regarded as symbols of bad omen in many human societies since time immemorial. Their nocturnal habits, haunting calls and unusual appearance have often contributed to fear and superstition. Their calls during the night may be disturbing to some residents, just as the howling of a dog or the cries of fighting cats can sometimes be disturbing. But these sounds have a perfectly natural purpose—they are part of the birds' communication, courtship, territorial behaviour and interaction between parents and their growing chicks.

The barn owl's appearance, too, has sometimes led to unkind descriptions and misconceptions. But behind that unusual face is an extraordinarily specialized nocturnal predator that plays an important ecological role.

I have personally lived alongside owls for many years near my home at JNU and have had the privilege of showing them to numerous birders and nature enthusiasts. Even today, I live in Greater Noida in the company of barn owls and spotted owls, without fear or hostility. I am certain that many fellow birders and naturalists share similar experiences.

These birds have adapted remarkably well to our rapidly urbanizing landscape.





As natural habitats disappear—with the loss of mature trees containing hollows, cliffs, crevices and other traditional nesting sites—some owls have increasingly found shelter in human settlements. Their return to familiar nesting locations should therefore not necessarily be viewed as a nuisance; rather, it can be regarded as evidence of their remarkable adaptability.

There is, in fact, a village temple nearby where a family of barn owls has been living for generations, apparently without fear or conflict with devotees or priests. Such examples demonstrate that peaceful coexistence between humans and owls is entirely possible when people understand their behaviour.

I have also witnessed the darker side of our relationship with wildlife. I possess horrifying photographs of seven young barn owl chicks whose legs had been tied with wire and who had been thrown into a filthy drain in Delhi. Fortunately, they were rescued, rehabilitated and, after recovering, released back into the wild. Such incidents remind us how vulnerable these beautiful creatures are when ignorance and fear replace understanding.

There is another important ecological dimension that deserves our attention. Gautam Buddha Nagar is a significant rice-growing region. After the harvest, rodent populations can increase substantially, creating serious agricultural and ecological challenges. Barn owls are natural rodent predators, and a single owl family can consume a very large number of rodents over the course of a year. Their presence can therefore provide an invaluable, completely natural pest-control service.

Instead of considering these birds our enemies, perhaps we should recognize them as our ecological allies. My humble submission is that the residents should be sensitized and educated about the behaviour and ecological importance of barn owls. Birders, naturalists, wildlife experts and local conservation groups can play a constructive role in explaining why these birds sometimes behave defensively and how potential conflicts can be avoided.

Simple measures such as maintaining a safe distance from nesting sites, educating children and residents, avoiding disturbance during the breeding season, and seeking expert advice when a bird appears to be behaving defensively can go a long way towards preventing conflict.

We must remember that these owls did not choose to invade our cities—we have expanded our cities into the habitats that once belonged to them. If they have adapted to living alongside us, perhaps it is now our responsibility to learn to live alongside them.

Let us not allow superstition, fear or misunderstanding to determine the fate of a species that performs such an important ecological service. Let us hear the silent side of the story too. Perhaps the real solution is not to drive these birds away, but to understand them. ■

Dr Surya Prakash, PhD (Retd.), SLS, JNU. Member – IBCN, BNHS & WWF (Education Department).



Global Warming Is Breaking a 400-Year Climate Link Between Two Oceans

For centuries, the tropical Indian and Pacific oceans have been closely connected, influencing rainfall, temperatures and atmospheric circulation across the region. New research suggests that this long-standing climate relationship is now weakening in an unusual way. Scientists from the Woods Hole Oceanographic Institution examined climate records preserved in corals, tree rings and stalagmites, reconstructing ocean conditions over roughly 400 years. Their analysis found that major volcanic eruptions temporarily disrupted the relationship between the two oceans during the 19th century. However, the researchers say the recent weakening appears different. Since the 1980s, the Indian Ocean has increasingly behaved independently of Pacific conditions, with human-driven warming identified as a likely factor. Understanding this changing relationship could improve climate and rainfall predictions in regions influenced by both oceans.

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

A Coral Reef Thought Dead for 60 Years is Teeming with Life

A deep coral reef off the coast of Benin, previously believed to be largely lifeless, has surprised scientists with evidence of thriving marine life. Surveys conducted more than 60 years ago had suggested that the reef was probably dead. However, recent underwater camera observations revealed healthy-looking coral patches more than 50 metres below the surface, supporting several species of fish. The discovery highlights how much remains unknown about deep marine ecosystems, particularly in regions that have received relatively little scientific attention. Researchers say deeper reefs may sometimes provide important habitats for marine organisms even when shallower ecosystems are degraded. Such findings could also influence how scientists assess and protect coral reefs, as conventional surveys may overlook biodiversity occurring beyond easily accessible depths.

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



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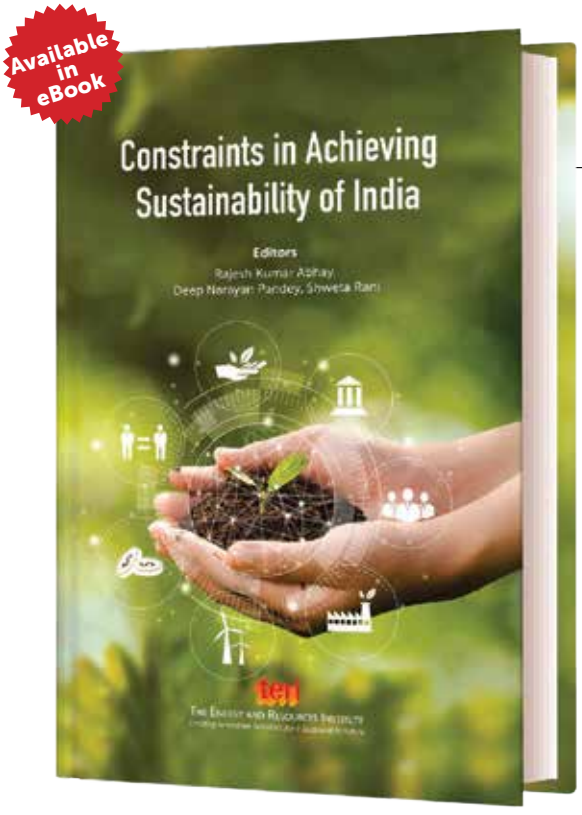
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Purpose of the book is to develop, contribute, and disseminate scientific knowledge pertaining to the issues related to sustainable development. The chapters are developed so that the contents can facilitate comprehension of the major constraints in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

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A Wildlife Oasis in Central London

A Tranquil Haven Where Nature Thrives Amid Urban Life

The WWT London Wetland Centre in Barnes is a remarkable urban oasis created from four disused Victorian reservoirs, offering refuge to a diverse range of birds, mammals, reptiles, amphibians, insects and wildflowers. This article by **Dr Marianne Furtado de Nazareth** explores its rich habitats, wildlife-watching facilities, accessible observation towers and hides, and citizen-science activities. Seasonal highlights include nesting sand martins, returning migratory birds, ducklings, native reptiles and colourful wildflowers. With its tranquil lakes, gardens and thriving biodiversity, the centre provides visitors with an opportunity to experience nature and learn about wetland conservation in the heart of London.

"Come on! Let me take you to the Barnes Wetland Centre," said my colleague and fellow journalist CS James on a recent holiday in the UK. "You are a Science and Environment Journalist and I am sure you will love these wetlands, which have been conserved, right in the heart of London." How right she was and what a wonderful day trip it makes, to get off the beaten track of the usual British icons and see this little jewel tucked away, as an indulgence for true nature lovers.

The WWT London Wetland Centre is a wetland reserve managed by the Wildfowl and Wetlands Trust (WWT) in the Barnes area of the London Borough of Richmond upon Thames, which is situated in Southwest London, England. The site, according to the information desk, is formed of four disused Victorian reservoirs tucked into a loop in the Thames. We got off the train at the Barnes station which meant a longish walk before we reached the centre. It's easier, if you get off at the Barnes Bridge station, which takes you immediately to the Wetland Centre.



We began our day by crossing over a wooden bridge, and stood enthralled in front of clumps of bull rushes, around a very appealing statue of Sir Peter Scott, the founder of the Wildlife and Wetlands Trust. It is a stunning sculpture that forces one to stop and take pictures of the man who was behind all that we were going to enjoy that day. It was a dramatic statue with a swan with its wings outstretched in front, of a bending and receptive, Sir Peter Scott.

Then, the two of us wandered into the Peter Scott Visitor Centre, named after the founder of WWT. There is a video playing in a loop, educating newbies on the centre. Plenty of literature was also available, but the best is to speak to the receptionist who immediately can alert you to the free talks going on, on the campus.

It first opened in 2000, and in 2002 an area of 29.9 hectares was designated a Site of Special Scientific Interest as the Barn Elms Wetland Centre. Occupying more than 100 acres of land which was formerly occupied by several small

reservoirs, these were converted into a wide range of wetland features and habitats, before the centre opened in May 2000. Unbelievable, but the WWT was the first urban project of its kind in the United Kingdom. Just beyond the horizon of the WWT, one could see the sky-scrapers of London, just 10 minutes from Hammersmith. An urban oasis for wildlife and people. In 2012, the London Wetland Centre was voted Britain's Favourite Nature Reserve in the BBC Countryfile Magazine Awards.

As we walked out of the reception, there was a mural on the glass of the reception centre with pictures of the birds found in the WWT. Many wild birds which have now made their home in the Centre cannot be found anywhere else in London. We were told that nationally significant numbers of Gadwall and Northern Shoveler are found here. Other wild birds include Eurasian Bittern, Northern Pintail, Northern Lapwing, Water Rail, Ring-necked Parakeet, Eurasian Sparrowhawk, Sand Martin, Common Kingfisher, Little Grebe, and Great Crested Grebe. The centre also holds a collection of captive wildfowl, who never leave.

"Sand martins are preparing their nests in the sand bank we have created for them. While Wheatears and wagtails are making regular appearances on the grazing marsh," said the receptionist to our questions on what birds to look out for.

"Look out also for the return of warblers, plus Blackcaps, Whitethroats and Lesser Whitethroats, as well as native reptiles and many wildflowers coming into bloom. Although close to the heart of the capital it is a haven of tranquility for both wildlife and people," he said. "For keen birdwatchers, there are Bitterns in winter and Yellow Wagtails on the grazing marsh in summer. Winter is one of the best times to visit our nature reserve, as some of the prettiest wild ducks, such as Wigeon, Teal and Pintail, arrive. Check out our Wildlife Sightings page online for full details of the 180 species we record here each year."

As we walked around we could see



the lakes, pools and gardens are home to kingfishers nesting in the banks, sand martins zipping over the ponds, wading birds searching for food at the lake edges and ducklings waddling after their mothers on the paths and of course tons of bird poop everywhere!

"But it's not just wildlife enthusiasts that enjoy the beauty of the nature reserve," said my colleague. "It's a wonderful place for a relaxing walk through the scenic paths that meander among the lakes and gardens. My most favourite place to come and relax after a hectic day at work." There are six hides, on the property, perfect for watching wildlife and photography. When we went there were four Japanese photographers, with their massive lens, clicking the wildlife they could see. If you are patient you can see frogs and lizards basking in the sunshine or watch dragonflies and butterflies fluttering over the wildflower meadows. And if you're lucky you'll see one of the many water voles that live here; look out for them chomping on the reeds at the pond edges.

The two-storey Observatory offers panoramic views of the reserve. The wetlands are accessible to everyone, which is why the three-storey Peacock Tower and the Observatory have lift access to their upper floors, while the Headley Discovery Hide has fixed floor-

Summer

One can see lapwings, little ringed plovers, great crested and little grebes, gadwall, mallards, pochards and tufted duck broods all over the reserve. Common terns are busy raising their chicks on the main lake rafts: One can watch them in the Observatory or Headley Hides. Look out for some of the most popular summer migrants, the sand martins, which will be nesting in the sand bank especially created for them.

Listen for water voles munching on reeds or marsh frogs calling to attract a mate. Keep an eye out for dragonflies and damselflies, as well as lizards basking in sunny spots and amazing displays of snake's-head fritillaries in the meadows for flower lovers.



to-ceiling windows. My colleague and I just opened a slat each and sat on the high stools and let our eyes relax and take in the beauty of untouched nature all around us, besides clicking pictures to our hearts content.

There is an Engagement team, which lay people can join, who go out on the reserve, doing some freshwater surveying—dipping for aquatic invertebrates, identifying them and assessing the overall water quality with their survey results. The sessions last for approximately one hour and is suitable for ages 12 plus. That is why there were large school groups present, when we visited. They also have Citizen Science team which helps people get to know what animals live in a particular pond, and can help biologists understand how good the water quality is.

My journalist colleague said, "I love it here at the London Wetland Centre. It's one of my most favourite places in the country. I love seeing the rare swans, ducks and geese, including American wood ducks, elegant smews, and noisy white-faced whistling ducks. The lakes, pools and scrapes are home to colourful garden birds, pretty wading birds, as well as frogs and newts."

Most of the visitors love the cheeky otters playing, or snoozing in their specially-designed 'holt' or watch them during feeding time—it's a real splash! Wardens feed the domestic ducks with their own special grain. With 300,000 plants and 27,000 trees WWT is a wildlife oasis in central London. As we headed for home we listened to the screeching croak of marsh frogs and the zip of dragonfly wings. Twilight showcases the aerial acrobatics of hundreds of swifts and sand martins overhead. And then as dusk fell we watched the bats swooping across the orange streaked skies. A wonderful end to a day spent in the pristine arms of Mother Nature. ■

Dr Marianne Furtado de Nazareth is a former Assistant Editor at The Deccan Herald, Bangalore, and a freelance science and environment journalist.

Spring

Visitors can come and watch Sand Martins preparing to nest in the sand bank, created for them and one can view inside their nest box on the CCTV cameras, installed. Wheatears and wagtails make regular appearances on the grazing marsh. Common terns come back in April to nest on the tern rafts. Spring brings the first house martins, swifts and yellow wagtails in April. In spring, there are lapwings on nests and redshanks and little ringed plovers visible every day.

The three native reptile species on the reserve—common lizard, grass snake, and slow worm—are usually active by early April. The first of the new season's ducklings hatch and butterflies start to appear: The Brimstone, Comma and Red Admiral. Wild orchids are among the many wildflowers coming into bloom and it is a great time to come to visit the three sustainable gardens.

Young Innovators

Inspiring the World

In this article, **Rakesh Agrawal** highlights how the INSPIRE Awards–MANAK programme is nurturing innovation and scientific thinking among school students in Uttarakhand. Through examples of young innovators such as Sonia Rawat and Shriyam, the article showcases student-led solutions to everyday and environmental challenges, including forest fires. Organized by the Department of Science and Technology, the programme encourages creativity, critical thinking, and problem-solving through science projects. With strong participation from schools across the state and notable achievements at national and international levels, the initiative is empowering young minds to become future scientists, innovators, and change-makers.



Sonia Rawat, a Class XI student at Swami Ramtirth Kanya Vidyalaya in Rajpur, on the outskirts of Dehradun, Uttarakhand's capital, was full of joy and hope as she travelled with her teacher, Megha Aggarwal, in a jeep. She carried a bag containing a rope roller that could be extended to provide a clothesline and rolled back after the clothes had dried, allowing children to play freely on terraces while also proving useful in small apartments. With her, was sitting a smart looking, Shriyam, a class X student, from the Army Public School, carrying a model for forest fire extinguisher that could wipe out forest fire within minutes, a recurring disaster in Uttarakhand where forests inferno is a routine affair, as soon as the summers set it, with his guide teacher, Dheeraj Dobhal. There were more girl students too, travelling along with, like one Niharika Chauhan, a class X student, from the Government Inter College (GIC), a higher-secondary school, Chakrata, also from Dehradun.

They were on the way to Narendra Nagar, Tehri district, about 50 kilometres away to participate in the state-level competition, exhibiting the products that they developed to participate in the 11th state-level 'Innovation in Science Pursuit for Inspired Research' (INSPIRE) scheme, one of the flagship programmes of the Department of Science & Technology (DST), Government of India. "The INSPIRE Awards – MANAK (Million Minds Augmenting National Aspirations and Knowledge), being executed by the DST with National Innovation Foundation – India (NIF), an autonomous body of DST, aims to motivate 10–15 years old students, studying in classes 6 to 10, aiming the cognitive development but also building character and creating holistic and well-rounded individuals equipped with the 21st century skills, like critical thinking, communication skills, creativity, understanding and collaboration," explains Richa Juyal, Coordinator, Dehradun district, accompanying 12 students from the district, for the competition.

Innovation in Science Pursuit for



Inspired Research (INSPIRE) is a national programme implemented by the Ministry of Science and Technology's Department of Science and Technology, Government of India. It aims to attract talented students to science and encourage them to pursue research careers. The INSPIRE Programme covers students and young people in the age group of 10–32 years and has five components. The first component, viz., INSPIRE Award is implemented centrally through the state Council for Science and Technology. Under this scheme, two students are selected from each school of the country including private schools, for an Inspire Award of INR 5000 for preparing a science project/model. These awardees, who are students from classes 6th to 10th, then participate in a 3-tier component, at District, State and National Level.

In Uttarakhand, the INSPIRE Award Scheme was implemented in 2010 by the Uttarakhand State Council for Science and Technology, Dehradun, through SCERT (State Council of Educational Research and Training), School Education, Government of Uttarakhand. To date, 7,400 students from the state have been selected for the INSPIRE Award. Similarly, 25 projects from the state have participated in the 2nd, 3rd and 4th National-level Exhibition and Project Competition held at Pragati Maidan, New Delhi. In these national-level competitions, Ayush Garg of Dehradun (1st NLEPC), Roshan Pant of Pithoragarh (2nd NLEPC), Kapil Chand of Pithoragarh (3rd NLEPC), and Subhash Kothiyal of Tehri Garhwal (4th NLEPC) secured first position for the state in their respective competitions.

Students were thrilled by the vibrant opening of the two-day competition, which was attended by several district-level and education officers, as well as state minister Subodh Uniyal, Minister for Forest and Technical Education, Government of Uttarakhand. Welcoming the students, he said, "*Duniya ka koi bhi lakshya insaan ki himmat se bada nahin ho sakta*" (No goal is bigger than human courage). "Today's students are tomorrow's responsible citizens, and this competition will instil a spirit of inquiry and pave the way for them to become scientists and innovators."

For two days, 122 young innovators from government and private schools across all 13 districts of Uttarakhand showcased their innovations with great enthusiasm and zeal. "This competition is designed for students from Classes VI to X, as curiosity and awareness are best nurtured at this age. Young minds observe even the minutest details keenly and have the potential to become real innovators," says Vandana Garbyal, Director, SCERT.

While participating in various categories of the competition, students apply the 4Cs of learning: critical thinking, communication, collaboration, and creativity to address the assigned topics. They develop science models using waste or low-cost materials, design posters and slogans, create video clips and short films, and conduct surveys,

all of which are directly related to environmental and societal issues.

This programme encourages students to gain hands-on experience in the fields of environmental studies, art, social science, science, and information technology. It helps raise environmental and social awareness among government school students and enables them to apply their learning in their daily lives. In turn, this equips them to better understand and develop solutions to the pressing challenges faced by society.

It was a tough competition, where all 122 young innovators excitedly exhibited their prototypes and projects, waiting for the jurists to pass their verdicts, as only 11 were to be selected for the next round, the national competition. "The projects of these young innovators were evaluated on the basis of their uniqueness, competence, relevance to the society, and cost-effectiveness," tells Dr Navneet Kumar, a jury member.

The 3-member jury panel finally selected 11 young innovators; six from Kumaon and five from Garhwal region of Uttarakhand. Shriyam, who was one such winner, is thrilled and very hopeful, "Every year, thousands of hectares forests are burnt by the man-made and natural fires, in my state. Hopefully, now some of them could be saved."



The students are eagerly awaiting the final competition, which could open doors to immense opportunities. If a commercial or consumer enterprise purchases and further develops their prototype, they would earn royalties from the innovation. In addition, a select few participants will receive the opportunity to visit Japan with full government support.



This achievement of the students of Uttarakhand, is no flash in the pan, but seemingly has become a regular phenomenon as out of total 28,870 proposals for the INSPIRE Award, submitted for the next year, 2140 proposals are from Uttarakhand! 345 students from all over the county, after a tough selection process, from the district and state-level completion, were selected. 31 were chosen at the national-level.

Earlier too, under the programme, Kapil Chand, Class 11th, Govt. Inter College, Kamleshwar, Pithoragarh participated in the SAKURA Exchange programme, at Japan in 2015. To share the experiences of school children from Asian countries, Japan Government has initiated this programme since 2014. Chand was among the 30 selected students who visited Japan. Chand was selected in the National INSPIRE Award for his novel model on Hydraulic Bridge in 2013.

Young innovators are the scientists of tomorrow, poised to improve people's lives. All they need is a little encouragement, and the INSPIRE Award provides just that. ■

Rakesh Agrawal, from Dehradun, writes articles on environmental initiatives, particularly those in Uttarakhand.

The Fertilizer Crisis in Southeast Asia

Demands a Sustainable, Homegrown Solution

The ongoing US–Iran conflict has exposed Southeast Asia's vulnerability to global fertilizer and agricultural input price shocks, placing additional financial pressure on small-scale farmers. Decades of dependence on chemical fertilizers have also contributed to soil degradation, water and air pollution, biodiversity loss, and climate change. This article by **Saptak Choudhury** and **Rupsa Banerjee** advocates regenerative agriculture as a sustainable, homegrown alternative, emphasizing locally produced bio-inputs such as compost, bio-formulations and organic manure. Experiences from India, Malaysia and Indonesia demonstrate that a gradual transition combining organic and inorganic inputs can reduce costs while maintaining yields. However, supportive policies, quality standards, farmer training, market incentives and investment in local agricultural research are essential for scaling these solutions

The ongoing US–Iran conflict poses a stiff challenge to Asia's agricultural sector, particularly for its small-scale farmers. The challenge is directly tied to the high consumption of chemical fertilizers in farms across the continent, especially in its southeastern parts.

- In India, as a result of the global spike in fertilizer prices, agricultural household incomes could shrink by as much as 27 per cent[1] in an adverse scenario, should the conflict continue.
- Bangladesh halted production[2] at most of its fertilizer factories, to drastically reduce fuel consumption. The country depends on imports for almost 80 per cent of its refined fuel needs.
- In Indonesia, the conflict prompted national pesticide producers to raise costs of pesticides[3] by 20–30 percent, adding to the financial woes of farmers already bearing the burden of increased production costs.
- In Malaysia, fertilizer costs[4] alone rose by 15 per cent within the first quarter of 2026. Trading volume in the agricultural sector fell by as much as 14.7 per cent[5] within the first quarter, spelling trouble for a country that depends on imports for meeting nearly 60 per cent of its food demand.



[1] Details available at <https://www.ifpri.org/blog/iran-war-supply-chain-disruptions-impacts-on-indias-economy/>

[2] Details available at <https://www.aljazeera.com/economy/2026/5/27/bangladesh-seeks-imf-aid-how-badly-has-iran-war-hit-its-economy>

[3] Details available at <https://ifcnews.id/>

[4] Details available at <https://www.straitstimes.com/asia/se-asia/expected-price-hikes-for-feed-fertilisers-in-malaysia-may-have-spillover-effect-on-spore>

[5] Details available at <https://www.supplychainbrain.com/articles/44146-malaysia-reports-fallout-from-iran-war-as-industries-get-hit>

Understanding the Crisis

Southeast Asia is one of the world's most populous regions—and the need to continuously feed a rapidly burgeoning population led farmers to intensify farming. From the 1960s onwards, this was achieved through the imbalanced use of chemical (particularly NPK—nitrogen, phosphorus, and potassium) fertilizers. These fertilizers are suited to a wide range of crops, climatic and soil conditions. In most cases, they release macro- and micro-nutrients at a rate that would take natural processes weeks and months.

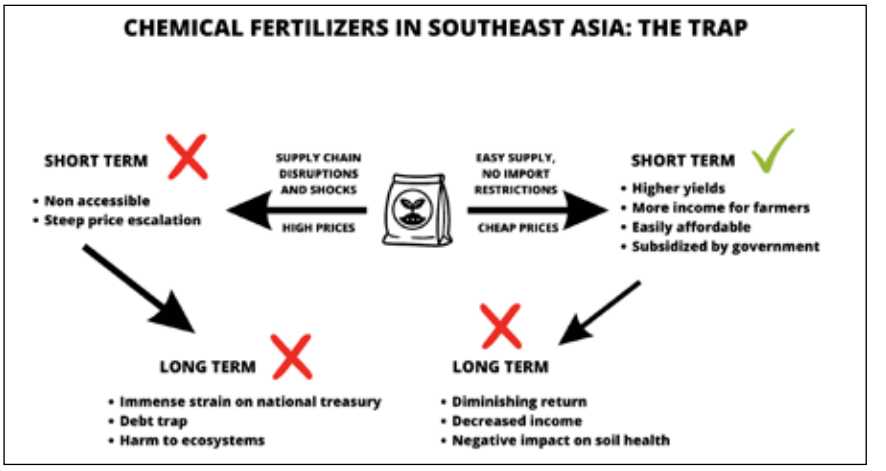
The quick action promised by chemical fertilizers makes it popular among farmers, but, as recent decades have shown, increased yields and food security have come at a very heavy price—both for the farmer and the environment.

The sustained use of chemical fertilizers in Southeast Asia has degraded soils, contaminated water and air, and contributed to global warming and biodiversity loss. Furthermore, as the US–Iran conflict has shown, excessive reliance on chemical fertilizers can leave small-scale farmers vulnerable to supply chain shocks and rising prices. This is, clearly, not a sustainable system.

Enter Regenerative Agriculture

Short-term fixes are insufficient to mitigate the overreliance on chemical fertilizers. A systemic shift is the need of the hour—and regenerative agriculture, a broad set of agricultural principles and practices that aim to regenerate, rejuvenate, and restore the soil, can provide solutions. One of its key elements is supporting farmers to curb the use of synthetic fertilizers.

Unlike synthetic chemicals, most natural and bio-inputs can be prepared on farms, using resources readily available. It is a circular model: the plants and livestock on the farm provide materials to prepare the inputs, while the inputs themselves go on to nourish the farm itself and the farmers' livelihoods.



In India, the state government-initiated Andhra Pradesh Community Managed Natural Farming (APCNF) project[6] prominently demonstrates the effects of implementing regenerative principles. In particular, the project focuses on "in-situ regeneration of soil health" through measures such as using bio-inoculants, covering the soil with live crops (live mulch) to reduce exposure to the sun, and applying solutions such as *ghana jeevamrut* (a nutrient-laden value addition to the soil). The steps have helped farmers reduce input costs and save water (by as much as 10%). In fact, in the long term, the use of synthetic chemicals (fertilizers and pesticides) itself can be reduced significantly through the use of indigenous bio-formulations (*jeevamrut*, *dashaparni ark*, *nimboli ark*, and *kandatonic*).[7]

However, the shift from using chemical fertilizers to sustained bio-input use cannot, and should not, be achieved

[6] Details available at <https://www.cgiar.org/news-events/news/the-natural-farming-model-of-andhra-pradesh-a-solution-for-sustainable-agriculture-in-india>

[7] The findings of Solidaridad, an international civil society organization working with small-scale farmers, reveal that soy farmers in Madhya Pradesh could reduce their use of synthetic chemicals by as much as 75 per cent over a period of five years, through the use of bio-formulations prepared on their own farms.





overnight. Such a drastic measure runs the risk of collapsing yields, when the soil is yet to recover from its dependence on synthetic fertilizers. It is the reason why, in the oil palm landscapes of Malaysia and Indonesia, agricultural experts instruct farmers on the correct ratio of organic and inorganic inputs to be used, and the right way to use fertilizers (for instance, the 3R—right amount, right time, right place—method of application). The approach has enabled bio-inputs (such as chicken manure, vermicompost, fertilizer from empty FFBs, bio-formulations, among others), in combination with other ingredients, to gradually improve FFB yields in both countries.

Compost, in particular, can be economical and is easily produced from locally available resources. A versatile bio-input that can even be derived from household waste, it finds application both individually and in combination with inorganic ingredients, and has been proven to improve soil fertility and reduce dependence on synthetic fertilizers (such as urea) by as much as 50 per cent. Beyond its on-field benefits, compost also provides small-scale farmers and collectives an additional source of income when sold to local farms and/or markets.

Closing the Gaps

Despite its manifold advantages, the use of bio-inputs in agriculture still remains limited in scope. What countries in Southeast Asia lack is a clear framework and guiding principles promoting and governing the use of these useful resources. Ideally, such a framework and its principles should officially identify what inputs can be classified as bio-inputs to eliminate the use of adulterated inputs, and establish regulatory and quality assurance norms. In addition, capacity building of farmers on bio-input preparation and storage is necessary. Institutional and infrastructural support from government and private sector can support farmers through incentives for bio-input preparation, better market linkages, and better prices for produce earmarked as sustainable, and cultivated using bio-inputs. Lastly, investing in local agricultural R&D/innovation efforts can help integrate traditional knowledge with modern solutions, and aid in the production of region/soil-specific bio-inputs. ■

Saptak Choudhury is a communications consultant with Solidardad Asia who contributes to stories for the Solidaridad Network website and Solidaridad Asia's social media handles and Rupsa Banerjee is a Senior Program Officer at Solidaridad Asia. She works on sustainable palm oil projects in Southeast Asia.



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TerraGreen promotes the concept of sustainable development. Launched in June 2004, this magazine from TERI is an effort to bring forth information and knowledge in the fields of energy, environment, and sustainable development. The magazine is in keeping with our mission to expand the base of environmentally conscious readers and popularize sustainability issues at the local level. TerraGreen aims to provide the readers with the necessary inputs to enable them to be a part of the process of change. The magazine stays away from all jargon, so that the educated, informed, yet lay readers are updated on all that happens around them everyday.

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Green events

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September 27–October 4, 2026
Across India
https://climateweek.in/

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October 7–9, 2026
New Delhi, India
https://environdec.com/isc/isc2026/registration

Mercom India C&I Clean Energy Meet 2026
October 9, 2026
Lucknow, India
https://www.mercomindia.com/

Renewable Energy India Expo 2026
October 22–24, 2026
Greater Noida, India
https://www renewableenergyindiaexpo.com/

18th GRIHA Summit 2026
November 3–4, 2026
New Delhi, India
https://grihaindia.org/

TerraGreen

EARTH MATTERS

FEEDBACK FORM

PLEASE TICK YOUR CHOICE.

1. **Which section(s) did you find the most interesting?**
   ☐ TERI Analysis ☐ Environmental Research ☐ Feature
   ☐ In Conversation (Interview) ☐ Cover Story ☐ Special Report
   ☐ Green Challenges ☐ Terra Youth ☐ Review

2. **In your opinion, which section(s) need(s) improvement?**
   ☐ TERI Analysis ☐ Environmental Research ☐ Feature
   ☐ In Conversation (interview) ☐ Cover Story ☐ Special Report
   ☐ Green Challenges ☐ Terra Youth ☐ Review

3. **What do you think about the look and feel of *TerraGreen*?**
   ☐ Brilliant ☐ Design is not a priority, content is
   ☐ Average ☐ Needs improvement

4. **In your opinion, what aspect(s) of *TerraGreen* need(s) improvement?**
   ☐ Choice of stories ☐ Handling of issues ☐ Language
   ☐ Design ☐ Presentation

5. **Please rate *TerraGreen* on a scale of 1–5 (5 being the best).**
   ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

6. **What issues would you like *TerraGreen* to cover?**
   .....
   .....

7. **Which other environmental magazine(s) do you read?**
   ..... ☐ None

8. **Any further suggestions?**
   .....
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- Matte paper
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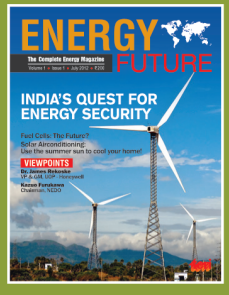
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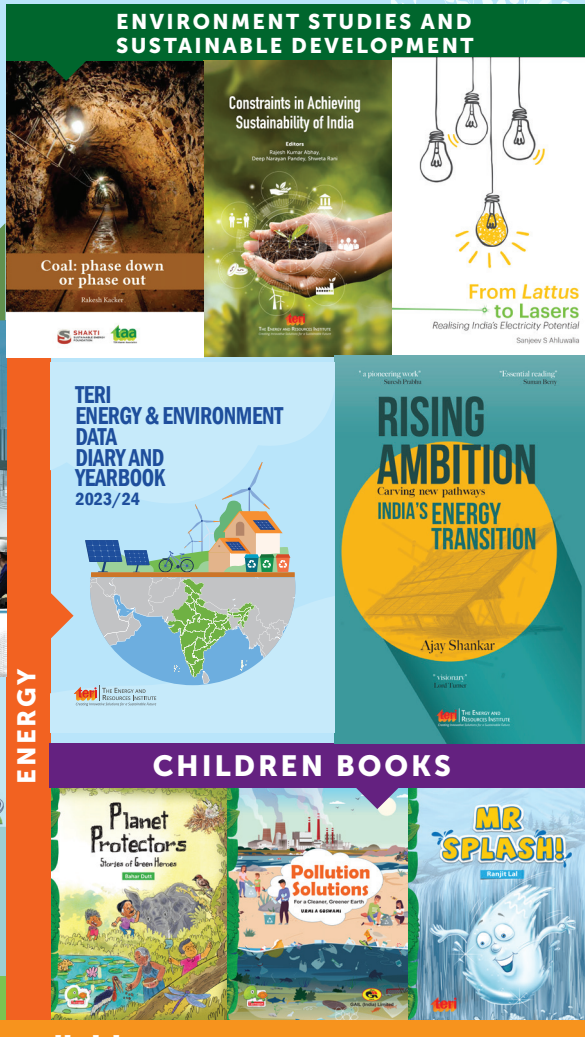
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