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LOCUST ATTACKS ARE BACK

Exploiting changing weather patterns, locusts are spreading to new territories and devouring crops

Fire in a gas and oil well devastates Assam's wildlife

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State governments dilute Forest Rights Act, threatening forest communities

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Tomorrow can be better, but only if we make it

THIS HAS to be the weirdest and the most tumultuous times we have lived in. But it is also the most confounding. Coronavirus seems to be unleashing the best and the worst in our world today. On the one hand, we have news of cleaner air—not only in Delhi, but also in other parts of the world. There is evidence of a dip in greenhouse gas emissions. There is also evidence of human fortitude; empathy; and above all, selfless toil by millions who work in healthcare and essential services. It's their determination to win the war against the virus and to save lives that will be the hallmark of this epic struggle against COVID-19.

On the other hand, we have increased use of plastic because we have to fight against this infection; there are cities in the country which are giving up the practice of segregating household waste because they just can't keep up with the growing medical waste and plastic personal protective kits. So, we are going backwards. Then, people don't want to travel in public transport. They fear congested public spaces will add to the risk of contagion. So, as cities open up, private vehicles are bound to increase on city streets. It's the same with fossil fuel emissions that contribute to climate change.

It's also the time when we are witnessing the worst of human nature—from the lack of action to provide money and food to the vulnerable, including the workers who lost their jobs and were desperate to go home; to the callousness to divide people based on religion or race; and of course, the untold misery of many who lost their loved ones because they could not get help in time. It's all there.

But let's look ahead because there will be light at the end of the Corona tunnel and the world we build now will be our future. And, as I say this, let's also be clear that this is not a rhetorical or an open-ended quest for answers. It is about doing the impossible—finding ways of doing things differently now when the health crisis is at its peak. We can't wait for the normal to return because then it will neither be new nor different.

And it is possible. The strategy is to find inventive answers, which will work for multiple challenges. Take air pollution in our cities. We know that vehicles are a major contributor to toxins in the air; of this, the worst are heavy-duty trucks that ply in and out of our cities. In January (pre-lockdown), some 90,000 trucks entered Delhi each month; in April (during lockdown) only 8,000 trucks entered. So, how do we avoid pollution as we resume our pre-lockdown days back?

The fact is that India has made the transition (during lockdown) to much cleaner fuel and vehicle technology. In the case of heavy-duty vehicles, this would mean a reduction of 90 per cent between the pre-April (BSIV) and current BSVI. It is also a fact that the automobile industry is in a massive financial distress. Here, we have a win-win solution. If the government was to devise a smart scheme to provide truck owners subsidy for scrappage of their old and replacement with new vehicles, it could be a game changer. But the trick is to make sure that the old vehicles are scrapped and recycled and do not end up adding to pollution somewhere else.

It is the same with public transport—today it is under pressure for safety. But it is also a fact that without public transport our cities cannot move. We now realise its importance. So, a financial stimulus to rebuild cities for the future that move people, and not vehicles, can begin now. We need to restart public transport with all precautions; we need to augment it fast and find ways to support cycling and walking. Data shows that a bulk of our daily trips is below 5 km in our cities—so it is possible. But the scale of the disruption we have seen today demands a similar scale of response as well. This can be done, but it needs imagination and needs concerted, obsessive action. When it comes to industry and its pollution, it boils down (literally) to what is burnt. So, if we can make moves to first change the fuel—from coal to natural gas—it will bring down pollution drastically. Then if we can move to electricity for combustion and if that electricity can be from cleaner sources (natural gas, hydel, biomass and renewables) it will work for local air pollution first and then also combat climate change. Again, this is within reach.

But all this is premised on the belief that we humans want a better tomorrow. COVID-19 is not a mere oversight or an inconvenient accident, it is a result of the actions we have taken to build a world that is both inequitable and divisive, and discounts nature and our health. So, let's not be naïve that tomorrow will be better—it will and can be better, but only if we make it. [DTE](https://www.dte.org.in) [@sunitanar](https://twitter.com/sunitanar)

The scale of the disruption we have seen today demands a similar scale of response as well

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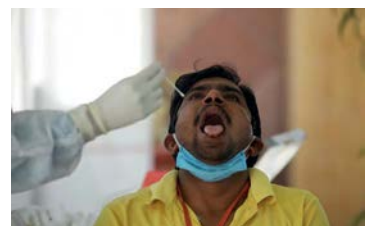


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Barely two months after locusts left India, the world's oldest migratory pests invaded again, battering an already battered rural economy

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and are consumed
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Engage



Micro level forecasts impossible

This is in reference to “Warning signal” (16-31 May 2020). In the article, the meteorological department has been criticised for not issuing warning about delayed rains that led to the loss of rabi crops. Forecasting of extreme and unusual weather events on a micro scale, allowing sufficient time to take action at the farm level, is impossible.

Though occurrence of showers late in the rabi season has become more frequent in recent years, these cannot be forecast to prepone the harvest. Under the circumstances the farmers should be advised to harvest the crops as soon as they are ripe enough. In this, the state agricultural departments have a great role to play—a role more feasible and important than that of the weather forecaster.

S VENKATARAMAN
VIA EMAIL

Need to review our urbanisation policy

This is in reference to “COVID-19: How to balance people’s safety and mobility”, published online on April 22. The government needs to review its urbanisation policy. In an overpopulated country like India, the working population needs to be judiciously dispersed in relation to its home and place of work. If we don’t want threatening migration problems, then either we have to resettle people in and around workplaces or provide them equitable wages near their existing homes. The social cost of urbanisation for absorbing people for jobs has become counterproductive. Besides, pandemic- and disaster-related migration has become a source for inter-state acrimony.

They deserve better

This is in reference to the editorial “Migrants: Future of work and production” (16-31 May 2020). Indeed, the mass exodus of migrant labourers is a colossal and unprecedented humanitarian crisis. The immediate priority is to monitor and ensure the safe transit of the migrants to their homes. But the larger, long-term challenge of their forced migration from urban areas to rural will be felt in every realm of socio-economic activity. Yet, as you have underlined, even in this crisis there is an opportunity: to overhaul the moribund structures and systems that have prevented healthy growth of the rural economy. These structures have sustained the hideously exploitative *thekedari* networks that have till now been routine in sectors like infrastructure, industry and construction. As the old maxim goes: we do not know the value of something until we lose it. Our countless migrant workers deserve a better deal. It’s now or never, and our lives depend on it.

R P SUBRAMANIAN
MUMBAI



A walk with workers

Watch *Down To Earth's* Vivek Mishra share his over 500 km journey with informal sector workers, who have been forced to return to their native



places after the lockdown to check the spread of COVID-19 snatched their livelihoods in the city. Will they ever return to urban areas?

Locusts thrive in rain

Several parts of India, including Rajasthan, Haryana, Maharashtra, Uttar Pradesh, and Madhya Pradesh, are under locust attack. Experts believe that unusual weather patterns and extreme events linked to climate change are helping these pests breed and migrate. The increase in greenery due to rains helps locusts multiply. The unseasonal rainfall in March and April this year may have given rise to the swarms that we see today.

Another industrial gas leak accident

In an incident reminiscent of the Bhopal gas disaster, styrene gas leaked out of a polyester plant in Visakhapatnam on May 7, leading to 12 deaths. Industries are rushing to recover lost ground due to the lockdown, but must ensure safety as they restart.

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MORE,
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Therefore the NITI Aayog has to deliberate instantly on this and advise the government to take a relook.

SHREE KRISHNA PHADNIS
MUMBAI

A budget for rich farmers

This is with reference to the article, "Expert's guide to rural distress" (16-29 February). We know that agriculture is the backbone of our national economy. About two-thirds of our populace live in villages and most of them depend on agriculture for livelihood. Their economic activities are farming and allied works.

This sector is now very sick because the input costs are increasing but the market value of the farm produce is decreasing. The farmers have increasingly failed to make profits. Rather, they are sinking in debt and are forced to kill themselves.

In this context, this year's budget does not give them much hope. This article points out that the allocation to various schemes was either reduced, remained static or was minimally increased. The flagship programme for rural development—the Mahatma Gandhi National Rural Employment Guarantee Act—is now dying due to reduced allocation and negligence. It was the instrument of rural development during the last one

and half decades.

Most items in the 16-point agenda announced by the finance minister in her budget speech were not for small and marginal farmers but for the rich ones. To build warehouses and cold-storage on P-P-P model or "Krishi rail" or "Krishi udaan" are farcical for poor farmers. These plans and programmes are not suitable for addressing rural distress.

The government promised *har khet me pani* (water in every farmland) and the PM Krishi Sinchai Yojana, which have not yet been fulfilled. So fulfilment of announcements made in this budget must also be considered doubtful.

TAPOMOY GHOSH
PURBA BARDHAMAN

Guard your village

This is in reference to "COVID-19: More than 40,000 turmeric farmers in Odisha's Kandhamal bear lockdown brunt", published online on May 1, 2020. In Punjab and Haryana, when villages faced a similar situation, they took to the age-old initiative of *thikri pehra* (community policing). This checked the movement of people due to the COVID-19 pandemic. The police of any state cannot guard every place and, as such, this is really a very good step. Every village in the country should adopt the same. This will ease pressure on the police and we can keep the disease away.

CHAITANYA AGARWAL
VIA EMAIL

ICMR unfit to lead

This refers to "Ignoring WHO, ICMR to go ahead with HCQ for COVID workers", published online on May 26, 2020. The Indian Council of Medical Research (ICMR) is proving itself unfit to lead Indian research from every perspective. That it still does not have any clinical studies on COVID-19 is a stigma in itself after the country has seen 150,000 cases. It might also be the first national research body that sends out advisories without any quantitative data but just on hearsay. There is utter confusion whether prophylaxis and treatment are the same biologic models. It is sad that even medical professionals are conflating the two. COVID-19 is a true "infodemic"!

AVEEK
VIA EMAIL

Down To Earth welcomes letters, responses and other contributions from readers. Write to Sunita Narain, Editor, Down To Earth, 41, Tughlakabad Institutional Area, New Delhi - 110062 or send email to editor@downtoearth.org.in



DATA CENTRE

Global cases near 6 million

The number of people infected with COVID-19 in the world was 5,909,003 in 213 countries and territories, as of May 29. A total of 362,081 have died of the disease.

COVID-19 in India

The total number of COVID patients in India was 165,799 on May 29. There have been over 89,987 active cases, 71,106 cured/migrated patients and 4,706 deaths.

Forest's carbon stock down

Total carbon stock in global forests decreased to 662 gigatonnes in 2020 from 668 gigatonnes in 1990. The carbon density has increased to 163 tonnes/ha from 159 tonnes/ha.

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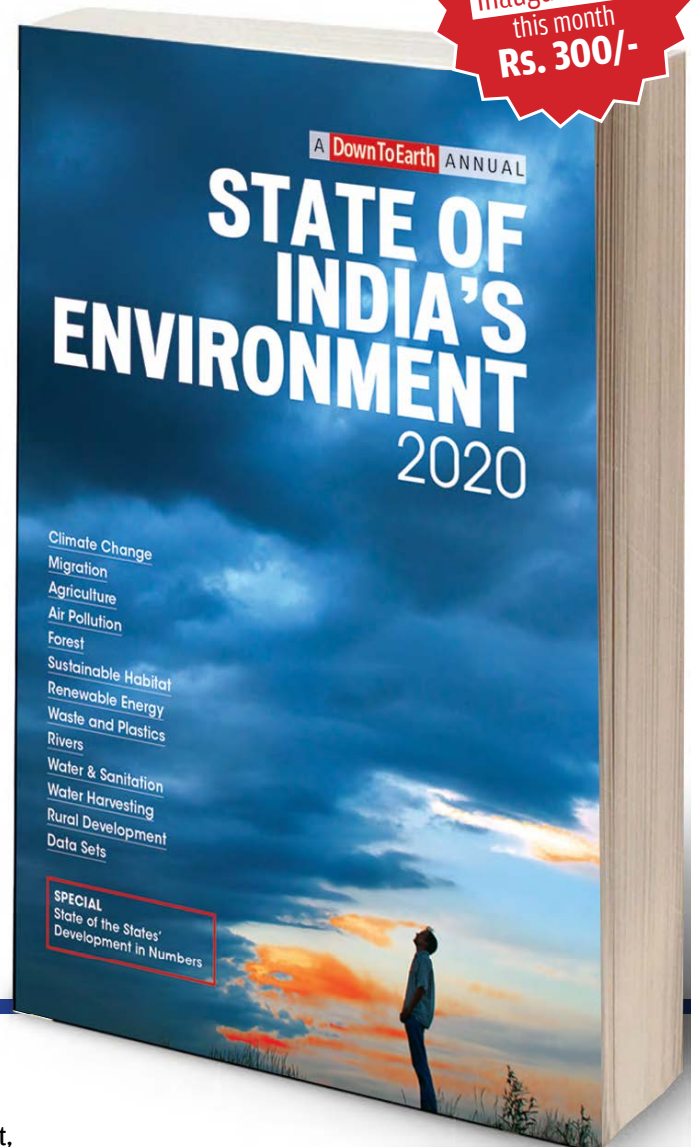
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Digest



WHAT'S INSIDE

Mahesh Sharma uses an age-old tribal tradition to solve a parched district's problems **P12**

The concept of race has no scientific basis and is only a social construct **P13**

Country receives 70 per cent more than normal rainfall in the first monsoon week **P14**

1,000 WORDS

VIKAS CHOUDHARY



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A worried fruit-seller adjusts a mask on his pet in Delhi's Paharganj market as the national capital fast declares fresh areas as containment zones. The total number of containment zones jumped to 219 on June 5

FOR MORE PHOTOS, SCAN



Catching water on the hills

HALMA IS a simple but unique tribal tradition in Jhabua district of Madhya Pradesh—when a person or community needs help, the entire village pitches in to help. But residents of Jhabua had long forgotten their own culture. When social worker Mahesh Sharma went to the district in 1998, he saw the entire area was parched and in deep distress due to water crisis. Government had initiated water programmes but those were restricted to digging borewells and tubewells. Sharma decided to remind the district of their age-old tradition and use it to solve their problems.

The hilly and undulating terrain of Jhabua does not allow soil to hold rainwater. Indiscriminate construction activity aggravates the problem. In 2005, he, along with some social leaders and tribals, started an organisation called Shivganga Mission. Through this, Sharma gave a call to the people of Gopalpura village, where he was living, to congregate at the Hathipava hills, located at the edge of village. The idea was to dig trenches and ponds on the hills that could slow down water flowing from the above, hold it and let it remain there.

The biggest hurdle came from the residents themselves. They were ashamed to carry their own tools. Sharma explained to them that they should hold their tools

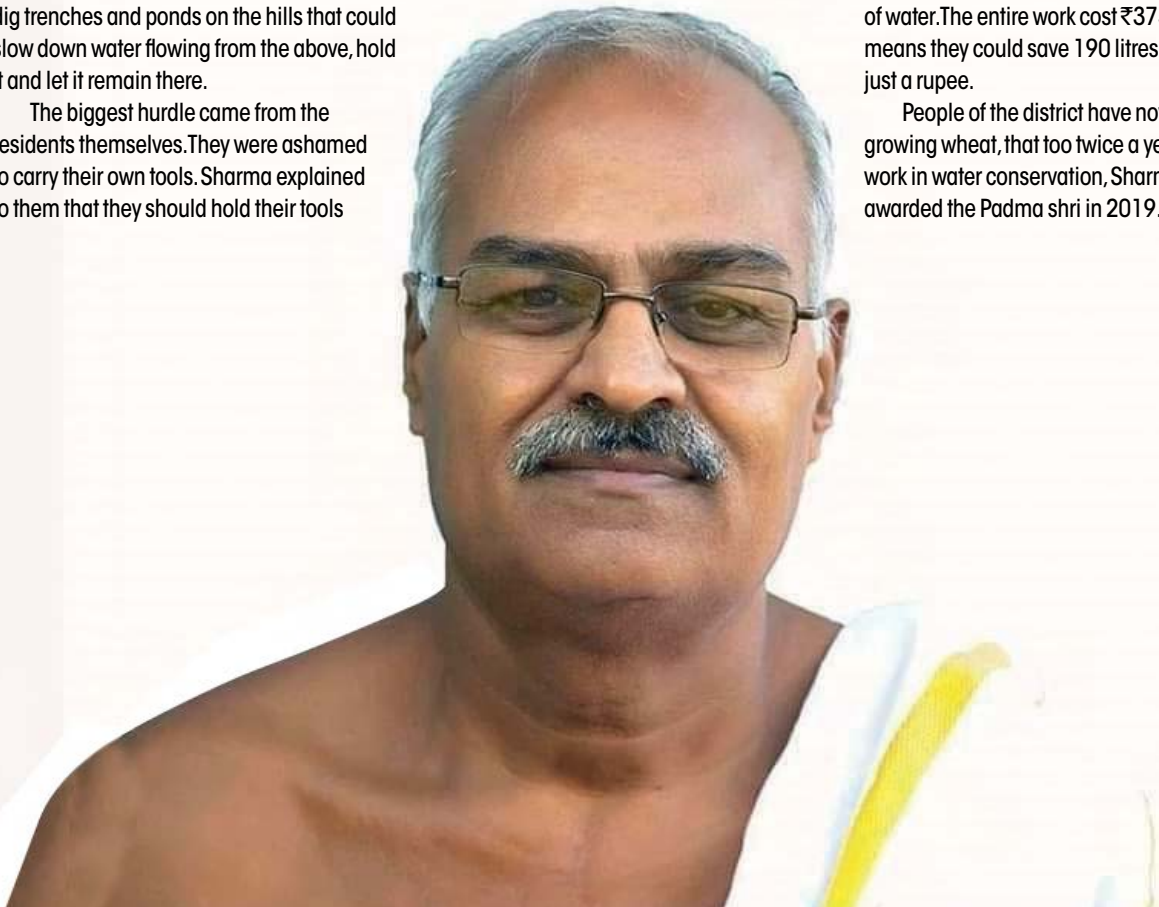
**Mahesh Sharma
initiates a people's
movement to harvest
rainwater in a
parched district of
Madhya Pradesh**

**MANISH CHANDRA
MISHRA**

with pride as it could save Jhabua. He convinced the people and mobilised them to rally through the village with their tools and placards with slogans to save water. In 2009, they built several trenches on the hills, and between 2009 and 2017, they had dug more than 12,000 small ponds that could hold 10,000 litres of water. Now, about 200 million litres of water goes inside the earth each time it rains, and recharges groundwater.

Riding on this success, Sharma initiated work in 325 villages with people digging trenches, ponds, earthen dams and taking up other water conservation methods. Soon he had turned his efforts into a people's movement. This year too, between April and May, the people of Jhabua have dug ponds in several parts of the district. Shivganga took recourse to crowdfunding for this. The aim was to spend not more than a rupee on saving 32 litres of water. When the work got over, six ponds and a stop dam had been created. These can collect 720 million litres of water. The entire work cost ₹375,700. This means they could save 190 litres of water in just a rupee.

People of the district have now started growing wheat, that too twice a year. For his work in water conservation, Sharma was awarded the Padma shri in 2019.



No scientific basis to the concept of race

RAJAT GHAI

THE SCENES that have flashed on television screens worldwide since May 25, 2020, when African-American George Floyd was killed by white policeperson Derek Chauvin in Minneapolis in the US, showed an ugly reality: we still do not live in a post-racial world.

Despite Civil Rights Movement in the US, the end of apartheid in South Africa and even the tenure of America's first non-white president, here is racism rearing its ugly head again. Science, however, proves race to be nothing more than a social construct, defined by dominant social groups in various legal, political and economic contexts.

In the last three decades, DNA testing has revealed that all humanity

is one. One of the first such studies was the Human Genome Project. Twenty years ago, when results of the project were announced at the White House, Craig Venter, a pioneer of DNA sequencing, said: "The concept of race has no genetic or scientific basis."

Science has also proved that the physical difference we term as race, including facial structure, hair texture and colour, eye colour and skin colour, are all caused by mutations in human DNA. Science also tells us that Africans have more genetic diversity between themselves than with people of other races. The reason is the waves of human migration out of Africa. Various African populations evolved from



individuals who migrated into other parts of the continent and established populations that developed in isolation.

American author Guy Harrison summed this up in his 2010 book *Race and Reality*: "Race is a poor empirical description of the patterns of difference that we encounter within

our species. The billions of humans alive today simply do not fit into neat and tidy biological boxes called races. Science has proven this conclusively. The concept of race is not scientific and goes against what is known about our ever-changing and complex biological diversity."

'WHY WERE SOCIAL CONSTRUCTS MADE AT ALL?'

Binalakshmi Nepnam is a humanitarian spearheading work on making women, peace and security an issue that is meaningful to people's lives. She tells *Down To Earth* that the social constructs of race is the bane in today's world



Why hasn't racism died even though race has been proved to be nothing more than a social construct?

Racism is a social construct

but it is important to ask who and why were these social constructs made in the first place to provide the reasons

of rampant racism that exists till today in India or in the US and around the world. Who created the terms "superior" and "savage" races?

The social constructs of race is what is the bane in today's world, whether it is in the Indian caste system, or racism against Indigenous Peoples in Northeast India or against the blacks and the native Americans whom no one talks about these days.

Will there ever be a post-racial world?

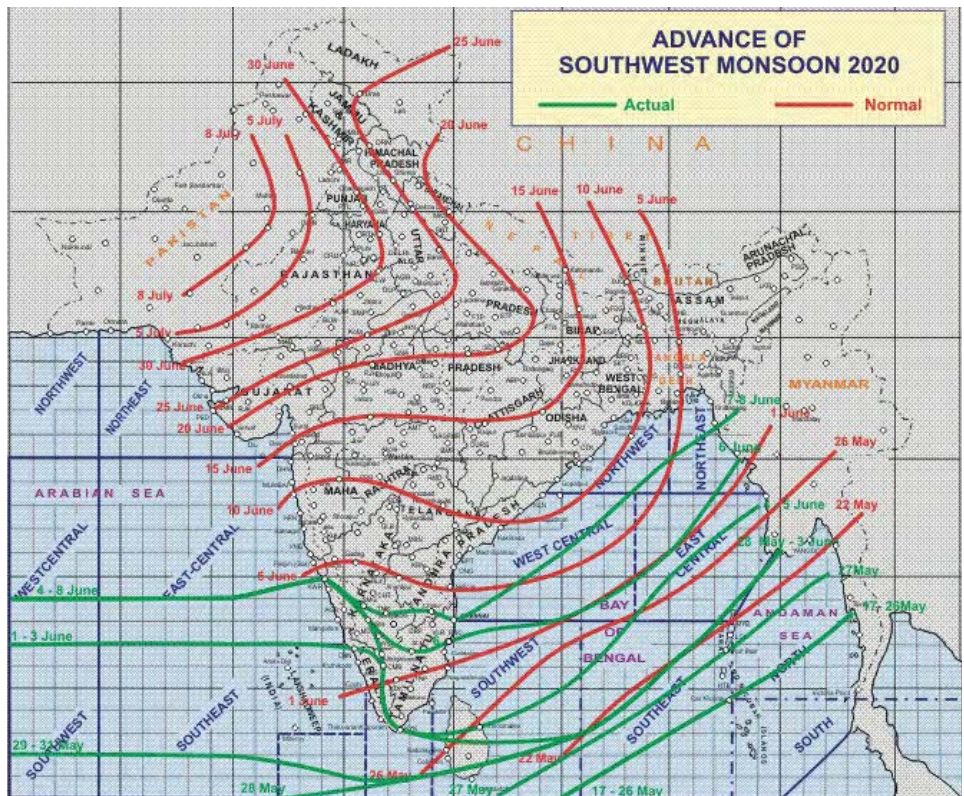
We live in an interconnected world and have the Constitutions of our nations and also the UN Declaration on Human Rights to guide us to cut through this racism division and work towards an equal and a just world to ensure that deaths of Nido Tania from Northeast India or that of George Floyd are prevented.

Monsoon brings 70% more than normal rains

AKSHIT SANGOMLA

THE COUNTRY witnessed 70 per cent more rains than normal in just the first week of monsoon—between June 1 and 7. While Met experts had earlier predicted a slow start to this year's monsoon, the heavy rains are being attributed to untimely formation of severe cyclonic storm Nisarga in the Arabian Sea. "We have seen quite a number of cyclones forming in the Arabian Sea close to the monsoon onset in the recent years. We don't know yet if this is part of a rising trend," says Roxy Mathew Koll, a climate scientist at the Indian Institute of Tropical Meteorology, Pune. "We were expecting the monsoon wind conditions would suppress the low pressure system despite the conducive ocean conditions," he says.

During 2019, eight cyclonic storms formed over the Indian seas against the normal of five with Arabian Sea alone



contributing five cyclonic storms against a normal of one, as per as per the India Meteorological Department (IMD).

The central region received 157 per cent more than normal rainfall, northwestern

India witnessed 115 per cent more rains. Southern and eastern regions received 30 per cent and 33 per cent more rains respectively. As of June 7, the southwest monsoon has advanced to parts of Andhra Pradesh,

Karnataka and Tamil Nadu after its onset over Kerala on June 1. It has also covered parts of Bay of Bengal. IMD predicts monsoon winds will now progress towards Goa, coastal Andhra Pradesh, and the northeast.

SpaceX begins taxi service to space

USHERING a new era of space exploration, on May 31 billionaire entrepreneur Elon Musk's company SpaceX successfully landed two NASA astronauts at the International Space Station, the world's only space-based laboratory, located about 400 km from the earth. The event created immense excitement as this was the first

time a private company had launched humans to space.

The two astronauts—Bob Behnken and Doug Hurley—rode for 19 hours into space inside a bullet-shaped automated spacecraft called Crew Dragon, designed to take people to and from the International Space Station. The rocket itself is designed

to be reused.

SpaceX was formed with the express purpose of sending humans to space, or rather creating a commercial taxi service to space, and building settlements on Mars. Now that the programme is complete, Space X can use Crew Dragon to create a new space tourism business.

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After an uncontrolled discharge of gas for two weeks, the Baghjan 5 gas well caught fire on June 9

Wildlife be damned

A SMOKE MUSHROOM hangs over Assam's Dibru-Saikhowa National Park. A gas well on the edge of the park that had been billowing methane and crude oil uncontrollably for the past two weeks caught fire in the afternoon of June 9. Within hours, the inferno spread to over a kilometre forcing residents of nearby villages to run for their lives. Four people have been injured and about 50 houses burnt as the fire continues to rage. The smoke will cause severe and long-term damage to the ecology of the world's only riverine island wildlife reserve and the Brahmaputra, Lohit and

A gas well on fire poses an existential threat to Assam's Dibru-Saikhowa National Park

ANUPAM CHAKRAVARTTY
TINSUKIA, ASSAM

Dibru rivers that surround it (see 'What's at risk' on p19).

The fire broke out "while clearing operations were on", says a June 9 press release by Oil India Limited (OIL), the public sector company that operates the well located in Baghjan village of Tinsukia district. The company undertakes oil and gas extraction and exploratory operations in 23 wells around Baghjan (see 'A question of priority' on p19).

The blowout, or an uncontrollable release of natural gas, had occurred on May 27 during drilling operations to access an untapped reservoir at the well named Baghjan 5. "They



On May 27, the Baghjan 5 gas well, located near the Dibru-Saikhowa National Park of Assam, saw uncontrolled release of pressurised gas and oil

were trying to drill a layer apart from where gas was originally found,” OIL spokesperson Tridib Hazarika told *Down To Earth* (DTE). At around 10:30 am on May 27, the workers sensed an oncoming blast of natural gas and evacuated the well. Within minutes the blast occurred and was heard by people living 10 km away. “Fire tenders and police officials reached the spot after two hours. The well spewed dark plumes of oil and gas,” says Niranta Gohain, an environmentalist based in Natun Rongagora village, a kilometre from the gas well. OIL technicians with the help

of fire tenders had formed an umbrella of water over the well (see photo above) to prevent the gas from catching fire. As per an assessment by OIL in 2017, the underground reserves are primarily of methane, an inflammable gas.

The district administration has set up three relief camps where about 3,000 people evacuated from four villages in the area have been sheltered. “If floods and coronavirus were not enough, this blast has thrown us out of our houses, damaged our crops and killed our livestock. New crops will not grow for a long time,” says Labanya

Saikia of Baghjan village who was stationed at the Dighal Tarang High School along with 500 families. Riju Chandra Moran, whose family of six depends on a small tea garden, betel nuts and paddy, has completely lost his farm. It is all covered under a layer of oil and gas condensates, he says.

The oil and gas released from the well has travelled with the wind to settle on the Brahmaputra, Lohit and the Dibru rivers. Park authorities recovered carcass of a young Gangetic dolphin and dead livestock on the wetland two days after the leak. People have reported burning eyes and sore throat.

THE BLOWOUT

On the day of the blowout, OIL technicians at the site and private contractors from Ahmedabad-based John Energy Limited, who had been hired to drill, were conducting “workover” operations. These refer to invasive procedures to determine the future of the well, and blowouts during these operations are not uncommon. “During workover operations blow-out preventers (BOP) are removed. They are reinstalled after the operations. In this case, however, the team present on the site did not get enough time to re-install the BOPs,” Hazarika says. Gohain counters by saying that as per the conditions stated in environmental clearance (EC) accorded in 2011 to OIL’s six drilling wells in Mechaki area in Dibrugarh, about 30 km from Baghjan, BOPs should be installed all the time during the drilling operations. Why was this not followed? On May 31, OIL has served a show-cause notice to John Energy Ltd.

There are doubts even about OIL’s EC for Baghjan. “After the dolphin carcass was recovered, we

wanted to go through the EC and the environmental impact assessment and contacted OIL, but we haven't received them," R S Bhati, district forest officer, told DTE. On June 7, the forest department has constituted a 14-member committee to probe the issue.

Even when OIL had set up wells in 2003-06, they did so without public consent, alleges Kamal Baruah, a resident of Baghjan. "They bought the land clandestinely and set up the wells in close proximity to the National Park which will now kill people and animals," Baruah says.

Baruah's assertion echoes with the National Board of Wildlife (NBWL) team that inspected the oil pipelines near Dibru-Saikhowa National Park in 2013. M D Madhusudan and Purna Singh Bindra, the then members of the Standing Committee for NBWL wrote in their report: "We strongly

THE DISTRICT ADMINISTRATION HAS SET UP THREE RELIEF CAMPS WHERE ABOUT 3,000 PEOPLE EVACUATED FROM FOUR VILLAGES HAVE BEEN SHELTERED

disapprove of the current trend of presenting the standing committee of NBWL with fait accompli situations and seeking post-facto clearances for projects on which work has already been undertaken without the requisite prior permissions. The expenditure thus incurred, in this case, from the public exchequer puts undue and unfair pressure on the standing committee of NBWL to ratify violations of wildlife and environmental norms."

Even the notification to demarcate the eco-sensitive zone—a buffer between the National Park and

surrounding areas—from the forest department has only come this January and has been kept 0 km to 8.7 km. Strangely, the buffer is 0 km at Baghjan—the wells are right on the bank of the river.

NEW TECH TO BLAME?

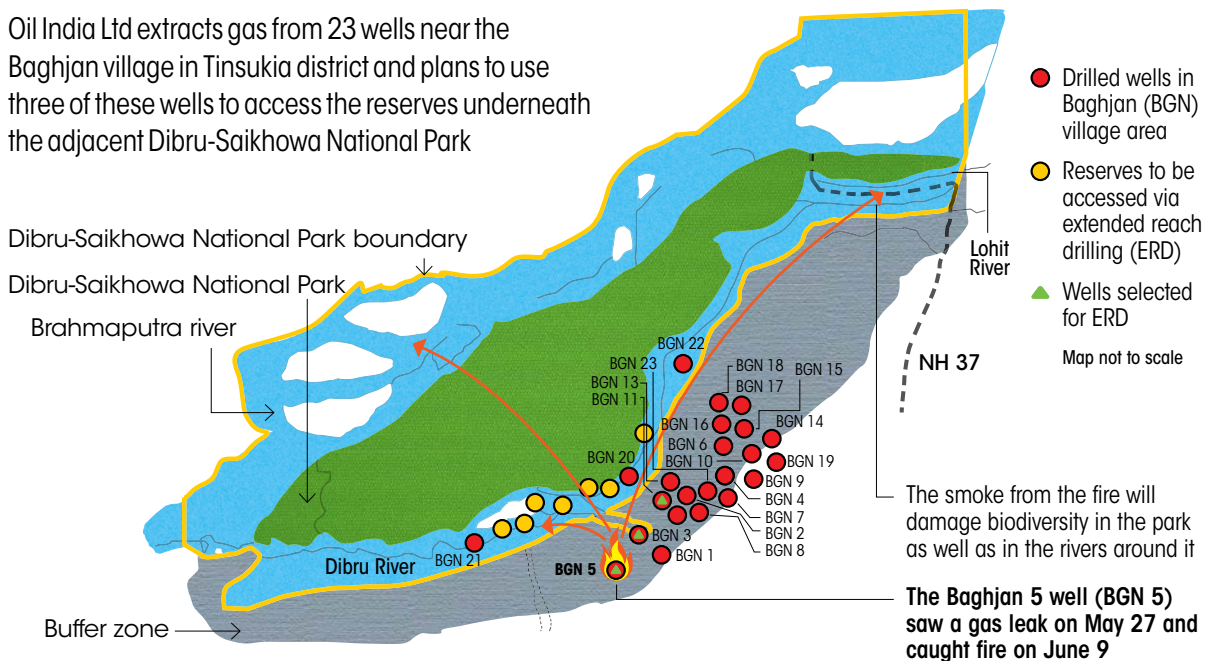
OIL has been operating in the area since 2001. It currently extracts natural gas from 23 wells in Baghjan, as per a proposal document released in 2016, and plans to use three of these wells—Baghjan 3, 5 and 11—to undertake exploratory operations underneath the National Park using extended reach drilling (ERD) technology (see 'A question of priority'). Just a week before the blowout, on May 20, the company issued a press release stating that it did not foresee any disturbance to the environment though it was undertaking drilling operations right underneath the National Park because it



About 1,000 people took shelter at the Dighal Tarang High School near Baghjan village after the well started releasing gas

A question of priority

Oil India Ltd extracts gas from 23 wells near the Baghjan village in Tinsukia district and plans to use three of these wells to access the reserves underneath the adjacent Dibru-Saikhowa National Park



Source: Eco-sensitive zone notification, published in the Gazette of India (Extraordinary) in January 2020

WHAT'S AT RISK

Dibru-Saikhowa National Park is a global biodiversity hotspot

The Dibru-Saikhowa National Park lies at the intersection of two of the world's 34 biodiversity hotspots—the Indo-Myanmar hotspot and the Eastern Himalaya hotspot. Known as the only habitat of feral horses, Dibru Saikhowa, is an island attached to some of the best birding habitats of the world. The wetland attached to the Dibru river attracts migratory species such as ruddy shelduck, bar-headed goose, falcated duck, ferruginous duck, northern pintail and the Eurasian widgeon. It also harbours critically endangered bird species such as the

Bengal florican, white winged duck, Greater adjutant stork, white-rumped vulture and slender-billed vulture, as well as the very rare and endemic black-breasted parrotbill. Overall, Dibru-Saikhowa has recorded over 500 species of birds and 104 species of fish, including the endangered Gangetic river dolphins.

The park is also home to tigers, elephants, wild buffaloes, leopards, hoolock gibbons, capped langurs, slow lorises. Overall it has 40 mammal species, 105 butterfly species and 680 types of plants.

was using ERD technology. The drilling will be done 1.5 km from the National Park and will be at a depth of over 3.9 km. A day earlier, on May 19, the company had announced that it had received EC from the Union Ministry of Environment, Forest and Climate Change to use ERD at seven locations under the park.

Hazarika says this is the first time ERD will be used to drill oil in India. The total reserve is 10 million

tonnes and OIL claims that it will be able to tap three million tonnes from under the National Park. "We plan to start operations within one and a half years," says Hazarika.

Activists believe otherwise. "We think OIL has already started the work on ERD from Baghjan 5. They have begun work on drilling underneath the park," says Gohain.

The project now faces stiff resistance from the people. Moran-Motok tribal communities, who

dominate the area, are threatening to launch an agitation. There is a social media campaign across Assam to save the habitat of endangered species. "We are trying to get legal help. We want to question the poorly demarcated eco-sensitive zone which has been notified without any consultation. We want OIL to stop all drilling in the vicinity of the park," says Gohain.^[DTE]

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OUR DAILY DOSE OF ANTIBIOTICS

As dairy farmers inject antibiotics in their livestock, chances are high that these are passed on to humans through milk, finds Delhi-based non-profit Centre for Science and Environment

**RAJESHWARI
SINHA, DIVYA
KHATTER and
AMIT KHURANA**

Most farmers CSE spoke to did not know they must wait after an antibiotic is given to an animal before its milk is sold



KHAIRATI LAL Chokra, a dairy farmer at Fatehabad in Haryana, injects heavy doses of antibiotics to treat his sick cows and buffaloes. He repeats it every two to three days for a week. Saurabh Shrivastav, another dairy farmer of Jhansi in Uttar Pradesh, injects antibiotics for three consecutive days. They do this to treat their cattle whose mammary glands have swollen due to an infection. The milk emits a strange odour and changes colour. “At times it turns curdy or has blood in it,” says Shrivastav. Selling milk is their livelihood and they have to keep their cattle healthy. Chokra has 20 cows and buffaloes and Shrivastav has 92 of them.

In 2018, when Food Safety and Standards Authority of India (FSSAI) tested milk samples from organised and unorganised sectors across the country, it found 77 of them had antibiotic residues beyond permissible limits. But the food regulator did not disclose the antibiotics that were detected or names of the brands tested. Delhi-based non-profit Centre for Science and Environment (CSE) filed a Right to Information application, but did not receive clear answers despite several follow-ups and an appeal. To understand the reasons for antibiotic misuse and its presence in milk, CSE spoke to a wide range of stakeholders across the country, including farmers of high milk-producing states—Punjab, Haryana, Uttar Pradesh, Rajasthan, Karnataka and Tamil Nadu.

BURDEN OF DISEASE

The biggest irritant for farmers is mastitis, a common disease in cattle. The animals contract it due to poor farming and milking

hygiene. If an animal sits on an unclean floor immediately after being milked, microorganisms enter its body through the udder and cause the disease. Mastitis can also occur if the milker’s hygiene is compromised or unclean milking equipment is used. The disease is most common in high milk-yielding exotic breeds or crossbreeds.

Farmers prefer to treat the animals themselves as it saves them the trouble of taking them to hospital. “Government doctors are mostly not available. Compounders come to the farm, but have little knowledge of either the disease or its treatment,” says Pruthvi Gowda, owner of Kaushik dairy farm in Karnataka. He discusses the

DEPARTMENT OF ANIMAL HUSBANDRY FARMER MANUAL RECOMMENDS USE OF ONLY PENICILLIN, GENTAMICIN, STREPTOMYCIN AND ENROFLOXACIN ON ANIMALS

problem with other farmers on WhatsApp and speaks to doctors over phone. Private doctors charge very high fees. Medicines are easily available over the counter, without doctor’s prescription.

Department of Animal Husbandry (DAHD) Farmer Manual recommends use of only penicillin, gentamicin, streptomycin and enrofloxacin on animals. Shrivastav, however, uses ceftiofur, amoxicillin, cloxacillin and ceftriaxone-sulbactam. Chokra uses ceftizoxime or ceftriaxone-tazobactam. The antibiotics are injected in the animal’s muscle or vein. At times, these are injected directly into the mammary glands. “Most farmers give the injections without knowing which antibiotic should be given and in

what dose. As a result, they end up underdosing or overdosing the animal,” says Jitender Pundhir, a veterinary officer at National Dairy Research Institute, Karnal. Many doctors give medicines without diagnosis. “If an antibiotic is ineffective, it is simply changed,” he adds.

Sandeep Kumar, who rears five dairy animals in Farwain Kala village, Sirsa, Haryana, says, “Once an animal gets mastitis, the chances of it getting fully cured are very low. It often gets an infection.” Some big farmers practise “dry cow therapy” to prevent mastitis. When an animal is not lactating, long-acting antibiotics are injected inside its milking glands to prevent the disease. “This procedure is routinely performed on each animal in my farm,” says Naresh Jain, a dairy farmer of Sonipat, Haryana.

Dairy cattle also contract bacterial diseases like hemorrhagic septicemia, black quarter, brucellosis, and viral ailments like foot and mouth disease. Government has vaccines for these but some farmers are unwilling to use them. “I rely more on privately procured vaccines than free government vaccination services as I am unsure of their cold chain,” says Shrivastav. Mastitis has no vaccine. With over 100 microorganisms causing the disease, finding its vaccine is difficult. National Dairy Development Board has a Mastitis Control Popularisation Project in place.

As farmers overuse antibiotics, it makes the healthy milk that we drink unhealthy.

TRUTH ABOUT OUR MILK

India is the world’s largest milk producer. It produced a massive 187.7 million tonnes in 2018-19.

While urban areas consume 52 per cent of the total milk, rural regions use the rest. The unorganised sector, comprising milkmen and contractors, cater to 60 per cent of the milk in urban areas. But how good is the milk that we consume?

There are times when milk comes from sick animals under heavy antibiotic treatment. Most farmers CSE spoke to did not know about withdrawal period—this is the time after the last day an antibiotic is administered and before the milk is sold. Farmers must not sell milk cattle during this period as it can increase chances of antibiotic residues in milk.

“I sell milk irrespective of the ongoing antibiotic treatment,” says Subhash Chandila, who owns 12 Murrah buffaloes in Badoli village of Faridabad, Haryana. Jitender Yadav, who has a dairy in Noida, wonders how farmers would sustain themselves if they do not earn for the 7-15 days of treatment and withdrawal period. Mohan Tyagi of Dhaulpur in Uttar Pradesh admits he has sold such milk to Parag, the state cooperative’s brand. Arjun Jat, too, used to milk the animals during treatment. But Saras, Rajasthan’s cooperative brand, whom he sold milk to, asked not to do so.

Consuming milk drawn during withdrawal period can lead to [resistance against antibiotics](#) because the antibiotics exert selection pressure among the gut bacteria in humans. Studies show that boiling or pasteurisation milk may not completely eliminate antibiotics. A 2019 Bangladesh Agricultural University research found that even after boiling milk at 100°C for 20 minutes, there was no change in the status of residual amoxicillin,

oxytetracycline and ciprofloxacin. No effect of pasteurisation on cloxacillin residues in milk was observed in a study led by West Bengal University of Animal and Fisheries Sciences in India.

PROBING COMPANIES

CSE reached out to milk federations and found that most dairy cooperatives only occasionally tested milk for antibiotic residues. The cooperatives serve 80 per cent of the consumers with packaged milk and retail products. These follow a three-tier structure—dairy cooperative societies in the villages, district-level milk unions and a state-level milk federation as the apex. Milk collected from farmers at a dairy cooperative society is stored in bulk coolers and transported in tankers to the district-level processing plants.

Historically, milk federations have focussed more on removing

MILK FEDERATIONS FOCUS MORE ON REMOVING ADULTERANTS LIKE UREA AND DETERGENT THAN CHECKING ANTIBIOTIC PRESENCE

adulterants like urea, detergent and starch than on checking antibiotic presence.

Responding to an email, Shabnam Chopra, in-charge of quality assurance at Parag, claimed the company has not reported any case of antibiotic residue. “We have upgraded our major dairy laboratories. These laboratories have been provided with antibiotic testing kits. Testing is done route-wise for incoming milk. Once in six months we get our milk and milk products checked for nutritional values, pathogens, antibiotic resi-

dues and veterinary drug residues. Qualitative testing is used for antibiotics testing,” she wrote.

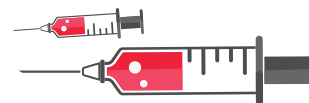
Similarly, T Thirupathappa, who is the additional director of quality assurance at Karnataka Milk Federation, that markets milk under the brand name Nandini, told CSE, “Milk is tested for antibiotics once in six months. Testing is done at NABL-accredited lab as per ISO standards.” Similar frequency of testing was cited by officials at milk federations in Rajasthan, Punjab and Haryana which sell brands Saras, Verka and Vita respectively.

“Testing of antibiotics in milk which gets pooled cannot be done with the lab infrastructure that we have,” says representative of Gwalior Sahakari Dugdha Sangh who did not wish to be named. The body is affiliated to Madhya Pradesh State Cooperative Dairy Federation Limited, that sells milk under the brand name Sanchi. “Testing requires high-end equipment from certified labs,” he said.

Some cooperatives, however, said they conduct frequent testing. Gujarat Cooperative Milk Marketing Federation Limited, which sells India’s largest and most popular brand, Amul, is an example. “Milk from all tankers is tested for antibiotic residues on a daily basis though FSSAI recommends less frequent testing. A kit-based quantitative method is used to test about 700 samples each day at a rate ₹1,000 per sample,” says Sameer Saxena, senior manager, quality assurance, Amul. It procures about 23 million litres of milk every day. “No antibiotic is found in samples taken from tankers as milk gets pooled from multiple societies,” he

RAMPANT MISUSE

Dairy farmers indiscriminately inject into cattle antibiotics that are critical for humans



Antibiotic	Antibiotic class	Use in human beings
Ceftizoxime	Third generation cephalosporins is highest priority critically important antimicrobial (HPCIA)	In infections caused by aerobic and anaerobic gram-positive and gram-negative organisms
Ceftriaxone		In bacterial dysentery, enteric fever, biliary tract infections, acute bacterial meningitis, cellulitis and community-acquired pneumonia
Ceftriaxone-tazobactam, ceftriaxone-sulbactam		Tazobactam and sulbactam are used in combination with other antibiotics for infections of the abdomen, gastrointestinal tract, skin and soft tissue, ear, bone and joint infections, respiratory tract, urinary tract etc
Cefotaxime		Ear infections, central nervous system infections, pediatric infections, neonatal infections
Ceftiofur [^]		Antibiotics of the same class are critical for humans to treat infections
Enrofloxacin [^]	Fluoroquinolones (HPCIA)	Antibiotics of the same class are critical for humans to treat infections
Gentamicin [*]	Aminoglycosides is critically important antimicrobial (CIA)	Sepsis during pregnancy and childbirth, pneumonia, pediatric infection, bone and joint infection, heart infection
Streptomycin [*]		Tuberculosis, heart infection
Penicillin [*]	Penicillins (CIA)	Cardiovascular infections, respiratory tract infections, gynaecological infections, ear infections, acute rheumatic fever
Ampicillin		Lower respiratory tract infection, abdominal infection, heart infection
Amoxicillin		Skin and soft tissue infection, ear infection, urinary tract infection, sinusitis, sepsis during pregnancy and childbirth
Amoxicillin-clavulanic acid		Infections of the abdomen, gastrointestinal tract, skin and soft tissue, ear, respiratory tract, urinary tract, genital tract and gynaecological infections

* The Department of Animal Husbandry Farmers Manual recommends these for treatment of mastitis. Penicillin is also recommended for treatment of anthrax and black quarter, and streptomycin for bovine tuberculosis

[^] While ceftiofur and enrofloxacin are used in animals, they could lead to development of cross-resistance in bacteria to other antibiotics belonging to the same class, which are otherwise critically important for use in humans

said. However, when CSE asked Amul to share the test reports, the company did not respond.

The Malabar Regional Cooperative Milk Producers' Union (MRCMPU), which operates under Kerala Cooperative Milk Marketing Federation, claimed to perform tests at three levels—daily from tanker samples, once in two months at society level, and also at individual farmer level for root cause investigation. When asked what is done in case antibiotics are detected in tested samples, James K C, senior manager at MRCMPU, said:

“We have a traceability mechanism in place to trace the farmer.”

“Our workers in villages know the probable source of contamination. If found guilty, the provider is warned. If he repeats, he is removed from the list of registered farmers,” says an official from plant operations division at Sanchi, indicating that tests are done only when doubts are raised.

CSE also reached out to other leading brands like Mother Dairy and private brands such as Nestle and Gopaljee. Nestle claimed milk processed and sold by them is

tested by both qualitative and quantitative methods at NABL-accredited labs.

When lab test reports were requested, the representative called to say the company does not share them. Mother Dairy and Gopaljee did not respond at all.

FSSAI has recently approved three kits for antibiotic detection and released Scheme of Testing and Inspection (STI) of milk for dairy processing. As per STI, antibiotics and veterinary drug residues will be monitored at two inspection points. But the frequ-

ency of inspection is quarterly, too low to check malpractices.

HOW THIS AFFECTS US

The biggest problem in the Indian dairy sector is that there are no standard treatment guidelines for livestock diseases. Veterinarians, therefore, cannot refer to a standard document and prescribe antibiotics.

Farmers indiscriminately use on animals antibiotics that are crucial for humans. According to the World Health Organization, critically important antimicrobials (CIAs) are the limited therapies to treat human infections caused by bacteria from non-human sources (see 'Rampant misuse', p23), of which some are categorised as highest priority critically important antimicrobials (HPCIAS). In India, bacterial resistance to third-generation cephalosporins is already high with *Escherichia coli* and *Klebsiella pneumoniae* showing more than 75 per cent resistance. Both these bacteria cause several common infections.

A 2018 data with National Centre for Disease Control's National AMR Surveillance Network shows 86 to 93 per cent resistance of *E coli* to ampicillin and 82 to 87 per cent to cefotaxime. Similarly, resistance of *K pneumoniae* to cefotaxime was 81 to 89 per cent. A study published in *Scientific Reports* in 2019 reported high levels of resistance in commensal *E coli* in a cohort of 125 children between one and three years in a rural area of Madhya Pradesh. Highest resistance was observed for ampicillin while for each child, more than 90 per cent resistance to cephalosporins was observed.

[It is disturbing how antibiotics are being passed on to environment.](#) About 70 per cent of the antibiotics

Farmers' guide

What can reduce bacterial infection and avoid antibiotic misuse

- Keep cattle sheds clean, dry
- Clean milking glands before and after milking the animal
- Use clean milking equipment, follow correct and hygienic milking methods
- Prevent the animal from sitting at least 30 to 45 minutes after milking
- Animals with chronic mastitis should be milked last
- Separate sick/infected animal from healthy ones, destroy fodder in contact with infected animal
- Use ethnoveterinary medicines for treatment
- Regularly vaccinate animals
- Use antibiotic judiciously
- Promptly inform authorities for early disease control

given to animals are excreted unmetabolised. As cow and buffalo dung are used as manure in agricultural farms, it can make soil bacteria resistant and environment a reservoir of antimicrobial resistance (AMR)-causing determinants. Other than food, human exposure to resistant bacteria through direct handling of dairy animal waste or through environmental route can lead to drug-resistant infections.

THE WAY OUT

India's bovine population is almost 300 million. Obviously, the scale of CIA use is gigantic. A well-defined roadmap to limit misuse of CIA, and no use of HPCIA, is critical to reduce the huge burden of antibiotic

resistance. DAHD should develop standard treatment guidelines to reduce the misuse of antibiotics. The outreach of veterinary extension system should be strengthened. DAHD must also expand the vaccine coverage for diseases through its programmes. It should run awareness campaigns for farmers so that they follow withdrawal period before selling milk. Good farm management and hygiene should be promoted to prevent mastitis.

It is time FSSAI set tolerance limits for antibiotics such as amoxicillin, ceftriaxone and gentamicin, which are used in dairy animals, and not listed by FSSAI. Antibiotics with no tolerance limits should not be allowed for use in them. The regulator should help state food and drug administrations to strengthen routine antibiotic monitoring in milk and make the data public. FSSAI must also increase the frequency of testing milk as per STI and support states on its implementation.

The Central Drugs Standard Control Organisation must regulate over-the-counter sale of antibiotics. It should work with state drug officials to ensure that no antibiotic is sold without prescription.

The Indian Council of Agricultural Research should also develop low-cost diagnostics for early disease diagnosis and antibiotic residue monitoring at all levels be it farm, veterinary healthcare setting or milk collection centre. Considering the linkages of environmental spread of AMR with dairy farm waste, the Central Pollution Control Board along with state pollution control boards should ensure that its guidelines for Environmental Management of Dairy Farms and Gaushalas are followed. [DTE](#) [@down2earthindia](#)

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Dangerous dilution

Change of Forest Rights Act in three states will hit forest-dwelling communities hard

ISHAN KUKRETI
NEW DELHI

IN MAY-END, Maharashtra, Odisha and Chhattisgarh, where over one-fourth of India's tribes live, changed a law meant to protect them. They modified the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, or FRA, threatening to make the forest-dwelling communities even more vulnerable.

On May 18, Maharashtra governor Bhagat Singh Koshiyari, using his powers under Schedule V of the Constitution, notified an amendm-

ent in Section 6 of FRA. Now, a divisional-level committee would serve as the appellate body to examine people's grievances. As per the government, the change would help serve justice to tribal people whose individual or community rights have been rejected by the district-level committee.

Creation of the new appellate body has taken many by surprise because under the FRA provisions, a state-level monitoring body already exists to oversee the process. "On several occasions, state-level bodies

RELATED STORY

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have asked the district-level committees to review their decisions. It's a different matter that state-level committees, which are supposed to meet once every two months, do not meet. Creating another body will only complicate matters," says Shomona Khanna, a Supreme Court advocate and former legal counsel of the Ministry of Tribal Affairs (MOTA). "It will also reduce the claimants' ability to approach higher courts to challenge the decision of the district-level committee, as the courts would hold that an appellate body has already rejected the claim," she adds.

More worrying is that the amendment applies only to areas covered under the Panchayats (Extension to Scheduled Areas) Act, 1996, (PESA). "The spirit of FRA was to take the provisions of PESA, such as gram sabha's ownership over forest resources, to non-scheduled areas. Now, scheduled and non-scheduled areas will be treated differently," says Khanna.

Forest rights experts say the state's decision to amend FRA may have been driven by an affidavit by Wildlife First, a conservation advocacy non-profit and petitioner in an ongoing case in the Supreme Court. On February 13, 2019, the apex court had ordered the eviction of tens of thousands of tribal people across 16 states whose claim as forest-dwellers were rejected under FRA. Accepting procedural lapses, state governments started to review the rejections suo moto. But such a process has no legal basis under FRA, Wildlife First stated in its affidavit.

"In a way, the decision to create a body to review rejections shows that Maharashtra agrees with the petitioner's rationale. This is despite the fact that MOTA has filed an

affidavit stating that the suo moto review is a procedural decision for ensuring natural justice and has no bearing on the judicial process under FRA," says a forest rights expert who did not wish to be named.

POWER SWITCH

Soon after Maharashtra, the Odisha Forest and Environment department issued a notification on May 21 appointing the *tehsildar* as the forest settlement officer, who would inquire into and determine the "existence, nature and extent of any rights or privileges alleged to exist in favour of any person".

The move overturns FRA's democratic process. Under its three-tier process, a claim is filed at the gram sabha-level committee, which goes to the sub-divisional committee and finally to the district committee, which accepts or rejects it. These

IN FEBRUARY 2019, APEX COURT ORDERED EVICTION OF TENS OF THOUSANDS OF TRIBAL PEOPLE ACROSS 16 STATES WHOSE FRA CLAIMS WERE REJECTED

bodies had representatives from forest, revenue, tribal and panchayati raj departments. The move would create conflict with FRA.

Experts say the step was taken to use the compensatory afforestation fund (CAF). "Odisha received the highest amount under the CAF Act to carry out compensatory afforestation. The notification will make it easier for the forest department to notify compensatory afforestation areas as reserved forests by bypassing the rights recognition process laid under FRA," says Giri Rao of Vasundhara, a Bhubaneswar-based forest-dweller rights non-profit. As per the CAF

Act, any land over which compensatory afforestation is done must be notified as a reserved or protected forest. "If the idea is to just notify new areas as forests then the government should amend relevant provisions under the Indian Forest Act, 1927, and the respective state forest Acts to incorporate the rights recognition process. To give all the powers to the forest settlement officer is regressive," says Tushar Dash of Community Forest Rights-Learning and Advocacy, a group of FRA activists and researchers.

FRA VIOLATED

On May 31, Chhattisgarh also amended the law. It made forest department the nodal agency for recognition of community forest resource rights. These rights are given collectively to the gram sabha and come with the power to conserve and manage forests by the village. The decision completely violates the provisions of FRA, under which a state's tribal department is the nodal agency. This drew strong criticism and the state government withdrew the notification within 48 hours.

Almost 14 years after FRA was enacted, its implementation remains far from satisfactory. Data with MOTA shows district-level committees approved only 34 per cent of the 4.2 million claims filed till January 2020. About 42 per cent of the claims were rejected, while the rest are still pending. [The Supreme Court's order to evict tens of thousands of tribal people](#) has been stayed after nationwide protests. However, it strengthens people's belief that forest-dwellers would pay the price for government's inability to implement the law properly. [DTE](#) [@ikukreti](#)

DEAD LINES

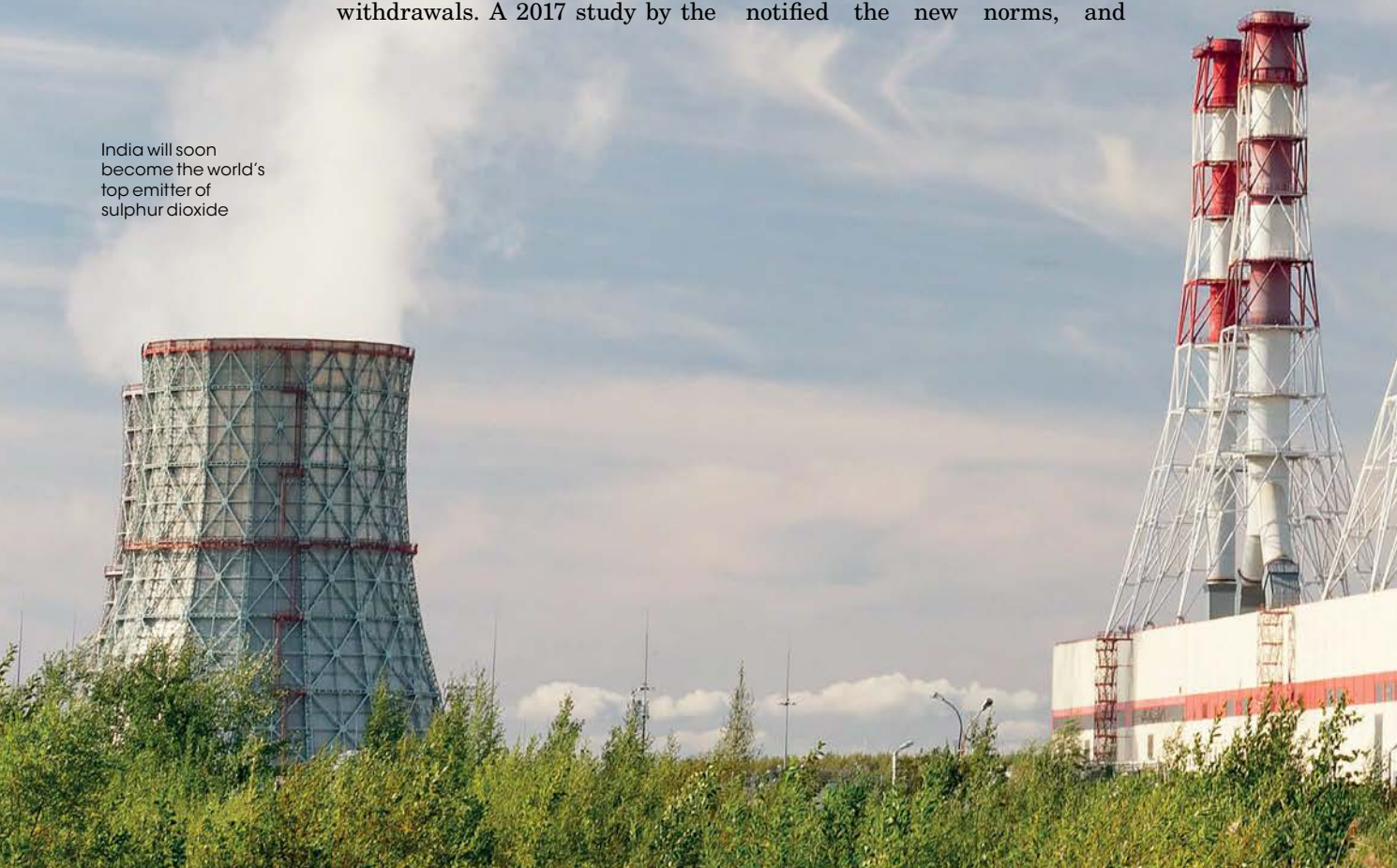
More than 70 per cent coal-fired power plants will not meet environmental norms by 2022, five years after their deadline was extended, says a new report by Delhi-based non-profit Centre for Science and Environment

C OAL-FIRED thermal power plants (TPPs) generate about 56 per cent of the country's energy needs. But they are a resource-intensive and polluting industry—they account for over 60 per cent of industrial emissions of particulate matter (PM); 45 per cent of sulphur dioxide (SO₂); 30 per cent of oxides of nitrogen (NO_x); and, over 80 per cent of mercury emissions. Moreover, the sector is responsible for 70 per cent of total freshwater withdrawals. A 2017 study by the

US-based University of Maryland says that India will soon become the world's top emitter of SO₂. This scenario has arisen due to lack of effective control measures over the decades in India.

In 2015, the Centre for Science and Environment (CSE), a Delhi-based non-profit, recommended a revision of the sector's emission norms. Taking cognisance, the Union ministry of environment, forest and climate change (MOEFCC) notified the new norms, and

India will soon become the world's top emitter of sulphur dioxide



wanted them to be implemented by 2017. But the industry not only obstructed and prevaricated this move, but tried to use the Supreme Court and other agencies to shift the deadline from 2017 to 2024. Finally, the deadline was extended to 2022. But a new report by CSE, *Coal-based Power Norms: Where do we stand today*, finds that with barely two years to go before the deadline hits them, almost 70 per cent of the plants will not meet the emission standards. Says CSE Director General Sunita Narain: “Our assessment finds that even after seven years since the notification and even after the agreed five-year extension given to this sector in 2017, most of the total installed coal-fired capacity will not be compliant with the crucial SO₂ standards by 2022” (see ‘SO₂ compliance and non-compliance’).

IGNORING DEADLINES

While 53 per cent of the plants are said to be complying and 8 per cent planning to upgrade, the status is not known for 38 per cent of the plants. Furthermore, there is little information in the public domain about compliance with PM or NO_x standards. Worse, the deadline to meet the water consumption norms was December 2017, but no firm action was taken on non-complying plants.

While extension of deadlines to meet emission norms has been granted, in the case of water, there has never been any such discussion on compliance. It was only in January 2019 that the Central Pollution Control Board (CPCB) asked TPPs to submit their specific water consumption data on a quarterly basis starting from October-December 2018. Based on

SO₂ compliance and non-compliance*

Of the 18 GW capacity that had to comply in 2019, only 1.3 GW has complied. Looking at the current scenario, a major share of the capacity is going to miss the deadline

Already complying (in 2017)		11,119 MW		Current status irrespective of deadlines (MW)
CPCB deadline		179,818 MW		
CPCB deadline (SO ₂)		Deadline-wise current status (MW)		
Deadline	Total capacity (MW)	Progress made	Capacity (MW)	16,029 MW (8%) Total complying
2018/comply immediately through lime injection	4,115	Complying	500	
		Feasibility study	500	
		Status not known – these plants were required to do lime injection; their status is not clear and is not being monitored	3,115	
2019	18,670	Complying	1,320	32,600 MW (17%) Tender awarded
		Tender awarded	3,520	
		Tender floated	8,150	
		Feasibility study	3,020	
		No plan	1,950	
		Retired/to retire	600	
		Status not known	110	
2020	31,280	Complying	720	59,930 MW (31%) Tender floated
		Tender awarded	2,760	
		Tender floated	6,140	
		Feasibility study	12,890	
		No plan	4,840	
		Retired/to retire/RSD	660	
		Status not known	3,270	
2021	63,168	Complying	630	64,963 MW (34%) Feasibility study
		Tender awarded	10,070	
		Tender floated	21,465	
		Feasibility study	29,683	
		No plan	1,320	
2022	62,585	Complying	1,740	1,260 MW (1%) Retired/to retire/RSD
		Tender awarded	16,250	
		Tender floated	24,175	
		Feasibility study	18,870	
		No plan	1,050	
		Status not known	500	
	190,937		190,937	9,160 MW (5%) No plan
				6,995 MW (4%) Status not known

Note: Above analysis includes plants that were issued directions by CPCB during 2017-18
*Progress status as of October 2019; Source: CEA, 2019 and CSE analysis, 2020

Note: Above analysis includes plants that were issued directions by CPCB during 2017-18
*Progress status as of October 2019; Source: CEA, 2019 and CSE analysis, 2020

the data obtained, the plants—which were not meeting the specific water consumption limit—were asked to submit time-targeted action plans to achieve the limit. CPCB issued directions to freshwater-based once-through plants (16 GW capacity) in June-July, 2019, to install cooling towers and comply with the standards by June 30, 2022. The plants were also directed to submit six monthly progress reports on actions taken on compliance.

However, the status of a majority of the plants—which claim to have already installed cooling towers—is not known. It is also not clear whether other non-complying plants (apart from once-through plants) have been issued any directions.

As far as other norms are concerned, it is highly unlikely for units with no plan to meet the 2022 deadline even if they are awarded tenders now. For instance, it takes at least two years for a station to complete the construction of a flue gas desulfuriser. Hence, a coal-based power project with a 2022 deadline should have begun construction by 2019. What is even more worrying is that there are a large number of units with no plan for installation. It is highly unlikely for these units to meet the deadline by 2022 even if they award tenders now.

Overall, the report says that Central plants are doing much better in terms of implementation of SO₂ norms. More than half had awarded tenders and another 34 per cent had floated tenders, as of October 2019. But about 94 per cent of Delhi-NCR units (10 plants) have missed the 2019 deadline for

SO₂ compliance (see ‘Status of plants located in the vicinity of Delhi-NCR’ on p32). Of the private and state-owned plants, only one state-owned plant (comprising two units) has awarded a contract so far. For NO_x, implementation data for a majority of the plants is still not available.

THE PHASE-OUT PLAN

In 2015, old power plants in India which had been in operation for over 25 years accounted for 34,720 MW capacity. The Central Electricity Authority (CEA) recommended in 2017 that out of this, 15,552 MW should be retired. The remaining capacity was to be retrofitted. MOEFCC in its affidavit to the Supreme Court (submitted in 2018) says that over 4,775 MW has been retired, and another 4,191 MW is in the pipeline for retirement. For the remaining, it requested exemption from meeting the norms. The plea was declined by the Supreme Court-empowered Environment Pollution (Prevention and Control) Authority (EPCA). Most of the older plants are owned by state power companies—governments and are reluctant to ‘retire’ these plants. In

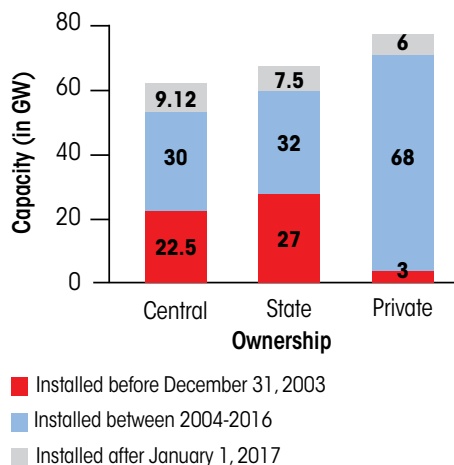
IMPLEMENTATION OF THE NORMS CAN CUT EMISSION OF PM BY 35 PER CENT, SO₂ BY 80 PER CENT AND NO_x BY 42 PER CENT. THEY CAN ALSO BRING DOWN FRESHWATER USE

the Union Budget 2020, the Union finance minister said utilities that run old plants would be asked to shut them if these emitted more than the “pre-set norms”. But there is no action plan as to how this will be done.

As far as the new plants are

Ownership V age distribution

From the ownership perspective, a major share of the power plants are old



Source: Centre for Science and Environment's (CSE) 2019 analysis

concerned, new capacity totalling 23,112 MW was added between January 2017 and October 2019, with the Central sector accounting for 41 per cent of it. However, the rate of growth of new thermal power plants has significantly slowed down, and in the past few years, has remained below target.

Plants have not been commissioned for one reason or another.

All new plants have to meet the stringent new emission norms—but as far as meeting SO₂ standards are concerned, they too will miss the deadline.

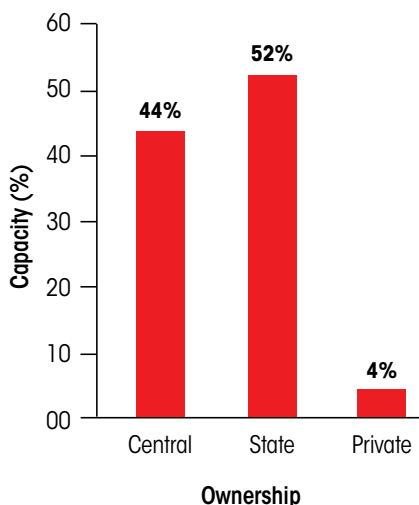
In other words, these plants are functioning but are not compliant with the standards.

MERCURY EMISSIONS

Mercury is one of the most toxic contaminants known to humans. Coal-fired power plants are the biggest source of mercury

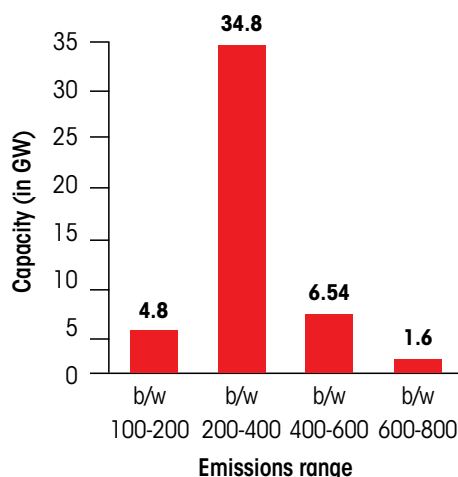
Who owns plants that are over 25 years old

Units that are more than 25 years old largely comprise Central- and state-owned plants



NO_x emissions intensity in the surveyed states

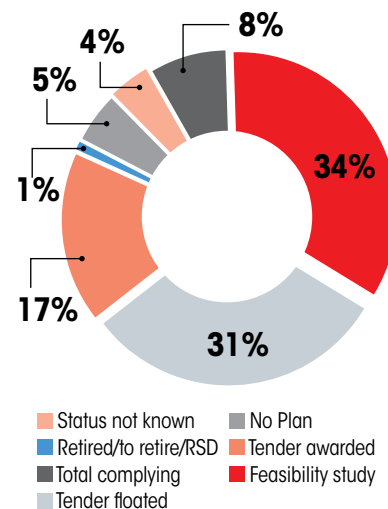
About 73 per cent capacity in surveyed states had emissions between 200 and 400 mg/Nm₃



Source: Centre for Science and Environment, 2019

Slow pace to curb SO₂ emissions

About 34 per cent of the capacity is still at feasibility study



Source: Centre for Science and Environment, 2020

emissions. India is one of the world's mercury hotspots, and coal-based power plants account for 80 per cent of the country's mercury emissions. India's energy sector consumed 576 million tonnes of coal in 2017-18; based on this, the annual mercury release works out to be about 160 metric tonne.

In December 2015, the environment ministry set the standard for mercury emissions from coal-based power plants at 0.03 mg/Nm₃. The environment ministry says all units are likely to meet mercury emission norms. But there is little information of the government is going to ensure its implementation.

Water use by these plants is another area of concern—44 per cent of existing coal power plants and 45 per cent of proposed plants are located/proposed in areas with high-to-extremely high levels of water stress. In many cases, the

very existence of these power plants is leading to water stress in the regions where they are located. In a business-as-usual scenario, 70 per cent of India's thermal power plants will face high water stress by 2030 and conflicts between industries and local communities is bound to intensify. The states in India where these plants are located include Maharashtra, Uttar Pradesh, Gujarat, Andhra Pradesh, Rajasthan, Tamil Nadu, Haryana and Punjab, among others. Due to scarcity of water, power plants in these states are forced to shut down during certain times of the year.

POWERING THE FUTURE

So how can coal-fired power plants be made to meet the new norms? The government must issue directions to the absolute laggards—the plants that have either not even floated tenders or

have no plans as yet. This direction must be punitive. It must either involve closure, or a substantial fine, or a fiscal disincentive. The government must also review the category of plants that have not yet awarded tenders and issue notices to them to speed up compliance. High penalties/closure notices should be issued for non-compliant Delhi-NCR airshed plants at least for the peak winter pollution months.

CSE says that over 70 per cent of the older generation plants that are not scheduled for retirement will not meet the SO₂ standards by 2022. Therefore, the government must also take urgent decisions regarding the older plants that cannot meet emission standards and should be retired/refurbished to use alternative fuels.

Power plants that have emerged after 2017 must also adhere to the deadline or face closure—there

Status of plants located in the vicinity of Delhi-NCR

Of the 11 plants, seven are complying with PM norms, and only one with SO₂ norms

Plant name	District	Total units	Total capacity (in MW)	Implementation progress as of October 2019
HARYANA				
Aravali Thermal Power (Indira Gandhi TPS)	Jhajjar	3	1,500	SO ₂ – Tender awarded PM – Complying NO _x – Tender awarded for combustion modification
Mahatma Gandhi STPS (CLP)	Jhajjar	2	1,320	SO ₂ – FGD installed; Complying PM – Complying NO _x – Combustion modification done
Panipat TPS	Panipat	4	920	SO ₂ – Re-tendering PM – Complying NO _x – Preliminary study
Rajiv Gandhi TPS	Hisar	2	1,200	SO ₂ – Tender floated PM – Complying NO _x – Preliminary study
Yamunanagar TPS	Yamunanagar	2	600	SO ₂ – Tender floated PM – ESP retrofit/upgradation planned NO _x – Preliminary study
UTTAR PRADESH				
NCTPP Dadri	Gautam Budh Nagar	6	1,820	SO ₂ – Tender awarded; Work in progress PM – Complying NO _x – Combustion modification done;
Harduaganj TPS (UPRVUNL)	Aligarh	3	610	SO ₂ – Tender floated PM – Tender floated NO _x – Tender floated
PUNJAB				
Guru Hargobind TPS (Lehra Mohabbat TPS)	Bathinda	4	920	SO ₂ – Feasibility study completed PM – Non-complying NO _x – Non-complying
Rajpura TPP (Nabha Power Ltd.)	Patiala	2	1,400	SO ₂ – Tender floated PM – Complying NO _x – low NO _x burners installed
Ropar TPS	Rupnagar	6	1,260	SO ₂ – Feasibility study completed PM – ESP installed in Units 3 & 4, and to be upgraded in Unit 5 & 6 NO _x – Complying
Talwandi Sabo TPP	Mansa	3	1,980	SO ₂ – Tender floated PM – Complying NO _x – Tender floated

cannot be any excuse for delays in the case of new plants, as the notification was issued in December 2015. While the older generation plants have to retrofit the emission technologies, the new-generation plants have no such reason to delay the implementation of emission standards. The government must also issue directions to power companies to include regular monitoring of mercury, and review the implementation of water standard and issue directions for monitoring and compliance.

“The 2015 standards are in line with global regulations. According to rough estimates, their implementation can cut down emissions of PM by 35 per cent, SO₂ by 80 per cent, and NO_x by 42 per cent. They can also bring down freshwater use by the industry,” says the CSE report.

We need different systems for deterrence: one, in which there is both an incentive for the first movers—the plants that invest in upgrading their technologies and so reduce their emissions—and a disincentive for the laggards, who continue to pollute and compromise public health.

“We know that this sector, which provides energy to the country’s industry and households, is difficult to shut down. We are suggesting that there should be changes in the merit order dispatch system so that it provides an effective tool to incentivise the cleaner plants and reward the best performers, while also disincentivising units that do not adhere to standards,” adds Narain. **DTE**

(This article is based on CSE’s report Coal-based Power Norms: Where do we stand today)

 @down2earthindia

New Initiative by **HP Forest Department**

EK BUTA BETI KE NAAM

A Scheme to associate

FAMILY OF NEWLY BORN GIRL CHILD
in tree planting.

Himachal Pradesh Forest Department
on the occasion of Birth of Girl Child gifts :

5 Saplings

Tree guards

Vermi compost

Name plates of Child



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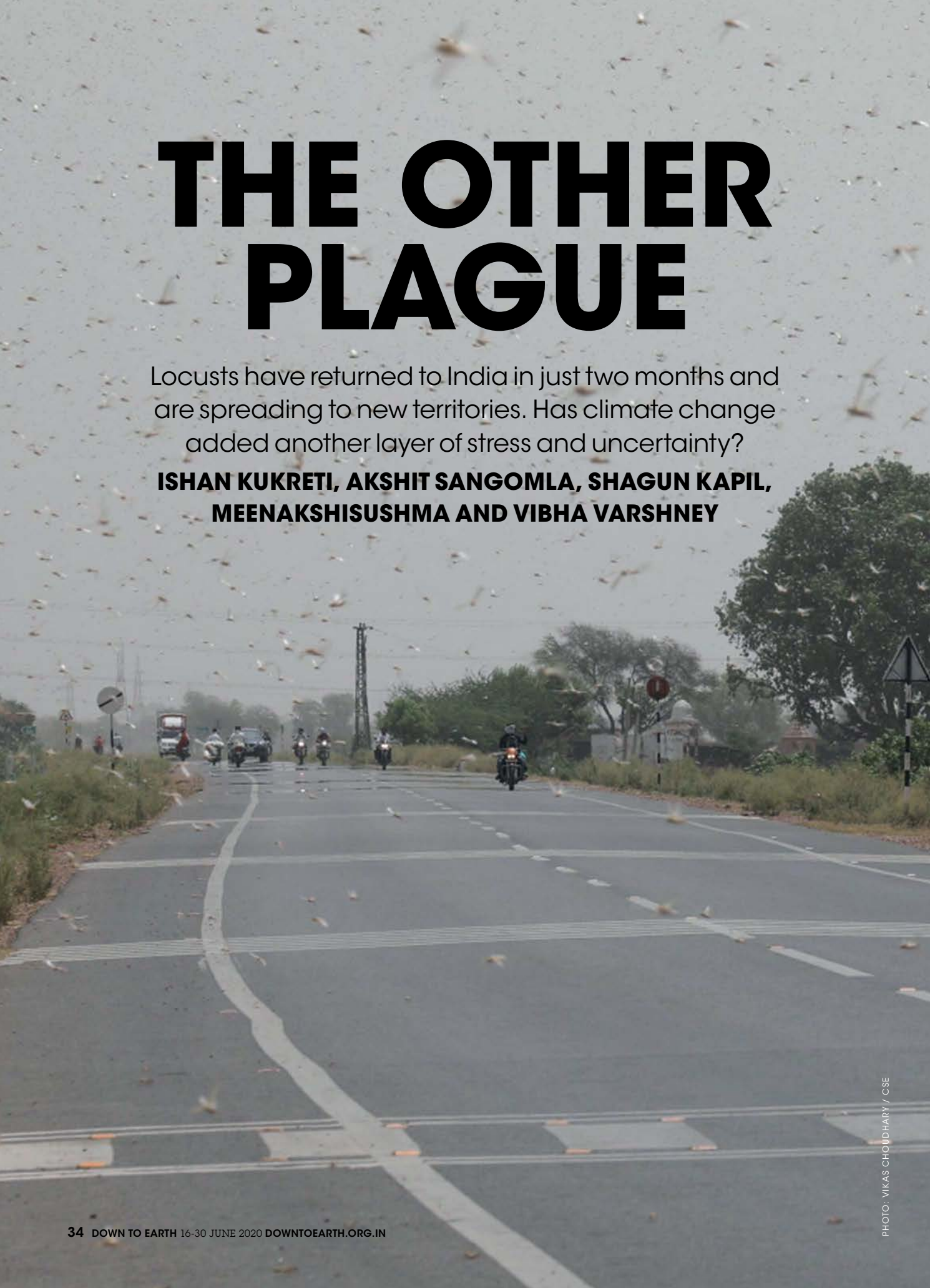
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THE OTHER PLAGUE

Locusts have returned to India in just two months and are spreading to new territories. Has climate change added another layer of stress and uncertainty?

**ISHAN KUKRETI, AKSHIT SANGOMLA, SHAGUN KAPIL,
MEENAKSHISUSHMA AND VIBHA VARSHNEY**



Dholpur district in Rajasthan
at 11 am on May 27, 2020

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IT'S MAY 27. A few minutes past 11 am. *Down To Earth* reporters had just arrived in Pachgaon village, Dholpur district, Rajasthan, to enquire about desert locusts that are crossing over to India way ahead of the monsoon rain and invading new areas. As if on cue, a huge swarm, resembling a long rust-coloured low cloud, appeared from nowhere. It quickly swelled forward, taking over the sky and nearly obliterating the desert sun. Bewildered, the residents ran out of their homes and gathered in the open. But before they could get a grasp on the situation, millions of locusts started falling like hail and clung to everything that looked green. Within no minutes, the trees and bushes turned into ragged mounds of glistening brown. Some leaned over to touch the ground—tropical grasshoppers weigh about 2-2.5 gram. A few youngsters took photographs as the others stood motionless.

^
A locust control operation at Mahar kalan in Karanpur village of Jaipur district, Rajasthan, on May 27

It was for the first time the residents had seen something like this. Soon the severity of the situation dawned on them. Some residents fetched their utensils and started beating and banging them. Ram Babu, a farm worker in his 60s, rushed to his farm to scare away the pests with a piece of cloth. He repeated the exercise for almost an hour in the 46°C heat. "I saw on the news yesterday about locust attacks in Jaipur, but did not think they would attack our village too," he said, trying to call the land owner to inform him about the attack.

The nervous clamour of people did not let the swarm stay in the village for more than 40 minutes. But during that short period, Babu lost almost one-fourth of his pumpkin crop planted on 3.5 *bigha* (0.3 ha) land. Peepul, babool and *keekar* (*Prosopis juliflora*) trees looked queer with almost bare branches and punctured leaves.

Only a few insects were fluttering

PHOTO: ADITHYAN P C / CSE

about when the district agriculture officials arrived at Pachgaon. They have been on alert since the night before and tracking the swarm with the help of their counterparts in other districts and the Locust Warning Organization (LWO)—a unit under the Ministry of Agriculture and Farmers' Welfare that runs the world's oldest national locust monitoring system. "At 5:21 am, I got a call from Karauli district that the swarm that settled on the forest for the night had started moving and the wind direction suggested they could enter Dholpur," says Dayashankar Sharma, deputy director at the district agriculture department. His team of 25 officers soon left for the bordering villages and alerted residents to resort to *dhwani aur dhuani* (sound and smoke). At around 7.15 am, a 10-km long swarm crossed into Dholpur at Jasora village. It was moving at 25-30 km per hour. The officials were on their toes. "They were carrying insecticides but it can be sprayed only when the insects settle at night. So, they joined the residents in stoking up the fire and beating utensils," says Sharma who was waiting at Saipau village road. It was supposed to be the next stopover for the swarm. But because of smoke from nearby brick kilns, it diverted its route and entered Pachgaon.

"The ones left behind would become food for lizards or birds," says Sharma. He was relieved that his team and the others did not let the swarm settle anywhere in the district and could drive it away before sunset. Because that's the time they dread, when locusts are on the move.

This gregarious species usually flies during the day and lands just before sunset. If they settle on a farm, they devour whatever green they spot before flying out in the morning. According to the UN Food and Agriculture Organization (FAO), which considers desert locusts as the "most dangerous of all migratory pest species" and runs the centralised monitoring and information service, Locust Watch, a swarm of 1 sq km contains

ANCIENT ENEMY

**1802-1804:
CROPS WERE
DESTROYED BY
LOCUSTS IN
KUTCH,
RESULTING IN
WIDESPREAD
FAMINE. THEY
ATTACKED THE
REGION AGAIN
IN 1834,
CAUSING
ANOTHER
FAMINE**

over 40 million locusts that can eat the same amount of food in a day as 35,000 people. Farmers of Sri Ganganagar and Bikaner districts know this voracious nature of the pest only too well. The districts are part of the state's cotton growing belt where agriculture has been made possible because of the Bhakra, Indira Gandhi and Gang canals. In the months of May and June short cotton plants dot the fields in this arid region. But this year most farms wore a desolate look. Mahaveer Saran, who owns 5 ha in Beenjhbaila village, narrates how locusts have pushed his entire village into penury overnight. "A gigantic 40 sq km swarm invaded our village on May 27. Some of my neighbours ran to the market to buy firecrackers as I made calls to the agriculture office and organised people to bang utensils, but to no avail. The officials did not show up. By the time the swarm left around 12 pm the next day, they had eaten every leaf and shoot off our farms," he says. Earlier that month, on May 10, an equally huge swarm invaded Lalawali village in Bikaner and destroyed all cotton crops in two hours.

Initial estimates by officials with the agriculture department shows locusts have mostly destroyed cotton crops in the state—4,500 ha in Sri Ganganagar, about 9,000 ha in Hanumangarh, 830 ha in Bikaner and 70 ha in Nagaur. On an average, every hectare produces 2,000 kg of cotton, that is sold for ₹1.20-₹1.40 lakh. Farmers say they have never seen such huge swarms and so early in the year.

This trans-border pest usually enters the scheduled desert areas of India from Africa, Gulf and Southwest Asia via Pakistan just ahead of the monsoon season for summer breeding and then returns around October and November towards Iran, Gulf and Africa for spring breeding. But this year, according to the Union agriculture ministry, they were sighted as early as April in the border districts of Rajasthan and Punjab.

Residents of Lalawali say with this

Flight of the locust

00 Locust arrival date



Districts infested with locusts



Districts with large excess rainfall

Ground Zero

Unseasonal heavy rainfall in Pakistan turned locusts' summer breeding ground, adjoining India, into spring breeding ground. Hoppers and young adults soon crossed the border

Rajasthan
April 11-30



23

23

Initial attack

May 13-19

Orange triangle: Swarms
Green triangle: Adults
Pink triangle: Groups

Gujarat
June 1



16

2

May 20-26

Brown triangle: Swarms
Pink triangle: Groups

All India District Rainfall Statistics (March 1 to May 25, 2020)

Dark blue: Large Excess (60% or more)
Light blue: Excess (20% to 59%)
Grey: Normal or less than normal

Initial estimates peg total crop land destroyed at **50,000 ha**; Rajasthan has lost 14,500 ha of cotton crop to the infestation

Overall wind direction over India after **super cyclone Amphan** is from the north west direction

Sources: Food and Agriculture Organization; India Meteorological Department; ground reportage

early arrival, locust attacks have become an unending ordeal for them. Last year's attack, considered a major locust invasion after almost a decade, had also begun way ahead of the season, in May 2019, and continued till February this year. Data with the ministry shows 11 districts in Rajasthan, two in Gujarat and one district in Punjab were exposed to locusts during the period. "Now, they are here again after

Punjab
April 24



18

1

Strong northwesterly winds, created after the cyclone Amphan carry locust swarms far and wide

Excess rainfall during March-May in northwestern, northern and central India aided in their spread by making ample fresh vegetation available

Uttar Pradesh
May 26-28



30

2

Chhattisgarh
May 31



13

1

Maharashtra
May 26



31

4

Madhya Pradesh
May 26-28



47

16

a gap of just two months," says Babulal Shaswat of Lalawali. On May 10, Shaswat and many other farmers in his village lost their third consecutive crop to locusts in less than a year. "In September last year, they devoured my standing cotton crop; in February this year *chana* (black gram) crop; and now, the American cotton," says Shaswat. To recover the losses, several farmers in the village have taken loans and sowed cotton again. But it's too hot for the seeds to germinate. Shaswat says he is in a fix. He plans to wait till the monsoon and then sow groundnut. But people say the locusts will come back during kharif. "I do not know how I will pull through. So far, I have accumulated a loan of ₹4.5 lakh and have neither paid my instalments nor the school fees for my children since last year. My family is surviving on the remittance sent by my brothers working in Bikaner," says Shaswat, adding that

such an invasion had occurred two to three decades ago. But this time the swarms are just too big and too aggressive.

They are also unusually pink. "Usually sexually mature, yellow-coloured locusts come first," says B S Yadav, assistant director, agriculture department, Jaipur. They tend to stay on the ground and move less once they mate. It's easier to spray on them and contain their spread. But this year, the presence of hoppers (freshly hatched locusts that are yet to develop wings) has been reported since April 11 and pink immature adults since April 30. These younger pests tend to settle on taller trees as compared to crops. They are like children full of energy and fly away as soon as you go near them, making it difficult to manage them, says Yadav, adding that it is unusual for the younger locusts to arrive at this time. Their behaviour has also changed because of the early arrival, says K L Gurjar, deputy director at LWO. During monsoon and winter nights, their wings get stuck due to moisture or dew and they cannot fly until the sun is out. Since the weather is dry now, they are able to fly even at night, making control operations difficult.

With an ability to ditch control measures, fly high and cover long distances, these swarms are now moving beyond the scheduled desert areas, taking people by surprise and posing challenges for LWO that operates with a limited staff.

In Jaipur district, which reported massive locust attacks in the last week of May, Sachin Yogi, a 24-year-old wedding photographer, says, "I have only heard my grandfather talking about locusts." On May 26, some 30 LWO officers, armed with a drone and six ultra-low-volume sprayers, Ulvamast, chalked out a war plan of sorts along with 16 state government officials manning four fire tenders to destroy a 40 sq km swarm that had taken residence at Mahar kalan in Karanpur village. They were out on the roads all night, spraying solutions of highly toxic insecticides like chlorpyrifos and lambda cyhalothrin on

every tree, bush and other vegetation in the area. The drone was also employed to spray insecticides on the hillocks of the Aravallis that border the district on one side.

At the end of the operation, it was hard to tell if there was anything more than a few random locusts flying around. "The swarm, of 180 sq km in size, entered India on May 22. We destroyed a part of it at Nagaur district. The remaining came here," said a LWO official. But as soon as sunlight hit the trees, thousands of locusts burst out of the canopies, blinded by chemical sprays yet eager to fly away.

In Uttar Pradesh, the district administration of Jhansi has carried out control operations thrice between May 22 and 27. "LWO officials have been staying in Jhansi since the district was attacked by a swarm," says Kamal Katihar, deputy director of the district agriculture department. "While we use chlorpyrifos, they handle the highly poisonous Malathion⁹⁶. Besides, we never had the need for the chemical as this is the first attack in Jhansi after 30 years," says Katihar.

While in Uttar Pradesh locusts have invaded two districts, they have spread across 40 of the 52 districts in Madhya Pradesh just within a week after entering the state. In Hoshangabad district, deputy director of agriculture Jitendra Singh says, *moong* is close to harvest now. "So as soon as the locusts entered the district on May 23, we deployed four fire engines and sprayers mounted on tractors to spray lambda-cyhalothrin early in the morning. Crops in our district have been saved," he adds. Though the agriculture department claims it has destroyed 40 per cent of the locust population, swarms were active in eight districts, including, Bhopal in the first week of June. Some have even crossed Madhya Pradesh to reach Koriya district of Chhattisgarh on May 31. As on June 7, locusts had spread to 44 districts in seven states; control works were done on 70,728 ha; and, nine states are on high alert for a possible attack. India had never faced a locust attack of such proportion.

ANCIENT ENEMY

1810: FLIGHTS OF LOCUSTS APPEARED IN THE BENGAL PROVINCE. ON ONE OCCASION THEY APPEARED AS FAR SOUTH AS BROACH BUT DISAPPEARED WITH THE BEGINNING OF THE MONSOON OF 1812

The wind factor

Desert locusts are age-old threats. But now something is changing in the way they spread and reproduce

STAYING ALERT is one way to gain the upper hand in a battle. But understanding the changing strategy of the enemy is equally crucial, particularly if it is a trans-boundary pest with an ability to travel 150 km a day riding the wind current. Worse, in India desert locusts appear to be expanding their territory both in terms of time and space—they are now coming early, staying longer and foraging deep into the country.

FAO says much of the country's current crisis was caused by the supercyclone Amphan that made landfall on the Sundarbans on May 20. Strong northwesterly winds (that enter from northwest and move towards southeast and east) were established in its aftermath, taking locusts into places as far as Chhattisgarh in the east and Maharashtra in south. An analysis of the wind data in six north Indian cities by the International Water Management Institute, headquartered at Colombo, also shows that there has been a sharp increase in the wind speed at 10 meters above the ground from mid-May onward which has helped the locust move from Rajasthan to faraway places. As a result, Uttar Pradesh and Chhattisgarh have reported sightings of locust swarms for the first time since 1962, Maharashtra since 1974 and Madhya Pradesh and Punjab since 1993. FAO predicts locusts could soon reach Odisha and Bihar. They too have not experienced locust attacks in recent decades.

However, wind is not the only factor responsible for this unusual spread. According to FAO, even before Amphan hit the country, dry conditions prevailing in the west forced immature adult swarms

to move eastward, who reached Ajmer by mid-May and Indore in Madhya Pradesh on May 21. "This is because locusts have a strong liking for tender leaves and possess a strong sense of smell for fresh vegetation," says Biswajeet Paul, principal scientist at Indian Agricultural Research Institute (IARI), New Delhi, who works on biological control of insects. Since vegetation in their usual territory in northwestern states is not lush green, the swarms are moving towards states like Uttar Pradesh and Maharashtra where cyclones and heavy unseasonal rainfalls, induced by western disturbance between March and May, have initiated vegetation growth. Paul says locust swarms are just taking the help of wind currents to move in the direction of food so that they use less energy.

For an insect as big as a paper clip and that travels across continents for survival, energy is a big asset which it must save for breeding. And there are only a few weeks left for it. It is estimated that by the end of June, most swarms in the country would attain maturity. They would turn yellow and settle down for breeding. That would also be the time, when monsoon rains would sweep across northern and central India and kharif crop cycle would begin, making ample food available for them. While locusts only nibble away the leaves of mature trees, they can gobble up entire saplings in a single morning, leaving no trace of vegetation. If the infestation is not controlled now, their next generation would threaten the country's food security that largely depends on kharif crops such as rice, maize and sorghum.

ANCIENT ENEMY

**1869:
RAJASTHAN
SUFFERED
CONSIDERABLY
FROM LOCUST
ATTACKS. VAST
SWARMS WERE
ALSO OBSERVED
BY SHIPS
PASSING
THROUGH THE
RED SEA. OLD
RECORDS FROM
THE 19TH AND
EARLY 20TH
CENTURY SHOW
THAT THERE
HAVE BEEN
LOCUST CYCLES
SINCE 1869:
1869- 1881,
1889-1907,
1912-1919
AND 1926-1931**



LWO officials say as on June 8, over 1,500 ha in Rajasthan's Nagaur and Bikaner districts were infested with yellow locusts.

Paul says there is a possibility that the next generation that will hatch outside the traditional territory would be fewer in number. Adult locusts require sandy soil, where they can make a hole, as deep as 10 cm, to push in their abdomen and lay eggs. This is not possible in ordinary soil. So the swarms would lay pods with fewer eggs than the usual 200 to 250. But even these small groups can cause mayhem at the local level. After all, [they thrive in areas that are warm, roughly 25°C to 40°C](#), and have ample rainfall and green vegetation. When conditions are less favourable, locusts take up to six months to mature. But given the right conditions, they can breed every three months and increase 20-fold in a single generation and about 400 times in six months after two generations of breeding. This will have a disastrous impact at a time when rural areas are facing reverse migration due to COVID-19.

^
Cotton farm of Mahaveer Saran, of Beenjhballa village in Sri Ganganagar district of Rajasthan. Before locusts attacked the village on May 26, young plants dotted the field

SO, HOW FAR FROM PLAGUE?

As of now, desert locusts are causing outbreaks in at least 10 other countries in the Horn of Africa and southwest Asia. Though the scale and intensity of the infestation is said to be the worst in decades, FAO describes this an "upsurge", meaning locusts have been able to breed uncontrolled for several successive seasons. In an e-mail interview, Keith Cressman, locust forecasting expert at FAO, tells DTE, "The occurrence of a locust plague depends on weather, rains, control and locust breeding before the end of the year."

However, such a declaration does not seem too far. For the past three years, locusts have been breeding early and multiplying profusely and spreading in huge numbers due to a series of unusual and extreme climate conditions.

For instance, locusts usually return from Gujarat and Rajasthan to Pakistan and Iran between October and November. But last year, Rajasthan experienced an extended monsoon, which prompted the

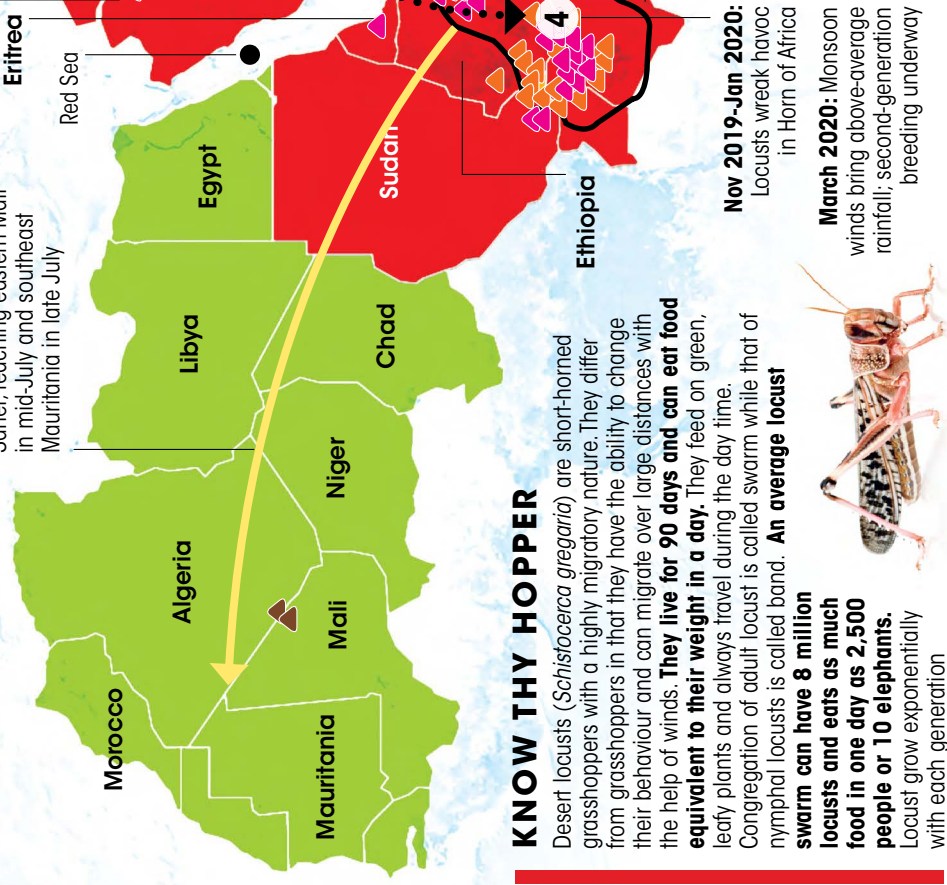
GLOBAL SWARMING

Climate change-triggered events like cyclones have resulted in extended and multiple breeding seasons for locusts. They now spend most of the year in India, causing frequent attacks

1 Apr - 14 May 2020

- Swarms
- Adults groups
- Hopper bands
- Hopper groups

July 2020: If rains are limited during June in Sudan, swarms would go to eastern Chad in June-end, migrate further west in the Sahel, reaching eastern Mali in mid-July and southeast Mauritania in late July



KNOW THY HOPPER

Desert locusts (*Schistocerca gregaria*) are short-horned grasshoppers with a highly migratory nature. They differ from grasshoppers in that they have the ability to change their behaviour and can migrate over large distances with the help of winds. **They live for 90 days and can eat food equivalent to their weight in a day.** They feed on green, leafy plants and always travel during the day time.

Congregation of adult locust is called swarm while that of nymphal locusts is called band. **An average locust swarm can have 8 million**

locusts and eats as much food in one day as 2,500 people or 10 elephants.

Locust grow exponentially with each generation



2018: Cyclone Mekunu in May and Cyclone Luban in October caused heavy rain in the Arabian Peninsula and created lakes in deserts. It created breeding conditions for locusts which are found in the region round the year. The numbers swell and they start moving across continents

April 2019: Locust swarms cross over the Persian Gulf and reach Iran-Pakistan, cause heavy loss of crop

May 2019: Western Rajasthan receives rain in six weeks ahead of schedule, creating food and breeding conditions for locusts in Pakistan. Swarms reported on May 21. Extended monsoon continues till November and locusts stay on, breeding thrice and swelling

July 2020: For the first time the locusts might also reach the western regions of Gujarat and Rajasthan directly from the Horn of Africa, traversing the huge expanse of the Arabian Sea

April 2020: Excess rainfall in March, April and May bring back locust swarms to India

Calm: No threat to crops, but swarms must be regularly monitored

Caution: Increased vigilance and protective measures for crops may be needed

Threat: Crops threatened. Surveys and protective measures must be taken

swarms to stay back. By the time, they returned in February this year, they had given birth to third-generation insects. During the current infestation, their early crossover to India is also linked to unseasonal rainfall in the deserts of Pakistan, adjoining India that act as summer breeding ground for locusts. “We are seeing an increase in swarms from Pakistan this time as the locusts’ spring breeding has happened right across the border. Usually spring breeding is restricted to Iran and Baluchistan,” says K L Gurjar, deputy director at LWO. Till the end of May, at least 25 swarms had crossed over to India. Such [unseasonal rain events are only going to increase](#) in a warming world.

In Arabian Peninsula and East Africa also, locusts are multiplying profusely due to changes in a climate system, the Indian Ocean Dipole (IOD)—a natural pattern of changing temperature gradients between eastern and western portions of the Indian Ocean. Historically, this temperature difference has stayed within safe limits. But in recent years, the western side of the Indian Ocean, or the Arabian Sea, has been unusually warm as compared to the eastern side. This change, dubbed positive diapole, causes a lot of evaporation from the area and then returns as additional rain or cyclones to the region.

In 2018, IOD remained positive for most parts of the year, leading to the formation of cyclone Mekunu in May and cyclone Luban in October. They first caused severe floods in the Arabian deserts and then the growth of lush vegetation, causing locusts to congregate and breed far more rapidly than they would when food is scarce. It is said that the rain also triggered dormant locust eggs to hatch. Just nine months and three generations later, locusts had increased by 8,000 times and were ready to expand their territory.

In the summer of 2019, they jumped the Gulf of Aden and moved to Ethiopia and Somalia. That period was marked by an even stronger positive IOD, resulting in

ANCIENT ENEMY

1926: DESERT LOCUST APPEAR AFTER A GAP OF 6 YEARS IN SINDH AND RAJASTHAN AND BREED PROFUSELY. THE ATTACK REACHES ITS PEAK IN 1929-30 WHEN ALL PROVINCES OF NORTH WEST INDIA ARE INFESTED AND SWARMS REACH AS FAR AS ASSAM IN THE EAST AND HYDERABAD IN THE SOUTH

the highest eight cyclonic events in a year. The swarms enjoyed the unusually wet weather, growing even larger. Soon they swept through adjoining countries. In Kenya, where agriculture dominates the country's economy, they have caused the largest outbreak in 70 years; so far, it has lost 30 per cent of its pastureland. A study published in *Nature* on April 12, 2018, says extreme positive IOD events could double in frequency in case of 1.5°C warming above the pre-industrial levels.

In March, as monsoon winds hit the region, East Africa has again received above-average rainfall. FAO says a second-generation breeding is underway there. Numerous hopper bands have formed. These young juveniles, 400 times more in number, will become voracious adults between second week of June and mid-July just as farmers begin to harvest. “The locusts, combined with the impacts of COVID-19, could have catastrophic consequences on livelihoods and food security,” said Qu Dongyu, director-general of FAO at a virtual meeting on May 22.

India, which is still struggling to flatten the COVID-19 infection curve despite imposing the world's most stringent and longest nation-wide lockdown, stares at an uncertain future. FAO warns that more swarms are forming in the spring breeding areas of Iran and Pakistan and migrating towards India ahead of the monsoon rains. “Several successive waves of invasions can be expected until July in Rajasthan with eastward surges across northern India as far as Bihar and Orissa, followed by westward movements and a return to Rajasthan on the changing winds associated with the monsoon,” it says. To compound the situation, in July, for the first time the locusts might also reach the western regions of Gujarat and Rajasthan directly from the Horn of Africa, traversing the huge expanse of the Arabian Sea. Most of them will come from northeast Somalia riding southwesterly monsoon wind. Is India prepared to handle this sudden upsurge?

How to ward off?

All the ammunitions currently in use against locusts can have serious health and environmental impacts

IN MAY 2019 when the Union and state governments were caught off-guard by the locust attack, their response was to pass the buck. Union minister of state for agriculture Kailash Choudhary during his visit to the affected areas blamed Pakistan, while the Rajasthan government complained that the Centre had not provided any help to control the menace. But the fact was since the last major locust upsurge in 1993, both the state and the Union governments had become complacent.

"LWO was on the verge of getting disbanded because no locust attack had happened in over two decades," says a district agriculture official, who does not wish to be named. As on June 2018, as many as 117 of the 250 positions were lying vacant across its 12 circle offices. "This time we were prepared," says K L Gurjar, deputy director, LWO. "Now we have more than 200 staff personnel. Last year, we had just 45 vehicles. Now, we have placed an order for 55 control vehicles and 60 ultra-low-volume spray vehicles." LWO has also improved its monitoring system and uses the eLocust2 device developed by FAO to monitor the movement of swarms on a real-time basis. Locust officers on the field enter all survey and control related data into the handheld device which then transmits the information via satellite. This is complimented by the village level data provided by agriculture supervisor, farmers and revenue officials.

However, there does not appear to be much changes in the insecticides being used. In 1993, during the last locust upsurge, LWO was using benzene hexachloride (BHC), dieldrin, fenitrothion and malathion.

While the use of BHC and dieldrin has stopped after the government banned them, malathion is now the preferred insecticide by LWO. Agriculture officials who accompany them during control operations mostly use chlorpyrifos and lambda cyhalothrin. Surprisingly, on May 14, the Union agriculture ministry issued a draft proposal on the ban of 27 insecticides likely to "involve risk to human beings and animals". The list includes malathion and chlorpyrifos. Though the ministry says the insecticides can be used on locusts, it does highlight the toxic-effects of the chemicals on human health and the environment (see 'Toxic tale'). During the five weeks till June 7, LWO has used 70,700 litres of malathion during operations over 71,000 hectares across 43 districts. Between May last year to February this year, LWO had used 3,02,686 liters of malathion.

The use of insecticides in such huge quantities has raised alarm among many. M S Swaminathan, the father of Green Revolution, on June 3 took to Twitter and said: "The #locust menace is causing serious damage to agriculture. Farmers are worried. The best way to control locust invasion is spray neem seed decoction over plants. Neem is a strong repellent & also a fertilizer. I hope our farmers will manage the serious threat to crop security." Biswajeet Paul, principal scientist at IARI, says the volume of insecticides used currently is atrocious. Fire engines spray bigger droplets that hold large amount of pesticides. This will cause severe pollution. "Unfortunately, spraying of chemical insecticides is the only effective method

ANCIENT ENEMY

1929: THE GOVERNMENT OF COLONIAL INDIA REALISES THE SERIOUS PROPORTIONS OF LOCUST MENACE, AND INCLUDES THE TOPIC IN THE AGENDA OF THE BOARD OF AGRICULTURE. IN 1939, THE LOCUST WARNING ORGANISATION IS SET UP

Toxic tale | It needs 4-5 times more insecticides than used for pests to kill locusts

CHLORPYRIFOS

It belongs to the class of organophosphates, which are essentially nerve agents, attacking chemical pathways and [causing a breakdown in the ability of nerves](#) to communicate. One can be exposed to it by inhaling, eating, or getting it on the skin. Being moderately persistent in soil, it can take weeks to years to break down; can reach rivers, lakes and streams where it accumulates [in the fatty tissue of fish](#). In surface water in urban areas and in agricultural areas, it has been found at levels potentially harmful to aquatic life. Its use is not approved in the EU.



LAMBDA CYHALOTHRIN

It belongs to the class of pyrethroid insecticides, which are known for moderate acute toxicity to humans and can cause irritation to the skin, throat, nose and other body parts. Some temporary symptoms of exposure includes skin tingling, burning and prickling feelings, particularly around the face. In severe poisoning cases, [seizures and coma may occur](#). Its residue in agricultural or urban runoff sediment have been found to be toxic to aquatic organisms including fish and amphipods.



MALATHION 96

Being an organophosphate pesticide, it can be absorbed by all routes. It can cause numbness, tingling sensation, [headache, dizziness](#), difficulty breathing, weakness, irritation of skin, abdominal cramps and death, depending on the exposure level. EU recognises it as an endocrine disrupter. It is however highly toxic to honeybee, earthworms and leads to soil contamination.



when desert locusts are in such large numbers," said Keith Cressman of FAO at a webinar by DTE. However, experiments over last three decades show promise.

BIO-CONTROL METHODS

At present, there are three major contenders. One is the spores of fungus *Metarhizium acridum*. When it falls on the locust, it germinates and penetrates the body of the insect. It then kills the insect both by expanding its filaments and releasing toxins on the insect. Some 70 to 90 per cent of the locust treated with it die within 14 to 20 days. In 2009, FAO recommended the use of Green Muscle™, a *Metarhizium* biopesticide by the International Institute for Tropical Agriculture. This year, FAO has ordered 4 tonnes of it to treat 80,000 ha in Somalia. The fungus has also been used in China, Australia, Brazil and African nations like Tanzania.

Locust pheromone, phenylacetone nitrile, can also be used to control the swarms. It governs swarming behaviour in adult males who use it to warn other males to leave them in peace while they mate. When a minute dose is used on juvenile

ANCIENT ENEMY

**1993:
THE LAST
MAJOR LOCUST
OUTBREAK,
WHEN 172
INVASIONS
WERE NOTED.
FOLLOWING
THIS, LOCUST
OUTBREAKS
HAPPENED IN
1997, 2005, 2010
AND 2015 AS
WELL, BUT THE
INTENSITY
WAS MILD**

hoppers, it instructs them to resume solitary behaviour. However, it is being experimented. It has been found exposure to this chemical confuses the insects who often show cannibalistic behaviour.

Then we have chemicals that work as insect growth regulators (IGRs) that hinders the ability of hoppers to moult and grow properly. Ingredients of the neem tree come in this category. Its chemicals are similar to the shape and structure of locust's own hormones. When a locust's body absorbs neem compounds, these block its endocrine system and affect its behaviour and physiology. They fail to reproduce and their populations plummet. Lab experiments show neem oil can also induce "solitarisation" among them. As neem trees grow well in locust affected areas, the oil required to control the swarm can be locally produced.

There are very few takers for these methods despite proven effectiveness and low cost. Locust attacks are only going to increase with changing climate. It's time we got our ammunition right. [DTE](#)

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WORST COMES TO THE WORST

The real impacts of the pandemic are only now beginning to surface: when countries are lifting lockdowns and the virus is spreading even more rapidly

RICHARD MAHAPATRA

MORE THAN six months into this pandemic, this is not the time for any country to take its foot off the pedal.” When Tedros Adhanom, Director-General of the World Health Organization (WHO), made this statement in his media briefing on June 8, he indicated two worrying developments in the six months of COVID-19’s unabated spread and human toll. First, notwithstanding the claim that many countries are finally flattening the COVID-19 curve, on the day of Tedros’ press briefing, cases reached 7 million with a death toll of over 0.4 million. Second, more worryingly, for nine consecutive days before Tedros made the statement, the world reported more than 100,000 new cases each day; the highest was on June 7—136,000.

Both developments reveal the uncertainty the world has been pushed into by the pandemic. Though the geography of the spread has not changed much, but the explosion of new cases and the degree of infection have certainly brought the focus on Africa and South Asia—India being a curious case of reporting a fast increase in spread despite having undergone the world’s longest national lockdown. In Africa, many new countries are reporting COVID-19 cases, even though in small numbers. The crisis is still unfolding, stretching the world’s capacity to fight it. Tedros, while admitting that the pandemic was worsening, said that in countries (where the spread has slowed down), the biggest threat now is complacency. Studies—to investigate how many of a country’s population have been exposed to the virus—show that most people globally are still susceptible to infection.

CAPITAL FEAR

On June 9, India’s capital, Delhi, offered a peek into the near-future scenario of the pandemic. The source of infection for more than half of the cases couldn’t be traced, said Delhi’s health minister, Satyendar Jain. Then he almost raised an alarm when he said that even though the capital qualified to be a case of community transmission, the Union government was refusing to admit this. This inferred that the national capital was about to witness an exponential growth in spread. Adding to this fear, the Delhi government says that there would be over half-a-million case by July-end in the city-state—from the 31,000-mark on June 10.

On June 8, India lifted the lockdown with a few restrictions. Before this, in May and in the first week of June, there was a huge exodus of workers to their respective states, resulting in a record spike in COVID-19 cases in most states. On June 12, India became the fourth worst-hit nation in the world with COVID-19 cases (see infographic ‘Half a year later’ on p49). The fear that opening up the economy would make the spread unbridled is still hanging heavy over a billion-plus population.

Between June 4 and 9, India reported over 9,500 cases on an average each day in a row. But the government is yet to admit community transmission, even though experts have long speculated that the country might have already entered into this stage a few weeks ago, based on the scientific definition of transmission stage. With the rate of spread increasing, other scary signs are emerging each day.

For example, wastewater samples collected from Ahmedabad, capital

**THE FEAR THAT
LIFTING THE
LOCKDOWN
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**INDIA WILL
HAVE THE
LARGEST
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POOR IN THE
WORLD DUE
TO THE
PANDEMIC,
SAYS THE
WORLD BANK**



of one of the worst-affected states in the country, Gujarat, were “found with a marked difference in the SARS-CoV-2 gene loading between the days the samples were collected”. Manish Kumar, a scientist with the faculty of earth sciences, Indian Institute of Technology in Gujarat’s Gandhinagar conducted the study, in association with the Gujarat Biotechnology Research Centre and the Gujarat Pollution Control Board. Wastewater samples collected from Ahmedabad’s civil hospital—a major medical facility treating COVID-19 patients—on May 8 and May 27, formed the basis of Kumar’s research. The surveillance of wastewater through wastewater-based epidemiology (WBE) helped reveal the spread of the novel SARS-CoV-2 virus that causes the COVID-19 disease.

Kumar says that it is not about detection of live SARS-CoV-2 samples in wastewater. It was, instead, about detecting genetic material (ribonucleic acid) through Real-Time Quantitative Polymerisation Chain Reaction (RTqPCR) followed by gene sequencing and matching with a library of coronaviruses. “We can extrapolate the results of this genetic material estimation to assign it with a probable number of people infected in a given locality or community,” says Kumar. This is the first time an Indian scientist has made a claim like this. Earlier reports of this finding had emerged from different parts of the world during the beginning of the pandemic.

GLOBAL TRACES

In April 2020, the city water authority in Paris claimed minuscule traces of the SARS-CoV-2 virus were found in non-potable water supply. During the same time, Biobot Analytics, a biotech start-up, along with a team from the Massachusetts Institute of Technology (MIT) and the Brigham and Women’s Hospital estimated that at least 440 people were likely to be infected with COVID-19 in areas around the treatment facility, much higher than the reported cases.

SARS-CoV-2 may be present in the water cycle, making the poor and the marginalised more prone to health risks, said an editorial published in *Environmental Science: Water Research and Technology* on April 2, 2020. Kumar says reports of the presence of molecular SARS-CoV-2 have emerged from countries struggling to curb the pandemic. Questions now arise over whether the pandemic can spread through wastewater. Till date, there is no concrete evidence to prove this. And India is well into its monsoon season, usually considered to be a season of diseases mostly related to water and sanitation.

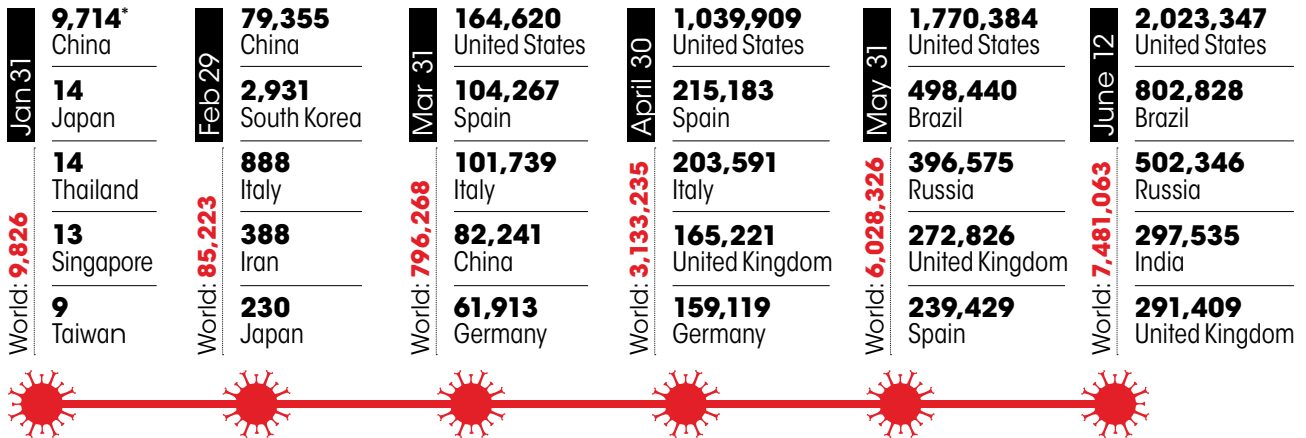
UNTOLD IMPACTS

The world is at crossroads. The choice between economy and curtailing the pandemic through lockdowns has already been made in favour of the former. But unlike many countries with severe infections, the hope to endure a contagious disease and avoid an economic death has taken over national strategies. India is an exception of registering it’s biggest-ever growth in spread even through a record lockdown. But *Down To Earth* has found that the pandemic’s toll in terms of economy is just getting clearer—into half-a-year since the outbreak of the COVID-19, some 200 countries have become poorer than in December 2019, strictly

Half a year later

High-income countries slowly move out of the deadly grip of COVID-19 as middle- and low-income countries become the new target

*Total confirmed cases



China confirms first COVID-19 patient on January 3, 2020. A month later, the virus spreads to **22 mostly Asian countries**. By **February-end**, the virus reaches nearly **60 countries**

By **end of March**, over **190 countries** have COVID-19 cases. **78 per cent** cases are in **high-income countries spread across Europe, along with the US**. More than **200 countries** record cases by April-end

With **209 infected countries, 61 per cent cases** are in **high-income countries** by May-end. In June, **India** joins the list of five countries with most total COVID-19 cases

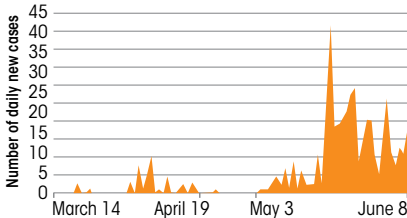
India's losing battle

The number of daily new cases are rising in 19 of the 23 states and Union Territories, seriously affected by COVID-19 with more than 400 total cases. Three states that have managed the pandemic well are experiencing a probable second wave

PROBABLE SECOND WAVE

Himachal Pradesh

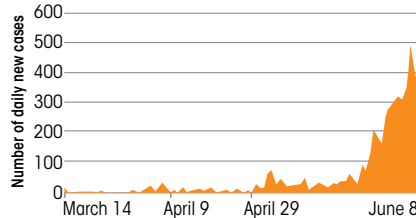
New cases dropped to almost zero in April 19-May 3 before a renewed spike



PROBABLE SECOND WAVE

Haryana

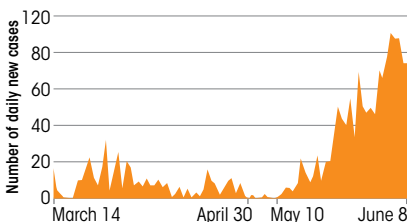
New cases dropped to almost zero in April 9-29 before a renewed spike



PROBABLE SECOND WAVE

Kerala

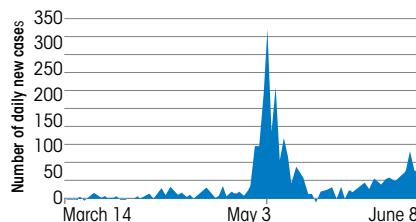
New cases dropped to almost zero in April 30-May 10 before a renewed spike



DOWNWARD CURVE

Punjab

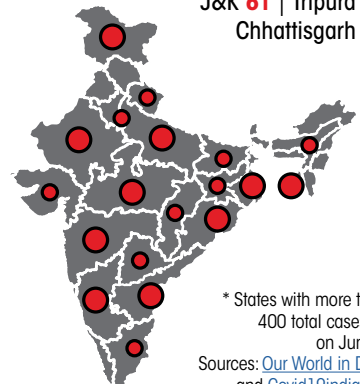
After peaking on May 3, the number of new cases has come down



UPWARD CURVE

States* with rising daily new cases

Maharashtra **2,258** (New cases on June 9)
Tamil Nadu **1,685** | Delhi **1,366**
Gujarat **470** | Uttar Pradesh **388**
West Bengal **372** | Rajasthan **369**
Telangana **270** | Andhra Pradesh **216**
Assam **215** | Madhya Pradesh **211**
Bihar **208** | Karnataka **161** | Odisha **146**
Jharkhand **126** | Uttarakhand **126**
J&K **61** | Tripura **26**
Chhattisgarh **14**



* States with more than 400 total cases as on June 9

Sources: [Our World in Data](https://ourworldindata.org/) and [Covid19india.org](https://covid19india.org)

**PREVENTION
AND TREATMENT
SERVICES
FOR NON-
COMMUNICABLE
DISEASES HAVE
BEEN SEVERELY
DISRUPTED SINCE
THE PANDEMIC
BEGAN**

in terms of economic outputs. India will have the largest number of the new poor in the world due to the pandemic, according to the World Bank.

The World Bank's *Global Economic Prospects* in June raised the level of poverty due to the pandemic in comparison to its earlier forecasts: in April it estimated 40-60 million people will be pushed into extreme poverty. The latest estimate shows that 71-100 million people would be left poorer. And these poverty estimates will continue till 2021.

There is another untold impact of the pandemic: as a country's medical systems are overstretched in fighting the pandemic, other killer diseases are not being treated resulting in human casualties. According to a survey carried out in 155 countries in May by WHO: "Prevention and treatment services for non-communicable diseases (NCDs) have been severely disrupted since the COVID-19 pandemic began". NCDs kill 41 million people each year, equivalent to 71 per cent of all deaths globally. The survey also found that, for instance, 53 per cent of the countries surveyed had partially or completely disrupted services for hypertension treatment. Similarly, about 49 per cent countries reported disruption in treatment for diabetes and diabetes-related complications. Some 94 per cent of the countries say their health ministry personnel working on NCDs have been diverted to COVID-19 duties.

According to GAVI, the vaccine alliance, some 13.5 million people might have missed out on vaccinations due to the postponement of campaigns and interruptions in routine vaccinations. "It will be some time before we know the full extent of the impact of disruptions to health care during COVID-19 on people with NCDs," says Bente Mikkelsen, director of the department of NCDs at WHO. After half-a-year since the pandemic was confirmed, we are still awaiting the grim news of its impacts and its ripple effects. Time, in this case, is not a healer, but a reminder of the deathly future that lies ahead. **DTE**

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ON COVID-19**
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Environment matters

[State of India's Environment 2020 in Figures](#) gives a detailed analysis of what ails India and its environment, be it forced displacements, contamination in water bodies or delayed justice

COVID-19 MIGRATION

As on June 1

4,150

Shramik trains operated across the country

5.5 million

migrants travelled on Shramik trains to return to their homes

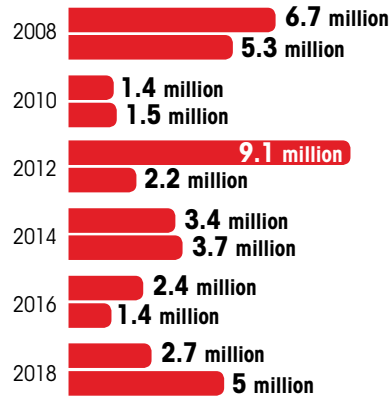
90%

of the 3,840 Shramik trains that operated till May 28 were travelling to Bihar and Uttar Pradesh



FORCED DISPLACEMENTS

NEW DISPLACEMENTS* DUE TO natural disasters in India



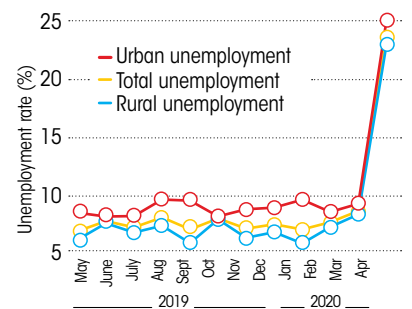
*New displacement refers to the number of movements, not people, as individuals can be displaced several times

UNEMPLOYMENT RATE

2.3 times increase in unemployment rate in the past one year

75.8% unemployment rate in Puducherry in April, 2020

47.1% unemployment rate in Jharkhand in April, 2020



MOUNTING LOSSES

India's expenditure on natural calamities is going down even as its impacts are increasing

₹37,212.48 cr

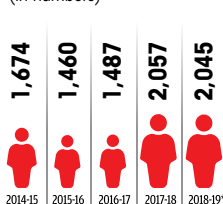
2018-19 (revised estimates)

₹28,858.54 cr

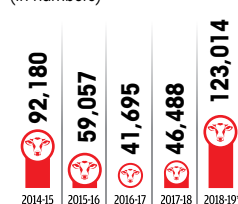
2019-20 (budgetary estimates)

*Updated till March 25, 2019

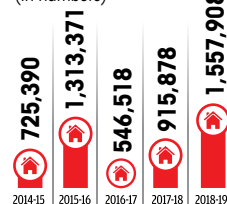
Human lives lost (in numbers)



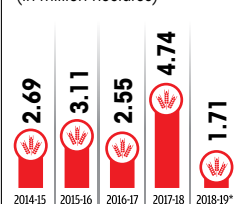
Cattle lost (in numbers)



Houses damaged (in numbers)



Cropped area affected (in million hectares)



RURAL EMPLOYMENT

PERFORMANCE OF MGNREGA

35.06 million

people demanded work under the scheme in May 2020, the highest demand for the month since 2013-14

12.82 million

people demanded work under the scheme in April 2020, the second lowest demand for the month since 2013-14

22

out of 31 states and UTs paid less than the notified wages in 2019-20

9%

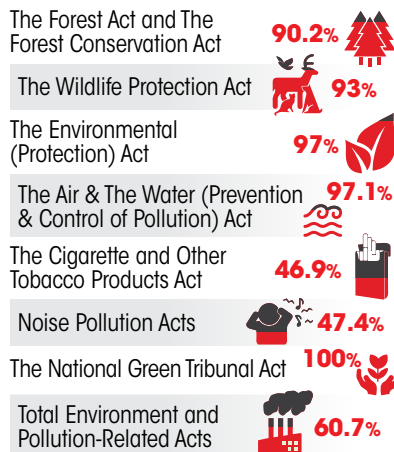
of households that demanded work were employed for the mandatory 100 days in 2019-20

5.6%

of the wages were delayed in 2019-20. This is equivalent to ₹2,591 crore

ENVIRONMENT CRIMES

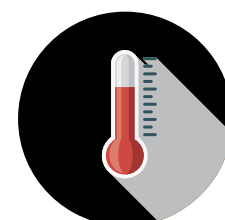
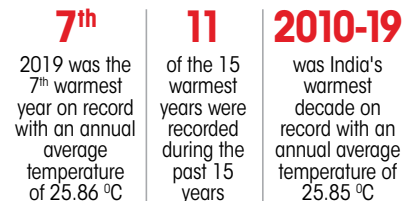
COURT PENDENCY*



* % cases that did not go to trial at the end of 2018

CLIMATE CHANGE

SEASONAL VARIATIONS



Annual average temperature

The 2019 annual mean land surface air temperature for the country was **25.86°C**, which was 0.36°C above the 1981-2010 period average



WATER

RISING WATER CONFLICTS

In the decade (2000-09 and 2010-19), water conflicts in the world have more than doubled. **India has reported higher rate than the global average**



World sees **111% increase** in water conflicts

466 | **220**
2010-2019 | 2000-2009

India records **118% increase** in water conflicts

32 | **11**
2010-2019 | 2000-2009

SHRINKING RIVER BASINS

1,608.26 m³

Estimated per capita average annual water available in 2010. Of the 21 river basins, five are absolute water scarce*, five are water scarce and three are water stressed

*As per Falkenmark Water Stress Indicator

1,340.94 m³

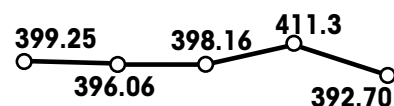
Estimated per capita average annual water available by 2025. Of the 21 river basins, five are absolute water scarce, six are water scarce and three are water stressed

1,139.82 m³

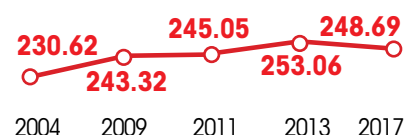
Estimated per capita average annual water available by 2050. Of the 21 river basins, six are absolute water scarce, six are water scarce and four are water stressed

DRYING GROUNDWATER

Both groundwater availability and its withdrawal decreased between 2013 and 2017



— Net annual groundwater availability (BCM)
— Net annual groundwater extraction (BCM)



STATE GOVERNANCE



INDEX ON GOOD GOVERNANCE

50.33 India average score



Rankings based on 10 indicators: Agriculture and Allied Sectors, Commerce & Industries, Human Resource Development, Water Resources Management, Public Infrastructure, Economic Governance, Social Welfare Development, Judicial & Public Security, Environment, Public Health

ENERGY

BLEEDING DISCOMS

₹91,813 cr
distribution companies owed power generators on May 24, 2020.
Close to 83% dues are delayed by over 2 months

18.82%
of discom's revenue gets wasted **due to aggregate technical and commercial losses**

₹0.4 /unit

is the average amount of losses discoms incur for **every unit sold in the country**

4

the number of times discoms have been bailed out since 2001.
The last three happened in just eight years

WASTE

BIOMEDICAL WASTE

559,084.5 tonnes/day
of biomedical waste was generated

84,805
authorised healthcare facilities in operation

57,010
unauthorised healthcare facilities in operation

518,574 tonnes/day
of biomedical waste generated gets treated

92.75%
of biomedical waste gets treated



HAZARDOUS WASTE

56,350
Hazardous waste generating industries



7.17
Total waste generated (million tonnes per annum)
2016-17

66,914
Hazardous waste generating industries



9.44
Total waste generated (million tonnes per annum)
2017-18



Prepared by DTE/CSE Data Centre

Source: [State of India's Environment 2020 In Figures](#)

Infographics: Sanjit

Authors: Kiran Pandey and Rajit Sengupta

For more such infographics visit: www.downtoearth.org.in/infographics

Drug giants dismiss WHO patents pool

IT'S BEEN called nonsense and dangerous. There was also the suggestion that it was a non-issue and immaterial to the discussion. As the World Health Organization (WHO) sought to garner support for an initiative to share the knowhow for treatments and vaccines for Covid-19, the biggest lobby group of pharmaceutical multinationals made its position clear: nothing doing. It was not entirely unexpected. Yet the manner and timing of Big Pharma's rejection of a patents pool to make the technology accessible to all was blunt to the point of being brutal.

A day before WHO was to launch the Covid-19 Technology Access Pool, or C-Tap, the International Federation of Pharmaceutical Manufacturers and Associations (IFPMA) held an online media briefing on progress related to Covid-19 vaccines with chief executives from four of its top member-companies, Pfizer, GlaxoSmithKline (GSK), Johnson & Johnson and AstraZeneca participating. It is clear that despite the hype, deflections and semi-truths, the world is not all that close to developing a vaccine against the new coronavirus SARS-CoV2 although billions of dollars are being thrown into the hunt. Reports in recent weeks have highlighted the problems that the frontrunners in the vaccine race such as Oxford University and Moderna are encountering.

As Covid-19 infections and fatalities spike, it would make sense for governments and the pharma industry to respond positively to the WHO call for "open and collaborative approaches in pre-competitive drug discovery" to stop the spread of the disease. But companies have other priorities like protecting bottom lines and pushing up shareholder value than equitable access on

their mind. That's why we heard some rather startling statements at the IFPMA briefing. Pascal Soriot, CEO of Astra Zeneca, claimed he was unaware of the WHO patent pool, bizarre as it sounded. But pressed on the issue, he said IP was fundamental for drug companies; if you don't protect it there's no incentive for anyone to innovate. The British firm has just received more than \$1 billion from the US for development, production and delivery of the vaccine that it has licensed from Oxford University. So which company would get first rights to the vaccine, the UK or the US? Everyone, of course!

The sharpest rejection of C-Tap came from Albert Bourla, Pfizer chief executive. He thinks "it is nonsense and at this point of time also dangerous". Why? Because the risks

The pharma industry is unlikely to back the initiative for pooling intellectual property to fight the pandemic

the companies are taking involve billions of dollars and the chances of developing something are still not very good. In other words, Big Pharma is in a tough spot and all this talk of

freely sharing IP and data is misplaced. Besides, as GSK's boss Emma Walmsley contends there isn't all that much evidence that IP is a barrier to access. Just look at the great work GAVI, the global vaccine alliance is doing through a public-private partnership. There was much praise for Bill Gates and his charitable foundation which is doing so much to widen access to vaccines by supporting GAVI and other initiatives like CEPI (Coalition for Epidemic Preparedness Innovations). The Gates Foundation does play a significant role. It's an investor in two of these companies to which it also makes huge donations, reveals the venerable New York magazine *The Nation*. Charity and business make for a good partnership. **DTE**

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Palette



WHAT'S INSIDE

Walking with migrants from Delhi to Uttar Pradesh **P60**

The two-lobbed leaves of *kachnar* are highly nutritious **P64**

Why informal workers lost their patience **P74**

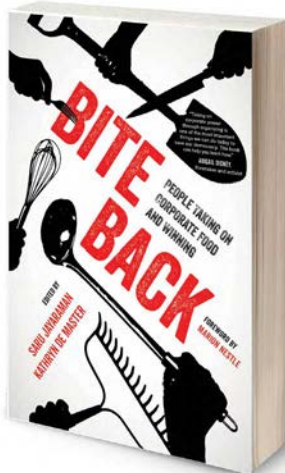
RECOMMENDATIONS

DOCUMENTARY

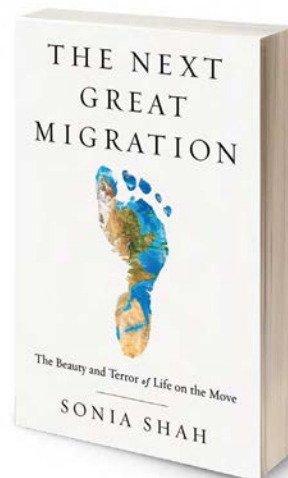


In the footsteps of Elephant is Disney Nature's new full-length documentary that tracks the epic journey of African elephants across the Kalahari desert. It captures how growing human settlements have disrupted most of the elephant migrational pathways throughout the continent. The migratory journey is dangerous for elephants, and the film shows how difficult it was for the filmmakers themselves, who risked their lives taking breathtaking footage, including shots taken on land, air and even under water.

BOOKS



How is corporate power taking control over our food and disrupting food systems? In *Bite Back: People Taking On Corporate Food and Winning*, released in June this year, editors Saru Jayaraman and Kathryn De Master reveal how corporate power is perpetuating injustices in our food system—from wage inequality to environmental destruction, and to corporate bullying. They say only direct public confrontation with corporate food elites will succeed. They also present solutions on how we can fight corporate greed to benefit workers and consumers everywhere.



We may have read about human migrations due to COVID-19, but a new book analyses migrations of plants, animals and humans over centuries, tracing ancient and life-saving responses to environmental changes as a biological imperative, as necessary as breathing. Migration breathes new life in societal ecosystems, says the book. *The Next Great Migration* unearths how climate change triggered the first human migration out of Africa catapulting us into the highest reaches of the Himalayan mountains. Migration is not a source of fear, but of hope, says the book.

GERMINATING RARITY

UTTARAKHAND HAS PUT TOGETHER AN EXTRAORDINARY
ENDEMIC VEGETATION IN THE LAST THREE YEARS

SEEMA SHARMA

SOME BEAUTIFUL photographs of a tulip garden in Uttarakhand's Munsiyari town that gained traction on the internet a few days ago offered nature lovers some joy amid the COVID-19 pandemic. Tulip gardens are a minor part of the germplasm collection of rare and endemic vegetation biodiversity. In Uttarakhand, it has been put together by the Forest Research Centre (FRC) of the

forest department during the last three years, a report of which was released by Sanjiv Chaturvedi, head of FRC, on May 24, 2020 in Haldwani. Germplasms are living genetic resources such as seeds or tissues that are maintained for the purpose of animal and plant-breeding, preservation and other research uses. These resources may take the form of seed collections stored in seed banks,





(Top) *Pteroceres Teres* growing in the Orchid Conservation Area in Pithoragarh Range (Right) *Saussurea Obvallata* at the Gopeshwar Range



trees growing in nurseries, animal breeding lines maintained in animal breeding programmes or gene banks. Chaturvedi told *Down to Earth* that this was the third-biggest germplasm collection in the country, after the National Botanical Research Institute in Lucknow and the Botanical Survey of India in Kolkata. “People at large are suffering from Plant Blindness—the inability to see or notice the plants in one’s own environment,” says Chaturvedi. We are more driven to conserve charismatic wildlife species, but not plant diversity, he says

Uttarakhand is home to a vast variety and unique range of floral and faunal diversity. The diversity, which includes 93 endemic species, is found in various types of vegetation—ranging from subtropical forests in the upper Gangetic plains and the Shivalik in the south to Arctic-alpine vegetation of the trans-Himalayan cold desert in Uttarakhand, according to studies.

Chaturvedi says that a total of 386 species with medicinal

properties have been conserved. For instance, medicines prepared with the bark of *Texus Beccata*—also known as Himalayan Yew—are considered to be one of the best cures for breast cancer.

Similarly, a local herb, *Van Kakri*, is always in great demand because of its enormous medicinal benefits—like lowering cancer risk, detoxification of the body and improving kidney and intestine health. Nurseries of this species have been developed at Badrinath and Munisyari. At least 375 tree species have been conserved—107 ficus, eight oak, 21 pines, six rhododendron species, 87 herb species, 85 shrubs, 33 bamboo

species, six canes, 57 grass, 75 ferns, 64 orchids, 11 alpine flowers, 23 wild flowers, 61 palm and six cycad species. Around 150 cactus and succulent species, 22 aquatic species, 25 moss and two species of liverworts have been conserved as well.

The research wing of the Uttarakhand Forest Department has conserved 1,145 species through *in-situ* and *ex-situ* conservation measures. Out these, 1,072 species were identified and 73 are yet to be identified. Eight species among these are critically-endangered and 23 are endangered; 14 species are vulnerable; and, 12 are near threatened, according to the International Union for Conservation of Nature.

OVERGRAZING, EXCESSIVE EXTRACTION OF MEDICINAL VEGETATION, DEFORESTATION AND CLIMATE CHANGE VARIATIONS HAVE PUSHED NUMEROUS SPECIES ON THE BRINK OF EXTINCTION

TOWARDS EXTINCTION

Overgrazing, excessive extraction of medicinal vegetation, deforestation and climate change variation have pushed numerous species on the brink of extinction. Hence, it has become vital to conserve the gene pool of existing



(Left) *Ficus krishnae* at the Lalkuan Range
(Top) *Bixa orellana* grown in the Tannin Species area, also at the Lalkuan Range

indigenous and introduced species for posterity. Chaturvedi explains: “*Thali* plant species, once abundant in the Didihat region of Pithoragarh and Nainital, are now extinct. Despite concerted efforts, we could not retrieve a single plant to create its germplasm. *Patwa* plant, after which the renowned Patwadangar town of Nainital is named, has disappeared to a large extent. We are fortunate to have protected some 150 *patwa* plants and prepared their germplasm,” he adds. The collection has been prepared in all eight ranges of the research centre—Gopeshwar, Uttarkhasi, Dehradun, Haldwani, Lalkuan (near Haldwani) Ranikhet, Naintial and Pithoragarh—encompassing all three Himalayan altitudes. The nurseries of the state flower, Brahmkamal, which grows only in high altitude areas, were prepared in Gopeshwar. Mandal, a town in Chamoli district, was selected for insectivorous plants. Riparian species were also grown in Dehradun and Haridwar, cactus

and supplements in Haldwani followed by musk and wildlife fruit berries in Nainital and oak, pine, fern and bamboo species in Ranikhet.

In the case of tulip bulbs, which he says looks attractive because of their captivating appearance, is still under observation for its impact on biodiversity. “It is very important to know the impact of a species, introduced from outside on the indigenous vegetation in the region. It can have long-term consequences and ecological side-effects. Take the case of lantana, which was introduced as an ornamental plant, but turned

out to be a menace, as it spread and blocked the growth of native species,” he says. “Similarly, Chir Pine, which grows in tough conditions and multiplies, choked the growth of other species, and caused wildfires and depleted groundwater.” He adds that FRC is also studying whether tulips can co-exist with other species.

Chaturvedi was appointed as the head of the research centre three years ago. However, all four positions under him—two of divisional forest officials and two of sub-divisional officials—have been lying vacant. The annual budget of ₹2.5 crore to the department has remained the same for almost a decade. Neha Verma, additional forest secretary, says the state government needs to look into the issue of pending vacancies and budget constraints with regard to the research centre. As of now, it is tied down with pressing issues related to the pandemic. **DEB**

(The author is a freelance journalist)

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THE INTRODUCTION OF OUTSIDE SPECIES HAS IMPACTED INDIGENOUS VEGETATION. FOR INSTANCE, LANTANA, INTRODUCED AS AN ORNAMENTAL PLANT, BLOCKED THE GROWTH OF NATIVE SPECIES

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Rejuvenation of Harmu River in Jharkhand: CSIR-NEERI provided the design for 8 Sewage Treatment Plants (STPs) with a total treatment capacity of 10 MLD



"WAYU (Wind Augmentation Purifying Unit)" reduces particulate matter and volatile organic compounds (VOCs) at traffic junctions



Electrolytic defluoridation for removal of fluoride from water



Deployed hand pump attachable iron removal plants in 240 hand pumps in rural areas

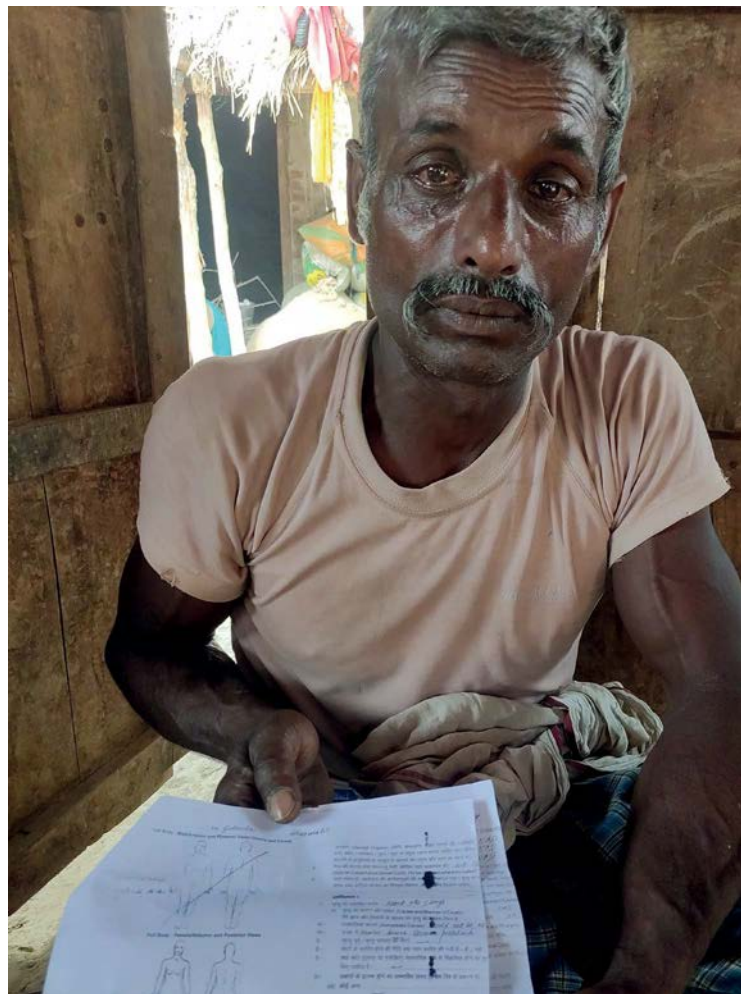


JIGYASA: Student-scientist connect programme

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Ram Chhabiley of Shravasti's Bangha village with the post-mortem report of his son Mukesh, who was returning from Ludhiana but died on the bus



The wait

DOWN TO EARTH'S **VIVEK MISHRA** HAS WALKED FROM DELHI TO SHRAVASTI IN UTTAR PRADESH TO CAPTURE THE PLIGHT OF WORKERS RETURNING HOME AFTER LOSING LIVELIHOODS DUE TO THE COVID-19 LOCKDOWN. THIS IS THE SECOND OF THE TWO-PART REPORT DOCUMENTING HIS 600 KM JOURNEY

I LEFT DELHI on May 16 and after three days of walking and hitching rides, [reached Ratanpur Kunda village in Shahjahanpur](#), Uttar Pradesh, on May 18. A group I met on my way had allowed me to accompany them to their village. Brij Kishore and Jagdish, brothers working in Haryana, were returning with their families and friends. I was curious to see what awaited those who returned to their villages after travelling hundreds and thousands of kilometres. We reached their home in Ratanpur Kunda at about 11:30 pm and crashed.

MAY 19: SHAHJAHANPUR

9:00 am: My interactions with the family made me realise that the main source of work in the village at a short notice could only be daily wage jobs under the Mahatma Gandhi National Employment Guarantee Act (MGNREGA). Rajbir, who lives next door and returned to the village from Delhi in March, told me

that a road was being laid on the outskirts of the village and people were being employed to work under MGNREGA. He decided to go and I accompanied him. We reached there to find that the contractor needed just seven-eight people. The village has about 500 families and almost each has a member who returned after the lockdown and would require a job.

12:00 noon: Rajbir and I returned home empty handed. I inquired about people who were earning from other means. I visited Ram Gopal, 70, who lives nearby and earns ₹200 a day by tilling land. I also chatted with Sarju, one of the relatives to return with Brij Kishore and Jagdish after the lockdown. Sarju had returned from Delhi after getting four fingers of his right hand severed in an industrial accident in December 2019. His employer had paid for his treatment and the fingers had been reattached but the grip was somewhat lacking. The lockdown started as he was trying to begin work again and he had to return.



About 11 million people registered for permission to return to nine states after the lockdown began

9:00 pm: There was ruckus in the house, with Brij Kishore and Jagdish searching for something. I enquired to find that the families needed to get their ration cards, Aadhaar cards and other documents in order to claim ration the next morning. Though we had managed to get ration the evening we arrived, it was not going to be enough, they said. Getting more ration quickly was necessary before it got distributed.

MAY 20: LAKHIMPUR KHERI

6:00 am: I left for Lakhimpur Kheri (see ‘The route’)—the next district that I heard had a large population of workers returning. Brij Kishore dropped me off to the main road from where I walked about 30 km to reach the bus stand in Shahjahanpur. I wanted to try my luck and find a ride.

11:30 am: I reached the bus stand and was glad to see buses lined. I asked around but officials told me that the buses were only for ferrying people to and

from the quarantine centre to nearby areas. I decided to continue walking towards Lakhimpur Kheri. On the way I met Qahar Singh who was headed to Bichhiya village of Bahraich—a district little further from Lakhimpur Kheri.

11:00 pm: We walked and hitched rides to travel another 60 km to cross the Shahjahanpur-Lakhimpur border. It was pitch dark and we were extremely tired. We decided to spend the night at one Hanuman dhaba at Rajapur chowki in Lakhimpur Kheri.

11:30 pm: A group of 18 workers arrived at the dhaba, asking for food. The owner said it would be ₹130 for *dal-roti*. It was too expensive for them. I shared biscuits with one of them named Kaushal, who seemed to be losing senses due to exhaustion. It was not possible for me to pay for everyone’s meal.

12:00 midnight: Someone from Qahar’s village arrived on a motorcycle and the two left. I took his contact number and said I will see him in a day.

Salma, wife of Insaf Ali, who died the day he arrived at his village Matkhanva, Shravasti, returning from Mumbai

Kaushal and his group wanted to keep moving. I went to a nearby police *chowki* to request officials to help them arrange a vehicle. Initially the *chowki* in-charge wanted us to go to the quarantine centre to get checked and leave the next day. When we persisted he yielded and asked the group to wait on the other side of the road. I returned to the dhaba and slept on a cot right next to the highway. At around 2:30 am in the morning, I woke up to a racket and realised it was the same group going past the dhaba on a truck, waving at me and shouting my name.



MAY 21-25: BAHRAICH

6:00 am: I left for Bahraich. Since I have lived and worked in Bahraich I have friends and acquaintances in and around the district. I walked about 35 km to a relative's place.

2:00 pm: Too tired and feeling a little weak upon arrival, I rested for the rest of the day.

On May 22, I went to Bichhiya village to meet Qahar, who told me that the village residents did not allow him to enter when he reached there early morning on May 20. He was asked to report to the quarantine centre at Sijauli and he spent the day getting checked. I enquired about his plans and he said he would not return to Delhi this year. He was looking for work as a *raj mistri* (mason). At around 7:30 pm, I left for my relative's place and reached home at 11:00 pm. I spent May 23 to May 26 looking for people and stories. I heard of Mukesh, 17, who was travelling from Ludhiana, Punjab, to his village Bangha in Shravasti and died on the bus close to the village. I also heard of a worker, Insaf Ali, who managed to travel from Mumbai to his village Matkhanva, also in Shravasti, but died the day he arrived. I decided to meet their families.

MAY 26: SHRAVASTI

12:00 noon: I arrived at Bangha to meet Ram Chhabiley, father of Mukesh. The man was completely broken. This was the story he told: Mukesh started on his bicycle from Ludhiana and rode it till Muzaffarnagar in Uttar Pradesh, where the police made him

board a bus to Bhinga, the town where their village is located. Mukesh fell ill on the way. The passengers raised alarm but the bus driver asked them to shut up, with the threat that he will put the bus in reverse gear. In Bhinga, Mukesh was declared dead on arrival at the quarantine centre. His post-mortem report, that Ram Chhabiley has been provided with but which he does not know is the post-mortem report, states that Mukesh did not have COVID-19 and the cause of death is unknown.

2:00 pm: I depart for a friend's place in Bhinga.

MAY 27: SHRAVASTI

12:00 noon: I arrived at Insaf Ali's home in Matkhanva. His wife, Salma, said that Insaf went to Mumbai last year to be able to repay a loan of ₹55,000 that they took when she was pregnant. On April 13, he left Mumbai, paying ₹2,500 to a truck driver to take him to Uttar Pradesh. The driver dropped him off at Jhansi, from where Insaf walked to Bahraich. He arrived on April 27 and went straight to the village school that was serving as the health centre. He found there was no food or medicines. He felt sick and telephoned Salma for help, who went to the village *pradhan* for assistance. The *pradhan*, Salma said, told her that all this was just an excuse for him to enter the village. At around 11:00 am the same day, Insaf died. The post-mortem report stated he was COVID-negative, the cause of death unknown. **DTI**

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(This is the final article of a two-part series)

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Turn over a delicious leaf

THE BEAUTIFUL LEAVES OF *KACHNAR* ARE NUTRITIOUS TOO

VIBHA VARSHNEY

JUST BEFORE May—when the *amaltas* and the *gulmohar* trees spread out their spectacular show—the *kachnar* tree too flowers in all its glory. The flowers look like orchids and have a delicate fragrance, but they are not as common as the *amaltas* and *gulmohar*, and it is quite easy to miss them. There is a tree near my house in Delhi which hugs on

the wall of a government primary school. But I doubt whether children have spent much time to appreciate its beauty or even play with its two-lobed leaves, shaped like butterfly wings.

But tribal communities in Jharkhand, however, will not miss it as they consume every part of this multipurpose tree. The flowers, fruits and leaves are

The leaves have anti-ulcer properties and are consumed to protect the kidneys and liver



PHOTOGRAPH: VIBHA VARSHNEY / CSE

edible and are an important source of nutrition. In fact, the leaves are a perennial source of food, unlike other flowers and fruits that provide nutritional support only for a short period. They can also withstand the vagaries of extreme weather. Trees-borne foods, like *kachnar* leaves, form the second-biggest source of food, after herbs, in Jharkhand, write Lal Ratnakar Singh, former chairperson of the Jharkhand Biodiversity Board and Varsha Rani of Birsa Agricultural University in their analysis on the role of leafy greens in food and nutritional security of tribal communities in the state.

VARIED PREPARATIONS

The young leaves can be prepared as a curry or fried, or they can be simply boiled with a little bit of salt, and is a good accompaniment with rice. They are also dried in times of food scarcity and sold in local markets, providing a source of livelihood to tribal communities. “I noticed that my housemaid in Dhanbad used to pluck tender leaves and shoots of the purple *kachnar* and collect them in her *sari pallu* to take it home. She told me that it is sun-dried over thatched roofs and stored for times when they don’t get fresh vegetables,” says Sangeeta Khanna, a nutrition consultant and a food blogger.

The Munda tribal community cooks the dry leaves in many ways: rehydrating it with hot water and then making a *chutney* along with chilli garlic or dry fish or dry shrimps or bamboo shoots; or, they cook it with cooked rice water along with spices and sauté it, she says.

The leaves of *kachnar* are an important source of food for tribal communities. Other than

RECIPE

KACHNAR KI BHAJI

INGREDIENTS

Tender *kachnar* leaves: 250g
Mustard oil: 2 tbsp
Onion: 1 (diced)
Tomato: 1 (diced)
Garlic: 2 to 3 pods (diced)
Red chilli: 2
Salt to taste

METHOD

Clean the *kachnar* leaves and cut them into small pieces. Pour mustard oil in a pan. Once it gets heated, add chilli, garlic and onion, and fry. Add tomatoes and cook for some time. Now add the leaves and salt, and cook till it becomes soft. The dish can be consumed with red rice.

Jharkhand, tribals in Odisha too consume the leaves of this tree.

The nutritive qualities of the leaves have also been investigated by researchers at the Sam Higginbottom Institute of Agriculture, Technology & Sciences, Allahabad, who found that leaves of *kachnar* (red flower variety) are rich in protein (15.19g/100g) and micronutrients like calcium and iron (240mg/100g and 21.73mg/100g respectively). These researchers from the department of food and nutrition found that the leaf powder can be incorporated in *idli* and *kachori* too. Others have incorporated the fresh leaves into soup, *chila* and *uthapam*.

The characteristic two-lobed leaves earned the tree its Latin name *Bauhinia*. It is named after the 16th century herbalists brothers, Johann and Gaspard Bauhin. Both had worked extensively on describing and classifying plants. Carl Linnaeus, who developed the binomial system of the classification of the plant, named this plant after the brothers inspired by the two lobes

of the leaves.

The tree is probably native to eastern Asia—globally distributed in Pakistan, India, Nepal, Bhutan, Burma and China. The *kachnar* flower is also used on the flag and coins of Hong Kong. In 1885, George Watt, the Scottish physician and botanist—who worked on economically important plants in India—had written in *A Dictionary of the Economic Products of India* that the plant is sacred to Hindus and worshipped during the Dashera festival. The white flowers of *kachnar* are used to worship Lakshmi, the goddess of wealth and Saraswati, the goddess of knowledge.

Research shows that the leaves have anti-ulcer properties and properties to protect the liver, kidney and also have antibacterial activity. Indians use the decoction of the leaves to allay headaches in malarial fever.

In south India, Sikkim, Bengal, Bihar and Odisha, the leaves are used to treat jaundice and to cure wounds and tumour in the stomach. But the benefits of the tree go far beyond. Its leaves, shoots and pods are used as fodder for livestock as the leaves contain 10-16 per cent protein, and that’s why they are relished by animals.

Though the plant is considered a weed and an invasive species in Cuba, the Bahamas, Australia, New Caledonia, USA, Kenya, Malawi, Rwanda and Zambia, there is a growing movement in USA to include this plant in their food. It may be a good thing to let the tree run wild as it belongs to the legume family and lives in a symbiotic relationship with *Rhizobium* bacteria, which helps fix atmospheric nitrogen and improves soil fertility. **DTE**

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Consumption in COVID-19 times

WE HAVE A UNIQUE OPPORTUNITY TO CHANGE OUR FOOD HABITS AND PUSH FOR POLICIES THAT PROMOTE HEALTHY, NUTRITIOUS AND SAFE FOOD. THIS CAN ALSO REDUCE OUR CARBON FOOTPRINT

Sane ecological choices at hand

How dietary habits can mitigate global warming and prevent new pandemics

GIULIA WEGNER

OVER THE past year, the world has witnessed an alarming succession of unprecedented environmental disasters. Millions of hectares of forests were incinerated in Amazonia and Australia. Floods, like the one in Venice, submerged entire cities with their historic and cultural heritage. An ever-increasing number of cetaceans, turtles and birds died in agony due to the ingestion of plastic. And to cap it all, the global COVID-19 pandemic, which is also a consequence of the way we interact with our planet. In the face of such events, we can feel a rising sense of powerlessness and despondency. We end up thinking: “It’s too late; is there nothing we can do?” As a species, humans are not used to considering ourselves a part of the environmental problem, and even less so, of its solution. Yet, there are actions that each one of us can take to prevent these environmental disasters from becoming the norm.

The past 60 years have been characterised by the increasing frequency of the emergence of new zoonoses, which are infectious diseases transmitted from animals to humans. The majority of these zoonoses (about 150 in total) were transmitted by wild animals, among which the most known are: Machupo (1961, Latin America), Ebola (1976, western Africa), HIV (identified in 1981 in USA), Hendra (1994, Australia), Nipah (1998, Malaysia), SARS (2003, China), and most recently COVID-19 (2019, China). This may be partly due to climate change, which alters temperature and rainfall patterns in ways that favour disease carriers like the mosquito. Melting glaciers may also release viruses that have been buried for thousands of years. Yet, the rise in new zoonoses is primarily caused by the way in which we are increasingly pushing into the few remaining pristine ecosystems left on the planet.

MAKING OF EPIDEMICS

When the Amazonian rainforest was burnt to obtain cheap land for cattle ranching; when African territories were cleared to extract timber and minerals (such as coltan used in electronic devices); and, when uncharted landscapes were penetrated to hunt exotic animals and sell their meat, skin, ivory and body parts for presumed medicinal uses—we came in contact with previously isolated populations of wild animals that host hundreds of thousands of viruses and bacteria which we had never been exposed to. These diseases are not new. Some viruses like corona have been on the planet for more than three billion years, but our interactions with them have been only recent.

That explains why the majority of new infectious epidemics are linked to deforestation, which creates new rural landscapes where wild animals and humans come into contact with each other and also facilitates the penetration of illegal hunters in pristine landscapes. Certain species of bats and rodents prosper in human-modified landscapes. Due to their high numbers and tolerant immune system, these animals act as ‘reservoir’ species that asymptotically host viruses. Once these viruses enter humans, they can prove to be lethal. Many

viruses also make use of an ‘intermediate vector’ through which they can evolve and transit from the reservoir species to humans.

For example, insufficiently-cooked meat from wild animals is one of Ebola’s vectors, as the animals probably get infected by eating fruits

that were partly consumed by bats that host the virus. The Nipah epidemic in Malaysia broke out when a large intensive pig farm was set up together with fruit orchards at the edge of the forest—the virus was transmitted from bats to pigs through fruits contaminated with the bat’s saliva and urine, and then it transferred from pigs to humans.

Thus, as long as we keep encroaching into the last uncontaminated ecosystems to extract resources, new infectious diseases will keep emerging. As explained by Alanna Shaikh, an expert in global public health, even if all countries in the world are able to develop effective protocols to contain new disease outbreaks—by identifying new viruses as soon as they emerge, immediately treating infected people, sharing all information with global health

HUMANS DO NOT CONSIDER THEMSELVES AS PART OF THE ENVIRONMENTAL PROBLEM, AND EVEN LESS SO, OF ITS SOLUTION. YET, THERE ARE ACTIONS THAT EACH OF US CAN TAKE TO PREVENT THESE CATASTROPHES



BACK TO CONTENT



Livestock production is responsible for a majority (72-78 per cent) of total agricultural food-related greenhouse gas emissions. This is also due to the fact that livestock is the world's largest user of land and water resources

authorities so that other countries can get ready for the potential spread of the virus; and, even if all these precautions are taken—new viral disease outbreaks are inevitable.

As highlighted by David Quammen, author of *Spillover*, the sharing of diseases between animals and humans reminds us of something fundamental: we are animals too and an integral part of nature, and the only way to mitigate the environmental disasters is to learn to accept and respect this basic truth.

The causes of ecosystem disruption are several, but they are all linked to our overconsumption of resources. One form of consumption, in particular, is at the root of both the increasing risk of zoonotic pandemics and global warming—the consumption of animal sourced foods.

Climate change is caused by greenhouse gas (GHG) emissions. There the four major sources of GHG emissions: electricity and heat production (25 per cent); deforestation, crop cultivation and livestock ranching (24 per cent); industrial production (21 per cent); and, transportation (14 per cent). To curb emissions and mitigate climate change, governments tend to focus on energy and transport sectors, but the global food system, and especially, livestock production, is also the key trigger. Livestock production is responsible for a majority (72-78 per cent) of total agricultural food-related GHG emissions. This is also due to the fact that livestock is the world's largest user of land and water resources. Agriculture, especially livestock production, with its high requirement of space and feed, is one of the main causes for habitat destruction, bringing us in increasing contact with wild animals which are hosts of many unknown viruses. The expansion of livestock and feed production occurs predominantly in tropical countries.

The risk of new zoonoses is, therefore, concentrated in tropical forests that are characterised by high mammal species diversity and, which are undergoing land conversion into crop and livestock production. Moreover, due to their high density and low genetic diversity, intensive livestock farms can also act as amplifiers for the transmission of new pathogens—as seen with Nipah virus.

FOOD FOR SURVIVAL

There is growing consensus among the scientific community that GHG emissions cannot be sufficiently mitigated without a radically-reduced consumption of animal-based foods. The Oxford Martin Programme on the Future of Food, and the *Special Report on*



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Climate Change and Land of the UN's Intergovernmental Panel on Climate Change (IPCC), assert that the target of keeping global warming well below 2°C will not be met without joint implementation of the following global food system measures: sustainable agricultural intensification; reduced food loss and waste; and, diets low in animal sourced protein. A so-called flexitarian diet consists of consuming large amounts of plant-based foods, modest amounts of animal-based foods and very low amounts of red meat. A global shift to a flexitarian diet has the potential to reduce agricultural food-related GHG emissions by 56 per cent, and, to feed more than nine billion people in 2050 in an environmentally sustainable manner.

The EAT-Lancet Commission on Food, Planet, Health (2019) concluded the same. The commission also highlighted how a reduction of animal-based proteins in our diets, along with a reduction of unhealthy products like added sugars and highly-processed foods, could help prevent approximately 11 million deaths per year (19-24 per cent of total adult deaths). High consumption of livestock products is, in fact, linked to obesity and chronic diseases such as diabetes, heart diseases and cancers. Therefore, to reduce GHG emissions and the risk of new epidemics, it is crucial that each one of us begins to start taking the following actions: shift to a flexitarian diet consisting of small quantities of meat, fish, eggs and dairy foods; very limited quantities of red meat; and, purchase sustainably produced food. Environmental disasters hit more violently on those who depend directly on nature for their livelihoods, and those who cannot rely on a welfare state that guarantees them with food and medical care during emergencies such as a famine or an epidemic.

The recent film *The boy who harnessed the wind* by Chiwetel Ejiofor compellingly illustrates these issues through the true story of a village in Malawi. In 2001, the village faced a severe food scarcity caused by deforestation and drought. The troubles experienced by citizens of western countries during the two months of domestic confinement seem to fade in comparison to the long months of anguish experienced by a Malawian family fearing that they may not be able to feed themselves and their children, and the break-up of the village's social fabric. Nonetheless, the COVID-19 epidemic has brought this to the surface: everyone is vulnerable to the consequences of environmental degradation. **DTE**

(The author is with the Wildlife Conservation Research Unit of the University of Oxford, the UK)

Eat right to fight off COVID-19

India is rich in nutrient-dense food crops. All we need to do is repurpose policies towards a food system that is resilient and sustainable

ARABINDA K PADHEE and JOANNA KANE-POTAKA

MEDICINES CANNOT make us resilient. But our lifestyle can. This wisdom is going to swell the demand for healthier and nutritious foods in this time of COVID-19, which requires us to urgently boost our immune systems and stay healthy. In India, which is a rich basket of nutrient-dense food crops, there has already been a growing demand for natural and organic food products. This is evident from the steep growth in the market share of natural and Ayurveda products of *desi* companies and a corresponding alignment to the trend by competing multinational companies. Aspirational consumers are going back to nature and natural products to live healthier and longer. A consumer survey by the World Economic Forum predicts that by 2030 India will no longer be an economy led by those in bottom of the wealth pyramid but by the middle-income class—some 80 per cent of the Indian households will be in middle-income group (from about 50 per cent now) and drive 75 per cent of the consumer spending. Alongside, the government has also launched initiatives like “Eat Right India” and “Smart Food” to enhance the demand for healthier and nutritious foods.

We now need to ensure that these foods are safe, accessible and affordable to all, particularly to the vulnerable sections of society.

Empirical studies indicate that malnutrition contributes to most of the country's child deaths as well as disability in adults. The Comprehensive National Nutrition Survey (CNNS) data further shows that overweight, obesity and even noncommunicable diseases are no longer confined to the adult population. Saving the productive populations of the future requires a serious focus on nutrition.

What could drive such a change, particularly at a time when agricultural intensification through



(Top) Pearl millet contains the highest amount of folate among cereals; Like millets, sorghum is gluten-free



Green Revolution technologies is depleting water resources, impacting biodiversity, degrading the soil and driving desertification? The impact of climate change on agriculture is also well established. How can public policies ensure the farming of nutritious and safe foods while sustainably managing the natural resources? What could be the pathways to incentivise this food system transformation?

COVID-19 offers a unique opportunity to seize the moment and repurpose policies towards a food system that is resilient as well as sustainable. The growing consumer demand for healthier and nutritious food has to be intensified through awareness programmes, respecting their culture, taste and food preference. Food safety standards, through labelling and incentives, have to be built in government schemes and programmes. Just like Poshan Abhiyaan, Eat Right India movement, Millet Mission and the Swachh Bharat Abhiyaan, relevant activities can be converged to create a mass movement to achieve good nutrition outcomes. Businesses also need to be encouraged to make responsible investments to transform the food systems.

Even though many staple and non-staple food crops are long known to be nutritious and good for the growth of individuals, food and agriculture policies across the world are confined to the “Big3” staples (rice, wheat and maize). In India, for decades the Minimum Support Price and public procurement policies have ignored the diversity of crops and are skewed in favour of rice and wheat. The enhanced production of these food crops might have taken care of the calorie requirements, but has increased the country’s double burden of under-nutrition and micro-nutrient deficiency.

Crops such as sorghum, millets and pulses not only require less water in comparison to rice and wheat, they are also rich in micronutrients and protein. Millets have a low glycemic index, which make them a good alternative staple for managing or preventing diabetes. Its richness in micronutrients can be gauged from the fact that some of them can be natural substitutes to correct micronutrient deficiencies. For example, finger millet (*ragi*) has three times more calcium than milk; pearl millet contains the highest amount of folate among cereals; and kodo millet is high in

Pulses like pigeonpea are main source of protein for vegetarians in India

dietary fibres—three times more than that in wheat or maize and 10 times than that in rice. Likewise, sorghum and millets are gluten-free. Being “good for you, the planet and the farmer”, they are referred to as “smart food”, and are fast becoming the choices of aspiring and health-conscious consumers, particularly in urban areas.

Various kinds of *daal* have been the main source of protein intake in India, besides fish and meat. Legumes are also an affordable protein source; however, many are not complete protein as they are low in one of the essential amino acids—methionine. A recent study shows that millets and legumes, when combined, can provide complete protein and highly digestible and power-packed nutrients. The recent growth in production of major pulse crops is, indeed, a significant achievement and the government must sustain this near-self-sufficiency through specific policies and research breakthroughs.

Consumption of fruits, vegetables and dairy products is also growing in India and this is a good indicator of nutrition-sensitivity of Indian agriculture.

Bio-fortification of food crops is now employed to enrich the nutrient profile of the country. Zinc- and protein-rich rice and maize varieties with high-protein and high vitamin-A have been developed and released by the Indian Council of Agricultural Research. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) has also developed and released India's first bio-fortified sorghum variety, *parbhani shakti*, in Maharashtra.

During this time of COVID-19, enhanced investments on research and innovation in this sector could be an effective pathway to boost the health and immune systems of people. Research efforts in major crops, including non-staples, can provide cost-effective and sustainable solutions to address micronutrient deficiencies in the population.



Government programmes like the public distribution system, mid-day meal scheme and integrated child development scheme are the best possible delivery channels to promote healthier and nutritious food in India. A recent study has shown that mid-day-meals served with millet-based products ensured 50 per cent faster growth in children in comparison to those eating the usual rice-based meals.

Interestingly, as often referred to by economists in food and nutrition discourses, Bennett's law seems to be very much applicable for most Indians now—with their incomes rising, people are eating smaller proportion of starchy staples. It's the right time to push policies that promote nutritious and sustainable food systems and value chains and create adequate demand for healthy, nutritious, qualitative and safe food, through behaviour change. **DT**

(Arabinda K Padhee is country director-India, the International Crops Research Institute for the Semi-arid Tropics (ICRISAT). Joanna Kane-Potaka is assistant director general (External Relations) and executive director, Smart Food programme, at ICRISAT. Views expressed are the authors' own. They can be reached at a.padhee@cgiar.org)

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Why workers lost patience

IN THE last two months or so, the country has been overwhelmed by the biggest-ever exodus of informal workers from business hubs to their respective states after the lockdown was declared. Probably for the first time, urban India—limited to their world and privileged—began to take note of the scale of India's informal workforce. They not only realised the fragility of their lives, but also that they are a critical part of the formal economy. In the absence transport facilities, thousands of workers simply walked barefoot for hundreds of kilometres to reach home. And their torturous experiences shook everybody, everywhere.

However, Union Home Minister Amit Shah blamed the returning workers for this situation. In an interview to a television channel, he said, "Some people lost patience and started walking on the roads." Earlier, many political leaders—mostly from the ruling Bharatiya Janata Party—also discounted the gravity of the situation. But Shah's reasoning is troubling. It forces us to ask the question: why did workers lose their patience?

Let's begin with a broad profile of the people who lost their "patience". They are mostly informal daily wagers sustaining an entirely cash-based economy in urban areas. They left their villages, both out of distress and due to lack of choice. In cities, they had to earn every day to sustain their household, and also to remit a little saving back home for the survival of their extended families. They do not enjoy job security like workers of the formal economy. When the lockdown forced all businesses to shut down, they lost employment and also their earning. So the question is: what could they have done?

In such situations—similar to a severe natural disaster—workers have two options: they either stayed back hoping that the business would resume; or they left home. In the case of the first option, there was some certainty as to when the business would resume. But India's

lockdown was extended three times. In such an uncertain governance structure, the workers opted for the second option. That's why migration picked up only after the second extension of the lockdown in April. And when it started, there were no government plans to arrange transport to ferry them back to their villages.

But in both options, people needed something that only the government could have ensured: assurance. Or, in other words, they needed the trust of the government to rescue them. But the migrants didn't have either the assurance or the trust of the government. They began their journey due to a jobless situation to a place they called home, where at least they had the assurance of a roof on their heads.

Shah is not factual in his assessment when he says "some" people lost patience. For how many months can you test a poor's person's

The rich now trust the government the most, while the less privileged experience its absence

patience? The government belatedly realised its mistake and finally started trains and buses to ferry them. Does this mean an entire

workforce accounting for a significant percentage of the country's population lost its trust on the government?

"The 2020 Edelman Trust Barometer Spring Update: Trust and the COVID-19 Pandemic", based on a survey of over 13,000 respondents—belonging to the educated and well-earning classes in 11 markets that include India—shows that trust in governments has hit the highest in last 20 years. Some 65 per cent of the respondents said they trust their governments would help them out of this pandemic. This is a trust level that was seen after World War II. The survey also found that 67 per cent of respondents believed that the less privileged and poor people suffered disproportionately more than others.

This is a scary verdict. The privileged classes, while accepting there was inequality in our governance, said they needed the government the most in this situation. Then how could poor daily wagers not have lost their patience? **DTE**

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