

16-30 SEPTEMBER, 2024

# Down To Earth

FORTNIGHTLY ON POLITICS OF DEVELOPMENT, ENVIRONMENT AND HEALTH

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OZONE DAY SPECIAL

## CARBON COLONISED

Can carbon markets combat the climate change crisis?



Scientists join forces to assess climate impact on India's tropical forests

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Misconceptions that obscure Chipko objectives

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# We need politics of inclusion

**WE KNOW** we stand at the crossroads. Unsustainable growth means that we are hurtling towards climate catastrophe and inequitable growth means that we are hurtling towards increased poverty, increased marginalisation and increased anger. Our learning in India is that growth that is not affordable, in other words not equitable, cannot be sustainable. This, then, is the agenda for the future.

Consider the challenge of Delhi's toxic air pollution. It's not that we are not trying to make a difference. All coal plants have been shut; pet coke import (incidentally the ones that the US exports as it is toxic for local use) has been banned; and we are switching to the cleanest fuels and vehicle technology. Despite these incremental actions, we stay behind the pollution crisis. My colleagues estimate that air pollution in Delhi has reduced by 25 per cent over the past three years, as compared to the previous three years; but it still needs to be reduced by 65 per cent to get what you will call clean air.

The reason is simple: today less than 20 per cent of my city drive in cars to work; roughly 25 per cent own cars. But these vehicle owners take 90 per cent of the road space. The question is, if the demand of just 20 per cent is leading to huge congestion and pollution, where and how can the city find the road and air space for all? This is where the environmentalism of the poor kicks in. The fact is, if the rich are to breathe clean air, we need to rework mobility for all. We cannot think of adding a few buses or trams or metros; we need to transform mobility so that it works for the rich and the poor. This means combining affordability and convenience and safety.

This is also the case with energy. Many households in my world still use biomass to cook food because they are poor. These air pollutants, which are killing poor people, are also contaminating the airshed they share with the rich. So, if we want clean air, we will have to get the rich out of their polluting vehicles, but we will also have to ensure that the poor households get options to move out of dirty fuels. Their energy transition is important for clean air. This is why without inclusive growth, we cannot have sustainability.

The opportunity is also enormous. If we reinvent for transformative action we will focus on the needs of the poor women and provide them viable, affordable options to leapfrog—from non-fossil dirty fuels to non-fossil clean fuels. But this is where the world needs leadership so that finance for the energy transition is concessional and provides the opportunity

to scale up the system for the poorest in the world.

The challenge of climate change is a mirror to the air pollution challenge we face in Delhi. In 1990, my colleague Anil Agarwal and I argued in our publication "Global Warming in an Unequal World" that the world cannot combat climate change unless the agreement is fair and equitable. Today, the same issue is on the table. If the solutions cannot meet the needs of all—are equitable—they will not work. This is where we need to understand this environmentalism of the poor again.

It is clear that events in our world are spiralling out of control. Every year is the hottest year, till the next year comes around. Then a new record is broken. From forest fires, to increasing frequency and intensity of storms to blistering cold waves and scorching heat—it's all getting worse. Then we face the most inconvenient truth. At current rates, the world will run out of the carbon budget—how much it can emit to limit global warming to 1.5°C—by 2030.

But there are vast numbers of people who do not have access to basic energy. They need energy for their development. This is why we need cooperation so that future development can be low-carbon for all.

It is clear that increasing numbers of disasters because of growing intensity and frequency of weird and abnormal weather will make the poor, poorer. Their impoverishment and marginalisation will add to their desperation to move away from their lands and to seek alternative livelihoods. Their only choice will be to migrate—move to the city; move to another country. The double-jeopardy, as I have called it, in the interconnected world is the push—lack of options—and the pull—bright lights that suggest a choice to better futures. This will add to the already volatile situation of boat people and migrants at the border walls, making our world insecure and violent. This is the cycle of destructive change that we must fight. Our globalised world is inter-connected and inter-dependent, and we must recognise this.

Sustainable development is not possible if it is not equitable. Growth has to be affordable and inclusive for it to be sustainable. But all this will not happen, unless we articulate that the environmental challenge is not technocratic but political. We cannot neuter the politics of access, justice and rights and hope to fix the environment or indeed development . [DTE](#) [@sunitanar](#)

**We cannot neuter politics of access, justice and rights, and hope to fix environment or indeed development**

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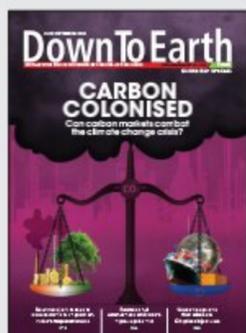
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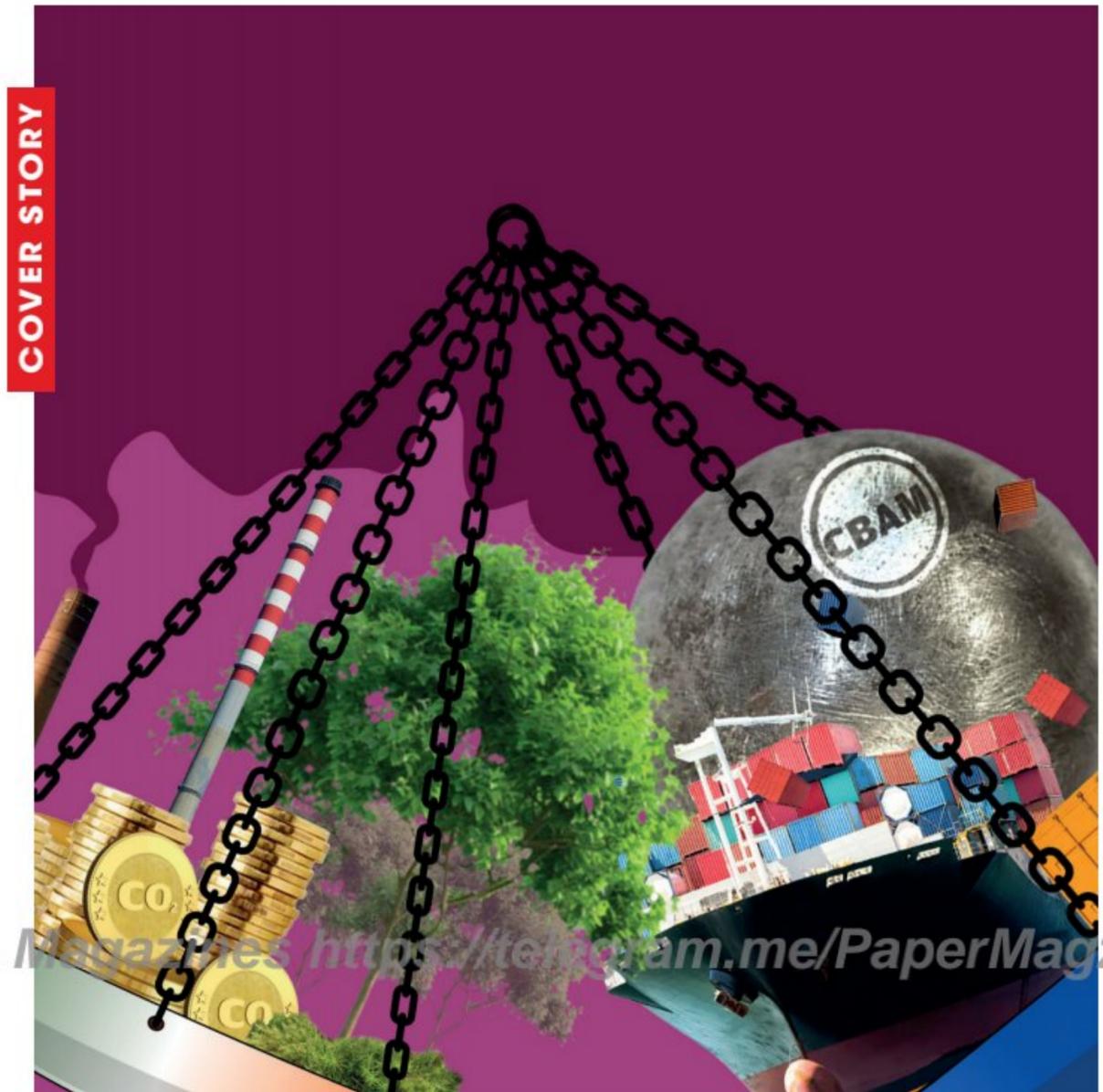
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# Engage



leaves have turpentine and are highly flammable, which plays a role in the spread of forest fires. The only remedy is to replace this tree with native species. But it seems that no one cares about the forests.

**PCS RAUTELA**  
SATTAL

## Agriculture needs proper focus

This is with regard to the 1-15 August, 2024 edition "Can we make India's agriculture climate resilient". The edition has covered most relevant issues pertaining to agriculture. I am seriously concerned about the future of the country and its people. I wonder why the annual Union budget does not plan for the impressive growth of the agriculture sector.

The cover story of this edition "The great gamblers", says that agriculture meets 18 per cent of the country's GDP. More importantly, 70 per cent of the households or nearly 42 per cent of population are engaged in this activity. Another article, "Price of being a farmer", shows how men in rural areas struggle to get married. The debate "How to measure the cost of farming" speaks of issues around minimum support price and farm losses. Is it not fair to expect that our government addresses these issues with more intent, so that our farmers' quality of life can be improved? They deserve monetary support, particularly in times of climate change, which is in line with the support provided to the corporate sector and income tax payers. One wonders how China, an equally populous country, deals with these issues.

**GOPINATH**  
BENGALURU

## No move to curb forest fires in Uttarakhand

Apropos "Hotter Himachal" (1-15 August, 2024), it is a well summarised write-up. Uttarakhand is suffering as much as Himachal Pradesh, perhaps even more. Last year, I noticed a forest fire as early as on December 23, while travelling from Jageswar temple in Uttarakhand's Almora district and passing through the Barechhina area. The flames were absent in the morning that day but moved shockingly fast.

By June, the forests, dominated by chir pine trees, had recorded a total of 522 fires. Forest department officials were forced to seek help from the Indian Air Force to extinguish fires in Nainital and the Binsar sanctuary. The Sattal forest, once a haven for kalij pheasants, jungle fowl, barking deer, porcupine, stag deer and some 400 types of butterflies, was razed. Pheasants and jungle fowl lay their eggs on the ground and the chicks are born around April, when the fires are at a peak. Even now, I do not see a single bird of these species in the region.

Chir pine is an invasive species, imported from Germany by the British in 1864, to meet the increasing demand of wood for railway sleepers. It was initially grown at an altitude of 900-1,200 m, but can now be found at an elevation of 1,900 m on the Himalayas. The tree increases the acidity of the soil. Chir pine

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The Society for Environmental Communications; 41, Tughlakabad Institutional Area; New Delhi-110 062. Letter writers should mention their full name, postal address and phone number.

# Digest

WHAT'S INSIDE

Women take charge in faecal sludge treatment plants **P8**

Unusual monsoon pattern skews rainfall distribution **P9**

Centre lifts cap on production of ethanol from sugarcane **P10**

1,000 WORDS VIKAS CHOUDHARY



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Fifty-three-year-old fisher Zakir visits the Sahibi river, a tributary of the Yamuna, near the Delhi-Haryana border every day to catch fish. He blames sewage and polluted water for reducing his daily catch to a fraction of the 50-60 kg of fish he would find here two decades ago. Large-scale pollution in the Sahibi has been reported for years due to indiscriminate and illegal dumping of sewage and industrial waste. In recent months, the National Green Tribunal has issued multiple directions to Delhi and Haryana authorities to clean up and restore the river.

FOR MORE PHOTOS, SCAN



# Breaking barriers

**WHEN APARNA** Sahu joined the faecal sludge treatment plant (FSTP) in her city, Jaunpur, in March this year, her family and friends were less than supportive. "They had concerns over my safety as well as the social implications of working with faecal sludge. They assumed I would work for a couple of days and quit," recalls Sahu, a sociology graduate. But now, as she nears six months as a supervisor at the plant, all doubts have vanished. "The confidence and financial stability I have earned has changed opinions," she says.

Like Sahu, 15 other women work at FSTPs in Jaunpur, Sitapur, Raebareli and Khurja in Uttar Pradesh. They belong to different self-help groups (SHGs), which the Union government has involved in its AMRUT (Atal Mission for Rejuvenation and Urban Transformation) Mitra programme for water management initiatives.

The AMRUT scheme funds 54 of the 59 septage treatment plants (FSTPs and co-treatment units) in Uttar Pradesh. "Operations and maintenance are the biggest challenges," says P K Srivastava, Additional Mission Director, AMRUT, Uttar Pradesh. "As of now, 18 plants do not even have any arrangement this work," he says. After the Union Ministry of Housing and Urban Affairs launched the AMRUT Mitra programme in February, the Uttar Pradesh government decided to close the gaps. AMRUT officials roped

Women in Uttar Pradesh take on crucial roles at faecal sludge treatment plants

**SUBRATA CHAKRABORTY  
AND ALKA KUMARI**

in the State Urban Development Agency (SUDA) to hold an exposure session for SHGs, after which the 16 women shortlisted were trained by Delhi-based think tank Centre for Science and Environment. They learned about different processes at FSTPs, safety measures and operating the technologies. "During the training, the officials also showed us videos of women in Odisha who had joined FSTPs under the AMRUT Mitra programme. I realised then that if they can do the work, so can I," adds Poonam Tripathi, supervisor of the Raebareli FSTP.

The women then split into four-member teams—one supervisor, two sanitation workers and one gardener. "The initial days were difficult, but slowly we picked up the work. After seeing the protection measures at the plants, even my family is less concerned," says Tanya, supervisor at the Khurja FSTP.

The state government transfers a monthly honorarium of ₹12,000 for the supervisor and ₹10,000 for the others. "Earlier when I was a part of the SHG, I made and sold pickles and *papads* from home. My earnings depended on the demand. But working at the FSTP has provided income stability," says Tripathi.

"After Odisha, Uttar Pradesh is the second state to rope in women from SHGs. We see that the women are more than capable for the work, and are looking to engage more," says Srivastava.



Aparna Sahu works as a supervisor at the Jaunpur faecal sludge treatment plant in Uttar Pradesh

**WEATHER**

# India sees unusual monsoon patterns

**THE 2024** southwest monsoon has, between June 1 and September 1, led to excess rainfall in western and southern states such as Gujarat, Maharashtra and Tamil Nadu, while others like Nagaland, Manipur and Punjab recorded a deficit. This season has also seen extreme weather events, including a rare August cyclone that formed over the Arabian Sea, Asna.

These variations may be due to the unusual movement of the main rain-causing low pressure region or the monsoon



trough. Over the past few months, while one end of the trough stayed at its normal position, the other deviated. When skewed to the south of its normal position, the trough shifts rainfall towards southern India; the core

monsoon zone, northern and eastern regions see poor rain. If the trough is skewed north, the monsoon is on break with rain over the Himalayan and northeast regions.

The rest of September may see warmer than

normal temperatures, with some extreme rainfall, according to the India Meteorological Department (IMD). The agency expects La Niña, the cooler phase of the El Niño Southern Oscillation, to develop in the equatorial Pacific Ocean towards the end of the monsoon season.

Weather conditions in 2024 seem to be similar to 1999, marked by record heatwaves and frequent cyclones. That year also saw La Niña after a strong El Niño, similar to the current trend.

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**ENVIRONMENT**

## EU faces legal challenges over climate goals

**NON-PROFITS** Climate Action Network (CAN) Europe and Global Legal Action Network (GLAN) on August 27 took legal action against the EU for its "insufficient" climate targets. The two groups argued before the EU General Court against the bloc's plan to reduce greenhouse gas emissions by 55 per cent by 2030, particularly from agriculture, waste, small industry and transport sectors. The EU rolled out the goals in June, following weeks of protests from the agriculture sector against proposed measures to cut emissions from farming. According to climate groups, the final measures are not in line with the 2015 Paris agreement to limit global warming to 1.5°C. Their case, which was formally filed earlier this year, is set for hearing in 2025. Later on August 28, a set of five other non-profits also announced that they would take legal action against the European Commission for including aircraft and ships in the EU's sustainable finance rules. In 2023, the EU allowed investment in new aircraft and ships labelled "green" for meeting certain emissions efficiency criteria.

**DISASTER**

## Widespread forest fires raze Brazil, Bolivia

**BRAZIL'S AMAZON** rainforests recorded 38,266 fire hotspots in August, more than double the number seen in the same period in 2023, according to government data. The fires spread across 11 states, including the capital Brasília and São Paulo, with reports of thick smoke and respiratory problems increasing through the month. Brazil's Pantanal region, the world's largest tropical wetland, also saw 3,845 fires in August, says the World Wide Fund for Nature (WWF), putting at risk endangered species such as jaguars, parrots and giant anteaters. The 2024 fire season in Brazil began in July rather than August, owing to a year-long drought. President Luiz Inácio Lula da Silva also said on August 26 that the fires are suspected to be started by humans rather than natural sources like lightning strikes. Brazil's neighbour Bolivia also declared a national emergency because of forest fires on September 7. The country is seeing the largest number of wildfires since 2010, burning at least 3 million hectares, according to Brazil's National Institute for Space Research (INPE).

## BITS GLOBAL

**At least** six people died and more than 131 were injured in Japan due to heavy rainfall and winds brought by tropical storm Shanshan in late August. The storm, which made landfall on August 29 as a typhoon, hit the southern regions of the country. As of August 31, some 1.4 million people in 46 cities were urged to evacuate to safer areas as heavy rainfall continued, increasing the risk of floods and landslides.



**Trials of** the world's first mRNA vaccine for lung cancer have begun in seven countries. About 130 people in the UK, US, Germany, Hungary, Poland, Spain and Türkiye will be inoculated by the BNT116 vaccine made by BioNTech, designed to treat non-small cell lung cancer, the most common form of the disease. According to the World Health Organization, lung cancer is the leading cause of cancer-related deaths globally, accounting for the highest mortality rates.

**Greek authorities** collected 100 tonnes of dead fish off the coast of Volos in the country's central region at the end of August after climate fluctuations caused a mass die-off in the city's lake Karla. The lake has seen drastic change in water levels due to severe rainfall in 2023 and heatwaves this summer. The cleanup process closed nearly 80 per cent of commercial activities in Volos, a tourist hotspot, for three days in August.

**Zambia shut** down its mainstay hydropower plant on September 14, due to a significant drop in water levels of its source, lake Kariba. The lake, shared between Zambia and Zimbabwe, has just 8 per cent of water available for generation due to severe droughts in the region. Zambia has warned its people of more power cuts as the generation drops.

## BITS INDIA

**The Union** government on August 29 lifted an eight-month cap on production of ethanol from sugarcane products. The government also allowed ethanol producers to participate in the Food Corporation of India's auctions of rice, which is used as a raw material to make the fuel. The cap was introduced in December amid concerns on production and price rise of sugar and rice.

**Uttar Pradesh** in late August mounted an operation to capture a pack of wolves, after reports of over 30 attacks on people in Bahraich district since July. At least seven people died after being attacked. As of September 4, four wolves were captured and at least two more were being traced.



**Assam on** August 29 said it has approved and forwarded to the Centre a proposal for an oil exploration project by the Vedanta group near Hoolongapar Gibbon Wildlife Sanctuary. The project is proposed 13 km from the sanctuary that hosts the hoolock gibbon, India's only ape, and the Bengal slow loris, the only nocturnal primate in the Northeast.

**Lightning strikes** kill nearly 1,900 people in India each year, says a new study published in the journal *Environment, Development and Sustainability*. The study says that lightning caused 0.2 million deaths in the country between 1967 and 2020, with the rates increasing significantly in the past two decades.

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## IN COURT

### NATIONAL GREEN TRIBUNAL

■ Noting that encroachment of forest land in Sonai Rupai Wildlife Sanctuary in Assam has been allowed for several years, the National Green Tribunal (NGT) has asked the Union Ministry of Environment, Forest and Climate Change to file an affidavit on its stand in the matter.

■ NGT has directed the constitution of a three-member committee to probe illegal dumping of waste at 10 locations in Thane district of Maharashtra. The committee will inspect the locations and recommend an action plan, if needed, by the end of September.

### SUPREME COURT

■ The apex court has directed governments of Rajasthan, Punjab, Haryana, Uttar Pradesh and the National Capital Territory of Delhi to fill vacancies in their respective pollution control boards within two months from August 27.

### HIGH COURT

■ Noting the poor quality of healthcare services in the national capital, the High Court of Delhi told the director of the All India Institute of Medical Sciences (AIIMS) to take steps to improve government hospitals, as per recommendations of an expert committee.

### So far...

Number of cases on environment and development tracked from January 1 to September 3, 2024

NATIONAL GREEN TRIBUNAL	SUPREME COURT	HIGH COURTS
314	66	79

FOR DETAILED VERDICTS, SCAN





Congolese health workers consult suspected mpox patients in a treatment centre at the Kavumu hospital in Kabare territory, South Kivu province of the Democratic Republic of Congo on August 29. The country has already reported 19,000 suspected cases and 650 deaths this year.

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# Festering troubles

The Democratic Republic of Congo struggles to contain mpox amid vaccine delays, conflict and fragile healthcare

**EMILIA GANKAMA**  
KINSHASA,  
DEMOCRATIC REPUBLIC  
OF CONGO

**D**ESPITE BEING the epicentre of the mpox outbreak that has infected over 103,000 people across 122 countries since January 2022, the Democratic Republic of Congo (DRC) received its first batch of vaccines on September 5—nearly two years after the US and European nations began stockpiling them following their own cases.

So far, DRC has received 99,000 doses from the EU, with another 110,000 doses expected soon. However, these figures fall far short of the 3 million doses officials estimate are needed to bring the outbreak under control (see ‘The politics and economics of mpox’, p44-45). Nigeria, the only other African country to secure vaccines, has managed to receive just 10,000 doses.

The World Health Organization (WHO) has declared mpox a public health emergency twice in the past three years—first between July 2022 and May 2023, due to its rapid spread outside Africa, and again on August 14, 2024, following a surge in cases across Africa, largely driven by mutations in the virus.

The mpox virus is categorised into two main clades: I, endemic to Central Africa, and II, which was previously known as the West African clade. Both have two subclades a and b. Clade IIb drove the 2022 global outbreak. The current spike in cases, however, is largely attributed to the more virulent clade Ib, which spreads through close contact and contaminated surfaces.

Since January 2024, Africa has

PHOTOGRAPH: REUTERS

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reported over 3,900 confirmed mpox cases and 52 deaths, with DRC accounting for the majority—3,365 cases and 25 deaths, according to WHO. The official numbers from DRC for 2024 are 19,000 suspected cases and 650 deaths. The most vulnerable population is children, who make up 62 per cent of the patients. Four out of five deaths have occurred in those under 15 years old. The vaccines currently available are only approved for adults.

**PROBLEMS GALORE**

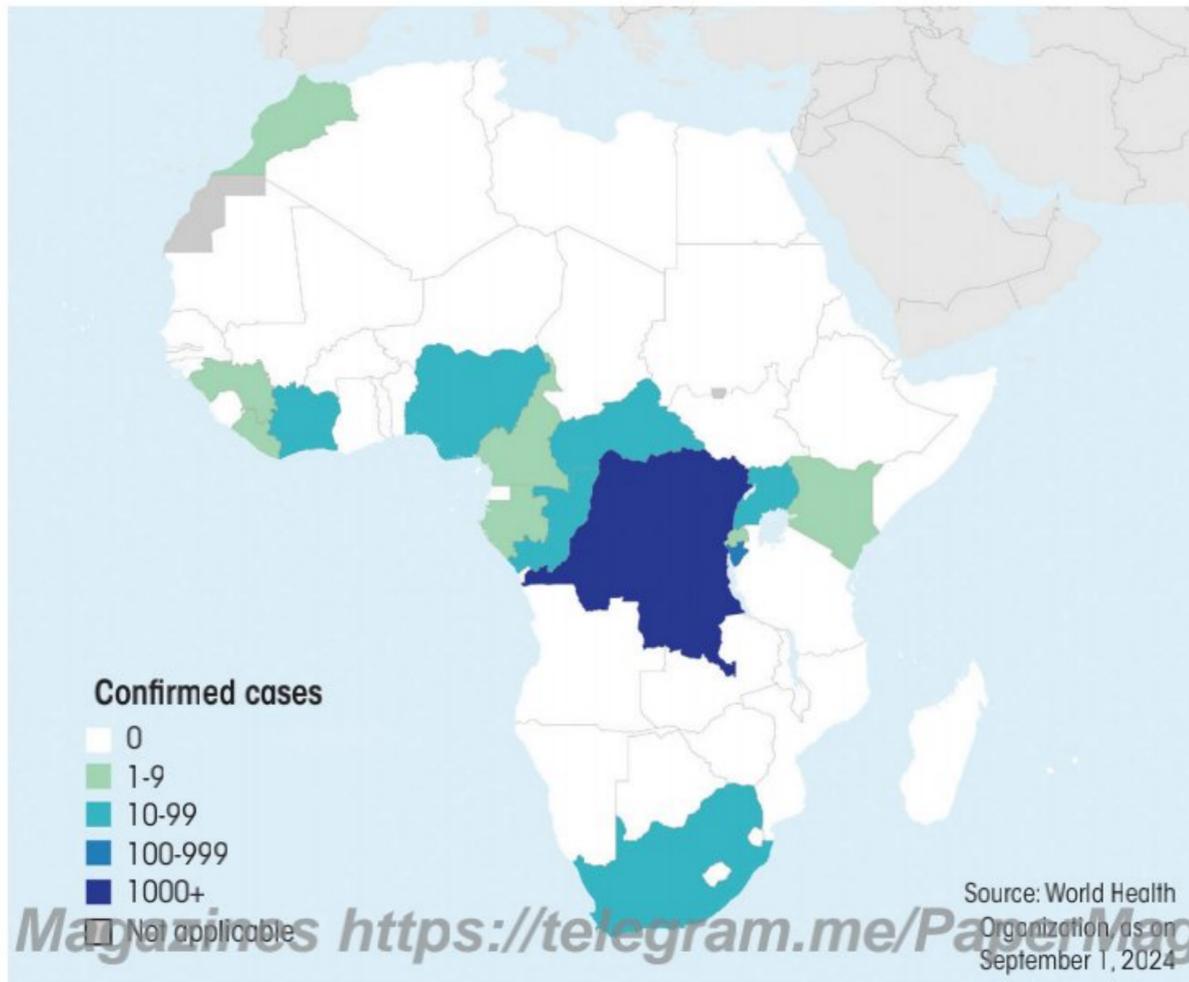
Mpox has been endemic in DRC since it was first identified in 1970. Though the country experiences outbreaks almost every year, the current crisis has laid bare deeper issues. “The resurgence of the current epidemic can be attributed to three key factors,” says Sharon Ngandu Binagula from Padiyath Medecity-Hopital du Cinquante-naire in Kinshasa. “First, the relaxation of preventive measures, especially the discontinuation of smallpox vaccinations in 1980 [which offered protection from the virus]. Second, in endemic countries like DRC, Nigeria and the Central African Republic, humans are increasingly encroaching on animal habitats. Finally, increased international mobility has facilitated the global spread of the virus.”

At a press conference, Dieudonné Mwamba Kazadi, director-general of the National Institute of Public Health (INSP), highlighted how poor access to healthcare has worsened the epidemic. INSP is responsible for the Public Health Emergency Operations Centre, DRC’s epidemic preparedness and response system.

DRC is one of the poorest countries in the world, with over 70 per cent of the population living in extreme poverty, according to the

**Heart of the outbreak**

The Democratic Republic of Congo accounts for over 90% of the confirmed mpox cases reported across Africa in 2024



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World Bank. In rural areas, where mpox is most prevalent, healthcare facilities are often under-resourced, lacking basic supplies, clean water and reliable electricity.

There is severe stigma associated with mpox patients as the clade II of the virus could be transmitted through sexual contact. According to WHO, many people delay seeking treatment out of fear of judgment, further fuelling the virus’s spread.

Ongoing conflict in the eastern provinces, particularly in North and South Kivu, has exacerbated the mpox outbreak. Refugee camps in conflict-torn provinces, where millions live in overcrowded and unsanitary conditions, have become hotspots for the virus. According to *Al Jazeera* news, armed groups, such as the M23 rebel faction, have made it nearly impossible for healthcare workers to operate in these re-

gions. Vaccine distribution will also be extremely difficult in conflict zones, says Jean Kaseya, director-general of Africa Centers for Disease Control and Prevention (CDC).

**GLOBAL INACTION**

Despite the first human case being reported in 1970, the global spotlight only intensified in 2022 when cases of mpox were reported in Europe and North America. This inaction for almost five decades allowed mpox to grow into a global scare. Not much has changed even now. On September 6, the Africa CDC and WHO launched a continent-wide response plan to combat mpox. The six-month plan, with a budget of nearly \$600 million, aims to bolster the response in 14 affected nations and improve readiness in 15 others. However, funding for this initiative remains uncertain. **DTE**



FOR More Newspapers & Magazines <https://telegram.me/PaperMagazine> Scientists deploy sensors to measure leaf temperature and calculate its vulnerability to climate change

# Turn a new leaf

**E**VERY NOW and then, biologist Deepak Barua takes a break from his usual assignments at the Indian Institute of Science Education and Research (IISER), Pune, and plans a trip to the 500 km away Sirsi forest. Located in the heart of the Western Ghats, the forest near Sirsi town of northern Karnataka is known for its tree species diversity. This is one of the latest forests that Barua has been monitoring, along with other scientists, to investigate the threat that climate change poses to the tropical tree species of India.

Studies suggest that heatwaves and frequent and intense droughts result in increased tree mortality and forest dieback across the world.

Scientists join hands to predict climate future of India's tropical forests

**HIMANSHU N**  
NEW DELHI

There is also evidence that extreme temperatures threaten the survival of sensitive species, resulting in local extinctions, range shifts and altered vegetation composition. A 2010 study, published in *Forest Ecology and Management*, documented 88 events of forest mortality, driven by water or heat stress since 1970. A May 2024 study, published in the *Proceedings of the National Academy of Sciences* shows that about 37 per cent of the Amazon forest in Brazil is unable to recover due to frequent droughts, suggesting the possibility of mass die-offs in near future.

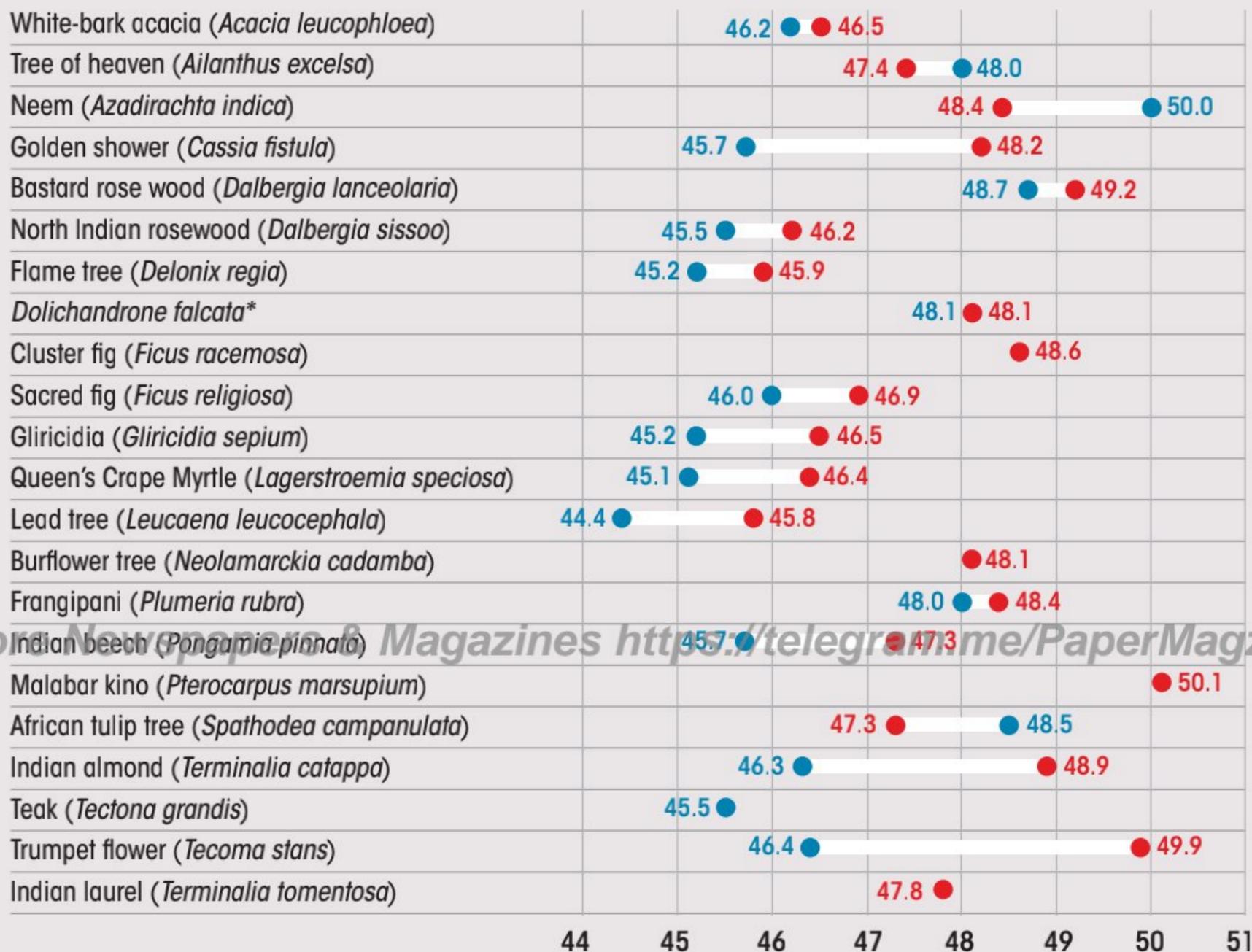
However, not much is known about how tropical forests in India are going to respond to extreme

PHOTOGRAPH: RON SUNNY

# DEGREES OF VULNERABILITY

● high temperature threshold during the hot-dry season ● high temperature threshold during the cool-wet season

## DECIDUOUS SPECIES: LEAVES SHOW LOWER TEMPERATURE THRESHOLDS THAN EVERGREEN SPECIES



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temperatures and frequent and severe droughts.

Mahesh Sankaran, professor of ecology and evolution at the National Centre for Biological Sciences (NCBS), Bengaluru, says events of forest diebacks have not been documented in India. But given future climate predictions, identifying which tree species are likely to be susceptible, or alternately resistant, to droughts and extreme temperatures can help us make more informed decisions about the future

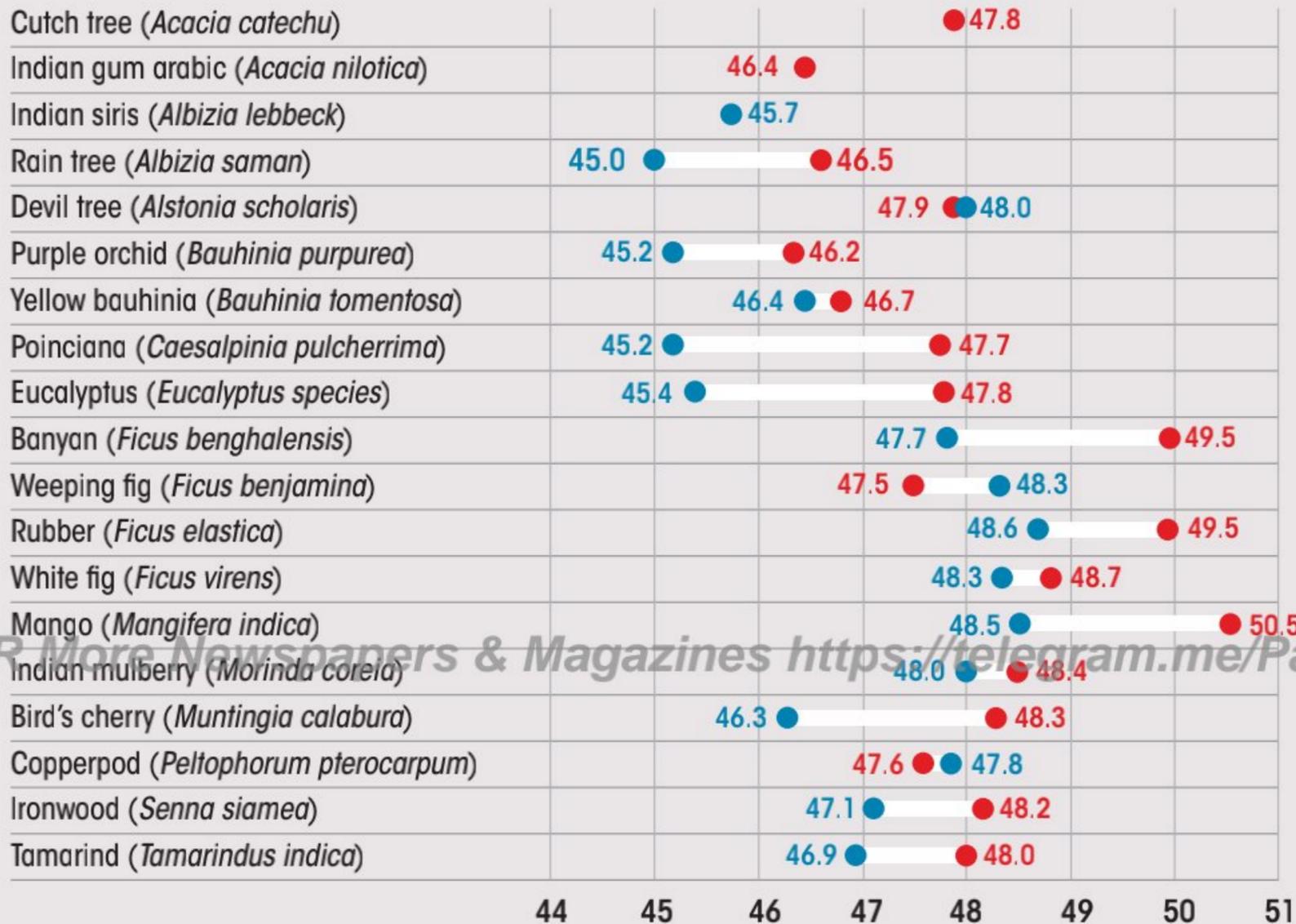
management of our forests. For example, he adds, in restoration efforts, it would make more sense to select tree species that can withstand droughts and extreme temperatures. Sankaran is part of the research that Barua has been spearheading for the past 10 years, along with scientists from NCBS, the Kerala Forest Research Institute, Thrissur, St Joseph's College Devagiri, Calicut, and Leeds University, UK. The group has so far monitored 200 tree species across the Western

Ghats and has quantified their temperature and drought tolerance, beyond which survival of the species may become difficult. The species also include mangroves, montane rainforests, grass, grasses, bamboos, palms, herbaceous plants and grasslands.

To assess climate vulnerability, the group monitors two organs of a tree: leaf and stem. While the leaf reveals temperature tolerance of the species, the stem indicates its tolerance to drought or water loss.

A study of leaves of 41 tree species in Pune shows that they can withstand temperatures ranging from 44.4°C to 50.5°C, depending on the season. Evergreen species, like mango and eucalyptus, show a higher temperature threshold than the deciduous neem or Indian almond

**EVERGREEN SPECIES: LEAVES WITHSTAND HIGHER TEMPERATURES SINCE THEY HAVE A LONGER LIFESPAN AND ENVIRONMENTAL EXPOSURE**



Note: \*English name unavailable Source: "Leaf thermotolerance in tropical trees from a seasonally dry climate varies along the slow-fast resource acquisition spectrum", *Scientific Reports*, September 2017

**LEAF GIVES THE CUE**

"Leaves are the primary organ of a tree that interact with the environment, temperature and light. It is also the organ responsible for many vital functions, such as photosynthesis that helps produce glucose and oxygen, and transpiration that helps maintain the plant's internal temperature," explains Ron Sunny, assistant professor of biology at St Joseph's College Devagiri. Besides, adds Barua, using leaves serves a practical purpose. "Carrying out

experiments by taking a leaf from an individual and studying it in controlled conditions such as a laboratory can bring us closer to representing impacts of an entire tree," he adds.

In fact, in 2014, when Barua started monitoring the trees to assess their vulnerability to climate change, along with another scientist from IISER Aniruddha Sastry, the study primarily relied on the leaves. They would collect leaf samples of 41 tree species, commonly

found in the urban parks of Pune, both during the hot-dry (pre-monsoon) and the cool-wet (monsoon) seasons, and bring those to the laboratory to analyse temperature tolerance. Using a globally recognised method, Barua and Sastry would rehydrate the leaves overnight and then expose those to a range of temperatures, say from 25°C to 55°C, and measure the leaves' efficiency to harvest light for photosynthesis. The temperature at which the leaf's efficiency drops to 50 per cent—

denoted as  $T_{50}$ —is a critical point as beyond this, the leaves undergo irreversible damage, experiencing cell mortality, tissue necrosis and ultimately death.  $T_{50}$  also helps scientists estimate thermal safety margins of the species—indicator of the species' vulnerability to warming—by assessing how close the trees' temperature tolerance is to the maximum temperatures it experiences in the region.

Initial findings of the study, published in *Scientific Reports* in 2017, suggest that most tropical forest tree species in India “may be highly vulnerable to future warming”. Thermal safety margins of the 41 species in Pune are “precariously low” at 3.5°C to 8°C, which implies that the trees are likely to be severely affected by increased temperatures.

When compared with evergreen species like banyan, eucalyptus and mango, the study found that deciduous and fast-growing species with low leaf mass per area, such as teak, Indian almond and frangipani, are likely to be more negatively affected by global warming.

### **STEMS COMPLETE THE TALE**

During the subsequent years, the group has expanded their research to monitor the branches as well. Extreme heat is not the only risk in a warming world. Trees are also vulnerable to droughts and water loss. Sunny says this vulnerability of a plant can be measured by assessing the risk of embolism or damage caused to the plant's vascular tissues due to disrupted water supply. On a pleasant day, Sunny says, the roots “pull” water from the soil and transport it to the leaves through a vascular tissue pipeline in the

branches known as xylem. However, during drought, dry soil “pulls” water threads away from roots. This tug of war, if intensifies, can snap the water threads and lead to embolism or formation of air bubbles in the xylem that ultimately kills the tree.

To determine tree species' tolerance to drought, the scientists bring branches to the field station and measure the water potential in the branch (the amount of water available in the xylem) and estimate the ability of the branch to conduct water. As the branch dries with time, both water potential and conductance decrease. The point at which the water potential that results in a 50 per cent decline in the branch's ability to conduct water is taken as the hydraulic vulnerability thresh-

**DATA SHOWS THAT AT SIRSI, LEAF TEMPERATURES CAN BE UP TO 10°C OR HIGHER THAN AIR TEMPERATURES. THIS SUGGESTS THAT THERMAL SAFETY MARGINS OF THESE SPECIES ARE EXTREMELY LOW**

old, denoted as  $P_{50}$ .

While the findings of the study are yet to be published, the team is constantly at work to further fine-tune the methodology. For instance, says Sunny, hydraulic thresholds are calculated with the assumption that all leaves, irrespective of the species, lose water at the same rate. But this is not the case, and hence the rate at which the leaves lose water may change the threshold risk in plants. The rate may also change depending on the species, geographic location, soil moisture, surrounding temperatures, and time and rate of environmental exposure. “It is not just the threshold, but also how quickly you reach the threshold that counts. Long expo-

sure to heat will put a tree in a dilemma of whether to continue transpiring to cool leaves, or close its stomata to conserve water but stop photosynthesis,” Sunny explains. If trees continually transpire to cool down, they risk dehydration.

“Moreover, a species may not even experience xylem embolism if it has a thick wax coat on the leaf that minimises water loss. This is akin to a person putting on Vaseline balm to lock in moisture on a dry day,” he adds. The scientists are now incorporating these parameters to their research methodology for a robust prediction.

At the same time, they are deploying new tools for real-time leaf temperature data. Leaf temperatures can often be higher than that of the air. Yet in 2017, due to lack of technology, Barua and Sastry based their calculation on ambient temperature. The group now uses a light-weight sensor that remains clipped

to the leaves and transmit the data wirelessly to the scientists' computers on a real time basis. Data shows that at Sirsi, leaf temperatures can be up to 10°C or higher than air temperatures for some species, says Barua. This suggests that the thermal safety margins of these species are extremely low. Simply put, future warming will pose a major challenge for trees in this region.

While there is an urgent need to accurately monitor trees across the country to assess their climate vulnerability, Barua says, the sensors are limited to Sirsi for now, due to resource limitations. Maintaining and analysing data from them involves a lot of time, effort and money, he adds. **DTE** ☒ @down2earthindia



# INTEGRATED ONLINE AND ONSITE TRAINING ON ENVIRONMENTAL IMPACT ASSESSMENT

CSE is conducting an integrated online and onsite training programme on EIA. The training programme will comprise of two parts: Basic learning (online platform) and Advanced learning (at our residential campus). The course is designed to provide an overall understanding of the EIA process which includes theoretical knowledge via lectures from experts and firsthand experience through group exercises, discussions and case studies.

## PROGRAM DESIGN

### PART A

#### BASIC LEARNING (ONLINE)

- Includes sessions on methodology for preparing an EIA, approach for baseline data collection, identification and assessment of impacts along with the Environmental Clearance process.
- Conducted on Moodle Platform where participants will be provided with pre-recorded reading / audio-visual training material which they are expected to self-study as per their convenience. The course material will be for the duration of 2 hours/day

### PART B

#### ADVANCED LEARNING (ONSITE)

- Includes practical experience on assessing impacts for different sector projects.
- Developing Environmental monitoring & management plans;
- Reviewing of EIA reports;
- Understanding the intricacies of the EIA system;
- Working on case studies through group exercises and role play;
- Discussion and knowledge sharing with experts;
- Conducted at CSE's residential campus, Anil Agarwal Environment Training Institute (AAETI) in Tijara, Alwar, Rajasthan.

### COURSE FEES

#### PART A

INR 3000 (Indian participants)  
USD 100 (Non-Indian participants)

#### PART B\*

INR 25,600/- (double occupancy)  
INR 28,000/- (single occupancy)

\* Fees includes accommodation, food, training material and travel from Delhi to the training center and back.

### COURSE DATES

#### ONLINE PART

June 18-27, 2024  
January 14-23, 2025

#### ONSITE PART

September  
17-20, 2024

February  
18-21, 2025

### WHO CAN APPLY

Industry professionals; environment consultants; environment engineers; researchers; academicians, civil society and students aspiring to work in the field of environment.

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Full waiver on online fees for participants applying for onsite programme.

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# TRADE ON EMISSIONS

EU's Carbon Border Adjustment Mechanism, a tariff on imports, is designed to protect European industries in the guise of climate action.

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The carbon tariff would hurt developing countries' export earnings and shift the decarbonisation burden on them, while overlooking developed nations' climate responsibilities and green funding failures

**TRISHANT DEV** and  
**AVANTIKA GOSWAMI**



**T**HE GLOBAL race to build a low-carbon economy is gaining momentum. But this much-needed push to reduce greenhouse gas (GHG) emissions has raised concerns about economic rivalry and trade protectionism. Under the guise of climate action, developed countries are trying to protect their domestic manufacturers from global competition while shifting their environmental responsibilities on others.

The European Union's (EU's) Carbon Border Adjustment Mechanism (CBAM) is a clear example of this. The initiative aims to impose a carbon tariff on imports of energy-intensive products, based on the GHG emissions generated during their production.

India, in its Economic Survey report released in July 2024, ahead of the Union Budget 2024-25, argues that CBAM and similar proposed measures from the US and the UK violate the Paris Agreement's principle of "Common but Differentiated Responsibilities" as developed countries shift the burden of climate finance from the Global North to the Global South through carbon taxes.

India's concerns are echoed by other developing nations. In June, South Africa condemned CBAM during the Ministerial Declaration for the High-Level Political Forum for Sustainable Development 2024, calling it an "extraterritorial, unilateral, coercive, and trade-distorting measure disguised as climate protection." In 2023, at the 28<sup>th</sup> Conference of the Parties (COP28) to the UN Framework Convention on Climate Change (UNFCCC) in Dubai, countries like Brazil, Egypt and China, along with blocs such as the 54-member Group of African States, and the newly industrialised group of countries, comprising Brazil, South Africa, India and China (BASIC), voiced fears that these measures could harm their economies and undermine poverty eradication efforts. The impact could be particularly severe over the short to medium term, affecting the competitiveness of developing countries' export-oriented industries.

The EU introduced CBAM in October 2023, as part of its "Fit for 55" package that aims



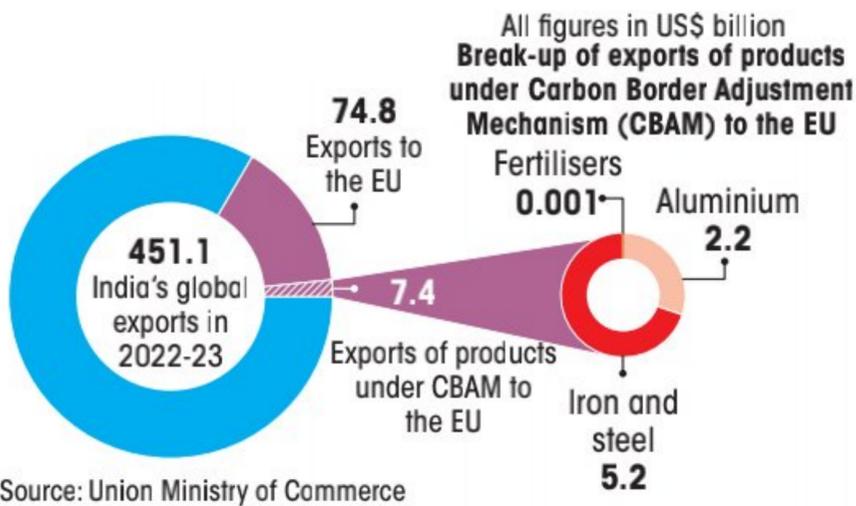
to reduce the region's GHG emissions by at least 55 per cent by 2030. At present, EU importers in six high-emission sectors—iron and steel, cement, electricity, hydrogen, fertilisers and aluminium—are required to report the GHGs emitted during the production of their imported goods (production emissions) at the end of each quarter under CBAM. Starting in 2026, the importers will be required to pay a carbon tariff on these goods, and by 2030, the EU plans to expand the list of sectors covered under CBAM (see 'It is all about trade', p29).

The EU argues that CBAM is essential to maintain the effectiveness of its emissions trading system (ETS), a mechanism introduced in 2005 to reduce emissions of domestic industries. Under ETS, companies in high-

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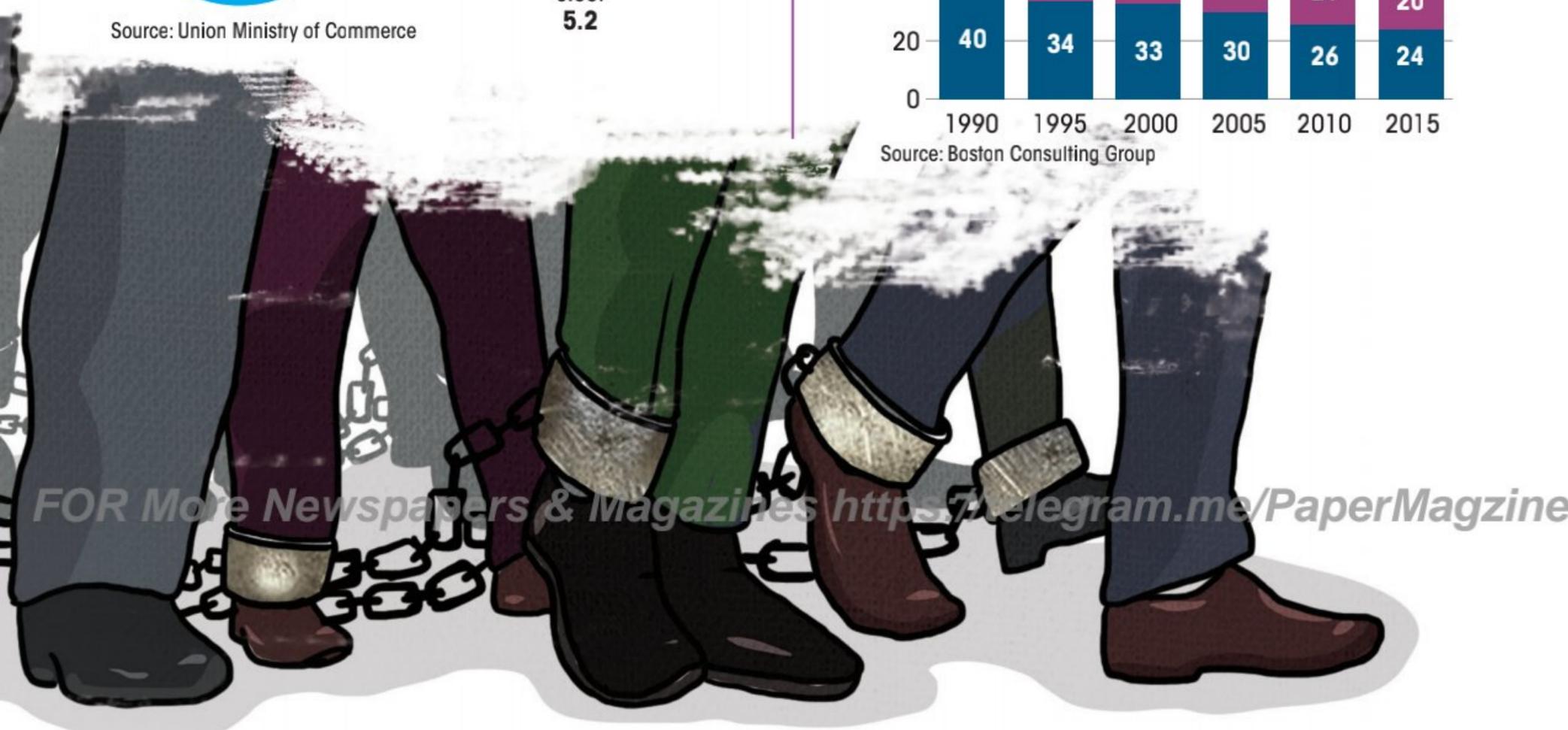
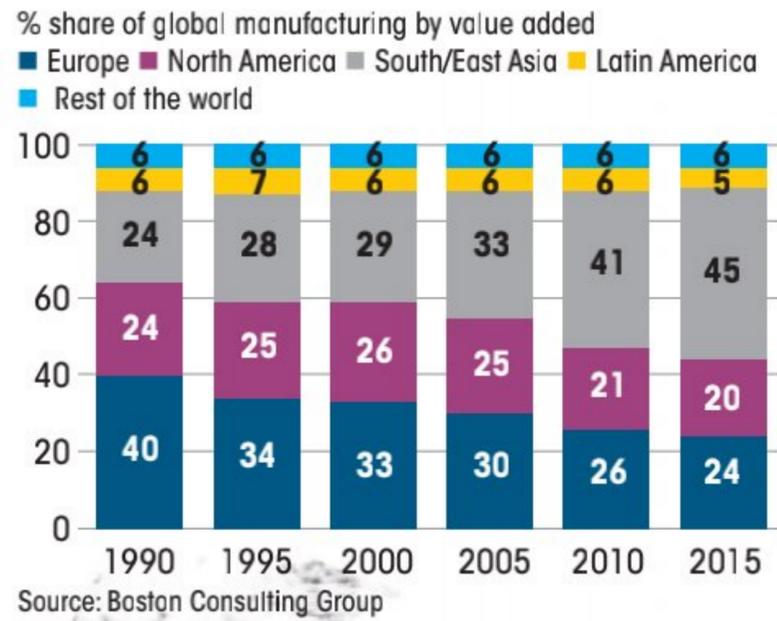
## INDIA'S EXPORT WORRIES

Nearly 10% of India's total exports to the EU in 2022-23 were from sectors covered by CBAM



## DELIBERATE SHIFT

In the 1990s, Europe began outsourcing production to cut costs, reducing its share of global manufacturing to 24% by 2015



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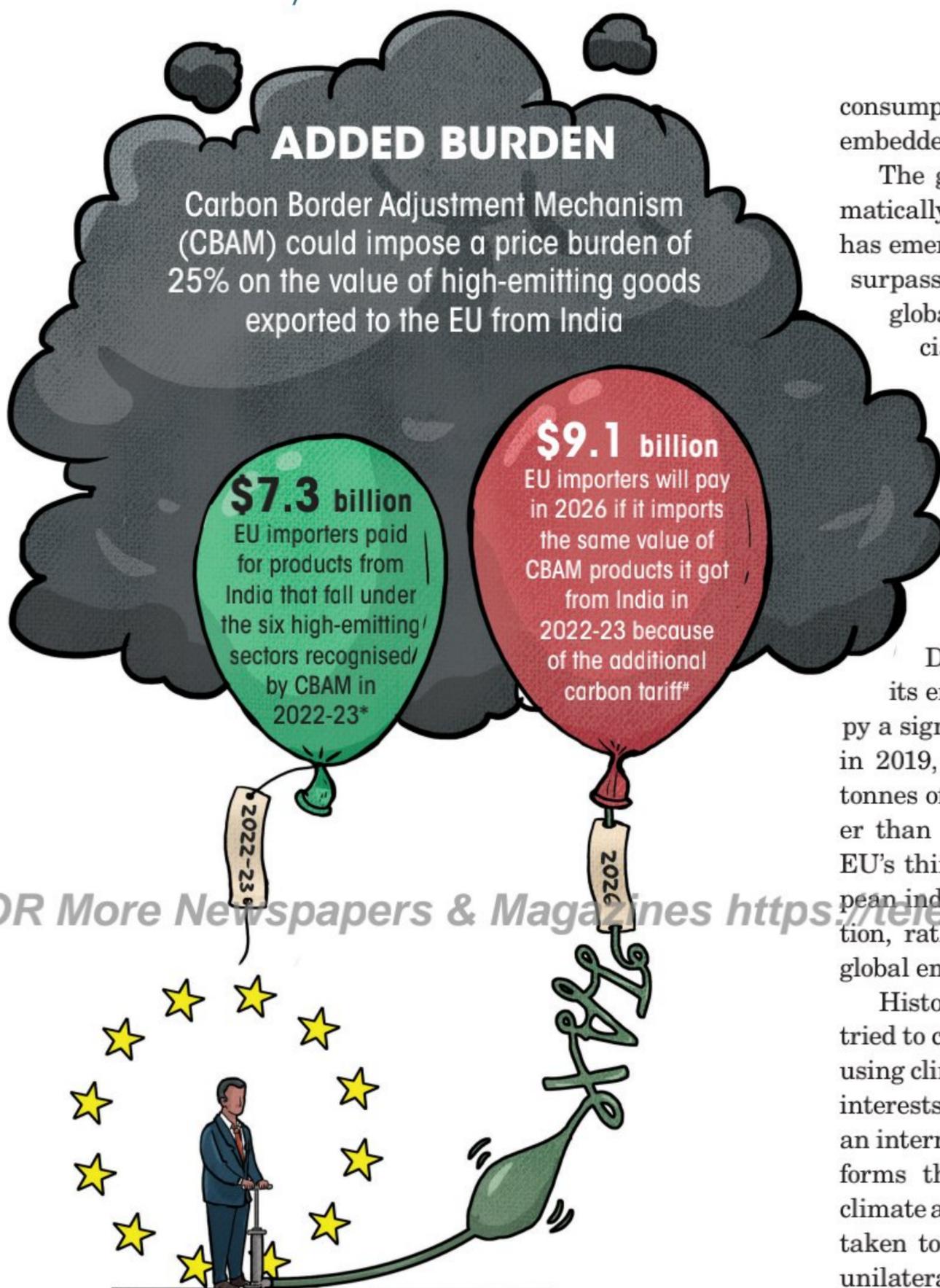
emitting sectors need to purchase EU allowances at the beginning of the year to cover their emissions. At the end of the year, companies must surrender the allowances equal to their actual emissions to the EU. These can be traded on the secondary market, enabling companies with excess allowances to sell them to those needing more.

Currently, the EU provides the bulk of these allowances for free to level the playing field for domestic industries compared to imports. However, this practice has reduced the incentive for industries to decarbonise. To address this, the EU plans to phase down free allowances and levy CBAM tariff on imports by 2026. The EU justifies CBAM as a necessary measure to prevent "carbon leakage," where industries relocate to regions

with weaker environmental regulations because of rising domestic carbon costs. However, there is no historical evidence to support this claim. In reality, production costs alone are not the primary factor driving companies to relocate; such moves involve significant expenses and potential loss of market share, while impacting brand image.

### IN THE NAME OF CLIMATE

The EU's current approach with CBAM marks a significant shift from the policies of the 1990s, when developed countries were focused on promoting free trade and seamless international commerce. During that era, wealthy nations sought to reduce production costs by relocating industries to countries like China, where labour was



\*CBAM sectors include iron and steel, cement, electricity, hydrogen, fertilisers and aluminium. In 2022-23, the EU imported CBAM-regulated products from India worth \$7.4 billion, though this calculation excludes the value of 13 iron and steel products due to unavailable weight data. As a result, the total export value is estimated at \$7.3 billion. #The CBAM tariff is calculated by multiplying the total production emissions of CBAM-covered products exported from India to the EU in 2022-23 by a carbon tariff of €100 (or US \$106) per tonne. Source: "CBAM: The Global South's Response to a Changing Trade Regime in the Era of Climate Change" report, Centre for Science and Environment, 2024

cheaper, regulations were less stringent and environmental standards were often overlooked. This allowed them to maintain economic growth at home through lower production costs. In effect, wealthy nations not only offshored their industries to developing countries but also "imported" emissions through high rate of

consumption—a phenomenon known as embedded emissions.

The global landscape has changed dramatically over the past three decades. China has emerged as the world's largest exporter, surpassing the US, and its dominance in global trade has only increased, especially after the economic disruptions caused by the COVID-19 pandemic. Meanwhile, Europe's share in global manufacturing has dwindled, shrinking from 40 per cent in 1990 to just 24 per cent in 2015, according to global consulting firm Boston Consulting Group (see 'Deliberate shift', p23).

Despite outsourcing a large share of its emissions, the EU continues to occupy a significant portion of the carbon space; in 2019, its per capita emissions were 6.5 tonnes of carbon dioxide—three times higher than India's. Thus, CBAM appears to be EU's thinly veiled attempt to protect European industries from international competition, rather than a genuine effort to curb global emissions.

Historically, developed countries have tried to converge trade and climate agendas, using climate action as a tool to benefit trade interests. This is despite the fact that UNFCCC, an international treaty reached in 1992 that forms the basis of all subsequent global climate agreements, specifies that "measures taken to combat climate change, including unilateral ones, should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade".

### RESPONSIBILITY OUTSOURCED

For developing countries, CBAM poses a significant financial challenge. According to the World Bank's CBAM Exposure Index study in June 2023, nations with high export dependence on the EU and carbon-intensive production chains will be the most severely impacted. Another study by the Asian Development Bank (ADB) indicates that if the CBAM tariff is set at €100 or US \$106 per tonne (the highest value of EU allowances in

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## IT IS ALL ABOUT TRADE

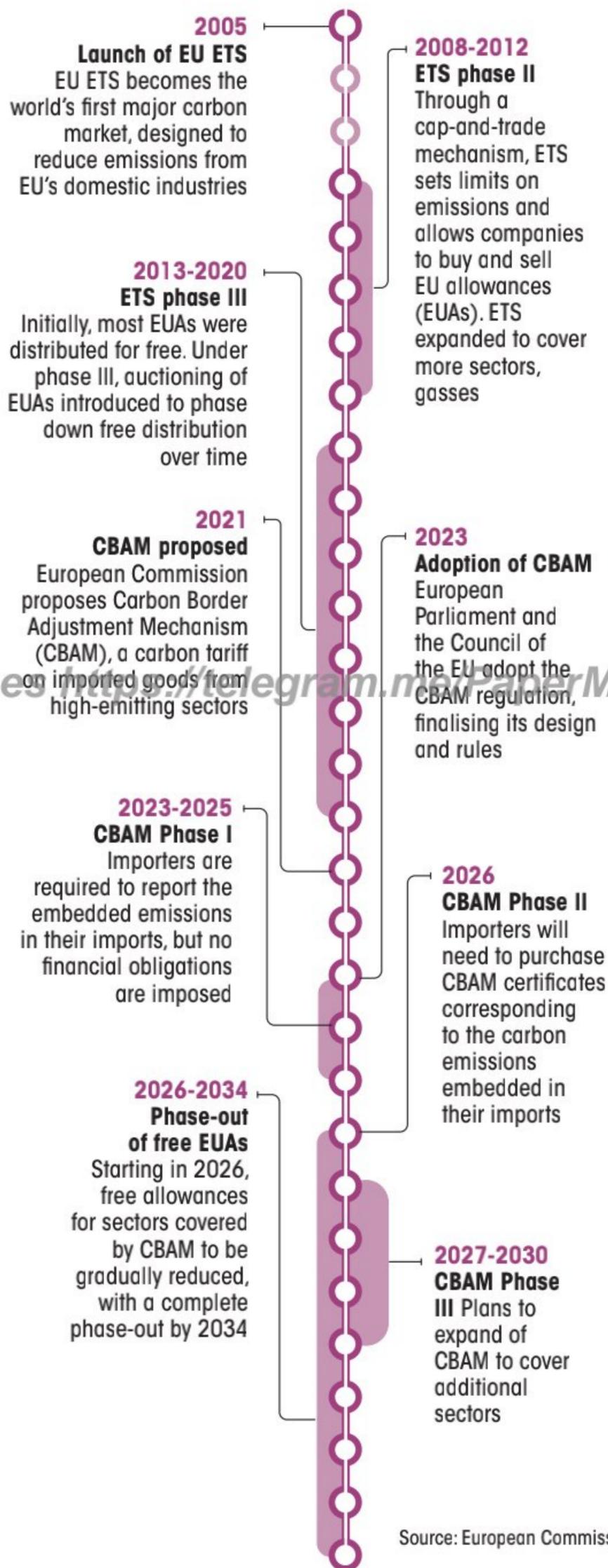
EU claims that Carbon Border Adjustment Mechanism will create a level playing field for domestic producers who are subject to its emissions trading system (ETS)

2023), it will reduce global emissions by only 0.2 per cent, while causing considerable disruption to global trade. The study shows that CBAM could lead to a 1.1 per cent decline in Asia's exports to the EU. The CBAM tariff will be equivalent to the traded price of EU allowances. A 2009 study by the US-based Brookings Institution and Syracuse University found that any emission reductions resulting from CBAM would primarily come from decreased international trade and not through cleaner production. As a result, it will lower global gross domestic product and not necessarily emissions.

An analysis by Delhi-based non-profit Centre for Science and Environment (CSE) suggests that the tariff could increase the cost of India's exports to the EU of products under CBAM sectors by nearly 25 per cent (see 'Added burden', p24). The analysis, published in July 2024 in the report "CBAM: The Global South's Response to a Changing Trade Regime in the Era of Climate Change," is based on the total CBAM-affected goods that India exported to the EU in 2022-23 and assumes a carbon tariff of €100 or roughly \$106 per tonne. The EU accounts for nearly 17 per cent of India's exports, with CBAM-affected products representing \$7,414 million, or 1.64 per cent of the country's total exports.

The CSE report adds that if the requirements for measuring and verifying carbon content under CBAM are overly complex, they could act as a non-tariff barrier, creating excessive administrative burdens. India's micro, small and medium enterprises, which accounted for 43.59 per cent of exports in 2023-24, would likely struggle with the additional measurement and reporting demands. "The capacity to measure emissions requires skilled personnel, resources and sophisticated frameworks—assets that are often lacking in developing economies. In contrast, the EU has over 15 years of experience with monitoring, reporting, and verification through its ETS, highlighting the disparity in capabilities between the EU and non-ETS countries," it adds.

Another challenge is that the cost under CBAM will be calculated based on the emis-



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## RESIDENTIAL TRAINING

### DECENTRALISED RENEWABLE ENERGY (DRE)

# Solarising India's Agriculture

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India's agricultural success hinges on a reliable water supply, a challenge considering its dependence on unpredictable monsoons. Solutions have emerged in the form of tubewells and diesel water pumps. However, traditional pumps, powered by the erratic grid or expensive diesel generators, leave farmers vulnerable to delays and economic stress.

This is where solar water pumps have stepped in as a solution. These pumps utilise photovoltaic technology, converting sunlight into clean electricity to power pumps that draw water from underground or surface sources. This eliminates reliance on the unreliable grid and polluting diesel generators. But there are challenges. The PM KUSUM scheme, launched in 2019 with aim of promoting solar irrigation, has only achieved 30 per cent of its targeted installations. Bridging the gap between policy and implementation is crucial to meet the target by its March 2026 deadline.

Centre for Science and Environment (CSE) is offering a tailor-made three-days residential training programme on 'Solarising India's Agriculture' with the objective to bridge the knowledge gap and develop specific skills for enabling relevant stakeholders.

#### COURSE FEE:

- **Rs 21,000** for Indian participants
- **US \$300** for foreign participants

- The fee is waived for government officials, CSOs and farmers/FPOs.
- For the rest, course fee is inclusive of travel between Delhi and the training institute, accommodation, food, and training charges.
- Costs of travel to Delhi and back for all nominated officials and other participants will have to be borne by the nominating authority, or by the participants themselves.

**PARTICIPANTS WHO COMPLETE THE TRAINING WILL BE AWARDED A 'CERTIFICATE OF COMPLETION' BY CSE.**

#### COURSE COORDINATOR

**VAANI KHANNA**

Research Associate, Renewable Energy Unit, CSE  
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**Note:** Registration is not a guarantee of acceptance of admission in the training programme. Limited seats available (a maximum of up to 40).

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## 2 EXPOSURE VISITS

### WHAT WILL THIS TRAINING COVER?

- Impacts of solarising irrigation in agriculture and associated challenges
- How to determine water requirements and energy needs of irrigation systems
- How to conduct a solar PV energy resource assessment
- Landscape of support schemes, including PM KUSUM, and how to avail them
- The economic benefits, both for government and farmers
- Agricultural subsidies, focusing on electricity subsidies for agriculture in India
- Applications of the scheme alongside other DRE systems
- Site visit to a farm for demonstration of solar water pumps

### WHO CAN APPLY?

- Representatives from state nodal agencies including agriculture department officials
- Civil society organisations (CSOs)
- Solar water pump developers
- Entrepreneurs and start-ups
- Beneficiaries including farmers, FPO representatives, panchayat officials, etc

sions intensity of the producing countries. This means EU traders will have to pay more under CBAM for imports from developing nations, compared to imports from developed countries. For example, if an EU importer gets 100 tonnes of crude steel from both India and the US, the value of the CBAM tariff on the Indian shipment would be approximately \$22,260, while the tariff value on the US shipment would be \$10,600, assuming a carbon tariff of €100 or roughly \$106 per tonne (see 'Discriminatory fee'). This difference arises because the emissions intensity of crude steel production in India is 2.1 tonnes of CO<sub>2</sub> per tonne, compared to 1 tonne of CO<sub>2</sub> per tonne in the US, according to US-based consultancy firm Global Efficiency Intelligence. By tying a carbon tariff to production emissions, CBAM overlooks UNFCCC which, under articles 3 and 4, mandates that developed countries take the lead in reducing emissions and provide financial and technological support to help developing nations lower their carbon intensity.

sectors in exporting countries requires economy-wide mitigation strategies and sustained international financial resources. Rather than helping in implementing such mitigation initiatives, CBAM adds an extra cost burden and acts as a trade barrier. It is unlikely to incentivise decarbonisation, especially when developing countries are expected to fund this entirely from their domestic budgets.

### UNILATERAL IN NATURE

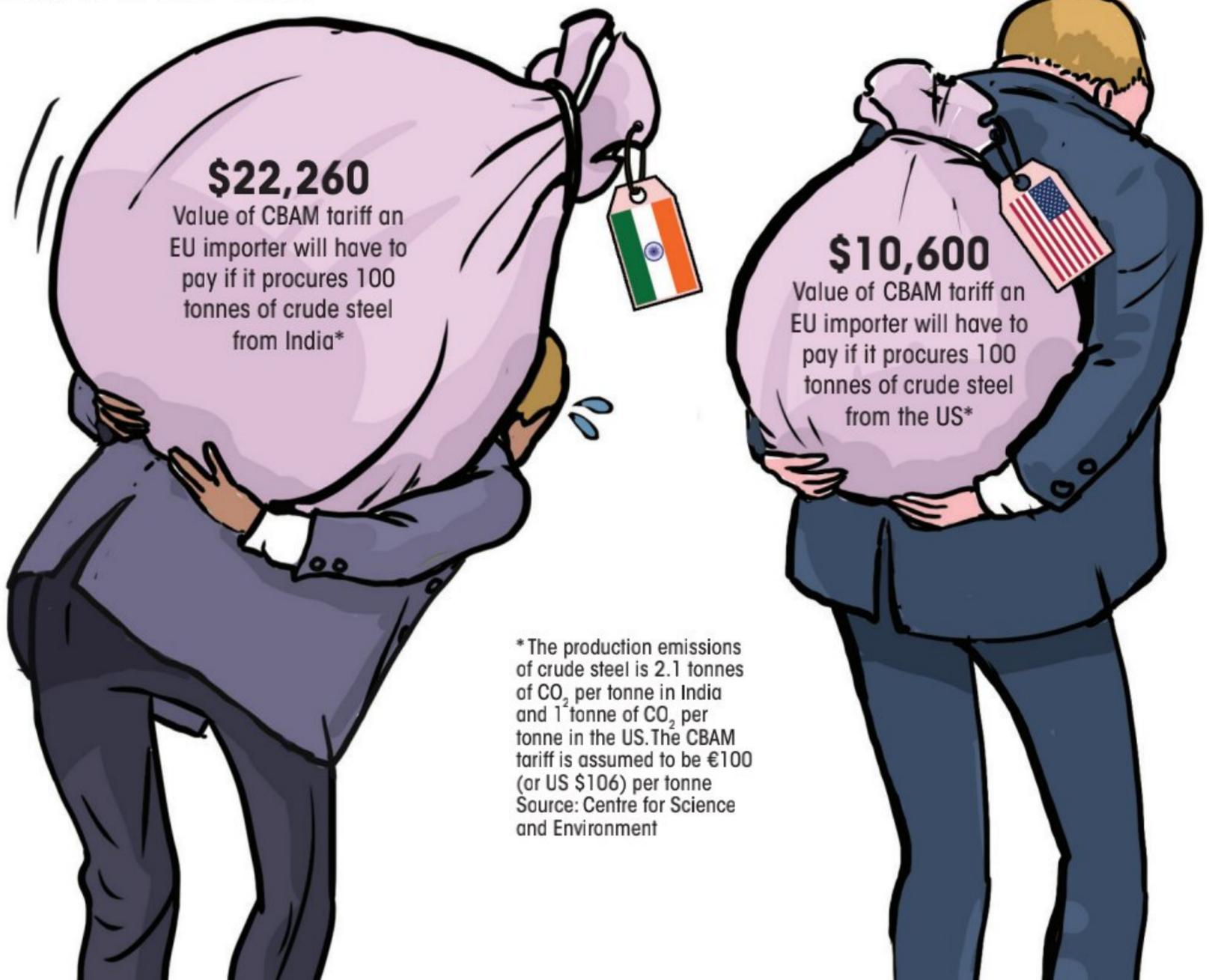
The inclusion of CBAM in the EU's regulatory framework has also sparked concerns about its compatibility with World Trade Organization (WTO) principles, particularly those related to non-discrimination and fair competition. While the EU asserts that CBAM complies with WTO principles, many developing countries argue that it is designed to protect EU industries from competition.

The carbon border mechanism could be in conflict with the WTO's Technical Barriers to Trade Agreement, which aims to harmonise technical regulations globally,

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## DISCRIMINATORY FEE

EU importers will pay 1.1 times higher tariff under Carbon Border Adjustment Mechanism (CBAM) for importing goods from India compared to the US, due to India's higher production emissions



\* The production emissions of crude steel is 2.1 tonnes of CO<sub>2</sub> per tonne in India and 1 tonne of CO<sub>2</sub> per tonne in the US. The CBAM tariff is assumed to be €100 (or US \$106) per tonne  
Source: Centre for Science and Environment



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and the “most-favoured nation” principle, which requires equal treatment for all WTO members. According to these rules, similar products imported from different countries should not be discriminated against based on their production processes. For example, aluminium products from China should be treated the same as those from the US.

The unilateral nature of CBAM raises the risk of a global trade war. Following the EU’s lead, the UK plans to introduce its own CBAM in 2027. Meanwhile, the US is considering several new regulations, including the Providing Reliable, Objective, Verifiable Emissions Intensity and Transparency (PROVE IT) Act, Foreign Pollution Act, Clean Competition Act and the Market Choice Act. These measures would scrutinise the carbon intensity of production, impose fees on emission-intensive imports, levy carbon intensity charges on both domestic and imported products, and tax fossil fuel combustion and imports, respectively. Other countries are also contemplating border tariffs and retaliatory measures in response to the EU’s CBAM.

Non-profit African Climate Foundation has developed scenarios for joint implementation of CBAM by the EU, US, UK, Canada and Japan, with a carbon tariff set at €40 or roughly \$42 per tonne. The model predicts a decline in the economies of Africa and India by 0.73 per cent and 0.69 per cent, respectively, with corresponding reductions in CO<sub>2</sub> emissions of 0.39 per cent and 0.34 per cent.

## OPT FOR A JUST CALL

The EU expects CBAM to generate approximately \$1.5 billion annual revenue by 2028. This number could rise to \$15.2 billion by 2030, suggests a February 2024 study by ADB. According to CSE, developing countries should demand that the EU allocates CBAM revenues to a decarbonisation fund to support cleaner manufacturing in exporting nations. This fund could be modelled after the EU’s Modernisation Fund, which finances clean energy projects in lower-income EU member states through revenue from the ETS. Given that the EU is responsible for 22 per cent of

historical CO<sub>2</sub> emissions, such an initiative would be a positive and fair step forward.

Additionally, developing countries should urge the EU to increase its climate finance contributions. This is not just a matter of fairness, but a pragmatic recognition of the challenges these countries face in achieving decarbonisation. Even the UNFCCC states that countries must look at the “impact of the implementation of (climate) response measures,” within and beyond national boundaries. Article 4.8 of UNFCCC further mandates that “Parties must address the needs of developing countries through funding, insurance, and technology transfer to mitigate adverse effects from climate change and/or the impact of the implementation of response measures”.

The developing countries heavily reliant on EU exports could consider implementing a domestic carbon tax on goods at the point of export to avoid paying the CBAM tariff. The revenue from this tax could be directed into a government-managed decarbonisation fund, supporting the green transition of domestic industries.

In the short- to medium-term, industries in emerging economies could also adjust production processes to meet market demands, allocating greener production methods to exports destined for CBAM regions. For example, a steel manufacturer could deploy the direct-reduced iron process, which emits less carbon, for exports to the EU, while continuing to use the more carbon-intensive blast furnace process for markets where cost is prioritised over environmental concerns. This strategy would help industries minimise CBAM-related costs and allow time for a gradual transition to greener practices.

Moreover, countries with minimal historical responsibility for climate change could impose a “historical polluter fee” on trade partners, based on their share of CO<sub>2</sub> emissions. For instance, if a trade partner accounts for 22 per cent of cumulative global emissions, a 22 per cent tax on imports from that country could be levied, with the revenue used for decarbonisation efforts. **DTE**

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# JOINING THE CARBON CLUB

India's carbon market will soon be a reality, but will it fulfil its aim of reducing emissions? A report by **PARTH KUMAR** and **MANAS AGRAWAL**

INDIA IS on the verge of creating a carbon market. The move will set emissions targets for emitters and allow overachievers to sell their excess emission cuts, while underachievers will have to purchase them to meet their goals. The market will be created once the Carbon Credit Trading Scheme (CCTS), notified in June 2023, comes in force.

In August 2024, the Bureau of Energy Efficiency (BEE), which will implement CCTS, released the scheme's compliance procedure (see 'Evolution of...'). But emission targets, which will determine CCTS' effectiveness, are yet to be announced. BEE officials say CCTS will likely take effect by 2026.

Simply put, CCTS is a market-based mechanism to reduce or limit emissions. Its genesis lies in India's commitment to meet its Nationally Determined Contributions—emissions reduction target for 2030 committed under the Paris Agreement of 2016. One of India's targets is to reduce the "emissions intensity of its GDP by 45 per cent from 2005 levels by 2030". In 2021, India also declared the target of becoming a net-zero emitter by 2070. These global commitments and the increasing impacts of climate change on India generated a need to limit emissions, leading to the government to launch new policies and instruments. CCTS is one such instrument.

The Carbon Border Adjustment Mechanism (CBAM), a tariff to be imposed by the European Union from 2026 (under which the bloc will put an additional price on imported products on the basis of greenhouse gases

emitted in manufacturing them) and the development of carbon markets by developing countries like China and Indonesia, have also likely driven India towards CCTS. The challenge, however, is to ensure that the scheme fulfils its purpose of reducing emissions. Here's how the CCTS will work.

## INDIAN CARBON MARKET

Created by an Act of Parliament, CCTS will be a compliance market and operate by the baseline-and-credit system (see 'Carbon glossary'). The scheme will be based on emissions intensity (the volume of emissions per unit of product) and will not have an overall emission cap for the emitters.

CCTS will initially cover four industrial sectors: iron and steel; cement; pulp and paper; and petrochemicals. In the near future, the government plans to cover nine industrial sectors, says the BEE Indian carbon market dashboard. With the four sectors, the emission coverage of the scheme is less than 10 per cent of India's total emissions. Even with nine sectors, the coverage



## EVOLUTION OF INDIAN CARBON MARKET

With the launch of Carbon Credit Trading Scheme, India will soon have a national carbon market

- **OCTOBER 2021**  
Draft blueprint for stakeholder consultation
- **OCTOBER 2022**  
Policy paper on Indian Carbon Market (ICM)
- **DECEMBER 2022**  
Enactment of Energy Conservation (Amendment) Act creates Carbon Credit Trading Scheme (CCTS)
- **JUNE 2023**  
CCTS notified
- **NOVEMBER 2023**  
Bureau of Energy Efficiency releases documents on CCTS compliance mechanism
- **DECEMBER 2023**  
Amendments to CCTS to notify offset mechanism
- **AUGUST 2024**  
BEE launches detailed compliance procedure for CCTS and accreditation process for carbon verification agencies

would still be less than 20 per cent, as per an estimate by the Centre for Science and Environment (CSE), a Delhi-based think tank.

The scheme proposes an offset mechanism through the domestic voluntary carbon market (or VCM, see 'Carbon glossary'), as per a December 2023 notification by the Union Ministry of Power. Under this, companies can compensate for their emissions through carbon-dioxide-saving projects (such as renewables) registered in the domestic VCM. But CCTS does not mention the percentage of

## CARBON GLOSSARY

Genesis, types, functioning of carbon markets

**IN 1997**, the Kyoto Protocol introduced greenhouse gas (GHG) emission reduction targets for developed countries and the market mechanisms to help them meet the targets. This created a new commodity—emission reduction/removal, along with a corresponding market. Since carbon dioxide (CO<sub>2</sub>) is the main greenhouse gas, emission reduction units and their trading markets are simply referred to as **carbon credits** and **carbon markets**. One carbon credit equals 1 tonne of CO<sub>2</sub> or carbon dioxide equivalent (CO<sub>2</sub>e).

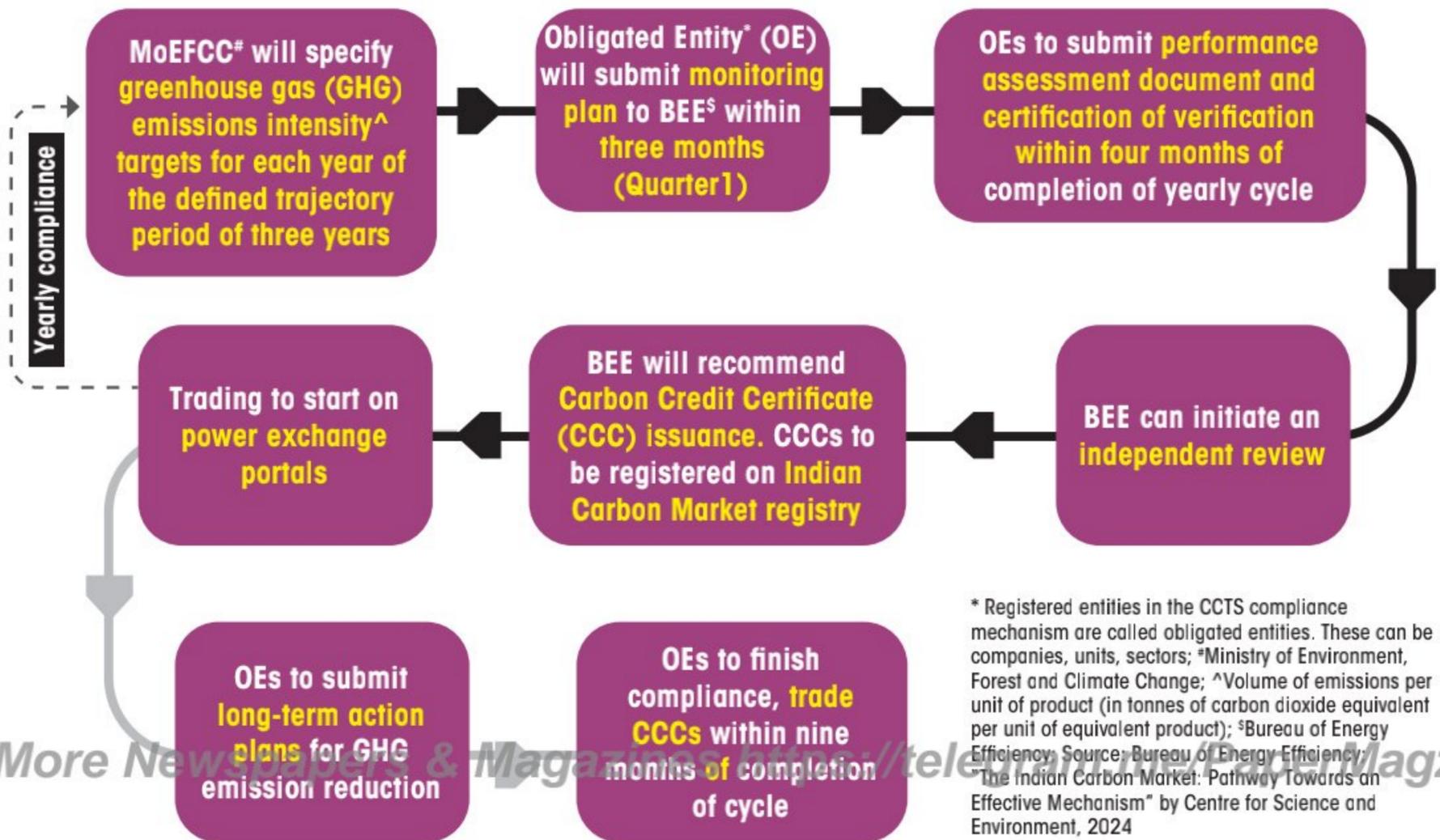
There are two types of carbon markets—compliance and voluntary. **Compliance carbon markets** are created and regulated by national, regional, supranational or international governments or bodies, where the regulated entities (units/companies/sectors) have a limit on their emissions, but can buy or sell allowances (volume of emissions allowed) or carbon credits with other regulated entities. **Voluntary carbon markets** (or VCMs, also called offset markets) are national and international markets where entities can offset their emissions by buying credits generated by carbon offset projects such as biogas plants and renewables. Unless explicitly accepted into the compliance regime, voluntary offset market credits are not allowed to fulfil compliance market demand.

Compliance carbon markets are instituted within an emission trading systems, which mostly operate in two ways: (i) cap-and-trade and (ii) baseline-and-credit. In **cap-and-trade**, a central authority, usually a government body, limits the aggregate emissions from a group of emitters by setting a 'cap' (limit) on maximum emissions. In this system, the government grants the right to emit pollutants through emission allowances, which are initially distributed, usually for free or through auctions, for the amount of emissions equivalent to the cap. Based on target achievement, the entities can trade these allowances/credits in the market. The total number of permits/allowances or credits cannot exceed the cap.

In **baseline-and-credit system**, there is no limit on the overall total emissions, but there is an emissions baseline. Reducing emissions below this baseline generates credits that can be sold to entities that have emitted beyond their baseline. Baseline emission levels are often set for individual entities within a sector. The baseline is usually defined on the basis of **emission intensity** (volume of emissions per unit of product) rather than an absolute figure. Growing economies typically adopt baseline-and-credit system because though overall emissions tend to increase under it, the rate of emissions growth falls.

## Compliance cycle

India's Carbon Credit Trade Scheme (CCTS) will likely become operational in 2026. This is how it will allow obligated entities\* to trade carbon credits and comply with emissions reduction norms:



emissions that an entity can offset through VCM. Globally, major carbon markets have limited the offset mechanism to 5 per cent of the unit's emissions mainly because of integrity issues and their cheaper costs compared to cutting their own emissions.

CCTS is modelled on India's ongoing Perform Achieve and Trade (PAT) scheme. PAT was launched in 2012 as a competitive mechanism for reducing energy use in large industries. Under PAT, the government shortlists industries, gives them energy efficiency targets, and defines a time limit for the achievement of targets. Industries have to, in turn, work towards improving their energy efficiency. Industries that are given targets under the scheme are called designated consumers. The industries that overachieve their targets are issued energy savings certificates (ESCs) that can be traded with industries that have not achieved their targets. It is important to note that India

will transition from the PAT scheme to CCTS. CCTS is, therefore, dependent on the PAT scheme in multiple ways. For instance, the selection of obligated entities from high-emitting industrial sectors in CCTS will be based on PAT. The multiple challenges faced in PAT (such as delay in compliance cycles, excess supply of energy certificate and non imposition of penalties) could raise vulnerabilities of CCTS.

## GLOBAL LEARNINGS

As BEE is in the process to develop the Indian carbon market, CSE has conducted a study to collate learnings from emissions-related schemes in the world's major carbon markets: European Union Emissions Trading System or EU ETS (the first emission trading system), Korea ETS (the first Asian carbon market), China ETS (the largest carbon market in terms of emission coverage) and India's Surat ETS for particulate matter

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emissions. The analysis also covers the PAT scheme. Based on these learnings, CSE identifies these challenges for CCTS:

**Low price of carbon credit and low market liquidity:** Many carbon markets have initially had low carbon prices and market liquidity. Korea ETS faced the issue because of low market participation by industries, China ETS gave too many exemptions to power plants and EU ETS had a huge influx of offset credits. India's PAT scheme had also faced the challenge of low pricing and excess availability of certificates.

**Unambitious target setting:** PAT scheme has faced criticism for its goal-setting, which was perceived as lacking ambition. This led to overachievement of targets and an oversupply of ESCerts, leading to their poor market price. CCTS must set ambitious targets for individual entities and sectors, taking into account best practices and existing policy targets to ensure the market drives genuine

progress rather than mere compliance.

**Dependence on PAT scheme:** This is one of the biggest challenges. PAT is an ongoing scheme, and running both the schemes in parallel can create confusion among the entities. Currently, the plan is that entities that complete their PAT cycle will receive CCTS targets. This might only shortlist entities that have completed the cycle and not necessarily the biggest emitters. It will also limit emissions coverage. It could also disorient companies that have different entities under different schemes.

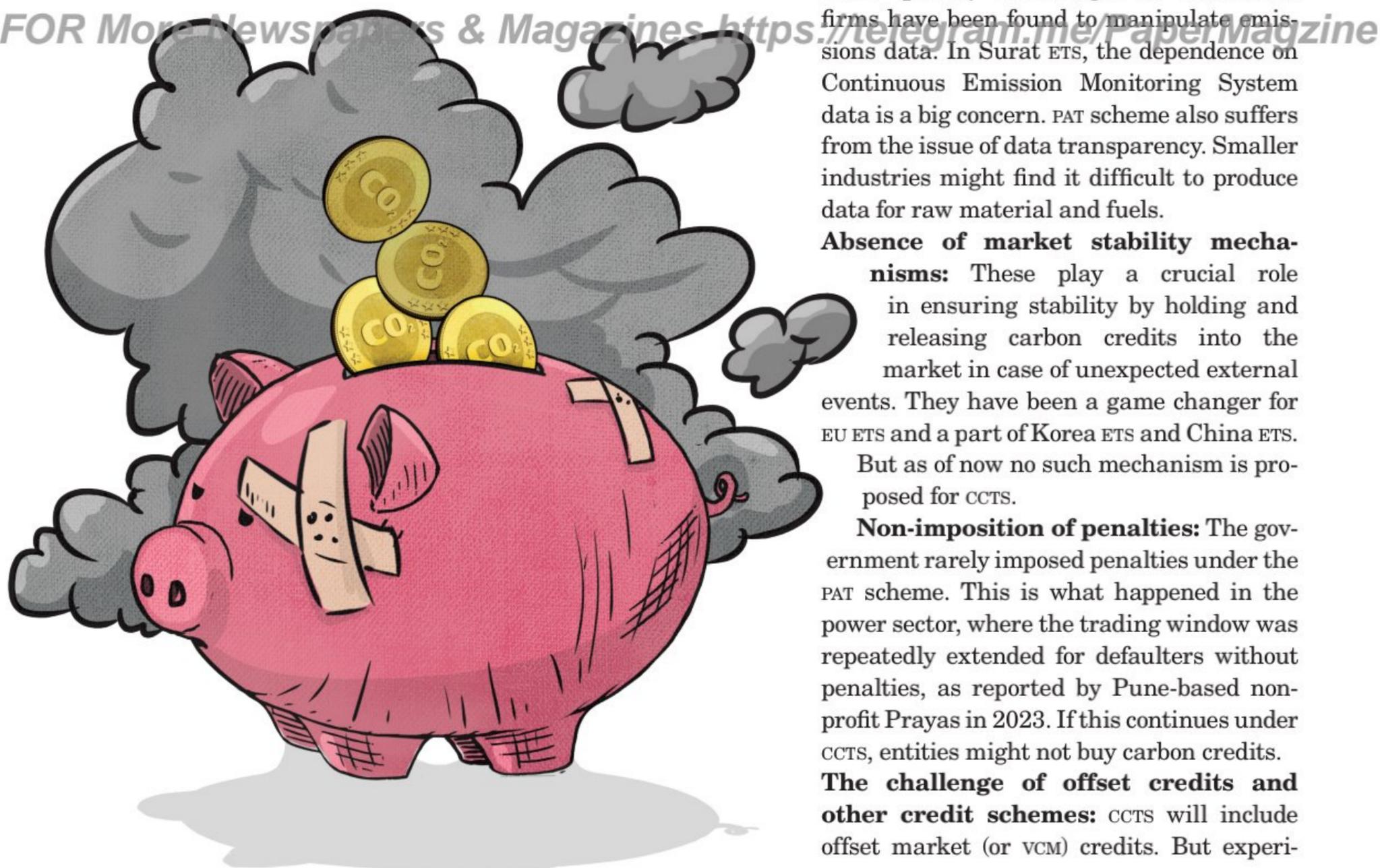
**No revenue generation:** ETS schemes around the world have a way of generating revenue through auctioning allowances (emissions an industry is allowed to emit) which are then allotted for modernisation; to support new entrants, small businesses and affected communities; and for financing decarbonisation. But CCTS does not have a clause for revenue generation.

**Data quality challenge:** In China ETS, firms have been found to manipulate emissions data. In Surat ETS, the dependence on Continuous Emission Monitoring System data is a big concern. PAT scheme also suffers from the issue of data transparency. Smaller industries might find it difficult to produce data for raw material and fuels.

**Absence of market stability mechanisms:** These play a crucial role in ensuring stability by holding and releasing carbon credits into the market in case of unexpected external events. They have been a game changer for EU ETS and a part of Korea ETS and China ETS. But as of now no such mechanism is proposed for CCTS.

**Non-imposition of penalties:** The government rarely imposed penalties under the PAT scheme. This is what happened in the power sector, where the trading window was repeatedly extended for defaulters without penalties, as reported by Pune-based non-profit Prayas in 2023. If this continues under CCTS, entities might not buy carbon credits.

**The challenge of offset credits and other credit schemes:** CCTS will include offset market (or VCM) credits. But experi-





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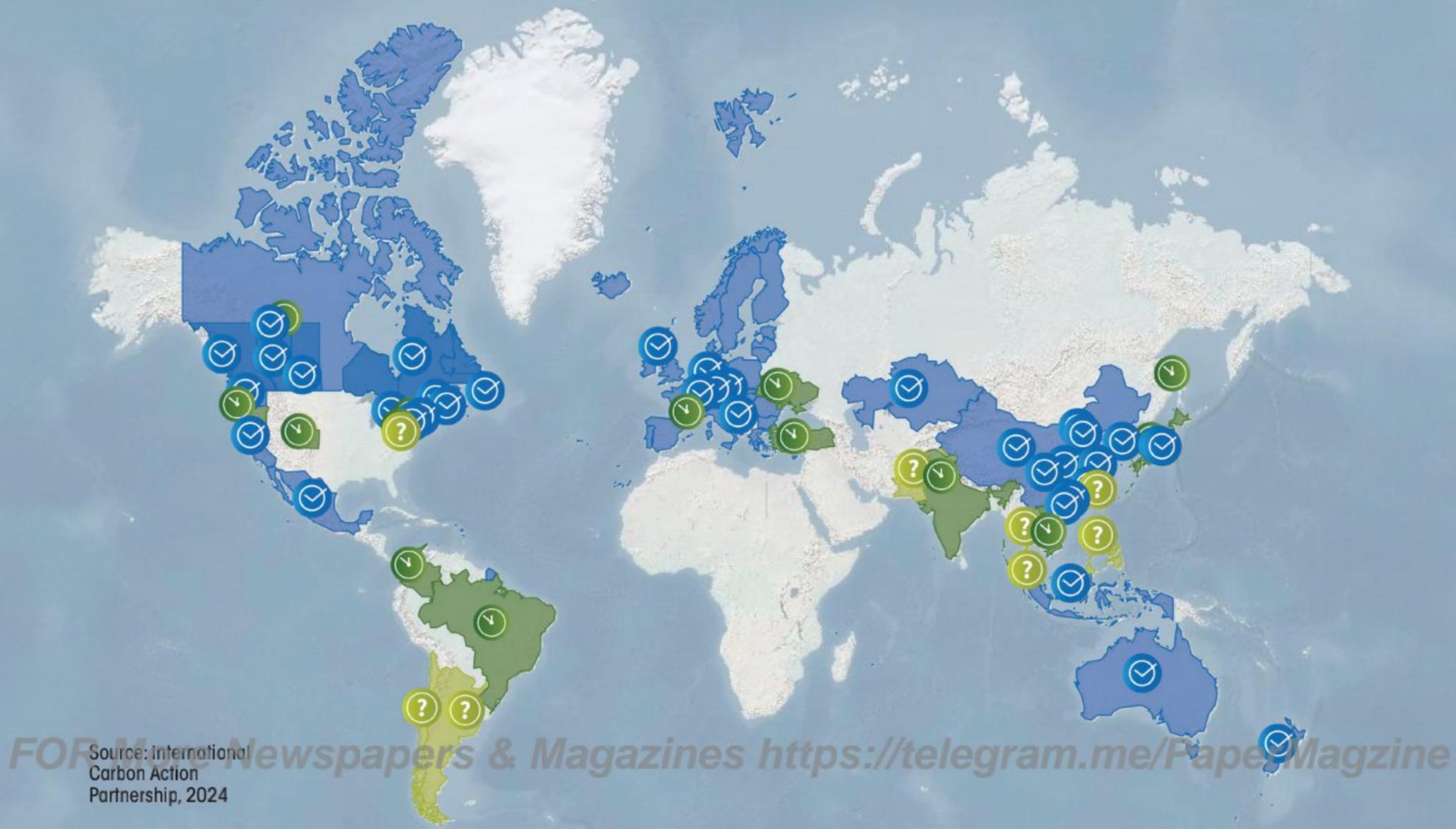
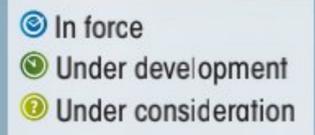


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# MARKET STATUS

Emissions trading systems in force, under development or under consideration, as of January 2024



ences from global markets show that offset markets face integrity issues and the carbon market is prone to being flush with cheap carbon credit. India's market-based mechanisms aim to enhance sustainability and efficiency, but oversupply and potential double-counting among the upcoming credit systems pose grave risks.

**Threat to smaller businesses:** CCTS aims to include large industrial sectors. Many of these sectors have a share of relatively smaller industries. These smaller businesses may also become part of the system based on their energy consumption. It could also indirectly affect entities in their supply chain. The challenges include obtaining emissions data from the smaller industries, which often use inefficient technologies and lack finances. They may struggle to afford carbon credits and meet targets.

**Exclusion of thermal power plants:** Globally, emissions trading schemes are

spearheaded by the power sector. The sector contributes close to 40 per cent of India's GHG emissions. But it has not been included in CCTS. This will result in non-coverage of a large chunk of the country's emissions.

## RECOMMENDATIONS

Based on the study, CSE recommends:

**Have a single, nationwide scheme for carbon-intensive sectors:** It is essential to free the carbon-intensive sectors from the PAT scheme at the earliest to ensure that CCTS is the only nationwide scheme for these sectors. This will enable the biggest polluters and a large number of entities to be given CCTS targets from the very beginning.

**Ensure a stable, high carbon price:** The carbon price should be high enough to encourage entities to reduce emissions and also create a level playing field for all entities. For this, it is essential that CCTS sets ambitious targets, ensures market stability

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## PRIME PLAYERS

Comparison of the world’s leading carbon emissions trading systems (ETSs)

Case studies	EU ETS	Korea ETS	China ETS	Surat ETS in India
<b>Type of system</b>	Cap-and-trade	Cap-and-trade	Partly baseline-and-credit	Cap-and-trade
<b>Year of commencement</b>	2005	2015	2021	2019
<b>Allocation of emissions allowed (measured in carbon credits)</b>	Initially allocated freely, the share of free allocations reduced and auctioning increased	Mix of free allocation and auctioning	All free allocations	Auctioning at floor price of ₹5/kg of particulate matter (PM) emissions
<b>Coverage</b>	37% of the EU’s greenhouse gas (GHG) emissions	89% of GHG emissions of the country	40% of country’s GHG emissions	342 textile industries from Surat
<b>Offset limits*</b>	No offset emissions allowed after 2020	5% of the verified emissions	5% of the verified emissions	No offsetting
<b>Emission reduction achieved</b>	ETS emissions in 2023 were 47% below 2005 levels (as per a 2024 report by European Commission)	Data not available	Data not available	It has claimed to have reduced PM emissions by 24% between 2019 and now. No study in public domain to back these claims
<b>Price of purchasing one carbon credit in the ETS*</b>	US \$90 (average auction price 2023)	\$6.4 (as of July 2024 )	\$11.74 (as of March 2024)	₹5/kg (PM emission permit price, not carbon credit, as of 2023)
<b>Penalties applied to defaulters</b>	€100 (\$106) per tonne of carbon dioxide	Three times the average market price of the given compliance year or Korean Won 100,000 (about \$75) per tonne	Failures or cheating in reporting starting from 500,000 Chinese Yen (\$70,582) to 10 times the illegal gains. Consultant firms and carbon verifiers involved in data fraud to face penalties up to 10 times of the illegal gains	Not specified
<b>Total market value (\$)</b>	834.18 billion	245.4 million	2.49 billion	Data not available
<b>Revenue generated (\$)</b>	206 billion	901 million	No revenue generation	Data not available

\*The emission reduction allowed through carbon-dioxide-saving projects in voluntary carbon markets; #One carbon credit equals emission of 1 tonne of CO<sub>2</sub>/CO<sub>2</sub>e. The carbon price should be high enough to encourage entities to reduce emissions, and also create a level playing field for all entities; Source: "The Indian Carbon Market: Pathway Towards an Effective Mechanism" by Centre for Science and Environment, 2024

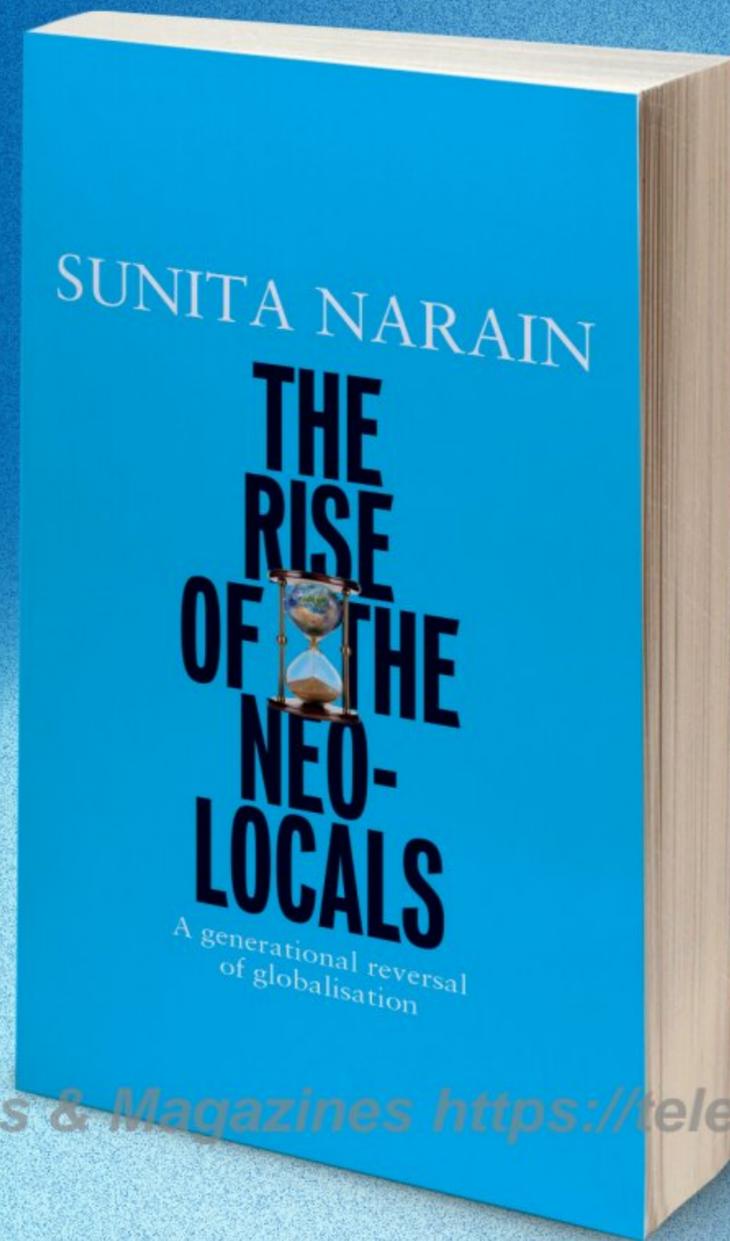
mechanisms and implements hefty penalties on defaulters and limits voluntary credits.

**Improve data quality, transparency:** To avoid data fraud, as seen in China ETS, India must introduce heavy penalties and rigorous monitoring cycles for the obligated entities. China has done it in its 2024 regulation. It is also essential to increase the capacity and number of carbon monitoring and verification agencies. All the data should be in public domain to prevent manipulation.

**Introduce revenue generation to support small businesses:** It is crucial to

devise methods to generate revenue from CCTS to fund small businesses. Korea ETS has supported small businesses by revenue generated in the carbon market.

**Consider inclusion of thermal power sector:** BEE officials say that thermal power will continue under PAT. This might not be enough to decarbonise the sector. There may be existing policies to drive decarbonisation, but this sector has flouted deadlines in the past. For effective progress towards India’s NDC targets, the power sector should be included in CCTS. [DTE](https://www.dte.com) [@down2earthindia](https://twitter.com/down2earthindia)



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Over the past half-century, the world has moved from post-colonisation to globalisation and now, to de-globalisation. The proponents of free trade are turning towards protectionism.

What does this mean for the world that faces the existential threat of climate change, combined with increased marginalisation of the poor and the anger of the rich?

And all this at a time when the world is losing the war against climate change to many other wars – from Russia's invasion of Ukraine to the conflict in Gaza to the angst against China for its domination of green technologies.

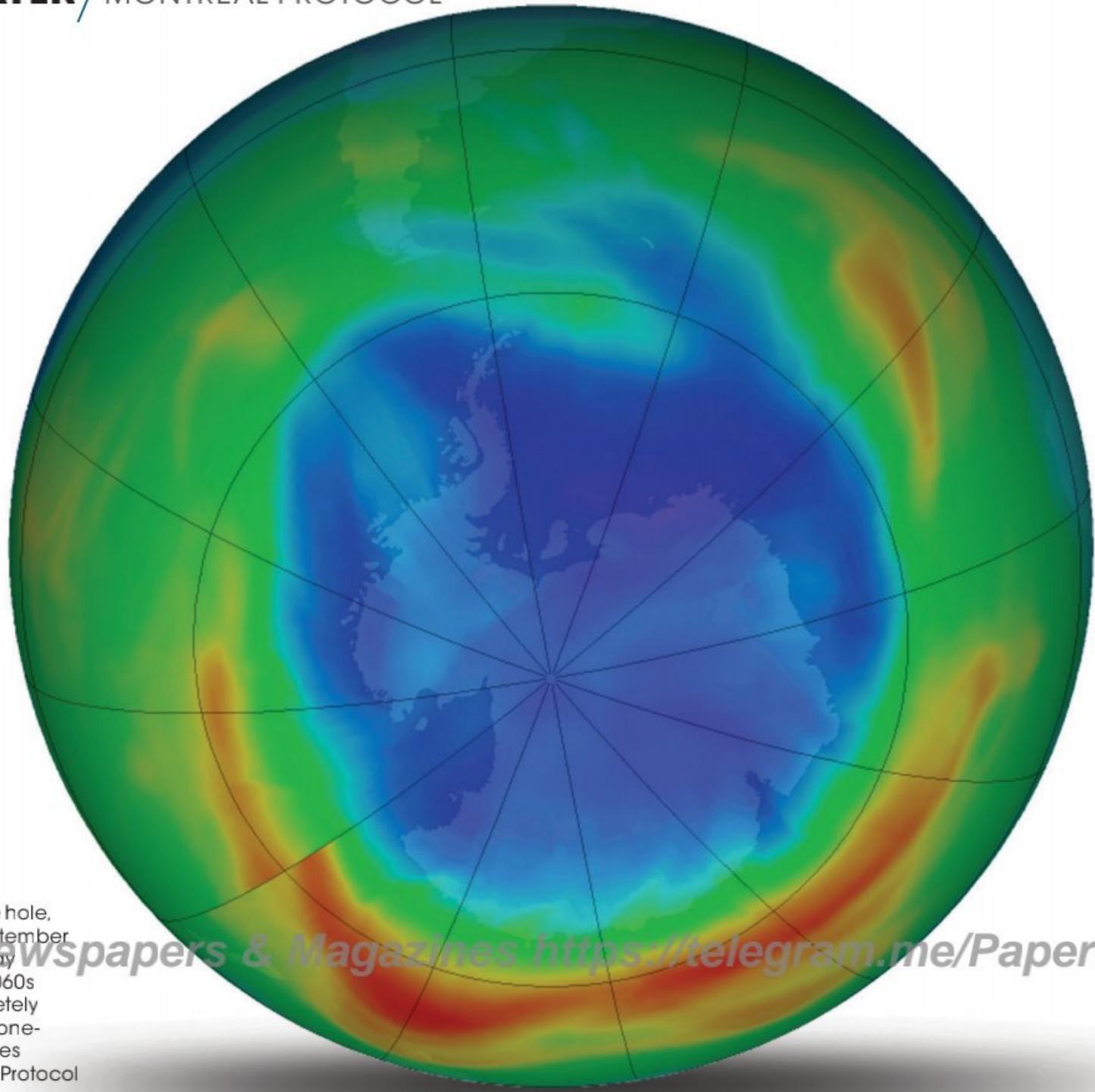
Born in the pre-globalisation era, environmentalist Sunita Narain argues that the developments of the past four decades, including India's environmental movements, the climate emergency, the sweeping protests and the rise of centre-right political forces, indicate that localisation may herald a new norm.

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The Antarctic ozone hole, as recorded on September 2, 2024. The hole may disappear by the 2060s as the world completely eliminates use of ozone-depleting substances under the Montreal Protocol

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# Emerging risks

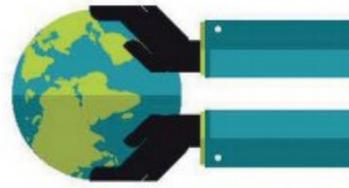
Even as the world gets set to eliminate substances threatening the ozone layer, climate change and space advancement pose new challenges

**DAKSHIANI PALICHA**  
NEW DELHI

**I**N JUNE this year, the world's 35-year-long effort to restore and preserve its ozone layer got a major boost, when researchers confirmed dropping levels of chemicals which deplete this shield that protects us from the sun's ultraviolet radiation. These chemicals, hydrochlorofluorocarbons (HCFCs), are part of a set of 100-odd substances which have elements like chlorine and bromine that destroy ozone molecules. Their release thus depletes the ozone layer 15 to 35 km above the Earth's surface. The ozone layer is the thinnest over the poles, especially in the Antarctic stratosphere, where the depletion is known as the "ozone hole". But the June study, led by a scientist from Bristol University, UK and published in *Nature Climate Change*, indicated signs of ozone healing by noting that for the first time since the 1970s, the impact of HCFCs on the Earth's energy balance and the amount of chlorine from these gases in the atmosphere have decreased after reaching a peak in 2021. This is five years ahead of the projected peak year of 2026.

More encouraging news came the same month, with a study led by

IMAGE SOURCE: NASA



researchers from the Indian Institute of Technology (IIT), Kharagpur, refuting claims made in 2022 of a “severe” ozone hole in the tropical stratosphere. Analysing ground-based and satellite data, the study says, “Current understanding and observational evidence do not provide any support for the possibility of an ozone hole occurring outside Antarctica today.”

The ozone layer is on track to recover because of successful implementation of the Montreal Protocol, a global agreement to phase out ozone depleting substances like HCFCs, primarily used in air conditioning and refrigeration. Some 99 per cent of all ozone-depleting substances are already phased out, says the UN Environment Programme (UNEP), due to which the Antarctic ozone hole may also disappear by the 2060s. But sustaining this success may not be easy.

### CLIMATE CONUNDRUM

The fight to preserve the ozone layer becomes more complex in a warming world. For instance, most sectors have replaced ozone-depleting HCFCs and chlorofluorocarbons with hydrofluorocarbons (HFCs). HFCs do not threaten the ozone since they do not contain chlorine, but they have a high global warming potential. Thus, with the 2016 Kigali Amendment, the Montreal Protocol sought to specifically phase out HFCs. UNEP is urging for greater action under the Kigali Amendment as part of its theme for World Ozone Day 2024 on September 16, “Montreal Protocol: Advancing Climate Action”. “If the Amendment is fully ratified and implemented, up to 0.5°C of warming could be avoided by 2100,” it says.

At the same time, climate change impacts may be threatening the stability of the ozone layer. In 2023, the Antarctic ozone hole emerged in August, rather than its usual time of September-October, and persisted till late December, according to the Copernicus Atmosphere Monitoring Service (CAMS). “It is the fourth year in a row that the Southern Hemisphere’s ozone hole showed peculiar behaviour,” said a December 21, 2023 article on CAMS’ website. Citing research studies, it suggests several reasons for this trend, in-

### A “MEGA-CONSTELLATION” OF SATELLITES COULD RELEASE 360 TONNES OF ALUMINIUM OXIDES PER YEAR, LEADING TO SIGNIFICANT DEPLETION OF THE OZONE LAYER

cluding a volcanic eruption in Tonga in 2022, which injected into the stratosphere huge amounts of water vapour that can break down ozone through chemical reactions with chlorine molecules.

According to US space agency NASA, greenhouse gas emissions also have a cooling effect in the upper stratosphere, creating conditions that increase chlorine efficiency in ozone depletion.

A thin ozone layer also exposes the polar ecosystem and species to several types of ultraviolet rays, but much of these are absorbed by the ice sheets. But an April 2024 study led by a researcher from the University of Wollongong, Australia and published in *Global Change Biology* says that climate change impacts in Antarctica such as shift in wind patterns and declining sea ice may increase organisms’ exposure to ultraviolet radiation.

Another emerging risk is space activity. In June 2024, researchers from the University of Southern California, Los Angeles, US, published a study warning that satellites may harm the ozone layer. “Satellites burn up at the end of service life during reentry, generating aluminum oxides as the main byproduct. These are known catalysts for chlorine activation that depletes ozone in the stratosphere,” says their study, published in *Geophysical Research Letters*. The study notes that a “mega-constellation” of satellites could release 360 tonnes of aluminium oxides per year, leading to significant ozone depletion.

In a June 24 *New York Times* article on the study, David Fahey, a co-chair of the Scientific Assessment Panel of the Montreal Protocol, is cited saying, “This is something the world should really take seriously, and the Montreal Protocol is aware and will be studying this.” In the article Fahey, who is also director of the Chemical Sciences Laboratory at the US National Oceanic and Atmospheric Administration (NOAA), said the subject would be explored in the next assessment of the Montreal Protocol in 2026.

In July, a UNEP report, “Navigating New Horizons—A Global Foresight Report on Planetary Health and Human Wellbeing”, also noted that increase in space activity can release gases and compounds that deplete the ozone layer. With the global space industry projected to grow to US\$ 3.7 trillion by 2040, monitoring is needed to ensure that the progress made to protect the ozone layer through the Montreal Protocol is not undone, says the report. **DTE**

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# The politics and economics of mpox

Africa's mpox epidemic stems from delayed responses, neglect of its health risks and the stark vaccine apartheid

**W**HEN IT arrived finally in Kinshasa on Thursday September 5, one could only wonder at the time and effort it took for a small consignment of vaccines from Europe to reach the Democratic Republic of Congo (DRC), the epicentre of the mpox (earlier called monkeypox) outbreak in Africa. The picture of the container of desperately needed vaccines, 100,000 doses donated by the EU, unloaded on a trolley at the airport, is reflective of the global politics, economics and bureaucratic heaviness that dictate how an epidemic in a poor country is handled.

Two days later, as this column was being written, another 200,000 doses sent by the EU arrived in the DRC capital and a few other African countries where mpox cases are spiking. Yet, together the donation is just a fraction of what is needed to combat the epidemic which has so far hit a dozen countries in the continent. In the eight months of 2024, over 18,000 cases of mpox have been reported in DRC alone which has recorded 629 deaths, the majority of them children. As before, and most recently with the COVID-19 pandemic, Africa is desperately short of vaccines, not to mention testing kits and therapies to help fight a disease which is a throwback to the times when smallpox was

the deadliest scourge in the world. DRC needs 3.5 million doses to stop the spread of the disease while other African states need 10 million doses. Vaccine though is the best tool to control the epidemic and what works is the smallpox vaccine; who has any shots to spare?

Most countries have little or no smallpox vaccine stocks at all after the World Health Organization (WHO) declared the world free of smallpox in the 1980s. We are told that only two companies worldwide produce mpox vaccines—the Danish Bavarian Nordic (JYNNEOS) and Japan's KM Biologics, which makes LC16, the only vaccine that can be administered to children but is yet to be commercialised. Another company, Emergent BioSolutions of the US makes the older smallpox vaccine which is primarily used by the US for stockpiling. All of this makes the shots expensive—one report says Bavarian Nordic charges US \$110 per dose—and creates a supply shortage.

The dark truth is that the US does have a huge stockpile of smallpox vaccines, only it is meant for use in case of biological warfare! It is said to have over 100 million doses of the older ACAM2000 vaccine in its Strategic National Stockpile apart from second-generation smallpox vaccine stocks which



ILLUSTRATION: YOGENDRA ANAND / CSE

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were added in recent times. These vaccines are regularly replaced when they expire. In July 2022, at the onset of the mpox disease in the US, the Centers for Disease Control and Prevention (CDC) said that it had ordered an additional 2.5 million doses of JYNNEOS vaccine, which add up to a comfortable 7 million doses by mid-2023. The US Food and Drug Administration explains that the availability of second generation vaccines in the Strategic Stockpile was necessary to enhance the emergency preparedness of the US against the use of smallpox as a dangerous biological weapon. That is why there was no shortage of vaccine to go around in the US, or in Europe for that matter, when mpox reemerged in these countries. And yet, despite such a comfortable reserve, the Washington has announced a donation of just 50,000 vaccine doses to Africa, most of it going to Nigeria, possibly for strategic reasons. Japan on the other hand has said it will donate 2 million to 3 million doses of LC16 though is yet to provide a timeline.

While vaccine inequity has been a constant, the response of WHO to the outbreak of mpox in the developed world, starting May 2022, and in Africa is rather curious to say the least. In the case of the former, WHO Director-General Tedros Adhanom Ghebreyesus declared the situation a public health emergency of international concern (PHEIC) within a couple of months, although WHO's own Emergency Committee failed at two meetings to approve such a declaration. The decision was taken by Ghebreyesus. This year, even after observing the spike in cases in DRC and nearby countries, WHO dragged its feet on declaring a PHEIC. It was only a day after the Africa CDC (Centres for Disease Control and Prevention) issued an emergency declaration that WHO finally did so on August 14—a year after DRC declared a health emergency in the county. WHO decides on PHEIC under the International Health Regulations that are set by the apex health organisation itself and it is difficult to understand why the director-general took so

**This year, even after observing the spike in cases in DRC and nearby countries, WHO dragged its feet on declaring a public health emergency**

long to issue this decision.

The PHEIC declaration is vital to galvanise action worldwide. The reason why vaccine consignments did not arrive earlier is because donor countries and agencies wait for WHO's assessment of the gravity of the situation even if public health campaigners have been warning of a runaway crisis. In fact, it was 15 days after the declaration that UNICEF issued an emergency tender for procuring vaccines, emphasising that Africa CDC had also categorised the mpox spread as a public health emergency.

The UNICEF tender is aimed at helping the hardest hit countries to secure supplies through conditional supply agreements with vaccine manufacturers. But this is contingent on countries and partners having secured

financing, confirmed demand and readiness, and the necessary regulatory framework for accepting the vaccines. A snag here is that WHO is yet to complete its review of information submitted by manufacturers for Emergency Use Listing.

But some lessons have been learnt. Africa is learning that it has to be in the forefront of the campaign and not leave it to global health organisations to take critical decisions. A clear signal of this development is the key role that Africa CDC is playing. In every initiative, it is an active partner and is laying out a joint response plan to contain the spread of mpox. Running from September to February 2025, the six-month plan with a budget of around \$600 million envisages a major chunk being spent on getting 29 African nations ready to tackle the scourge. As WHO's regional boss noted, the joint action marks a milestone as the two agencies act swiftly and effectively to mobilise resources and capacities in a region which has for too long come across as helpless and incompetent in dealing with health catastrophes.

It is a big sign of change—and hope—for some of the least developed nations. DRC in particular needs a big helping. **DTE**

⊗ @jjishnu

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# Palette

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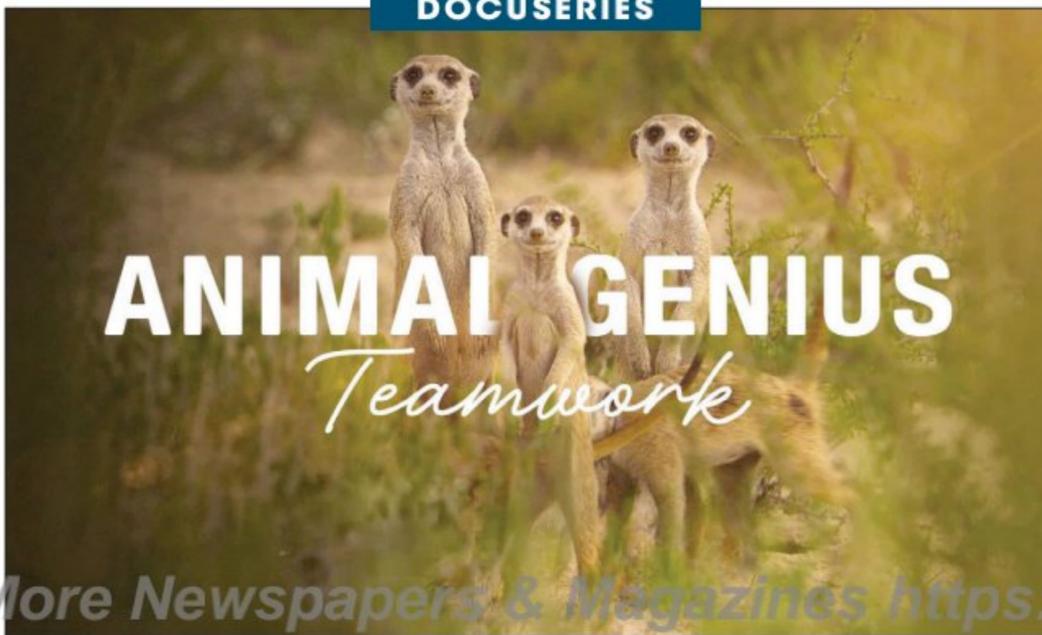
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## RECOMMENDATIONS

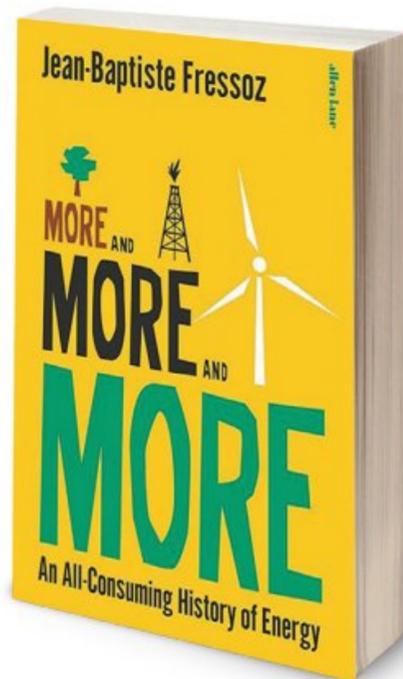
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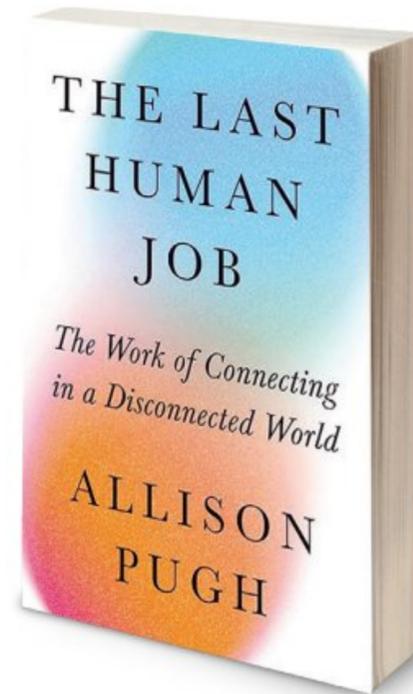
Every species has different survival instincts, be it camouflage, escape tactics or even picking a particular time for birth. In National Geographic's new docuseries, *Animal Genius*, wildlife biologist and broadcaster Liz Bonnin sheds light on some of these unique survival techniques and how they help species thrive. Bonnin travels to Africa to explore how meerkat pups learn a secret family language to stay safe, and how Matabele ants perform "first aid" on their colony members after fighting off termites. In Mexico, baby sea turtles vocalise and communicate while still inside the eggs, so that they can hatch in unison. Learn about these unique behaviours and more in the series, now available on streaming platform Disney+ Hotstar.

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### BOOKS



In a warming world, countries and industries are working to transition from polluting fossil fuels to cleaner power sources. But is it possible to make a complete clean break? Science historian Jean-Baptiste Fressoz does not believe so. In fact, he says, the perception that humankind has completely moved from wood to coal to oil and now to "green" fuels does not hold true. All these fuels are increasingly used even today. In *More and More and More: An All-Consuming History of Energy*, he explores what this reality means for the future we strive to reach.



Artificial intelligence (AI) is slowly taking over all fields. People have started to consider a world where AI would put humans out of certain jobs. Academic Allison Pugh tries to understand whether this also applies to professions that require an inherent "human" touch, such as teaching, coaching, therapy and healthcare. In *The Last Human Job*, Pugh speaks to professionals in such fields to understand whether AI and the race to develop new technologies pose any risks to the way we work and live.

# MANY MYTHS OF CHIPKO

Misconceptions about the Chipko movement have overshadowed its true objectives

**DEBARATI BANERJEE AND JAYANTA BANDYOPADHYAY**

**T**HE ICONIC images of Garhwali peasant women hugging trees, apparently to protect them from being cut down, have become synonymous with the Chipko movement. Perceptions of the movement that have also become popular are its ecological and feminist forms. However, these are only misconceptions that overshadow the real and initial objectives of a people's movement for rights over local forests.

The movement began in 1973 in Uttarakhand, then a part of Uttar Pradesh, by communities in the Garhwal Himalaya region against commercial tree-felling that led to degradation of forests and natural disasters. Their demands were clear: abolish the contract system of tree-felling and establish the rights of communities over the management and use of forests. Their aim was to develop local economies by promoting small-scale forest-based industries, while ensuring forest conservation. However, "the ecological and feminist form of Chipko was invented" in 1977-79, as writes historian Shekhar Pathak in *The Chipko Movement: A People's History*. This shift came when Sundarlal Bahuguna, considered a pioneer

of Chipko, demanded "a complete ban on tree felling" in line with his perception of deep ecology.

The feminist image, on the other hand, was created due to a single incident that social activist from Uttarakhand Vandana Shiva highlighted in her book without context. The 1988 book, *Staying Alive: Women, Ecology and Development*, introduces Bachni Devi as protesting in Adwani forest against her husband, described as contractor Sunderlal Saklani. Shiva identified it as "the most dramatic turn in the new confrontation," perceiving it as the rise of a gender conflict. But historical facts show that the movement had gender collaboration.

As per Pathak's book, Bachni Devi's husband was not Saklani but rather Bakhtawar Singh, a village head. Dhoom Singh Negi, a Chipko leader present at the protest, also alludes to this in an interview cited in a 2006 book, *Chipko* by Kunwar Prasun, a journalist and social activist in Garhwal. Negi is quoted saying that it was Singh who had alerted the village residents of Saklani's plan to fell trees.

We also have found, through analysis of literature and conversations with activists of the region,

that the situation unfolded quite differently. On December 4, 1977, Negi began a fast in Adwani forest to protest tree-felling. He ended the fast four days later after women of the village tied *rakhis* to the trees marked for felling and assured Negi that they would protect the forest. That month, a seven-day recitation of Srimad Bhagwat was



The photographs of women encircling trees, often associated with Chipko movement, bear no mention of dates, names of activists or locations. These photographs are reenactments



organised to attract more people. Bachni Devi joined the movement with Jhabri Devi of Adwani, Sudesha Devi of Rampur and Saunpa Devi of Berni, who later emerged as prominent leaders—they were not “peasant women”, as often claimed. Men, children and college students pledged to protect the forest, but their role is ignored in literature.

The “gender conflict” has also been negated by Gaura Devi of Reni, one of Chipko’s most publicised personalities. In a book, *Tribal movement, politics and religion in India*, she is quoted saying, “We have no quarrel with anybody”. She acknowledged that the large-scale women participation was due to the migration of men seeking jobs.

In interviews with us, activists Vimla Bahuguna, Madhu Pathak, Ranjana Bhandari, Dulari Devi, Bachni Devi and Sudesha Behn denied claims of Chipko being an “ecofeminist” movement against male “exploitation” of women and nature. For Sudesha Behn, it was a struggle for life and livelihood for all. Her male comrades were her “*bhai log*”, many of whom including Negi inspired women to participate in the movement. She implied that not all women joined, contradicting the solidarity of Chipko women projected in feminist literature.

Then there is Chipko’s ecological slogan: “What do forests bear? Soil, water and pure air”. Shiva’s book incorrectly states that the slogan was created by Bachni Devi in 1977. The slogan was, in fact, composed by Prasun, and we confirmed this during interviews with Negi, Prasun’s family and activists.

Next come the widely circulated photographs of women encircling trees. A close inspection shows that they bear no mention of dates, names of activists, contractors, forests or locations. These photographs are reenactments. Sudesha Behn, one of the women photographed, told us they were clicked during a demonstration requested by visitors from outside Uttarakhand.

In an 1993 interview with *Down To Earth*, Chandi Prasad Bhatt, a veteran Chipko activist, said, “No woman ever had to hug a tree to protect it...It was not necessary to

do so, for the mere threat was enough.” The women were ready to cling to trees and guard forests against loggers. But, said Vimla Bahuguna in a 1992 interview, loggers fled when women approached them.

Finally, the very name “Chipko” is related to a misconception. The popular belief is that it came up as media circulated images of women embracing trees. But the word was first used in a poem by Ghanshyam Raturi, a poet associated with the movement, and popularised by Bhatt, says Pathak’s book.

What were the results of these misconceptions? In 1981, the then Uttar Pradesh government banned tree-felling. This not only negated the original demand for localised, forest-based economies, but also ignored people’s desire to be involved in forest management—which in turn would have enhanced women’s participation. This contradicts the feminist image of Chipko.

People blamed “internationalisation” of Chipko as a conservation movement for halting Uttarakhand’s development. But over the past 50 years, mechanised transportation and telecommunication led to penetration of the market system in mountain villages. With enhanced education and diverse livelihood opportunities, younger generations aspire for a better life in cities. Availability of LPG cylinders, water connections and education reduced women’s reliance on farming and nature, but also weakened their bond with the environment. The birth of another Chipko, and revival of a demand for right to local economies and development, seems unlikely now. [DTE @down2earthindia](https://down2earthindia.org)

(Debarati Banerjee is associate professor of history at Netaji Subhas Open University, West Bengal. Jayanta Bandyopadhyay is former professor at the Indian Institute of Management Calcutta)



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# TASTE IT RED

Popularity of Karnataka's red jackfruit shows how biodiversity can be conserved by ensuring that communities benefit from it

## SHREE PADRE

**F**OR GENERATIONS, a handful of households in Karnataka's Tumakuru district have been closely guarding a hidden treasure. It is a jackfruit variety that yields delectable bulbs, with pleasant aroma and colours ranging from copper red to bright orange. Until a decade ago, few from outside the villages knew the whereabouts of the plants or their custodians. Once in a while, as the summer season progressed, one would

come across vendors selling on the roadsides the fleshy bulbs, referred to as *chandra halasu* in Kannada. Even they would not reveal details about the growers. So, for Ganesan Karunakaran, principal scientist at the Indian Institute of Horticultural Research (IIHR), Bengaluru, it took a great deal of effort and years of visits to households across Tumakuru to bring the variety to the limelight. Today, the plant is being grown across Karnataka, Tamil Nadu,

PHOTOGRAPH: BY ARRANGEMENT



A farmer associated with Toobugere Jack Growers Association peels red jackfruits for sale at a fest in Mangalore in June 2024. Due to the recently discovered category of red jackfruits, the association gets invited to all jackfruit fests organised in coastal Karnataka

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Kerala and Odisha on about 2,000 hectares. It has also emerged as an example of how biodiversity can be conserved by ensuring that communities and traditional custodians of the biological resource benefit from it.

"I had only heard about *chandra halasu* before joining IIHR's Hirehalli regional station in Tumakuru. At Hirehalli, when I tasted the fruit for the first time, from a roadside vendor, I could not resist my temptation to eat more and know more about it," he says. "There are several red jackfruit varieties in Hirehalli. But farmers were not willing to show us their trees. At best, they would offer us a fruit," recalls Karunakaran. Their fear was that if trees are exposed, scientists would propagate the varieties, which would hamper their interest. This is when Dinesh MR, then director of IIHR floated an idea. IIHR organised a "jackfruit diversity fest" at Hirehalli. Prizes

were promised for the best fruits. The fest saw a huge turnout. Farmers brought 75 jackfruits, of which 20 were red. "No one had seen so many red jackfruits at one place before," says Dinesh. And thus began the search for the trees and a scientific study to document them and evaluate their properties. Over the next three years, the IIHR scientists with the help of jackfruit enthusiasts and non-profits, identified 125 varieties from across Tumakuru. Based on parameters like depth of colour shade, taste, crispness and nutrient profile, 10 were selected as best varieties. A tree, owned by farmer S K Siddappa from Gubbi taluk, topped the list, while another owned by Shankarayya from Tiptur taluk bagged the second position.

The next obvious step was to promote the varieties by producing grafts using scions. "But we wanted to link the biodiversity with the livelihood of farmers, who

have been the custodian of the varieties. This way the varieties get popular and get conserved," says Dinesh. In an unprecedented step, IIHR released jackfruit varieties in the names of the custodian farmers: Siddu variety was released in 2017 and Shankara variety in 2019. IIHR also signed MOUs (memoranda of understanding) with the custodian farmers under which the farmers received 75 per cent of the proceeds from the graft sales. The varieties were also registered under the Protection of Plant Varieties and Farmers' Rights Authority (PPV and FRA) to ensure that no one else can propagate and sell the variety.

Over the years, Siddappa's son Paramesh and Shankarayya's son Kemparaj have learnt grafting techniques, and have set up their own nurseries. Paramesh, who has so far received a royalty of ₹40 lakh from IIHR, says that every year he develops around 25,000 saplings,



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Scientists with the Indian Institute of Horticulture Research and the University of Agricultural Sciences, both in Bengaluru, have played a crucial role in bringing the red jackfruit to limelight while allaying growers' fears that they might lose ownership of their unique variety

which he sells for ₹250 each. "Initially, I used to sell the plants at fests. But with the fruit's growing popularity, I receive orders from across the country. So we have tied up with a courier company for safe transportation of the saplings in a customised carton box," says Paramesh. "Never in my wildest dreams did I imagine that our jackfruit tree would bring such prosperity to us. I now offer employment to 15 families from the village," he says. Kemparaj, who has received ₹18 lakh in royalty from IIHR so far, plans to buy 0.8 ha land to expand his nursery and set up a scion bank.

In 2014-15, two scientists from the state, Sampath Kumar KK from Government First Grade College, Devanagere, and Bharathi TR from University of Mysore, Mysuru, assessed the nutritional value of the fruit. "The orange-flake jackfruits have more phenols and flavanoids as compared to the yellow ones. This means the antioxidant activity is more in the former," the scientists write in the report. Grafting expert Gururaja

Balthillaya of Athradi village in Udupi district says the main attraction of the fruit is its colour. "It has a sort of addiction value. Though less sweet when compared with the yellow jackfruit, one feels like eating more," he adds.

Shashibhushan Choudhary, chief of National Bureau of Plant Genetic Resources, Ranchi, has been studying the fruit for the past five years and is impressed by its genetic wealth. "Till recently, we thought 26 brix is the highest in this category. [Brix is a measure of sugar value; higher brix value indicates better pest and disease resistant ability of the crop.] Of late, we have a variety with 31 brix. When compared with the gene pool of India's jackfruit varieties, red fruits are not reported from north or northeast India," Choudhary says. Trilochan Mohapatra, chair of PPV and FRA, says his organisation has recently registered 16 farmer varieties of jackfruit, 11 of which are red-flaked.

Whether for its exotic value, nutritional content, colour or taste, the demand for red jackfruits, both

the saplings and bulbs, have grown multifold in the past few years. The fruits command a price that is twice or thrice of the regular yellow jackfruit.

K S Ashok Kumar, a farmer from Doddaballapur taluk in Bangalore Rural district, has shifted to dryland horticulture a decade ago due to fast depleting groundwater level in the region. He now grows different jackfruit varieties, including Siddu and Shankara, on 20 ha. Kumar is, however, not happy with the marketing system of jackfruit. "Whole fruits have a shelf life of a few days. But most consumers like to buy peeled bulbs, which have limited shelf life. Farmer-producer companies or supermarket chains should devise ways so that the bulbs can be preserved and sold in packets," he says. Choudhary also suggests creating reliable supply chains for the fruit so that both farmers and consumers can benefit. [@down2earthindia](https://t.me/down2earthindia)

(Shree Padre is editor of Adike Patrike, a Kannada farm magazine)

# 'The project will facilitate physical and cultural decimation of indigenous people'

Environmentalists have decried the Great Nicobar project as ecocidal and genocidal for the island and its inhabitants ever since the government of India envisioned it in 2021. The project includes a transshipment port, airport and power plant, proposed to be built on the southern tip of Great Nicobar island. But Great Nicobar is home to tribes like the Nicobarese and the Shompen, the latter being a particularly vulnerable tribal group, which have special needs and rights. The arrival of people from outside could expose these tribes to cultures and diseases against which they have no defence, **PANKAJ SEKHSARIA**, curator of *The Great Nicobar Betrayal*, a collection of articles on the Great Nicobar Project published by media outlets, tells **RAJAT GHAI**. Excerpts:

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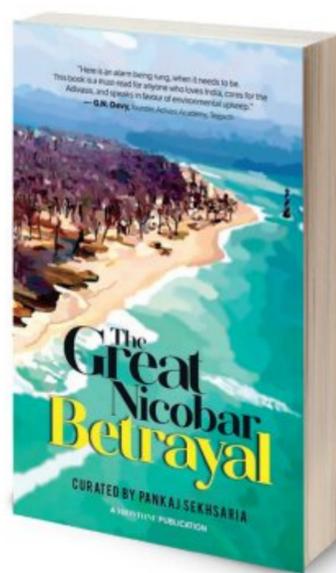
## The Great Nicobar Project has all the hallmarks of a disaster—seismic, ecological, human. Why did it get the go-ahead?

I find this difficult to understand, particularly since the concerns are quite clear, well known and well documented for these islands. I think, there is a lack of awareness in the policy ecosystem as well as a complete buy in into “one” kind of idea of economic development—big infrastructure. Coupled with an ignorance of the situation on the ground, the challenges and the vulnerabilities, this makes for a deadly combination.

## Essays in the book show how the National Green Tribunal (NGT) and the Wildlife Institute of India (WII) did not put a check on the project.

It is not about just putting a check on the project. Institutions like WII, NGT and others have actually facilitated the clearances the project needed. The Directorate of Tribal Welfare of the Andaman and Nicobar Administration, the main body tasked with ensuring tribal welfare, is on record promising the project proponent all help in clearing regulatory processes, including for de-reservation of tribal reserve land, for the project. This is really unfortunate. And this is also not an isolated instance. We are seeing this again and again. The autonomy and scientific rigour of institutions like WII and NGT are clearly compromised. The position of NGT, as the lawyer and environmental activist Norma Alvares explains so clearly in her essay “The flawed judgment”, is contrary to the purpose of what NGT was created for.

## Can the Nicobarese and Shompen survive the project?



## THE GREAT NICOBAR BETRAYAL

Pankaj Sekhsaria

Publisher: Frontline Publication

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Pages: 124

The project is a huge attack on their rights that are enshrined in law and in the Constitution. It will, without doubt, facilitate physical and cultural decimation of these people. For instance, the Shompen are a particularly vulnerable tribal group (PVTG) with special needs and special rights. The project document says that this island will have about 0.3 million people by 2050. Now just look at one statistic—the ratio of one Shompen individual to that of the outsider: it is 1,000 outsiders to one Shompen. Their needs, their demands for land, for water, for resources, waste management... and the cultural impact the project will have. The indigenous communities stand no chance whatsoever. The Nicobarese have, on record, said they are opposed to the project and they should be allowed to go back to their traditional lands. They were moved to settlements after the tsunami and have been wanting to go back ever since. They are not being allowed to.

## What can be done to save the indigenous peoples and the endemic biodiversity?

This project should not be pursued if we want to ensure that these communities have a future. This is in addition to the huge ecological cost that will have to be paid. And it is shocking that the geological volatility of the landscape is being ignored. The islands sit on the Ring of Fire, the most tectonically active zone of the planet. Earthquakes happen here on a weekly basis. The site of the project in Great Nicobar saw a permanent subsidence of 15 feet (more than 4.5 m) in the immediate aftermath of the earthquake of December 26, 2004. We will be putting that entire investment of ₹72,000 crore in harm's way. We will put the settler populations of 0.3 million people in harm's way. And this after we have destroyed the rare rich ecological wealth, as also the indigenous communities who have been here for thousands of years.

## What would you say to those who cite strategic importance and national security as the rationale behind this project?

I would request them to look at the project documents. This is an entirely commercial project. The heart of the proposal is a ₹40,000 crore transshipment terminal which is a commercial project. Over 100 sq km, most of it pristine forest, is to be made available for a township and tourism project. Where is the strategic dimension?

## Do you think the government will rethink the project?

There is compelling evidence that we have put together in the book to show the folly the project is. The new Union Minister for Tribal Affairs has agreed to look into the project, which suggests that the concerns are being acknowledged. Hopefully, there will be a complete rethink [DTE](https://www.downtoearth.org.in) [@down2earthindia](https://t.me/down2earthindia)

# Why the youth is so angry

**T**HERE ARE waves of protests sweeping across continents, from Asia to Africa to Europe to the Americas. The protesters predominantly are young; and their agendas varied—from regime change to high inflation. When one examines the agendas and the structure of protests worldwide, one broad picture emerges: these protests are informal by leadership and very much issue-based. In Bangladesh, students staged protests in August to change the political regime; in India, the ongoing protests triggered by a doctor's rape and murder in Kolkata demand women safety in health facilities; and in Kenya the "Gen Z" forced the government to withdraw new tax proposals. These protests are not steered by any chosen leadership. Rather, these movements are being fuelled and sustained by various developmental issues and steered by the youths.

This seems obvious at a time when the world by far has the largest youth population in history. The US Agency for International Aid (USAID) estimates that the world is currently home to 2.4 billion young people between the ages of 10 and 29. One can term it as the largest generation ever. A recent study by UNICEF on youth protests amid the polycrisis says that the proportion of people in general, willing to participate in demonstrations has "increased to its highest levels since the 1990s." However, since the turn of the 21<sup>st</sup> century, the UNICEF study asserts, "new trends that distinguish recent protests from those of the past have become more evident. Young people have played an important role in defining some of these patterns."

What are the issues that drive the youth to lead such massive movements? There have been massive protests against globalisation in the early 21<sup>st</sup> century followed by outrage against economic hardship and more recently for democracy and freedom. Climate justice is also slowly featuring as a trigger for global mobilisation. In recent years, particularly after the pandemic, the cost-of-living crisis seems to be the dominant trigger. As per an estimate,

between November 2021 and October 2022, as many as 12,500 protests and riots were recorded in 150 countries. Most of these protests or riots revolved around inflation, energy cost and food shortages, and youths played a key role in them.

Social scientists and policy makers are trying to understand why the youths are so angry. Most assessments, including the one by UNICEF, point towards a young world, asserting against lack of basic survival means and the ineffectiveness of the current political system to respond to their needs. The overarching issue of most protests is economic security—simply put, employment and livelihood. Many treat this as a sign of the current development model not being able to meet the aspiration of the generation. So, the protests are for a new development model which has not been defined or developed till now. Some years ago, the International Labour Organization (ILO)

**Protests show a generational change in acceptance of democracy**

taking note of the increasing restless among the youth noted, "The youth employment crisis, in all its manifestations, is not merely a transitory

development related to sluggish economic growth, but it may become a structural trend if no significant policy changes are put in place."

Some interpret these protests as reflection of the youths' political profile or affiliation. A survey published in *SAGE Open* analysed data from 1 million people in 128 countries from the early 2000s up to 2017, and said, "Those under 40 were more likely to prefer informal political activities than those older than 40. Some believe this is because young people have greater interest in issue-based politics and action that requires no intermediaries, rather than in traditional, institutionalized politics." The UNICEF study supports this change in outlook and role of engagement between the old and new generations. "Global analyses have shown in recent years that older and younger cohorts have different views on democracy as a platform for political engagement. Compared with older cohorts, the youth have become increasingly frustrated by the inadequate performance of democratic institutions," it says. **DTE** @richiemaha

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