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STILL A MYSTERY

Annual tryst with unknown disease outbreaks once again highlights India's defunct health surveillance system



Assam floods: Uneven rains, urbanisation and deforestation to blame
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Headline management will not work

THE COVID-19 pandemic has ebbed, but only in our mind's attention space, and this is extremely unfortunate. The virus is ravaging now and has spread across the country. It has gone beyond cities to more remote states and villages, where there is not even a semblance of healthcare, forget ventilators. Now is when the impact is worse—people who have the infection are doubly, no, triply hit and hurt, devastated. They have no option but to go back to work. They cannot afford a lockdown. They are not only hit by the disease and the lack of healthcare facilities, they also have to fight crippling poverty and now extreme weather-related disasters.

Today, our worst nightmare—the worst-case scenario—is playing out. And somehow the commentary on the daily counts seems like a replayed cricket match. It's been too many months and now it seems like old news.

Let's do a quick recap of this tumultuous year. We slipped into 2020 without any indication of the horrors that awaited the world. Something was happening in Wuhan in China, but not many of us noted it (except for your magazine—in the February 16 edition we carried a cover story on how this virus would lead to a pandemic, and this column on February 14 reminded "this health crisis will disrupt business all across the world").

By February and till later in March, nothing was amiss, not really. People could travel in and out of India including the US President who attended a massive rally in Gujarat. The usual was going on; including Parliament was in session and Madhya Pradesh government was being felled. Then came the first shock—on March 24th, the lockdown was announced dramatically and without notice. Life came to an abrupt halt.

Attention was on the daily count—how many cases of COVID-19; where; what was the source of the infection; and, every day's death rate was noted. The first phase of the lockdown ended in mid-April and it seemed when it was extended till May 3, 2020 and then till the end of the month that the end of the disease was within reach. But since June, things went downhill, and fast. In the beginning of May, India was adding roughly 2,500 cases each day. Today, at the end of July, we are adding over 55,000 new cases each day.

If the poor are hit today, the rich—who started this transmission in the first place in most cases—will be hit tomorrow

In May, there was another humanitarian crisis that needed our attention. Hundreds and hundreds of hungry, helpless people fled their place of work—as the economy collapsed and they ran out of money—to go to their villages. We saw how the invisibles of our city—people who provided labour; produced goods and services so crucial for our well-being— became outcasts. They were literally thrown under the bus; lost their lives because they slept on railway tracks and a train went over them or a truck mowed them down. I write this, because we must not forget—we must not allow these images to be erased from our hearts and minds. All this happened in our world.

On June 1, when the first lifting of the lockdown was announced, the rush was to open up. Rightly so, as the economy was on its knees, the worst-hit was the daily workers who had no jobs to pay for food or anything. Government's relief packages, however welcome, were hardly sufficient to manage the distress. But this was not easy—as we opened, we had to shut again and again as the case load increased. Different cities and different state boundaries were under lockdown—some for weekends; some for a few days; and, some opened and then shut.

Numbers are mounting every day; our death count is the fifth highest in the world—India's death toll on July 30th stood at 35,800. We are now part of the world's most infamous trinities of macho men—the US and Brazil. And what is worse is that the cases of the virus are no longer restricted to cities—where there is media attention and some kind of healthcare infrastructure—but are widespread and hitting where it hurts the most.

So, as we enter August, let's remind ourselves of this reality. COVID-19 has not gone away; it is raging across the country. We know that. We also know that we can deny as much that there is no community transmission, but governments neither do not have any idea of the source of the infection nor do they have a grip on the disease. Now, our best bet is that the disease fades away—it doesn't remain the headline news but an obscure item in some inside pages. We need new distractions.

But this news will not go away. Let's be clear. If the disease exists in any part of the country, it will spread. If the poor are hit today, the rich—who started this transmission in the first place in most cases—will be hit tomorrow. The economy cannot be dictated into action, it will be derailed if there are frequent and unplanned lockdowns. So, this time, we can't just turn the page. Headline management will not work, not in this case. DTE

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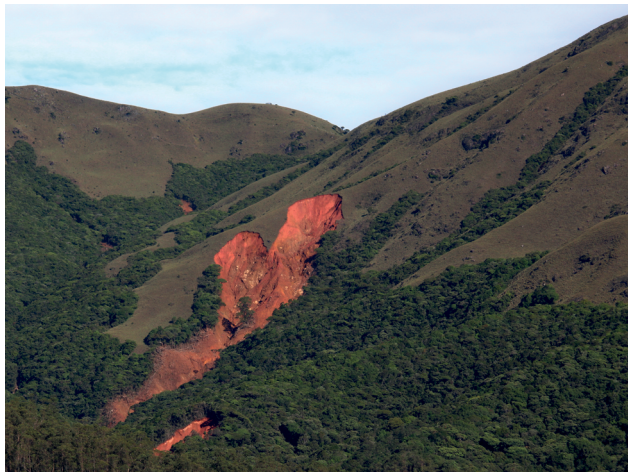
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GOBAR TIMES

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Engage



Restore dwellers' rights over forests

This is in reference to the article "Dangerous dilution" (16-30 June, 2020). In an earlier article titled "Forest Rights Act: Who is the encroacher and who is encroached upon", dated March 19, 2019, it is mentioned that, "Since enactment of the law, 4.22 million applications have been filed for the settlement of rights. Of this, 1.94 million have been rejected. Only 54,591.07 sq km of forest land has been recognised, while the total forest land under occupation prior to 2005 was 112,000 sq km." The article "Dangerous dilution" makes us ponder how the changes in the Forest Rights Act (FRA) will threaten the forest dwellers. Besides, there is the debate on whether the states are empowered to amend FRA or not. But the real task of looking into restoration of forests (roughly 57,000 sq km) is sidelined and seems to be not under active consideration of the authorities. The experts should dwell upon the legal method of safeguarding the forests so encroached, as well as on the declaration of community forests after having spent huge amounts of money in compensatory afforestation. Otherwise, all the exercise will be futile.

SUNIL KUMAR AGGARWAL
VIA EMAIL

ILLUSTRATION: RITIKA BOHRA / CSE

Why asphyxiation deaths continue?

On July 2, 2020 four young men lost their lives due to asphyxiation in Tamil Nadu's Thoothukudi district when they got inside a septic tank to clean it. Though manual scavenging deaths are reported regularly in newspapers and the government has passed stringent orders to prevent the deaths and to help the families by paying compensation, the deaths continue. Many say that we have to live with the impact of lockdown and COVID-19 for years to come. Despite the stringent laws on its abolition, must we also live with the menace of manual scavenging and of septic tank cleaning deaths? Unfortunately, Indians accept it as fate when the government fails to implement the rules and regulations it has passed.

V GANAPATHY
VIA EMAIL

Decision-makers conspicuously silent

This refers to "World Environment Day 2020: Looking ahead of lockdown" published on June 5, 2020. The message from the piece is very powerful and do-able. Media is replete with stories on the need and urgency for a cleaner post-COVID world. But the voice of the decision makers—bureaucrats, ministers, corporates—is missing. This silence does reflect a fault line between the real concerns of the people and the political agenda, which tragically is very different and disturbing. What do our Parliament and Assemblies really stand for and represent?

VINAY
VIA EMAIL

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DTE TV

Locust menace persists

Locust attacks may have come into prominence now, but for some of the villages in Rajasthan close to the border this is the third time within a



year that they face the pest. *Down to Earth* travels to Lalawali village of Bikaner to talk to farmers about the crisis. Farmers say they have been fighting the locusts with very little help from the government. Rajasthan is India's worst affected state.

Styrene leak: company did not follow protocol

A state government probe into the leakage of toxic styrene gas from the Visakhapatnam plant owned by LG Polymers Ltd on May 7, 2020, says that safety protocols were not followed by the company. Alarm systems were not functional in at least 36 areas, says the 4,000-page report.

COVID negates gains

COVID-19 is not just the biggest health problem of our times but also the biggest economic crisis since World War-II. The pandemic will undo the progress the world has made in the past few decades in fighting extreme poverty, says the June edition of World Bank's "Global Economic Prospects" report.

FOR MORE, CLICK



PHOTOGRAPHS: WIKIMEDIA COMMONS

Don't blame people for feeding dogs

This is in reference to "Killing with compassion: Why feeding dogs in public places must stop!", published online on July 2, 2020. I do not agree with your view that people who feed stray dogs should be held accountable for them. They did not breed them. The dogs are already there because the government failed to neuter them. People feed them because of compassion and not because they want to see a rise in their population. The whole article sounds very stray dog phobic. Killing with compassion is still killing. Murderer with compassion is still a murderer.

ERA CHAWLA
VIA EMAIL

↘ I was horrified reading the article and the utter lack of empathy of the authors. Dear *Down To Earth,* the ideas may be of authors but you are certainly promoting the concept through your respectable portal.

VIDUSHI
VIA EMAIL

↘ Why are the writers targeting the general public? Why not the civic bodies responsible for sterilising stray animals and running shelter homes?

PREMA
VIA EMAIL

↘ Stray dogs are really a nuisance. One of the strays outside my house bit my dog a year ago. They keep breeding and now there's a pack of 10-11 that runs around everywhere the whole day.

PINKY
VIA EMAIL

↘ Your words are inciting all those animal haters who maim and kill dogs. If you read the Constitution, it calls compassion to animals our duty.

LEENA SHARMA
VIA EMAIL

Authors' response

Far from being an attack on dogs, the article makes a case for better management and welfare of homeless dogs. There is no such thing as "community animals". Dogs are domestic, companion animals protected under the Prevention of Cruelty to Animals Act (PCAA) and have the right to food, water and shelter. Any attempt to keep them homeless and on the streets is illegal and cruel. If the complainants think sheltering is "useless", it is their belief. The authors will continue to promote it as the only viable solution for the protection of people and homeless dogs. It is also one of the primary responsibilities of the Animal Welfare Board of India (AWBI) and is funded extensively by the board. AWBI gave non-profits ₹9.59 crore of tax payer's money in 1993-2005 and ₹6.5 crore in 2007-17 for sheltering.



Primary causes of dog attacks are territoriality and fear; sterilisation and being fed do not check aggression in dogs. Studies have shown that neutering may in fact increase aggression in them. Compassion for living creatures cannot mean feeding animals in public places and on the streets. This is not mentioned in PCAA either. Feeding and caring for animals can only be done in shelters. These activities in public places are not protected under the law. They are, in fact punishable for being a public nuisance under Section 268 of the Indian Penal Code. A Circular by AWBI regarding protection and rights of pets and street dogs and animal lovers places stringent rules on dog feeding, all of which are being violated, as mentioned in the article. All dog feeders are in fact in violation of these guidelines and are carrying out illegal activities. AWBI has itself submitted to the Supreme Court that the only way to control the stray dog population is to remove food sources. It states, "The overall, ultimate answer to street dog population control is to control the availability of edible wastes."

IPC Sections 428 and 429 deal with killing and maiming animals. These do not pertain to anything written in the article.

(For complete response, log on to www.downtoearth.org.in)

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

Over 0.6 mln COVID deaths

More than 648,445 have died of COVID-19 while 9,913,795 have recovered in 213 countries and territories, as of July 26. The number of people infected globally stands at 16,202,385.

1.3 million cases in India

Number of COVID-19 cases in the country was 1,287,945 as of July 24. A total of 440,135 were active cases; 817,209 cured/migrated patients; and 30,601 deaths.

Depleting fish stocks

The fraction of fish stocks that are within biologically sustainable levels has decreased from 90 % in 1974 to 65% in 2017, says the Food and Agriculture Organization. More than one-third of the world's fish stock are being overfished.

e-Waste sector still ignored

India generated over 53 tonnes of e-waste in 2019. Over 82% of this waste most likely not formally collected and managed in an environmentally sound manner, as per the World Health Organization.

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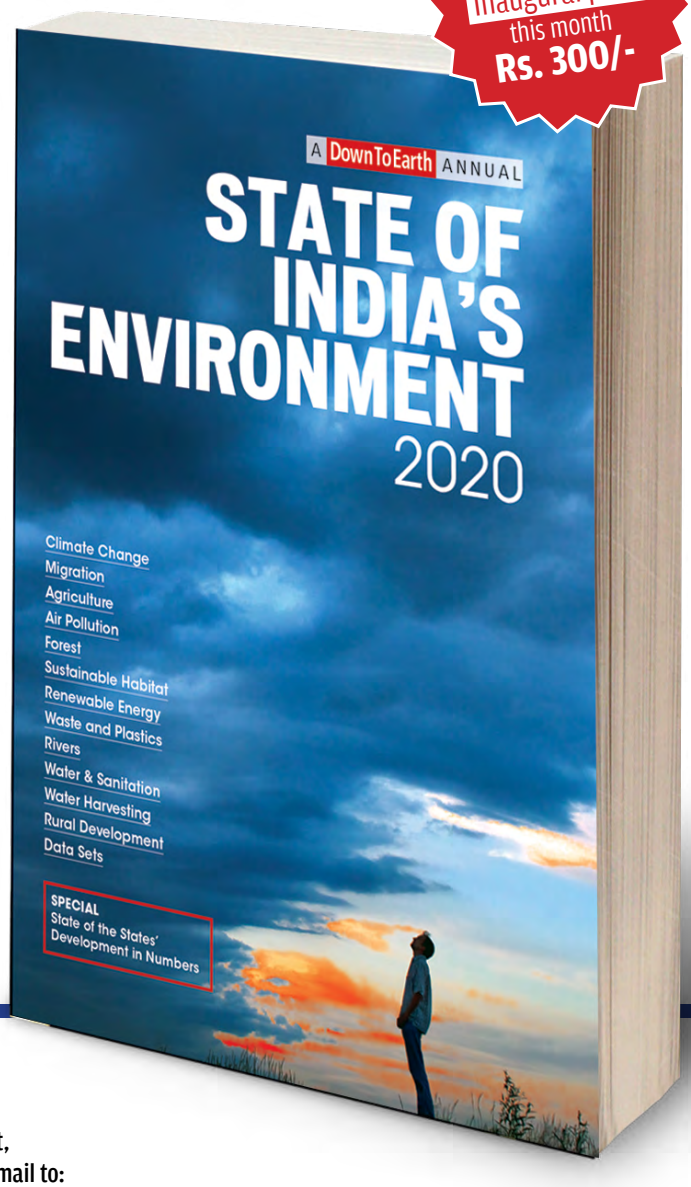
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Digest

WHAT'S INSIDE

A fashion designer creates a vest that can help observe social distancing **P12**

Diseases kill half of Gir lions between January and May this year **P13**

First active leak of seabed methane discovered in Antarctica **P15**

1,000 WORDS VIKAS CHOUDHARY



Satyendra Pal, who runs a free school for children from economically weaker families in Y K Jhuggi camp in East Delhi, restarted physical classes after students complained they were unable to study online due to limited or no internet access. Pal teaches 20 students in batches of six to seven students to maintain social distancing

FOR MORE PHOTOS, SCAN

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Viral shield

Former professor at the National Institute of Design teams up with artisans to craft a jacket that can help one move around without much hassle during the pandemic

SNIGDHA DAS

SOON AFTER the government announced lockdown and I realised that the pandemic was not going to get over anytime soon, my first worry was how to ensure the necessary physical distancing," recalls Somesh Singh, co-founder of Crafts Village in Delhi. "After all, no one is visually trained to maintain the minimum distance of 2 metres around them from all sides. Besides, stepping out of the house requires complete alteration of behaviour, right from wearing a mask to keeping it at a place so that it does not infect other belongings." Over the next one-and-a-half months, the former head of National Institute of Design, Ahmedabad, used his skills and experience to craft a vest, which he claims can help people move around and carry out their day-to-day activities without much hassle.

The garment, named Covest, is an intelligent product. It has an in-built mask, sensors to ensure social distancing, an attached thermometer and magic sanitisation pockets. Covest runs on battery, which remains embedded in the garment and can be operated with the help of buttons that act as switches and seams that act as circuits. "Switch on the sensors when you are in a crowded place. It will create a 2-metre *Laxman Rekha* (safe boundary) around you and sound an alarm if someone invades that boundary. This not only helps the person wearing the vest but also makes others conscious of maintaining distance," says Singh.

To ensure that the mask, keys, gloves and even mobile phone remain free of germs, including viruses, the pockets are equipped with devices that emit ultraviolet light, at the wavelength of 260 nm that are known to have germicidal effect. "Simply slide in the keys or the mask into the pocket and close the flap button. The device will start emitting the UV rays and sanitise all the products in just 30 seconds. We have lined the pockets with absorbing materials to ensure that the UV radiation does not come in contact with the body. The radiation supply gets cut off as soon as you open the flap," explains Singh, who in 2008 trained scientists at the Defence Research and Development Organisation on clothing with various in-built features.

Many times people forget to carry their masks while stepping out, so the vest has a mask built inside the collar. Singh claims that the four-layer mask, prepared with woven and non-woven materials, offers 99.4 per cent protection from the COVID-19 causing virus. Though Singh prepared the initial prototype of the product using cement fabric, that has a leather look, the final product uses the fabric with Ajrakh designs (block printing), especially prepared by Abdul Jabbar Khatri of Bhuj, Gujarat, who has won several awards from the World Crafts Council and Unesco for the traditional form of handicraft. Some 30 artisans are now engaged in preparing the product, which costs upwards of ₹4,999.

Once the pandemic is over, Singh says, the product can help those who need navigation support, particularly the visually impaired, to avoid collisions.



Diseases claim the lion's share at Gir

ISHAN KUKRETI



OVER 85 Asiatic lions have died between January and May 2020 and more than half of the deaths were due to diseases, shows the report submitted by a committee set up by the Union Ministry of Environment, Forest and Climate Change (MoEFCC) on May 29 to examine the high mortality rate of the animal. At least 59 deaths were reported from Gir east division, Dhari, which saw an outbreak of canine distemper virus (CDV) in 2018.

The committee, which included representatives of the wildlife division of MoEFCC, the National Tiger Conservation Authority, the Indian Veterinary Research Institute, Bareilly, and the Wildlife Institute of India, visited the area on May 30 and June 1. Its report submitted to MoEFCC and the Prime Minister's Office in the first week of June, lists reasons like "shock because of intussusceptions and respiratory failure (positive for blood protozoa)", "shock because of respiratory and renal failure", "shock because of septicemia due to fracture", as the cause of death of 44 of the 85 lions. As many as 15 died of multiple organ failure, four of rabies and two of pneumonia, reads the report, which also notes that 112 and 134 lions died in 2018 and 2019.

However, the treatment record sheet and postmortem report of an Asiatic cub that died during the period suggests there could be serious aberrations in the investigation conducted to ascertain the cause of lion deaths. *Down To Earth* accessed the reports through the RTI route.

The treatment record sheet notes that the cub was "dehydrated, emaciated, anaemic, pale and had icteric (jaundiced) mucus membrane of eyes and palate" when it was first brought to the centre on April 19. It weighed nine kg. On the first day at the centre, its temperature was 38.7 °C — a lion's normal body temperature ranges from 38.05°C to 39.16°C — and was kept under observation.

The next day, the cub's temperature spiked to 40.4°C and was given veterinary drugs like imidocarb, vetalgin, tribivet, noroxin and biocef. The temperature went down the next day, but the medicines continued and within four days, the cub had become active and was exhibiting "circling movement" by April 25. But by April 27, its condition started to deteriorate and it died on April 30. Yet, the post-mortem report says the cub died of multiple organ failure.

'INDIAN VETERINARY EXPERTS NEED TRAINING'

Aniruddha Belsare, disease ecologist, modeler and wildlife veterinarian at the Michigan State University, US, says veterinary experts must be trained in wildlife medicine



What are the challenges veterinary sciences face in India?

Although there are veterinarians employed in zoos and wildlife rehabilitation centres across India, we do not have veterinary experts trained in wildlife medicine. The lack of expertise is truly alarming and has serious consequences for wildlife conservation as well as livestock and public health sectors. Veterinary colleges in India neither have expert faculty, nor proper courses in wildlife medicine. Veterinarians lack even basic training in wildlife handling and immobilisation, and this is reflected in the manner in which most wildlife emergencies are handled in India. There is also dearth of robust research data and publications on health and disease of wildlife species in India.

How can we fix this?

We need capacity building of students and field veterinarians in the basics of wildlife medicine—when and how to intervene, diagnosis and treatment protocols, and postmortem examinations. We also need to establish a system of academic training that provides advanced clinical experience and leads to board certification in wildlife health.

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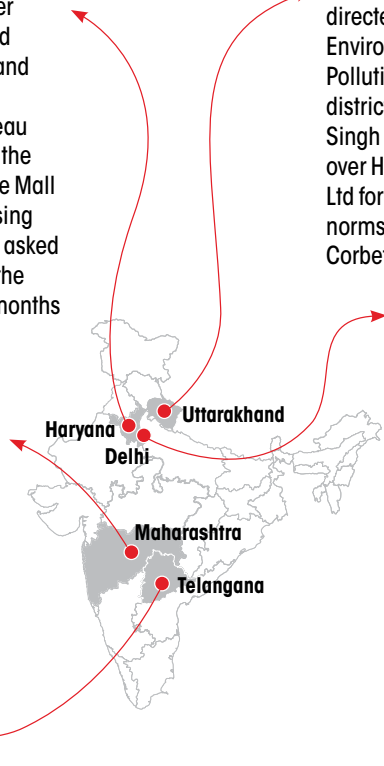
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Observing that the builder and authorities had acted in collusion, the Punjab and Haryana High Court has directed the Central Bureau of Investigation to probe the construction of Ambience Mall on land meant for a housing project in Gurugram and asked the agency to complete the investigation within six months

National Green Tribunal has directed the Uttarakhand Environment Protection and Pollution Control Board and the district magistrate of Udham Singh Nagar to furnish a report over Himalayan Food Park Pvt Ltd for violating environmental norms by operating near the Jim Corbett National Park

Observing that sale of BS-IV vehicles had spiked during lockdown, the Supreme Court withheld its March 27, 2020 order allowing new registration of BS-IV cars beyond the March 31, 2020 deadline. Suspending fresh registrations of BS-IV cars, the apex court said only BS-IV vehicles sold till March 31, 2020 will be registered. The court has asked the additional solicitor general to check all pending registrations to see if the request came before March 31

Nagpur bench of Bombay High Court has rapped the Buldhana district collector and the Lonar Municipal Council for poor uptake of the Lonar crater lake, formed from a meteorite collision some 50,000 years ago



The Telangana High Court has said the state government has taken no concrete action in the past five years to stop the illegal trade and butchering of camel for meat. Reacting sharply to a state government report, the bench said it does not even mention what is being done to the rescued camels

So far...



Number of cases on environment and development tracked from January 1, 2020 to July 17, 2020

Supreme Court	High Courts	National Green Tribunal
47	56	296

Compiled by DTE-CSE Data Centre

FOR DETAILED VERDICTS, SCAN

Unnecessary RO use to continue till year-end despite NGT order

UNNECESSARY USE of RO (reverse osmosis) purifiers in areas where the water is clean and the resulting wastage of potable water will now continue till the end of the year as the Union environment ministry has recently sought more time for implementing the National Green Tribunal (NGT) order.

NGT had earlier asked the ministry to issue a notification banning RO purifiers in areas where the total dissolved solids or contaminants in water were below 500 milligrams per litre. Though in January, the ministry had sought four months for executing the other, during a recent hearing on July 13, it expressed its inability to complete the exercise due to COVID-19 pandemic. NGT has now asked the ministry to take the necessary action "completely positively by December 31, 2020".

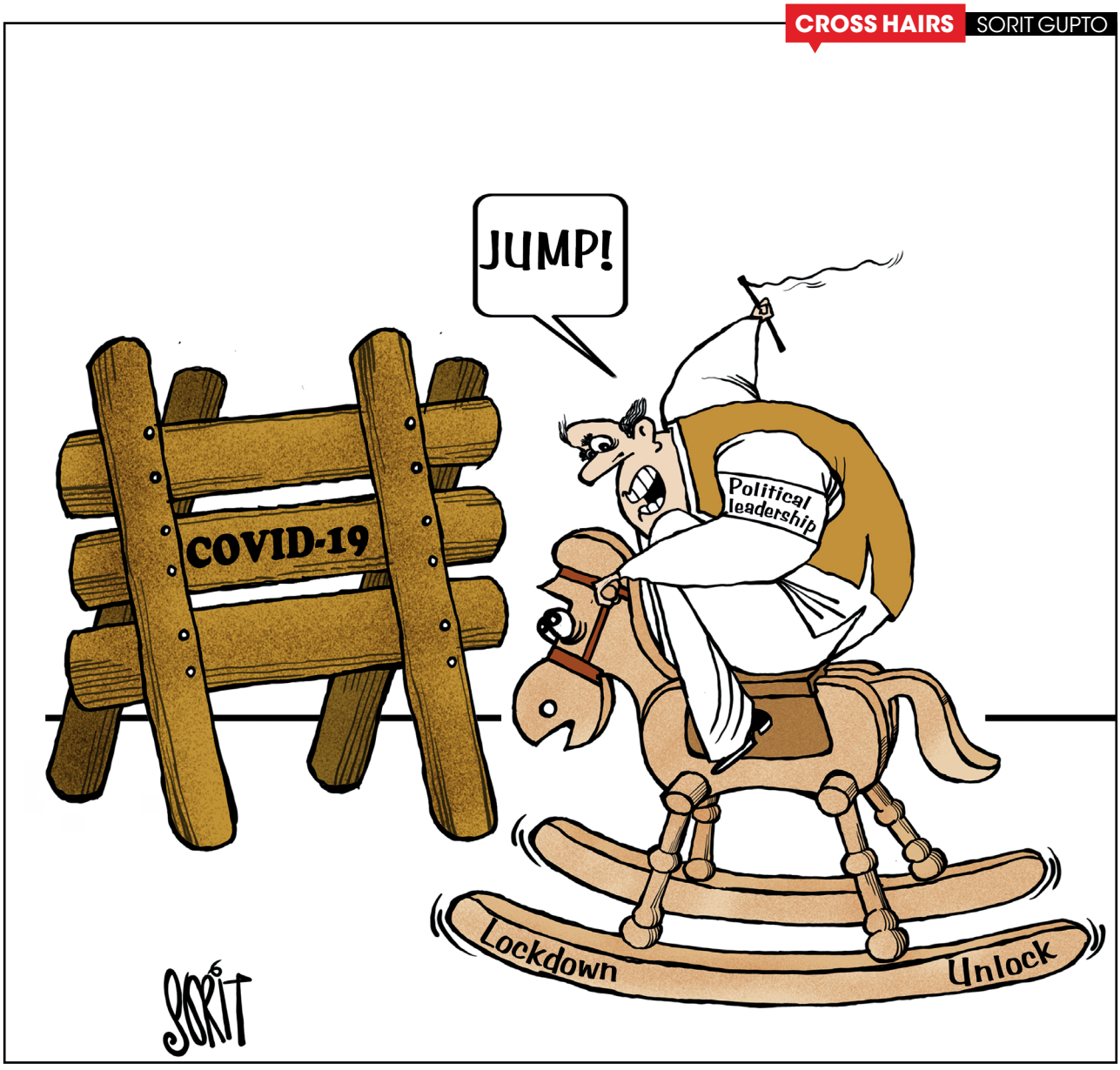
BITS

A GROUP of 17 former finance ministers and former central bank presidents in Brazil have released a letter arguing strongly for drastic shifts in the direction of the country's environmental policy. It asks the incumbent Jair Bolsonaro government to end deforestation in the Amazon and Cerrado biomes, and resume an economic policy that takes climate change into account after the pandemic is over.



A NEW research has claimed the worst and best case scenarios with climate change are both unlikely. Until now, the United Nations has estimated a doubling of atmospheric CO_2 from its pre-industrial level of about 280 parts per million has a 66 per cent chance of heating the planet by between 1.5 ^{0}C and 4.5 ^{0}C. In May, atmospheric CO_2 reached 417 parts per million (PPM), and is rising by about 2.5 PPM per year. The study, published in *Reviews of Geophysics*, shrinks that 66 per cent-likely range of climate sensitivity to between 2.6 ^{0}C and 3.9 ^{0}C.

AT LEAST 19 million people in West and central Africa could face food insecurity between June and August 2020, due to the novel coronavirus disease (COVID-19) pandemic. The findings by Action Against Hunger, a global humanitarian organisation, notes people are more likely to die of starvation caused by the economic fallout of the pandemic than the disease itself. Chad, Mali, Mauritania, Niger, Senegal and the Sahel region across Burkina Faso are the most vulnerable regions.



FOR MORE CARTOONS, SCAN

Antarctica seabed is spewing methane into air

A GROUP of researchers have discovered the first active leak of seabed methane in Antarctica, which holds a quarter of Earth's methane.The US-based researchers also found that microbes that normally consume the potent greenhouse gas before it reaches the atmosphere had only arrived in small numbers after five years, allowing the gas to escape.

The active methane seep was first spotted in 2011 and the researchers returned to site in 2016 to study the phenomenon. "What was really interesting and exciting was that the microbial community did not develop as we would have predicted based on other methane seeps we have studied around the globe," says Sarah Seabrook, one of the authors of the research published in *Proceedings of the Royal Society B*. The researchers had assumed that microbes should respond really quickly to changes in the environment, but that wasn't reflected in what the team saw in Antarctica. "To add to the mystery, the microbes we found were the ones we least expected to see at this location," says Andrew Thurber, a marine ecologist at Oregon State University.

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Rain rupture in monsoon pattern

While some parts of the northeast, especially Assam, are suffering from unprecedented floods, other states are receiving deficit rainfall

AKSHIT SANGOMLA NEW DELHI

ASSAM IS facing one of its worst floods—with almost all districts having suffered from some level of flooding—yet eight of the 27 meteorological districts of Assam have received deficit rainfall, according to the India Meteorological Department (IMD). This shows that while flood waters have inundated most parts of the state, rainfall was not well distributed. For instance, Nagaon and Morigaon districts have rainfall deficit of 50 per cent and 43 per cent respectively. But these districts are also bearing the brunt of extreme weather floods.

There were first three waves of floods that killed 115 people and



People cross a flooded area on a boat in Buraburi village, Morigaon district, Assam, in June

affected 56,000 people, according to the Assam State Disaster Management Authority. The first wave of floods occurred at the end of May, when the southwest monsoon season had not even started. The second wave occurred at the end of June and the third in July. Till June 22, Assam had received 309 mm of absolute rainfall, which was one per cent more than the long-term normal—average of rainfall received over a 50-year period between 1951 and 2001—according to IMD data. In the next two days, there was 34 mm of absolute rainfall, which increased the excess rainfall percentage to 2 per cent.

But in the first wave of intense monsoon rains on June 25, the state received 51.5 mm rainfall in a single day, which is 29 times the normal for that day. It brought the seasonal absolute rainfall to 395 mm and the excess rainfall to 13 per cent. This intense rainfall was the beginning of the second wave of intense floods in Assam, which has only deteriorated.

Raghu Murtugudde, a climate scientist at the University of Maryland, USA, says: "It is always a see-saw between the northeast and central India. Each year, when the core monsoon zone and the Gangetic plain are in a break period, then rainfall happens over the northeast." And when it is a break period over the northeast, then it rains over central India or the core monsoon zone and the Gangetic plain, he adds.

Heavy rains happen for different reasons in different places over India. Strong south-westerlies produce heavy rains on the west coast, but a combination of south-westerlies and easterlies from the Bay of Bengal produce large-scale heavy rains over the core monsoon zone. The northeast mostly gets its moisture from the Bay of Bengal. Of course, just heavy rains don't cause floods; urbanisation, deforestation and mono-cropping are also responsible for igniting floods during heavy rains.

UNEVEN DISTRIBUTION

Rainfall has been below normal over the west coast and the core monsoon zone this year. For example in Kerala, 13 of the 15 districts received less rain than normal. The worst was Wayanad with a rainfall deficit of 55 per cent. Both Thrissur and Idukki districts have received 42 per cent less than normal rainfall. Similarly many districts in coastal and interior Karnataka like Dakshin Kannada, Kodagu, Chikmaglur Shimoga and Hassan are reeling under a dry spell.

THE NUMBER OF DROUGHT WEEKS DURING MONSOON MONTHS IN ASSAM, ARUNACHAL PRADESH, MEGHALAYA, MIZORAM, TRIPURA AND MANIPUR WILL INCREASE BY 25 PER CENT IN THE FUTURE, SAYS A STUDY PUBLISHED IN *CURRENT SCIENCE* IN 2011

"The west coast being dry implies that moisture is not being brought by the south-westerlies, but from the Bay of Bengal," says Murtugudde.

As the moisture gets pumped in from the Bay, the complex mountain territories of the northeastern states squeeze out rain and produce a very patchy distribution over the northeast. So some places have been flooded, while others received below normal rainfall, according to Murtugudde.

This has been the story of the northeast for quite some time now. In 2019, the region recorded a deficit of 12 per cent, while the rest of the country had excess rainfall of 10 per cent—the highest in the last 25 years. The northeast has been drying up in the last few decades—18 of the last 19 years (2001-2019), northeast India received seasonal rainfall less than normal, except in 2007, according to a 2019 IMD report. "This indicates that seasonal rainfall over northeast India is passing through a below normal epoch like it was during early 1950s to mid-1980s," says IMD.

In a research paper published in *Current Science* in 2011, scientists had predicted that climate change would affect agriculture, water availability and forests in northeast India. The number of drought weeks during monsoon months in Arunachal Pradesh, parts of Assam, Meghalaya, Mizoram, Tripura and Manipur would increase by 25 per cent in the future, according to the study. "I am worried that this late into July we have below normal rain over the west coast and the core monsoon zone. But if heavy rains also occur in August and withdrawal is delayed like last year, then we may again have a "normal" rain year, but the distribution is not really normal," adds Murtugudde. DTE

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Toxic row

Industry lobby is at work to dilute the proposed ban on 27 widely used hazardous pesticides

MEENAKSHISUSHMA AND **CHINMAYI SHALYA** NEW DELHI



PHOTOGRAPH: ADITHYAN PC / CSE

Malathion being sprayed on locusts. Though in the list of 27 pesticides that the Union agriculture ministry intends to ban, it has been exempted for use on locusts

JUST AS it was thought that India took the landmark step towards banning the manufacture and sale of 27 widely used hazardous pesticides, already discontinued in other countries, the draft notification has whipped up a storm with the Ministry of Chemicals and Fertilizers (MoCF) and the industry groups vehemently opposing the ban. Worse, the Union agriculture ministry that proposed the draft order on May 14 and sought suggestions or comments from stakeholders within 45 days, now appears to be buckling under the pressure. On June 10, it extended the period for public comments to 90 days and quietly changed the notification text to allow manufacturers to produce the pesticides for export.

The list of pesticides include monocrotophos, methomyl and

carbofuran, three Class I pesticides that contain ingredients classified as "extremely hazardous" or "highly hazardous" by the World Health Organization. These pesticides have long been banned across several countries—monocrotophos, for instance, is banned in the EU and in 112 countries, including the UK, Brazil, China, Indonesia, Myanmar, Pakistan and Thailand, while carbofuran is banned in 63 countries including the UK, Argentina, Canada, South Korea and New Zealand. Their use, however, continues heavily in India despite being linked to the death of farmers. In 2017, some 35 farmers died and hundreds of others fell sick in Yavatmal, Nagpur, Akola and Amravati districts of Maharashtra after they inhaled monocrotophos and acephate, another hazardous pesticide on the list of 27, sprayed on the fields. Following the incident, the state government prohibited their use. "Banning Class I pesticides is an important step. We hope the draft is notified without any dilutions," says Amit Khurana, programme director, Food Safety and Toxins, at Delhi-based Centre for Science and Environment.

The other 24 pesticides are being used for a long time in several parts of the country and include chlorpyriphos, quinalphos, thiram and zineb that are known to disrupt the body's endocrine (hormone) system and are categorised as harmful by the EU.

The notification is the culmination of a long-pending process that began in 2013 with the setting up of a committee under agricultural scientist Anupam Verma to review the use of 66 pesticides in India that have been barred or restricted for use in farming in other countries. Based on its recommendation, the Union agriculture ministry banned 18 pesticides, including seven Class I pesticides, in 2018 and has now proposed to ban another 27.

THE USUAL DEFENCE

The agro-chemical industry, however, has been lobbying against the draft order. They allege that the ministry has taken the decision in a haste. Since the 27 generic molecules are used to manufacturer more than 400-500 formulations, they cannot be suddenly banned. Kandarp Trivedi, director, CHEMET Wets and Flows Pvt Ltd, a Gujarat-based pesticides manufacturer, who has written a letter to the Union agriculture ministry opposing the ban, claims that the pesticides have been banned based on research conducted in other countries. "Till date we have never received any complaint from any of the end users that these products are causing any adverse impact to human lives, animals, honeybees and the environment as claimed in the draft notification," Trivedi says. Highlighting that a ban on the pesticides would be detrimental to the agro-chemicals industries during the times of COVID-19, he further warns that the decision will result in very few suppliers, monopolisation and price hike of the products by four to five times.

Just a week before the Union agriculture ministry made changes to the notification text, it received a letter from R K Chaturvedi, secretary, ministry of chemicals and fertilizers, opposing the proposed ban and stating that the move would not be appropriate at this moment. The letter, written at the behest of the association of the pesticide industry, stated that generic pesticides constitute 40 per cent of the Indian pesticide market and a ban on them would affect the industry adversely. "Banning of a particular pesticide by a few countries based on some studies somewhere may not provide us enough ground to take similar action in India without adequate scientific evidence in Indian context," he writes in the letter.

"This is just a double standard. When it comes to pesticide registration, India has a MAD (mutual acceptance of data) agreement with the Organisation for Economic Co-operation and Development (OECD) countries," says Kavitha Kuruganti, associated with the Alliance for Sustainable & Holistic Agriculture (ASHA). MAD is a multilateral agreement that allows participating OECD countries (including non-members) to share the results of various non-clinical tests done on chemicals using OECD methods and principles. "So, how is data from elsewhere not acceptable for ban in India?" she asked during a webinar on "Why government's proposal to ban 27 pesticides is a welcome development".

INDIA HAS AN AGREEMENT WITH OECD COUNTRIES THAT ALLOWS ALL PARTICIPANTS TO SHARE THE RESULTS OF NON-CLINICAL TESTS DONE ON CHEMICALS. SO, HOW IS DATA FROM ELSEWHERE NOT ENOUGH FOR BANNING PESTICIDES IN INDIA?

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Predicting a shock

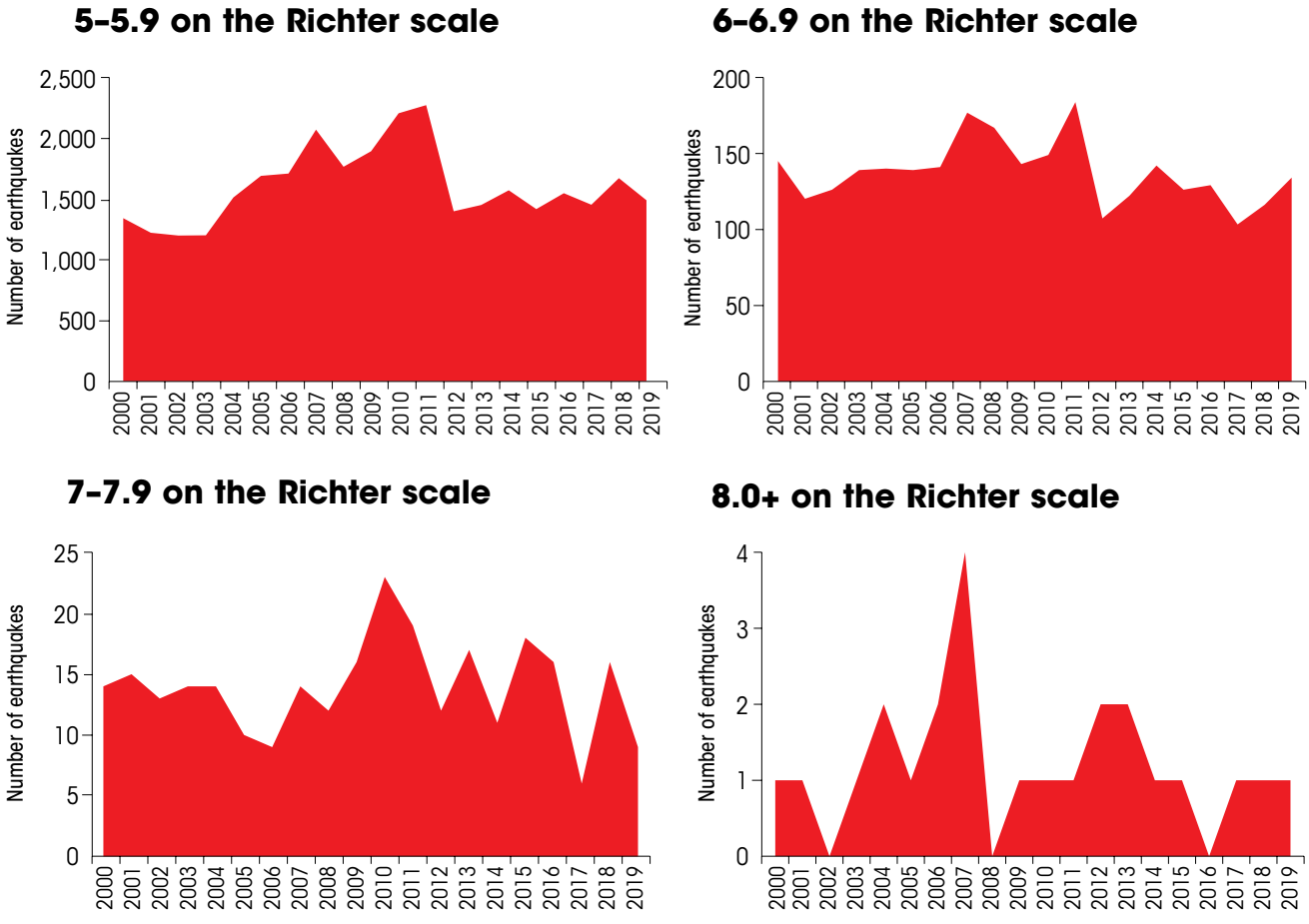
In the past few months, India has been rocked by numerous small earthquakes. But science to predict them is still in its infancy

AKSHIT SANGOMLA NEW DELHI

DELHI AND its surrounding regions were jolted by 10 earthquakes between June 16 and July 22. The strongest quake was on July 3 with a magnitude of 4.7 on the Richter scale with its epicentre in Gurugram, Haryana. Similarly, more than 10 earthquakes occurred between April 10 and May 29, which led many media outlets and the public to speculate that the recent seismic activity was a sign that a major earthquake was in the offing. A series of small earthquakes known as foreshocks can lead to a larger

Annual average analysis of earthquakes

More smaller quakes than big ones have occurred since 2000 globally



Source: United States Geological Survey

quake, but this can be known only after the big earthquake has occurred, according to the United States Geological Survey (USGS).

Earthquakes usually occur along faults or fault lines, which are fractures between rocks and can range from a few millimetres to thousands of kilometres. During an earthquake, the rock on one side slips with respect to the other in a short span of time generating seismic waves which then travel to the surface causing destruction. The place under the Earth's surface where the slip takes place is known as the epicentre. The largest of these faults are formed along the boundaries of tectonic plates which are the major divisions in the Earth's crust.

Many of the earthquakes in April and May had their epicentre in Sohna, Haryana, which lies in a fault line near Delhi. Other fault lines around the city are the Moradabad fault, Mathura fault, Great Boundary fault in south eastern Rajasthan, Delhi-Sargoda fault and the Delhi-Haridwar sub surface ridge fault. "When any of these fault lines become active, tremors are felt in Delhi," says B K Bansal, director of the National Centre for Seismology (NCS), New Delhi. The fault lines also crisscross each other making the region prone to earthquakes. This crisscrossing induces regular activity and is the reason for the city's location in seismic zone IV, according to the Bureau of Indian Standards, where the risk of a big earthquake and subsequent destruction is high.

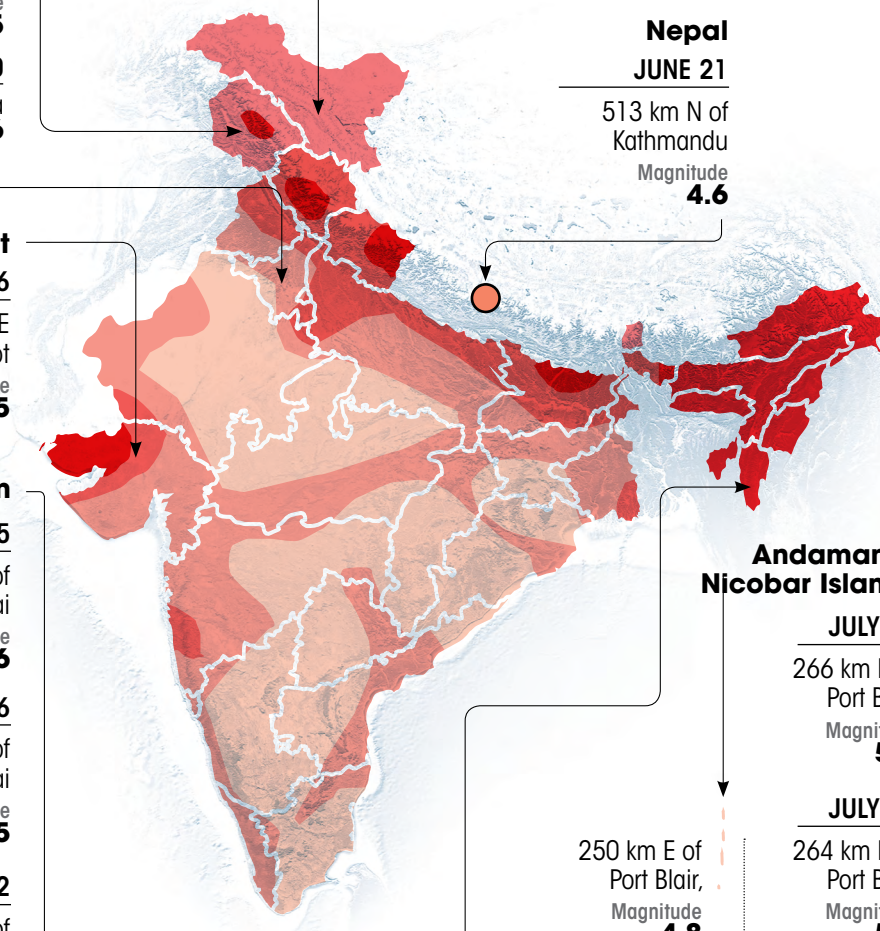
"We analysed data for the past two decades and found that there is no abnormal increase in earthquake activity recently," says Bansal.

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TREMOR NATION

There were 93 earthquakes across the country between June 16 and July 22



Jammu & Kashmir

JUNE 26

451 km NE of Hanley
Magnitude **6.1**

434 km NE of Hanley
Magnitude **5**

437 km NE of Hanley
Magnitude **4.6**

459 km NE of Hanley
Magnitude **4.5**

JUNE 30

103 km E of Katra
Magnitude **4.6**

Ladakh

JUNE 26

200 km NW of Kargil
Magnitude **4.5**

JULY 5

432 km NNW of Kargil
Magnitude **4.7**

Nepal

JUNE 21

513 km N of Kathmandu
Magnitude **4.6**

Haryana

JULY 3

60 km SSW of Gurugram
Magnitude **4.7**

Gujarat

JULY 16

16 km SE of Rajkot
Magnitude **4.5**

Mizoram

JULY 17

18 km S of Champhai
Magnitude **5.1**

JULY 5

25 km SSW of Champhai
Magnitude **4.6**

JULY 3

52 km SSE of Champhai
Magnitude **4.6**

JUNE 26

295 km SSE of Champhai
Magnitude **4.5**

JUNE 25

21 km S of Champhai
Magnitude **4.5**

JUNE 22

27 km SSW of Champhai
Magnitude **5.5**

JUNE 21

12 km W of Ngopa
Magnitude **5.1**

JUNE 18

98 km SE of Champhai
Magnitude **5**

Andaman & Nicobar Islands

JULY 18

266 km E of Port Blair
Magnitude **5.7**

JULY 17

250 km E of Port Blair,
Magnitude **4.8**

264 km E of Port Blair
Magnitude **5.6**

293 km E of Portblair
Magnitude **4.5**

261 km E of Port Blair
Magnitude **5.1**

JUNE 18

130 km WSW of Campbell Bay
Magnitude **4.8**

319 km E of Port Blair
Magnitude **4.5**

270 km NE of Campbell Bay
Magnitude **5**

Sources: National Centre for Seismology and Bureau of Indian Standards

GRAPHIC: SANJIT / CSE

According to Bansal media has also misreported the number of earthquakes in Delhi during the lockdown months of April and May. The actual number was 4; the others were aftershocks—smaller earthquakes after a large quake—of these earthquakes. NCS has a network of seismic sensors across the country which can measure any earthquake above 3.5 on the Richter scale. Around Delhi, the sensors are more sensitive and record tremors as low as 2.

There were as many as 93 earthquakes across the country between June 16 and July 22 (*see* 'Tremor Nation', *p*22). Of these, 25 quakes had a magnitude 4.5 or above on the Richter scale. The strongest of these was a 6.1 or above, close to Hanle in the Ladakh region on June 26 (see graph "Annual average..." on *p*21). Most of the earthquakes have been concentrated in the northern and northeastern regions of the country. Even though earthquake activity has not increased in recent times, the ones that do occur can be devastating. Two of the most deadly natural disasters in the past 30 years were earthquakes—the one in 2004 and the subsequent tsunami killed 0.2 million people.

Earthquakes are incredibly difficult to predict. "We can provide a few minutes of early warning, exploiting the fact that electronic signals travel faster than the speed of transmission of ground motion," says Ian Main, a professor of seismology and director of research at the School of Geosciences, University of Edinburgh, the UK. "Sadly, we are nowhere near providing the kind of reliable, accurate prediction of the size, time and place of a future earthquake," he says.

PREDICTION METHODS

A recent study published in the *Journal of Geophysical Research* has brought back the focus on earthquake prediction. Researchers claim that they can improve earthquake prediction with the new equation that they have developed. Scientists have tried to recreate faults in their laboratories and tried to understand the conditions in these faults during earthquakes to understand these natural calamities better. But the actual conditions are so complex that it is difficult to recreate them with great accuracy, hence making prediction is difficult.

Sabine den Hartog at the Lyell Centre, a strategic partnership between Heriot-Watt University and the British Geological Survey and her colleagues at the University of Liverpool and Utrecht University have adopted a novel approach. They are trying to predict the frictional strength of phyllosilicates—minerals in the form of thin plates found along the weakest part of the faults where earthquakes occur. Frictional strength is the force required to cause movement along a fault. For this, the group analysed artificial fault zones on the microscopic scale to identify the processes.

Then they formulated a set of equations to predict how the frictional strength of phyllosilicates changes with a change in conditions such as humidity or the rate of fault movement. This makes it much easier for scientists to simulate fault movement in natural conditions, including earthquakes. "Our model predicts that movement along phyllosilicate-rich fault zones becomes more difficult as the movement goes faster, which is consistent with experiments. This behaviour prevents earthquakes and suggests that minerals other than phyllosilicates are important to trigger earthquakes," says Hartog.

Another interesting earthquake prediction technique has recently come from researchers at the Max Planck Institute of Animal Behaviour in Konstanz/Radolfzell and the Cluster of Excellence Centre for the Advanced Study of Collective Behaviour at the University of Konstanz, Germany. They have investigated whether cows, sheep and dogs can actually detect early signs of an earthquake.

The experiment was carried out by scientists at a farm in a region in Italy which is highly prone to earthquakes for a period of six months. The scientists discovered unusual behavioural patterns up to 20 hours before an earthquake. "The closer the animals were to the epicentre of the impending shock, the earlier they changed their behaviour. This is exactly what you would expect when physical changes occur more frequently at the epicentre of the impending earthquake and become weaker with increasing distance," explains Martin Wikelski, director of the Max Planck Institute of Animal Behavior, Germany.

The idea that animals can sense earthquakes has been around since at least 2000 years from the time of Greek philosophers. "What is new now is that we have bio-logging technology that allows us to observe the behaviour of many animals continuously and simultaneously," says Wikelski. The researchers observed that different types of animals showed different behaviour and also influenced each other in different ways. DTE

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WHO IS TRACKING INDIA'S HEALTH?

The burden of mysterious ailments mounts in India as its disease surveillance system lies in a shambles

VIBHA VARSHNEY



PHOTO: VIKAS CHOUDHARY / CSE

EARLY THIS year, just as governments across the world were scrambling to contain the spread of the novel coronavirus (COVID-19), healthcare practitioners in several rural pockets of India were fighting a similar battle—blindfolded. In Odisha's tribal district of Malkangiri, panic gripped Kenduguda village after over a dozen people died within three months since the end of February. They were all in the age group of 15 to 35 years and complained of acute respiratory problems, fever, swollen legs and bloated stomach. Medical officers from the district hospital, who visited the village in early June, have failed to ascertain the reason behind the deaths and say the deceased could be suffering from either chronic kidney disease, anaemia, tuberculosis or heart ailments. Around the same time, the authorities of Karimganj district in Assam were thrown into confusion after six children in Bazaricherra village died one after the other. Though the reason is not known, media reports say that they had infected tonsils. A similar fear swept through Karnataka's forested district of Dakshina Kannada, infamous for rare illnesses like viral haemorrhagic monkey fever or Kyasanur Forest Disease, in January after the residents of Venoor village complained of prolonged fever with fatigue, pain in the abdomen and headache. Medical officers rushed to Venoor to investigate the illness. Though it could be cured with symptomatic treatment, the authorities are yet to figure out what caused the fever and whether it will strike again.

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These unidentified, mysterious diseases are like terrorists with unknown motives and unpredictable moves. They might lead to epidemics, creating a situation worse than COVID-19 where scientists are at least familiar with the pathogen.

India has an elaborate arrangement for early detection of such disease outbreaks under a century-old institute, now known as the National Centre for Disease Control (NCDC). Surveillance and investigation of communicable diseases have been an integral part of NCDC's activities for close to six decades. Since 1997, after the 1988 cholera outbreak in Delhi and the 1994 outbreak of pneumonic plague in Surat caught the country unprepared, it has a dedicated wing for early detection and systematic reporting of emerging (new) or re-emerging infectious diseases and for timely response. The wing was scaled up in 2012 to fulfil the World Health Organization's (WHO's) International Health Regulations, 2005, that requires each country to assess public health emergencies of international concern within 48 hours and report them to WHO within the next 24 hours. It was renamed Integrated Disease Surveillance Programme (IDSP) and turned into a national health programme with surveillance committees at the Centre, state as well as district levels; trained rapid response teams and other medical and paramedical staff; involvement of frontline health workers; a network of laboratories; and IT-enabled infrastructure for dissemination of disease surveillance data on a weekly basis.

Yet, every year, unnamed and unidentified diseases continue to kill or sicken hundreds of people across the country. Some of them remain a mystery despite resurfacing in a particular region almost as an annual phenomena.

One such is life-threatening *chamki fever* or encephalitis that grips Bihar's Muzaffarpur district every summer since 1995. The fever, which impairs functioning of the brain, primarily affects children and is the cause of hundreds of deaths in this impoverished district. Last year, the fever infected 653 children and caused 164 deaths. So familiar are people with its symptoms that at the first sign they rush their children to the hospital. The government sets up camps for treating and investigating the illness. Occasionally, the outbreak attracts the attention of researchers who visit the area because of personal interest. But all that are available so far are a plethora of hypotheses that implicate everything from pesticides, heat strokes, toxins in litchi fruit to undernourishment among children in the disease. This year the region has witnessed a mild impact of the disease—only 95 encephalitis cases and 12 deaths till June 30. Strangely, no one knows what has helped improve the situation.

A THIRD OF THE FEVER OUTBREAKS IN THE COUNTRY GO UNDETECTED BECAUSE OF LIMITED DIAGNOSTICS CENTRE AND POOR TESTING

An equally mysterious disease has been doing rounds in neighbouring Uttar Pradesh since 2005, when it resurfaced after going into hiding for 30 years. Initially, the authorities labelled it as Japanese Encephalitis (JE), a viral brain infection spread by mosquitoes, and focused on vector control and vaccination. But children continued to fall ill in Gorakhpur and neighbouring districts. In 2007, the National Institute of Virology (NIV), Pune, found enterovirus in the patients but could not link it to the disease. The symptoms of enterovirus infections and JE are similar. The only difference is that the fever caused by enterovirus stretches up to 15 days as against JE which lasts about a week. In 2017, scrub typhus, a mite-borne disease, was held responsible for the illness even though symptoms were atypical. Without any knowledge of the pathogen, the outbreaks rage uncontested.

WHO IS TO BE BLAMED?

IDSP has been designed for early detection of disease outbreaks and diagnosis of mysterious diseases through syndromic surveillance, which is essentially



PHOTO: REUTERS

^ The Nipah virus disease outbreak in Kozhikode district of Kerala in May 2018 infected 200 people and claimed 17 lives

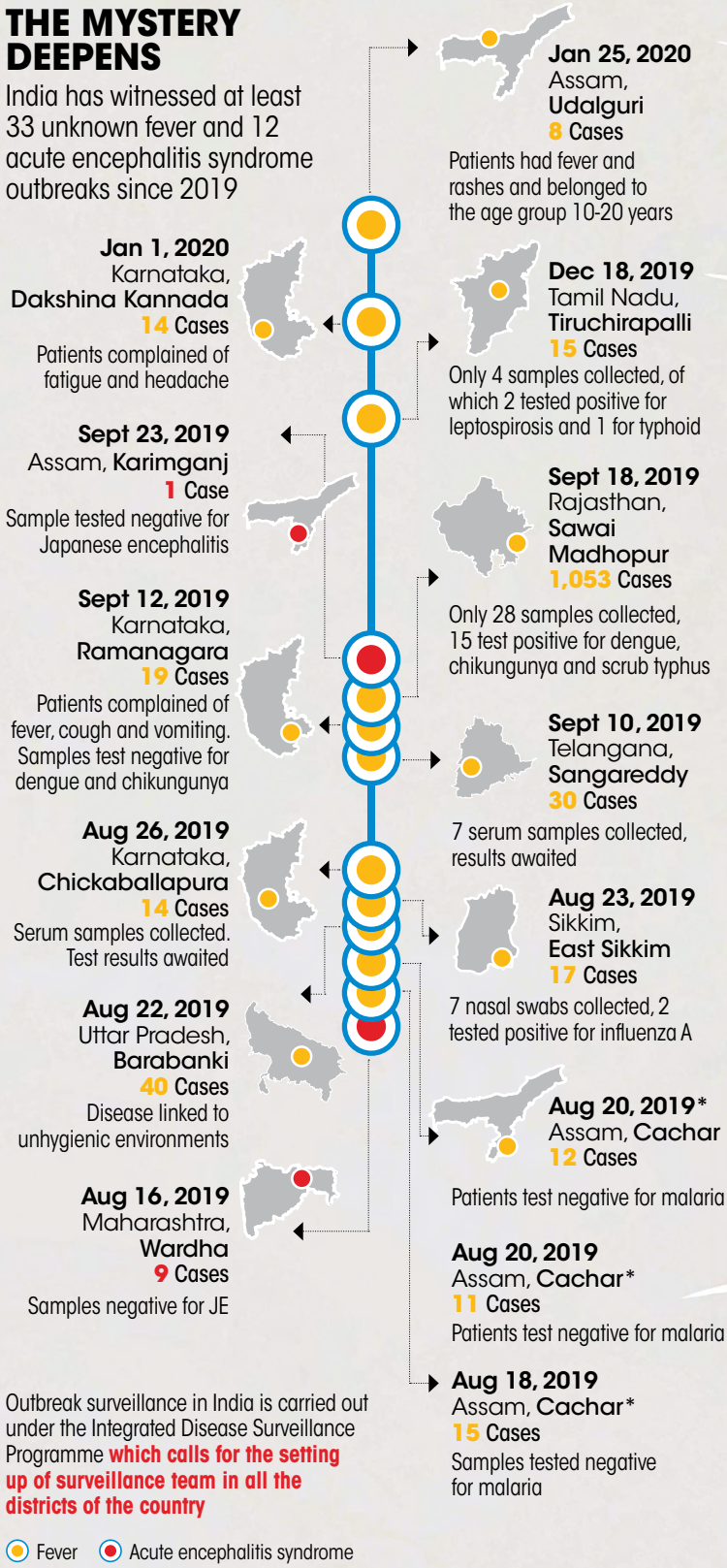
monitoring people's health on a real-time basis. The first round of surveillance activities are carried out by the frontline health workers, including accredited social health activists or ASHA, village volunteers and paramedical staff, who during their routine visits to households keep a lookout for those suffering from six symptoms: fever, cough for less than two weeks, acute flaccid paralysis in adults, diarrhoea and jaundice and unusual events causing death or hospitalisation. IDSP classifies these as indicators of 22 major diseases. They are then expected to fill up the suspected case or S-form for the patients, analyse the data to figure out if the numbers are higher than the previous records for the region and inform the district medical officer. The data is then sent to IDSP. The health workers also collect basic test samples and direct patients to doctors. At the district level,

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THE MYSTERY DEEPENS

India has witnessed at least 33 unknown fever and 12 acute encephalitis syndrome outbreaks since 2019



Outbreak surveillance in India is carried out under the Integrated Disease Surveillance Programme **which calls for the setting up of surveillance team in all the districts of the country**

Fever Acute encephalitis syndrome

* Outbreaks in different villages in the same district
Source: Weekly outbreak update by Integrated Disease Surveillance Programme

CONTINUED ON *P30*

government and private hospitals along with medical colleges are expected to raise an alarm if there are "clustering of cases" from the same locality on a given day or on consecutive days. According to IDSP manual, doctors at the outpatient department (OPD) should refer such suspected cases of a disease outbreak to the laboratory. At the end of every week, the hospital superintendent is expected to fill up a presumptive or P-form based on the provisional diagnosis and upload it on the IDSP website. Labs across districts also need to fill up the laboratory confirmed or L-form based on their investigation. This too is uploaded on the IDSP site.

However, IDSP no longer works the way it was conceptualised, says Rajan R Patil, epidemiologist and associate professor at the School of Public Health, SRM University, Tamil Nadu. He was involved in setting up IDSP as part of his UN assignment. "Currently, the surveillance work is being done in a mechanical manner. Instead of monitoring and providing data on a real-time basis, people are filling the data after weeks and even months, and the weekly bulletin is often given retrospectively," he says, adding that this defeats the very objective of early detection of outbreaks and averting large-scale sickness and deaths due to infectious diseases. His claims are not unfounded.

A DISTURBING PAUSE

As on July 21, IDSP on its portal provided weekly alerts till March 16-22, which had inputs from only 17 states and Union Territories. The next day, it released two more alerts for the weeks of March 23-29 and March 30-April 5. While the update for March 23-29 provided consolidated data related to only COVID-19 and redirected to the Union health ministry website for more details, the last alert provided data on two outbreaks.

Down To Earth (DTE) analysed the weekly reports of IDSP for 2019 and 2020 (till March 22) and found that it has recorded 33 outbreaks of fever and

Fresh Start Foundation
ENABLE • EMPOWER

Rehabilitation Opportunities for the Differently Abled

Himalaya Fresh Start Foundation (HFSF), in association with Bhagwan Mahaveer Viklang Sahayata Samiti (BMVSS, also known as Jaipur Foot), organized a three-day mobility camp in Hassan this year. The camp focused on providing prosthetic limbs and calipers for the differently abled.





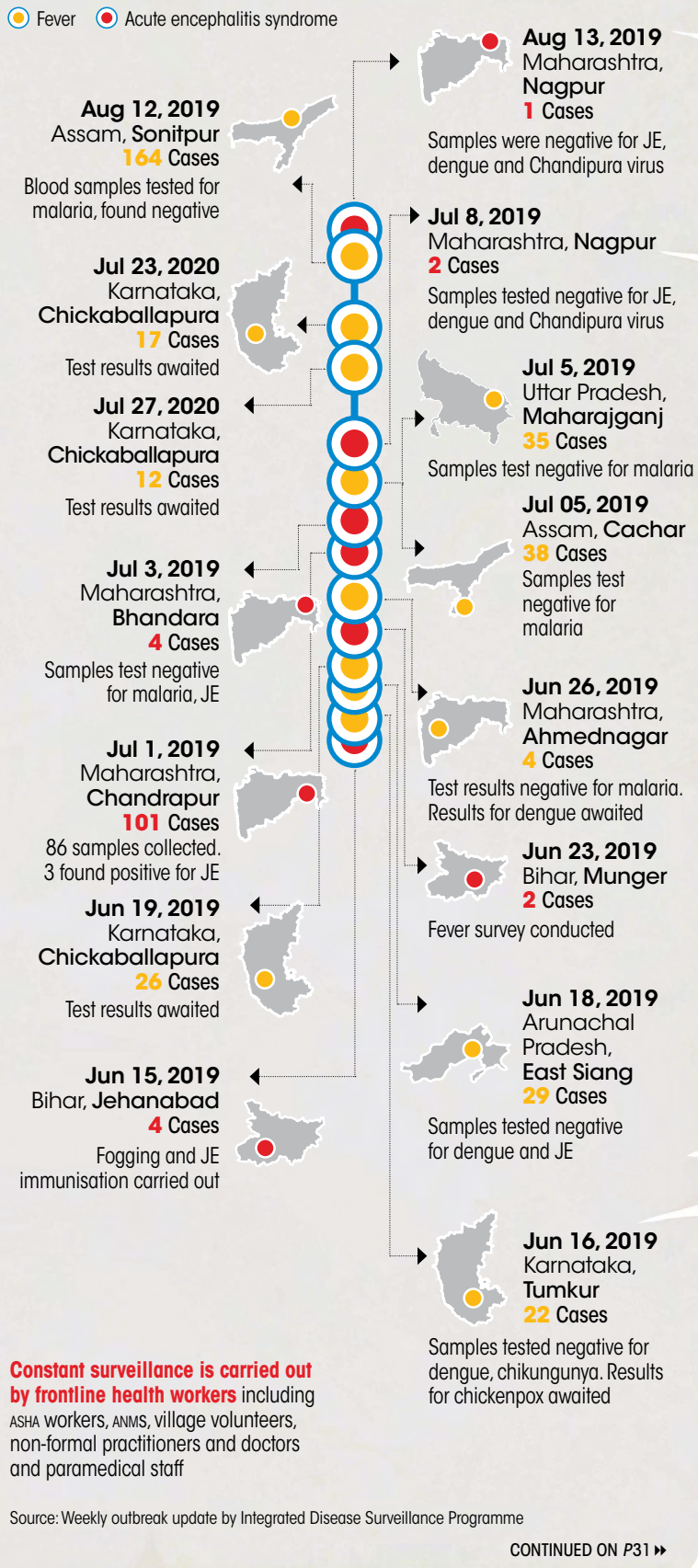


The Himalaya Drug Company is committed to bringing wellness and improving lives, and the initiative is inspired by this very spirit to enrich and empower people. **HFSF** helps in bringing a fresh start to the lives and dreams of differently abled individuals from underprivileged families by providing adequate medical intervention and creating opportunities to hone their existing skills to be employed with dignity and rehabilitated in society.



The first part of our **HFSF** engagement commenced with a three-day mobility camp. Beneficiaries from Hassan and other smaller neighboring cities, who were either unaware of artificial limbs or unable to afford the same, attended the camp. These patients were first medically examined and then provided with a customized artificial limb that could help them walk. Around 300 individuals were enabled by the limbs made by the dedicated workforce of Jaipur Foot.

HFSF is committed to enabling and empowering people and believes that disabilities can be overcome with determination. The Foundation will continue contributing to the lives of many more people and enable them to achieve their dreams by conducting similar meaningful initiatives in the future.



Source: Weekly outbreak update by Integrated Disease Surveillance Programme

CONTINUED ON P31 ▸▸

another 12 outbreaks of AES during the period (see 'The mystery deepens', *p*28). Fever outbreaks are reported from just 10 states—Karnataka, Assam, Tamil Nadu, Meghalaya, Arunachal Pradesh, Maharashtra, Uttar Pradesh, Sikkim, Telangana and Rajasthan. In most cases, the cause of fever remained unknown. DTE also found that IDSP does not follow all disease outbreaks. For instance, its weekly alerts do not include this year's mystery outbreak in Odisha's Malkangiri district. It also did not document the mysterious fever outbreak in Gujarat's Surat district in September 2019 that was widely covered by the media. In the absence of an investigation by IDSP, the government doctors in Surat maintain that the outbreak was caused by dengue even though more than 25 per cent of the patients tested negative for the disease.

Another trend observed by DTE is that in 12 of the 52 weeks in 2019, the alerts did not mention how many states uploaded data. In other weeks, there was a discrepancy in the number of states and UTs mentioned in the total tally and in the description list of the outbreaks. For example, the alert for the first week of April 2019 says 35 states and UTs shared their records and 25 had outbreaks, but the description of outbreaks was available only for 15 states and UTs. This indicates a lackadaisical approach to data by an organisation that has been bringing out weekly alerts since 2007; data collection and dissemination is, in fact, one of its primary functions.

IDSP also seems to lose interest in the outbreaks after initial investigation. Most weekly reports mention that the disease is under surveillance but there is rarely any update on this later. In its monthly alerts, IDSP provides the details of investigation for just one disease. But the last monthly alert is for September 2019. While the outbreak could have been investigated further by the state governments, as health is a state subject, information on the outcomes are not

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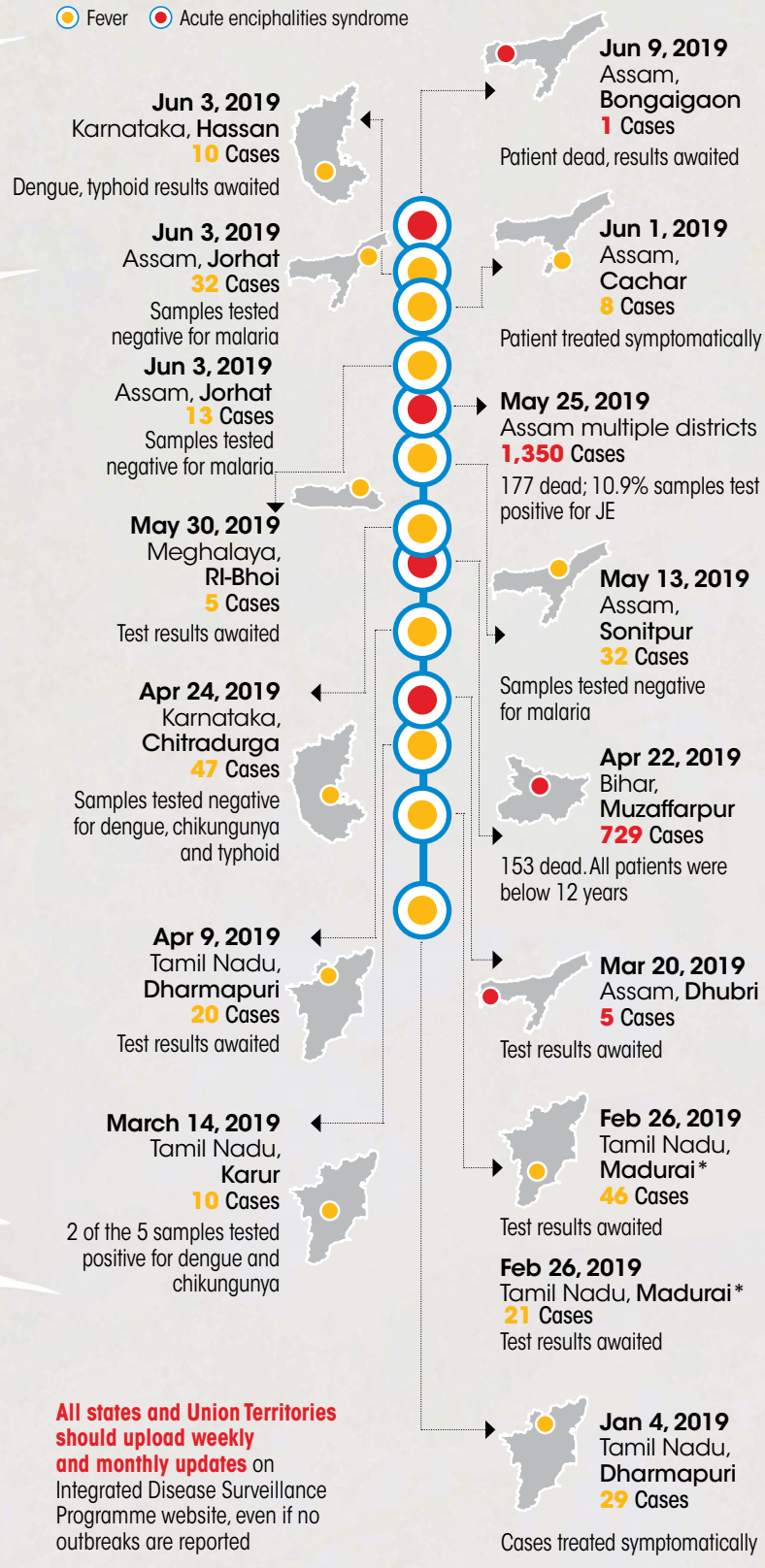
available in the public domain. DTE even tried to see if there are any published studies on disease investigations, a search in *PubMed*, an online database of biomedical and life sciences research literature for the term "integrated disease surveillance programme" threw up 16 results. None of them were on fever or AES outbreaks in 2019 and 2020.

DTE sent multiple emails to officials working under IDSP in states that regularly report mysterious fever to understand the final outcome of their investigation, but did not receive any response. Its request for an appointment with Sujeet Kumar Singh, director of IDSP and NCDC, was met with silence.

TAKE A CLOSER LOOK

The reason for IDSP's failure may not be as straightforward. Under the programme, all districts should have disease surveillance committees. However, the Parliament reply by Ashwini Kumar Choubey, Minister of State, Ministry of Health and Family Welfare, on July 9, 2019, shows only about half, or 380 of the 739, districts in the country have such committees in place to monitor disease trends and respond to outbreaks in early rising phase.

The elaborate arrangement also gets hindered by limited diagnostic facilities, faulty collection and testing of samples, suggests a 2019 study paper published by researchers and the directors of multiple government agencies, including NCDC, NIV and the Indian Council of Medical Research. The researchers had analysed outbreaks in 2017 and pointed out that even simple viral and bacterial infections such as dengue, JE and influenza go unidentified at times because of poor diagnostics. At least a third of outbreaks of fevers of unknown origin in the country go undiagnosed, they say in the paper, published in the *Indian Journal of Medical Research*. According to IDSP site, there are just 114 labs in the country. The lack of interest is also visible through the fact that budget allocated under the scheme is



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49%
districts do not have the mandatory disease surveillance committees

29%
districts have vacancies for epidemiologists

382
posts lie vacant in Integrated Disease Surveillance Programme

23
of the 43 emerging and re-emerging viral diseases in India are zoonotic

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seldom spent. In 11 of the 13 years between 2004-05 and 2016-17, expenditure was lower than the allocated budget. The last expenditure information is available on the IDSP portal till October 2017.

An April 2019 study published in the *Clinical Epidemiology and Global Health* highlights that researchers or institutes seldom adhere to NCDC's 10-step outbreak handling methodology. These are: determining the outbreak; confirming the diagnosis; defining it; searching for cases; generating a hypothesis using findings; testing the hypothesis with analytical study; drawing conclusions; comparing it with established facts; communicate the findings; and then executing preventive measures.

The report, which reviewed 136 articles on outbreak handling in India between 2008 and 2016, found that all the 10 steps were followed in only during 16 per cent of the outbreaks and in only 24 per cent of the cases proper analytical study was conducted (step 6). In 98 per cent of the outbreaks, researchers were more interested in arriving at the conclusion without following other steps.

LIMITED SCOPE

In 2015, a Joint Monitoring Mission set up by WHO and the Ministry of Health and Family Welfare, assessed IDSP and highlighted that it is limiting the scope of epidemiological studies of diseases by not collecting mortality data. The mission also raised concerns over the fact that IDSP looks at only 22 diseases, including malaria, dengue, chikungunya and AES that are already monitored by the National Vector Borne Disease Control Programme. They also pointed out that IDSP was not investigating zoonotic diseases despite the fact that it is just a matter of time that one of the emerging/re-emerging diseases become virulent and result in a major pandemic.

A THIRD OF THE FEVER OUTBREAKS IN THE COUNTRY GO UNDETECTED BECAUSE OF LIMITED DIAGNOSTICS CENTRE AND POOR TESTING

Even the 2019 paper identifies 43 emerging and re-emerging viral diseases that could affect India—23 of these are zoonotic in nature. One such is Chandipura virus that has emerged as a major encephalitic pathogen in India in recent years. The virus, spread by sandflies, has caused outbreaks in Andhra Pradesh (2004, 2005, 2007 and 2008), Gujarat (2005, 2009-12) and Vidarbha region of Maharashtra (2007, 2009-12), according to a study published in *The Open Virology Journal* in August 2018. Similarly, scrub typhus is being reported from newer geographies. The disease, earlier found in Himachal Pradesh, was implicated for the mysterious fevers in Uttar Pradesh's Gorakhpur district in 2018. Even the Nipah virus, first reported in Siliguri in 2001, had reached Kerala in 2018.

Cutaneous leishmaniasis, JE, scrub typhus and leptospirosis are spreading to a much wider area at an alarming rate in the past 68 years, writes Ramesh C Dhiman of the National Institute of Malaria Research and Aakanksha Tiwari of Banaras Hindu University in a 2018 research paper. "Sudden outbreak of rare diseases like Kyasanur Forest Disease can be fatal due to unavailability of strategies and policies to fight against them," they write in the paper published in the journal *Medical Reports and Case Studies*.

They advise that India should strengthen the public health surveillance systems and provide quick medical support to control the damage caused by outbreaks. The question remains how?



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THE OTHER SCARE

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THE FAILURE of the government machinery to identify the disease has meant that individual researchers and doctors often try to unravel mystery outbreaks. "But in the absence of support from the government, a consensus on the cause is rarely reached," says Vipin M Vashishtha, consultant paediatrician in Bijnor, Uttar Pradesh, who was part of the team that unraveled the mystery fever in Saharanpur district.

Between the 1980s and 2000s, there were reports of an average of 400 children dying each year in Saharanpur. In 2002, after 100 children died in two weeks in September, the Industrial Toxicology Research Centre, now renamed Indian Institute of Toxicological Research, visited the area and blamed it on a pesticide. Soon, the National Institute of Communicable Diseases (now NCDC) stepped in and said Japanese Encephalitis virus is killing the children. As the deaths continued, Vashishtha and a group of independent doctors studied the patients in 2007 and found that the toxic pods of a weed, *Cassia occidentalis* (locally called *kasondi* or *pamaad*), is the cause of the illness. Children, especially from poor families, ingested the pods which then affected their liver, brain and muscles. They termed the illness hepatomyoencephalopathy. However, cases continued to be reported. In 2009, when 25 children died because of the illness, Vasistha claimed it was because the local authorities did not spread awareness about the toxic pod.

In most outbreaks where the disease remains unidentified, doctors simply treat patients for the symptoms and the local administration follows it up with sanitation and sensitisation drives.

India needs to revisit public health system to fight the rising threat from disease outbreaks

Milind M Gore, who set up National Institute of Virology (NIV)'s lab unit in Gorakhpur in 2008, says, "We would be able to solve the problem of infectious diseases in the country if we can solve the Gorakhpur puzzle." But identifying the aetiology of a disease is not easy. "The search often leads to wild goose chases and you need patience," says Lalit Kant, former head of epidemiology and communicable diseases division at the Indian Council of Medical Research.

It also requires an experienced eye, explains Prabir Chatterjee, epidemiologist formerly with the State Health Resource Centre, Chhattisgarh. It is difficult to identify even a well-known disease if it is new to an area. If a patient from Gujarat with symptoms of Kala Azar visits the Christian Medical College (CMC), Vellore, in Tamil Nadu, doctors there are less likely to have encountered the disease and might classify it as a mysterious disease, Chatterjee explains. A well-read doctor would be able to guess it but he or she would still need help in disease confirmation and treatment.

So the way to identify a mysterious disease involves a thorough clinical, biochemical, histopathological and microbiological investigations. In case the disease has caused deaths, autopsies must be performed to reach conclusions. The second stage of identification should consist of epidemiological investigations

PHOTO: ADITHYAN P C / CSE



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The mysterious fever in Saharanpur district of Uttar Pradesh has on an average killed 400 children a year since the 1980s

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"IDSP is not what we need"

T JACOB JOHN, virologist and former professor at the Christian Medical College, Vellore, has closely monitored mysterious outbreaks over the decades. He says no agency in the country is equipped to investigate outbreaks

India has seen several outbreaks of unknown aetiology. Can we hold the Integrated Disease Surveillance Programme (IDSP) responsible for not identifying them?

No. They are like the post-office. You cannot hold them responsible for a bad message. IDSP receives messages and forwards them to the correct authority —National Centre for Disease Control (NCDC), under the Directorate General of Health Services (DGHS) which is designed to provide services and not investigate outbreaks. DGHS and NCDC have a small set up that is unfit for a country with 1.38 billion people. IDSP is doing its job, though with extensive delays, but they are not what we need for investigating outbreaks.

Then what do we need?

We need a public health system. Disease surveillance is a tool to notify diseases to public health experts. If there is no public health system, disease surveillance becomes an exercise for collecting data for updating knowledge. True surveillance is information for action, then and there—not delayed. IDSP cannot do this as the design of the health management system in India is deeply flawed. The human health management, which is both prevention and treatment of diseases, is of dismally low standard in the country. The outbreaks in Saharanpur and Muzaffarpur have been going on for decades, but health management system did not take them seriously. The



truth is that they did not know how to handle the outbreaks. They were not serious about the identification of the disease and its causation. NCDC is not competent enough to solve the problem.

Who is responsible for investigating outbreaks then?

In countries with good health management system, the public health system is responsible for investigating outbreaks. In the absence of public health, agencies like NCDC try to investigate. They take the responsibility" to do their best, but they are without "accountability". So if they fail, they fail. If they would have been accountable, then when they failed, they would have brought in the best experts from the country.

Outbreaks can be of diseases with known or unknown causes. Investigation of the former is easy. The faculty of the local medical college can double up and investigate them. The objective is to detect the risk factors and take immediate remedial measures. Investigation of the latter involves first discovering the cause and then determining the risk factors and finally stopping the outbreak. If the cause can be easily detected, as is in most instances, they need to be handled like an outbreak of known cause. Here is the tricky problem: all outbreaks need not be due to infectious disease. Inexperienced and untrained investigators tend to assume that an outbreak has to be due to a transmitted agent, hence infectious.

Can we improve the situation?

In India, I don't see any honest desire to improve the situation. We—the Union health ministry, healthcare experts in government and private sectors—are arrogant enough to assume every disease can be treated and there is no need to "waste money" on prevention. If India wanted to prevent diseases, it would have improved the situation decades ago. But that would involve some expenditure. If that is considered as waste, then we will not improve. If we spend that 2-3 per cent GDP on public health, it will push the GDP higher. India cannot become a 5-trillion dollar economy without establishing a public health system in the country. It is a well-kept secret in the profession that doctors (healthcare experts) are the worst enemy of public health as there is huge profit in disease-care industry. So I ask: do we really want to improve?

to identify risk factors, says Vashishtha. This requires the deployment of a team that includes epidemiologists, pathologists, neurologists, toxicology and public health experts and paediatricians.

"Skilled and experienced people are especially important in recognising a zoonotic disease," says Kant. The problem is more with new and emerging diseases as there are no diagnostic tests and the doctors have to diagnose on the basis of symptoms. So, for a new disease of suspected zoonotic origin working in collaboration with a veterinarian would be ideal. "This synergy between agriculture experts and doctors helped India contain the bird flu outbreak," he says.

Synergy was also at play during the Nipah outbreak in Kerala in 2018. "We have excellent examples of promptly recognising a serious outbreak and quickly getting the act together to control an epidemic which could have been disastrous," says George M Varghese, professor at the Department of Infectious Diseases, CMC, Vellore. An unusual infectious disease was noted by an astute clinician, the sample was sent to a reference laboratory which then quickly identified it as Nipah virus in 2018. "In all my years of work, I have not seen an outbreak handled as well in India as that of Nipah in Kerala. Education has paid dividends and people are aware," he said. Public health infrastructure too is much better in the state. The lesson from this success is that we need to work on public health infrastructure, he says.

Unfortunately, there is a shortage of such health infrastructure as well as skilled and experienced persons in the country. Capacity building was thus one of the major recommendations made by the Joint Monitoring Mission set up by the World Health Organization (WHO) and the Union Ministry of Health and Family Welfare (MOHFW) in 2015. It had found that the government had only 407 epidemiologists as against the sanctioned posts of 703. There was a 33 per cent shortage of microbiologists and 80 per cent shortfall in veterinary doctors. The situation is equally dismal now. To handle the COVID-19 pandemic, states are scrambling to hire 227 epidemiologists, as per the media reports. The desperation started when Preeti Sudan, secretary, MOHFW, wrote a letter to all state governments, on April 7, to immediately fill up vacancies for epidemiologists in 216 districts. The letter indicated that IDSP has 382 vacancies at present.

IN MOST OUTBREAKS WITH INCONCLUSIVE INVESTIGATIONS, DOCTORS TREAT PATIENTS ON THE BASIS OF SYMPTOMS AND LOCAL ADMINISTRATION USUALLY FOLLOW IT UP WITH SANITATION AND SENSITISATION DRIVES

If the situation does not improve, experts warn that the biggest challenge in the future will be the country's inability to handle zoonotic diseases, which are usually behind most mysterious diseases and are showing regular resurgence. Globally, over half of the 1,407 human pathogens are zoonotic and in many cases can cause fevers of unknown origin, warns a 2007 analysis published in the *Infectious Disease Clinics of North America*. Developing countries like India are at a higher risk of fevers of unknown origin than developed countries, it says, and for a reason. The country's public health infrastructure is so weak that many times even common diseases do not get identified in time.

One of the fundamental reasons for this is that doctors in the country are not trained to carry out basic research and they lack curiosity, says T Jacob John (see 'IDSP is not what we need', *p*36). He says if a person with fever symptoms comes for treatment, most doctors think only of malaria, dengue or typhoid. Similarly, if a child with seizure comes to the doctor, it is identified as encephalitis in most cases. Rajib Dasgupta, professor at the Centre of Social Medicine and Community Health at the Jawaharlal Nehru University, Delhi, is optimistic. He says, "Public health systems are built brick by brick, the experience of COVID-19 shall also contribute to the strengthening of the surveillance system." DTE

@vibhavarshney

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COVID-19 has left its indelible marks on poverty levels

DISEASE OF INEQUALITY

COVID-19 has drilled deep holes in an already unequal world, making life for the underprivileged unlivable

RICHARD MAHAPATRA

THE LATE microbiologist and environmentalist, René Dubos, famously articulated that every civilisation created its own diseases and epidemics. Into the 8th month of the novel coronavirus disease (COVID-19) pandemic, one is convinced about what ours would be: inequality. And it took a pandemic to bring this out. It is now being popularly mentioned as the 'pandemic of inequality'. Nobody is sure when this defining point of the pandemic would be declared over.

In the last fortnight, global conversations on the pandemic revolved around its impacts on hunger, poverty and inequality, making the world once again slide into a time from where it started talking about various global goals like the Millennium Development Goals (MDGS) and Sustainable Development Goals (SDGS). Recent estimates and analysis show that the pandemic is impacting the already poor more, whether they are in developed or developing countries.

Secretary-General of the United Nations António Guterres, while delivering the 2020 Nelson Mandela Annual Lecture, said: "The COVID-19 pandemic has played an

PHOTOGRAPH: VIKAS CHOUDHARY / CSE

important role in highlighting growing inequalities. It exposed the myth that everyone is in the same boat. While we are all floating on the same sea, it's clear that some are in superyachts, while others are clinging to the drifting debris." He highlighted that the world ignored inequality for too long, further putting the poor at greater risk during the pandemic.

It is not just that the world is witnessing the first recession to be triggered by a pandemic, but COVID-19 has set off the "sharpest decline in per capita income" since 1870. Impacts of the collapse of the economy and economic activities have trickled faster to the poor. Oxfam, a non-profit operating across the world, estimates that 121 million more people are on the brink of starvation due to mass unemployment, disruption to food production and supplies. "As many as 12,000 people could die every day from COVID-linked hunger," declares Oxfam.

"The frontline in the battle against the coronavirus is shifting from the rich world to the poor world," says David Beasley, the executive director of the World Food Programme (WFP). He says the global body is running its biggest-ever humanitarian response to avail food to millions. In 2019, WFP assisted 97 million people which were a record at that point in time. At present, it assists 138 million people. A severe hunger crisis is precipitating, especially among those who were already surviving on subsistence level or with external support. According to WFP, the number of hungry in the countries where it operates would increase to 270 million by the end of this year. This will be an increase of 82 per cent from the level before the pandemic erupted.

The geography of hunger, however, remains the same. COVID-19 pandemic is impacting areas that were already in a crisis. Spikes in hunger are evident in West and Central Africa, which has seen a 135 per cent jump in the number of food-insecure people, as well as in Southern Africa where there has been a 90 per cent rise. This geography faced the wrath of climate change, conflicts and also lack of development aid. In the last four years (before COVID-19), the population of severely food insecure rose by 70 per cent. In the past, these people were not counted or escaped from the "severe levels of food insecurity". But the disruptive events have made them so. Now, they are again the victims in disproportionate degrees. For the first time since 1990—when the concept of human development measurement was adopted across the world—the human development measure would come down in 2020. Inequality makes any recovery difficult for the already poor and disadvantaged. For instance, economy recovery in 2021, as per the forecast, would not have the desired impacts on the poor.

Over time, economic growth has led to a reduction in income inequality among countries. But within countries inequality in income has, in fact, increased—by 4 per cent in Gini Coefficient (a statistical measure to gauge wealth distribution) since 1990. This global increase in inequality was driven by widening inequality in China, India, Indonesia and the US. An assessment by the Food and Agriculture Organization shows that COVID-19 may cause an increase in each country's Gini by 2 per cent. In this case, the number of poor will additionally increase by 35-65 per cent. In India alone, some 400 million people would slip into poverty due to the impacts of the pandemic. And these people are mostly workers in the informal sector. This again shows how disproportionate has been the pandemic's impacts.

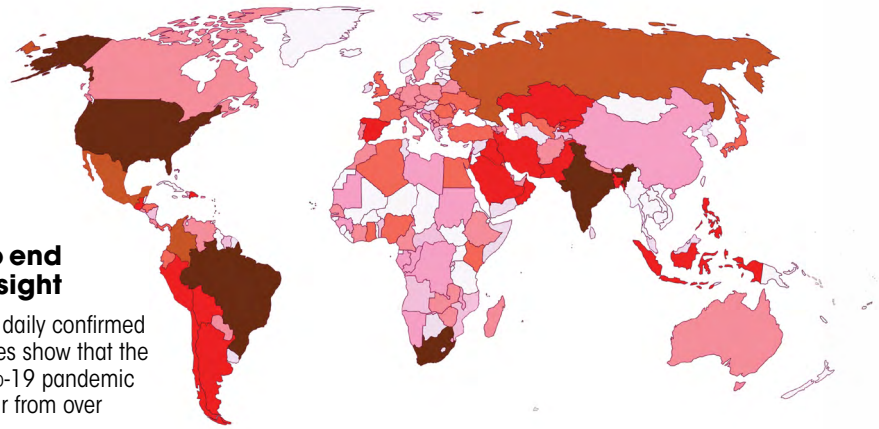
This year's recently-concluded High-Level Political Forum on Sustainable Development expressed concerns on this developmental challenge. First, the world has slipped on its commitments on SDGs. Second, the inequality will further widen thus making it very difficult to garner the global support to fund the development agenda. Most of the countries in this Forum highlighted the challenge of inequality and the economic devastation caused by COVID-19 pandemic. DTE @down2earthindia

AS MANY AS 12,000 PEOPLE COULD DIE EACH DAY FROM COVID-LINKED HUNGER

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DOUBLE TROUBLE

India, like most other countries, is fighting two pandemics: COVID-19, the casualty numbers of which are reaching a new high every other day, and swine flu, which never really left the country after being declared a pandemic in 2009-10



No end in sight

The daily confirmed cases show that the COVID-19 pandemic is far from over

8 nations reported over 5,000 daily cases on July 23. It was just 4 on June 23

Over 10,000 daily cases	5,001-10,000 daily cases	1,001-5,000 daily cases	501-1,000 daily cases	101-500 daily cases	51-100 daily cases	21-50 daily cases	11-20 daily cases	0-10 daily cases
Jul 23 4*	Jul 23 4	Jul 23 17	Jul 23 19	Jul 23 39	Jul 23 7	Jul 23 20	Jul 23 14	Jul 23 84
Jun 23 3	Jun 23 1	Jun 23 16	Jun 23 13	Jun 23 30	Jun 23 18	Jun 23 14	Jun 23 11	Jun 23 101
May 23 2	May 23 2	May 23 10	23 May 15	May 23 33	May 23 15	May 23 17	May 23 11	May 23 100
Apr 23 1	Apr 23 1	Apr 23 14	Apr 23 9	Apr 23 25	Apr 23 9	Apr 23 24	Apr 23 11	Apr 23 111

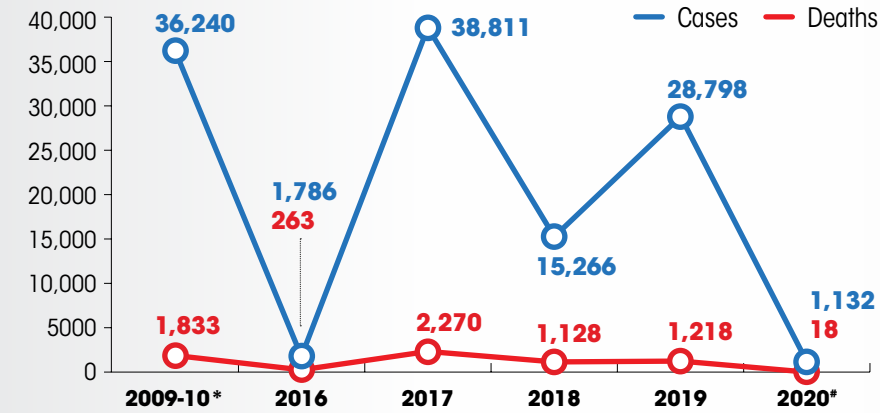
*Number of countries as per daily reported cases; updated till July 23

World Health Organization says **a pandemic never really leaves**. Instead it continues to hit countries seasonally

Almost every year, **India records** seasonal outbreaks of **swine flu**, which triggered **world's last pandemic** in 2009-10

The pandemic that never left India

The country recorded more swine flu cases in 2017 than during the pandemic year



* May 2009-August 2010; #till February 2020

MUSICAL CHAIRS

The list of 10 states worst hit by swine flu keeps changing during every major outbreak year

2009-10*	Cases	Deaths
Delhi	9,895	100
Maharashtra	7,574	612
Rajasthan	3,382	198
Karnataka	2,899	198
Kerala	2,850	114
Tamil Nadu	2,248	7
Haryana	1,953	38
Gujarat	1,560	323
Uttar Pradesh	1,324	22
Andhra Pradesh	1,067	73

2017		
Gujarat	7,709	431
Maharashtra	6,144	778
Uttar Pradesh	3,858	132
Rajasthan	3,619	279
Tamil Nadu	3,315	17
Karnataka	3,260	15
Delhi	2,835	16
Telangana	2,165	21
Kerala	1,414	76
MP#	802	146

2019		
Rajasthan	5,092	208
Gujarat	4,844	151
Delhi	3,627	31
Maharashtra	2,287	246
Uttar Pradesh	2,096	37
Karnataka	2,030	96
Telangana	1,388	22
West Bengal	1,073	26
Haryana	1,041	16
Tamil Nadu	1,038	4

* May 2009-August 2010
Madhya Pradesh

Sources: European Centre for Disease Control and Prevention Disease Control and Prevention, National Centre for Disease Control and Directorate General of Health Services

GRAPHIC: SANJIT / CSE

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ONLINE TRAINING ON

UNDERSTANDING ENVIRONMENTAL LAWS FOR BETTER ENVIRONMENTAL MANAGEMENT



Course date: August 24-30, 2020
Last date to apply: August 10, 2020

COURSE FEES: INR 2000

India has a comprehensive system of regulations to protect its natural environment and the health of its people. From the enactment of Water Act in 1974, a number of laws and regulations have been put into force in this regard. However, the intended purposes of these laws are far from being fulfilled due to various reasons. One of the issues which sterns out is a holistic understanding of the different laws and how they should be looked into in a concerted manner for better environmental management.

Considering the need to fill the gaps, Centre for Science and Environment, is organizing a one week online training course on "Understanding Environmental law for improving environmental management".

COURSE OBJECTIVE

This one week online course has been designed to capacitate the people working in the field of environment and the prospective environmentalist with an objective to develop a better understanding and knowledge of the laws and their interrelationship. This course will also be beneficial for students as well who aspire to develop their carrier in environment field.

The course will be conducted through technological learning tools such as presentations, videos, discussion with experts and reading material.

LEARNING FROM THE PROGRAMME

- Better understanding of environmental governance structure of the country, major institution, and their implementation statistics.
- Increased understanding of the obligations of industry and individuals under various environmental laws and regulations and how to meet these obligations.
- Understanding the impacts of violations and noncompliance.
- Role of National Green Tribunal (NGT), environmental courts and public interest litigation (PIL).
- Understanding of international treaties and agreements Government of India subscribes to the impact of non-compliance with such agreements on business.
- Understanding that environmental compliance is not a financial burden but a clear business opportunity.

WHO CAN APPLY?

- Industry professionals; Environment Consultants; Environment Engineers
- Researchers and academicians
- Students aspiring to work in environment field

PARTICIPANTS WILL BE AWARDED WITH A **"CERTIFICATE OF PARTICIPATION"** ON SUCCESSFUL COMPLETION OF THE PROGRAMME

COURSE LINK:

https://www.cseindia.org/understanding-environmental-laws-for-better-environmental-management-10248

COURSE ORGANIZERS

Ishita Garg,
Progarmme Officer, Industrial Air Pollution
Email: ishita.garg@cseindia.org

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Predatory pricing of an unproven drug

FOR AN experimental drug whose safety and efficacy have not been established, remdesivir has hit the jackpot. The pandemic is providing windfall profits for its maker, Gilead Sciences of the US which used the initial research of leading health institutes to develop the drug. It illustrates best the drawbacks of a patent regime that gives monopoly rights to a private drug company to make unconscionable profits even in the time of a pandemic. As the company announced its pricing of the drug—$2,340 for a course for patients covered by government health programmes in the US and other developed countries, and as much as $3,120 for patients with private insurance—there was widespread outrage.

Health economists and activists were universal in their criticism, saying the drug should be offered close to production cost in view of the global health emergency. That cost has been estimated at between $1 and 9. Pharmacology experts also wondered why the price was so obscenely high since remdesivir has not proved survival benefit for patients with COVID-19, the disease caused by the SARS-CoV2 virus.

Here's Gilead's explanation. Treatment with remdesivir cuts hospital stay for COVID-19 patients by five days and that's the "value" it provides. In the US, it apparently results in hospital savings of around $12,000 per patient. Presto, the government saves that much by taking remdesivir at Gilead's rate. This even before it factors in the direct benefit to those patients, states Gilead virtuously. To the fuzzy studies and company claims, Andrew Hill, a senior research fellow in Liverpool University's pharmacology department, has a simple query: why should five days of treatment improve clinical responses, but not 10 days of treatment?

Remdesivir is also a case study in how the US system forces Americans to pay twice over for a drug: first through government funding for the initial research conducted by public institutions and again through the company's unchecked predatory pricing. An analysis of remdesivir's milestones by non-profit Public Citizen reveals that it got public funds of over $70 million, and critics claim Gilead contributed very little to the drug's development. Yet patents on remdesivir, repurposed from its original target of treating the Ebola virus, are all with Gilead—and so, too, the profits.

Most Americans appear to think that Gilead is only playing along with a system that has been set in place by policymakers even if some of them like Bernie Sanders, a former presidential candidate, are extremely critical. Some of them have written a letter accusing the Trump administration of signing a deal that will give Gilead up to $500 million in windfall revenue borne almost entirely by American taxpayers. It was with a sense of unreality that one watched Gilead boss Daniel O'Day tell CNBC TV that at the prices set by the company "we focused on making sure that all patients would have access, even the uninsured". The reporter left it unchallenged although the channel had just reported that an additional six million Americans had joined the ranks of the uninsured owing to job losses in the wake of the pandemic. In our part of the world, we have Gilead's licencees promising remdesivir at a little over ₹5,000. Just as unaffordable for most Indians who have no insurance. DTE

Gilead's price for remdesivir reveals the faulty patent system and the skewed policies of the US

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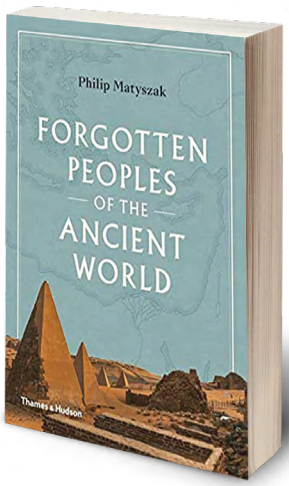
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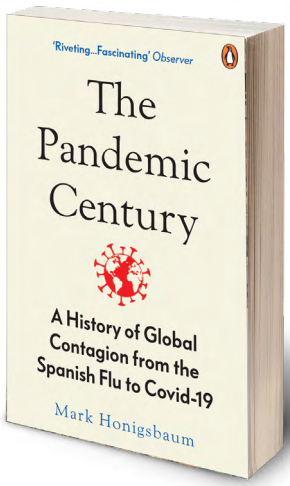


ENDGAME 2050 is an urgent call to action to combat the existential crises of the planet. Featuring musician Moby along with leading scientists, and created by physician turned environmentalist Sofia Pineda Ochoa, the new documentary also includes a fictional segment set in 2050 to enable people to imagine the consequences of our continued inaction—a harsh future of food and water shortages, runaway climate change, fishless oceans and civil unrest.

BOOKS



Forgotten Peoples of the Ancient World is about 40 forgotten ancient civilisations—from Hyksos to the Hephthalites—that maps humanity and displacement from 3000 BCE-550 CE, and helps understand who we are. Each of the 40 ancient peoples gives a wealthy insight into the diversity of culture and their contributions to the modern world. The author explores how these people fought and survived alongside the Egyptians, Greeks and Romans, but most importantly, why they were forgotten.



The last 100 years are dotted with a string of pandemics—Spanish Influenza, SARS, Ebola, Zika and now COVID-19. In *The Pandemic Century*, medical historian and journalist, Mark Honigsbaum, analyses 10 outbreaks in the last 100 years using science history, medical sociology and ground reportage, and comes up with striking similarities among them, warning us that new diseases and strains will be inevitable even with the latest breakthrough scientific technologies.

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THOSE WHO STAYED BACK

The COVID-19 lockdown triggered an unprecedented exodus of workers from urban centres to villages. But there were many who stayed put because they did not have a place to go back to, or hoped that the shutdown would be short, or believed that villages will not be able to provide sustainable income. In Delhi, where 40 per cent of the people are from outside the state, **BHAGIRATH SRIVAS** tries to understand how those who stayed back coped with the lockdown



"A person facing hunger is not scared of a virus"

MOHAMMAD GESAR E-Rickshaw driver, Aligarh, Uttar Pradesh

Mohammad Gesar lives in Delhi's Sangam Vihar locality and plied an e-rickshaw around the Govindpuri Metro Station before the lockdown was announced and the Metro service stopped, killing his source of income. He now uses the same vehicle to sell vegetables door-to-door. "The lockdown has forced people like us to switch jobs," he says. Father of three daughters and a son, Gesar says he barely earns ₹300 a day. "Before the lockdown I could earn ₹800-₹900 a day. The Delhi government announced a grant of ₹5,000 to e-rickshaw drivers but I am yet to receive any money," he says. Gesar came to Delhi 20 years ago. He worked as a watch repairer and then as a daily wage labourer, and saved enough money to buy an e-rickshaw three years ago.

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"Struggling to get two square meals a day for the past four months"

KISHANVEER
Construction worker, Farrukhabad, Uttar Pradesh

Kishanveer arrived in Delhi about three decades ago and has been living in Sangam Vihar, an unauthorised colony, for the past 28 years. Every morning, he packs his tools and goes to the nearby Labour Chowk, where prospective employers pick labourers to work on a daily wage. "There was no work during the lockdown. Even after it was lifted, I have got work only twice. Look at the tools, they have all rusted," he says. Kishanveer has a wife and three children to feed and is surviving on ration supplied by the government. He did not go to his village because he thought the lockdown would be a short affair. "But it kept extending. Now the situation has worsened," he says.



"I have been looking for work for a month, without any success"

SUBHASH KUMAR
Vegetable vendor (in blue shirt), Agra, Uttar Pradesh

Subhash left for his village after the lockdown was announced and returned to Delhi on July 1. "There was no work there. After I returned, I see there is no work here too," he says. The 20-year-old used to work as a daily wage labourer before the lockdown. After his return, he tried selling vegetables for a couple of days. "One has to go to Okhla *mandi* everyday to buy vegetables. Getting nice, fresh produce is difficult. I incurred a loss of about ₹1,800 and decided to quit," he says.



"They have not given us any money for the duration of the lockdown"

MUKESH KUMAR
Autorickshaw driver,
Mahoba, Uttar Pradesh

This is Mukesh's complaint about the family that employed his wife Usha as domestic help for ₹9,000 a month but fired her for fear of contracting coronavirus from her. Mukesh and Usha live in a one-room house in Faridabad, Haryana, with their two children. Mukesh drove his family in his autorickshaw to Mahoba in June but returned on July 10. "I could not find work there, nor could I ply my auto because it is not registered in the state," he says. Earlier, he ran a service to pick and drop children from a school to their homes in Faridabad. "That has stopped because the school is closed. Before the lockdown, we earned ₹25,000 a month. Now it's a task to save ₹100," Mukesh says.

"Unable to pay house rent, I have to hear abuses from my landlord everyday"

RAJKUMAR
Painter,
Bulandshahr, Uttar Pradesh

"He even throws out cooking utensils of tenants who have been unable to pay rent and insults us everyday," says a visibly distressed Rajkumar about his landlord. "Earlier I earned ₹450 in daily wage for my work, but now I am not in a position to bargain and accept whatever comes my way," he says. "It once occurred to me that going to my village might ease my problems, but then I heard stories of workers dying en route to their villages and changed my mind," he says, adding that he does not have enough money to travel.



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"I never took a loan in my life. The lockdown made me borrow ₹20,000 just to meet day-to-day expenses"

MOHAMMAD HIRA
Fruit seller, Begusarai, Bihar

"I am on the road from 9 am to 10 pm but barely make ₹200 a day. There are no customers," says Mohammad Hira. He came to Delhi 15 years ago and is the only earning member of his family. "I sent my wife and daughter to our village after the lockdown and have not been able to transfer them a penny in the past four months. And I am just not earning enough to call them back," he adds.

"People don't have money to buy anything. There are not enough customers anymore"

LAL MOHAMMAD
Tobacco vendor, Muzaffarpur, Bihar

Before the lockdown, Lal Mohammad sold cigarettes and *gutkha* on his bicycle near the Mehrauli-Badarpur road and did part-time embroidery work in a factory to earn about ₹20,000 a month. "Now the factory is shut and I make ₹6,000 a month from selling tobacco products from 5:30 in the morning to 9 at night," he says. Lal Mohammad came to Delhi three decades ago from Bihar and has a wife and a daughter. "I did not go to my village because I do not have land to farm. But things here have just gone from bad to worse. It is impossible to pay house rent and still have enough to eat everyday. We often sleep empty stomach," he says.



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Hundreds of native trees get uprooted and washed away in landslides in the Avalanche valley region in the Nilgiri Hills

Peril in the hills

THE NILGIRI HILLS ARE WITNESSING ECOSYSTEM COLLAPSE DUE TO EXTREME WEATHER EVENTS TRIGGERED BY CLIMATE CHANGE

GODWIN VASANTH BOSCO

PHOTOGRAPHS: GODWIN VASANTH BOSCO



(Left) An Aerides ringens orchid growing on a shola tree; (Below) Shola-grassland mosaic in the hills of the Nilgiri plateau, with the sholas growing in valleys and grasslands covering the slopes



THOUSANDS OF trees lay dead and strewn around the western parts of the Nilgiri Plateau in southern India. Deep gashes scar ancient mountains, standing a stark contrast to the lush green vegetation that they otherwise support. As conservationists and activists are fighting to protect forests and wilderness areas from being deforested, mined and diverted to "developmental" projects, there is another level of destruction happening to our last remaining wild spaces. Climate change is causing widespread collapse of ecosystems.

Carbon dioxide levels in the atmosphere hit a record-breaking 417 ppm in May 2020, highest in 3 million years. Along with global warming caused sea level rise and the melting of polar ice caps and glaciers, the steep increase in greenhouse gas concentrations has led to a surge in the frequency of extreme climate events. A region of the Earth where climate change caused weather extremities are exceedingly apparent are the coastal plains and the Western Ghats regions of southern India. In the last four years, this region has been affected by eight tropical cyclones and consecutive extreme rainfall events during the southwest monsoon periods of the last two years. These bouts of intense storms have been interspersed with periods of severe droughts, heatwaves, deficient and failed monsoons.

On August 8, 2019, the Avalanche and Emerald valley regions, which are part of the Kundha watershed, received an unprecedented 900 mm rainfall within 24 hours. It broke the record for the highest rainfall in Tamil Nadu, by nearly twice the amount. Over four days, the region experienced close to 2,500 mm rainfall. To put this in perspective, Coimbatore, the nearest city in the plains of Tamil Nadu, receives 600 mm of rain annually. The Kundha watershed bore a deluge that was four times the annual rainfall amount, over just four days.

The upper watershed of the Kundha river is a complex of several peaks above 2,400 m and broad deep valleys. The river, which is a primary tributary to the Bhavani that feeds into the Cauvery, is fed by numerous streams and rivulets at the headwater sections. With the barraging downpour, nearly every stream and rivulet burst its course. Vast tracts of precious soil and shola ecology slipped away on either side of the watercourses. Gone are the rich black soil layers topped with spongy humus that line the streams; washed away are the dark moss and wild balsam covered rocks that shaped the flow of every stream; lost are the thousands of shola trees, dwarf

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Record-breaking rainfall and landslides have made deep cuts into the Earth revealing the underlying soil and rocks

bamboo and forest *kurinji* (shrubs of blue flowers which covered the hills) that guarded the streams, saplings, ferns and orchids of the forest floor. In place of these are deep cuts of gauged out Earth, revealing the underlying lateritic soil and rocks.

Shola-grassland mosaic in danger

The cloud forest ecology, known as sholas, grows along the folds and valleys of these mountains. They are old-growth vegetation and harbour several endemic and rare species of flora and fauna. These naturally confined forests are already some of the most endangered forest types because of habitat loss and destruction. The recent episode of extreme precipitation caused landslides have dealt a telling blow on these last remaining forest tracts. What is even more shocking is that montane grassland stretches have also experienced large landslides.

The montane grasslands occur over larger portions of the mountains here, covering all the other areas that sholas do not grow in. Together, the shola-grassland mosaic is most adept at absorbing high rainfall amounts and releasing it slowly throughout the year, giving rise to perennial streams. Over a year they can experience 2,500 to 5,500 mm of rainfall, which is intricately sequestered by complex hydrological anatomy that carefully lets down most of this water, using what is needed to support the ecology upstream.

The native tussock grasses are highly adapted to hold the soil strongly together on steep slopes. However, even this ecology is now giving way under pressure from extreme weather events. The shola-grassland mosaic ecology cannot withstand the tremendously high amounts of rainfall (over 2,400 mm) that occur in significantly short periods (over four days). Worsening climate change is driving the intensity and frequency of extreme weather events, resulting in a level of ecosystem collapse, never witnessed before.

IN 2018, UNUSUALLY HIGH RAINFALL OVER IDUKKI, WAYANAD AND COORG CAUSED LANDSLIDES. MOST OF THESE OCCURRED IN SPOTS WITH NO APPARENT DISTURBANCE SUCH AS ROADS AND PATHWAYS CUT THROUGH THEM

In the southwest monsoon season of 2018, unusually high rainfall over the highland districts of Idukki, Wayanad and Coorg caused hundreds of landslides. A predominant view was that this was primarily because of the indiscriminate construction of roads and proliferating concretisation of the hills. However, even within the highly stable shola-grassland ecology, a large number of landslides occurred in spots with no apparent disturbance such as roads and pathways cut through them. This signifies that climate change has reached a level that is beyond the capacity of the ecosystem and land resilience.

What is causing the collapse of the last remaining wild spaces is the cumulation of every action that has contributed to the climate crisis. The actions



Numerous large landslides have occurred on intact grassland slopes too

invariably stem from places that have long lost their plant ecological cover—the global urban-industrial-agricultural complex. There is no time to keep ignoring this primary cause. If we overlook the main cause and only try to safeguard the last remaining wilderness areas from the more direct forms of destruction, they will be susceptible to climate change-related collapse. It is important that threats closer to the last remaining ecological spaces are also curtailed.

But despite the consecutive years of extreme precipitation over short periods in the Nilgiri Biosphere, hardly any step has been taken to address ecological security. Building regulations stand to get eased and road expansion works continue in full swing. Till June-end, parts of Tamil Nadu experienced a 45 per cent deficiency in the monsoon. The trend is worryingly similar to what happened in the last two years when much of the annual rainfall was concentrated over a few days later in the monsoon period.

DESTRUCTION BY DAMS AND TUNNELS

The Kundha watershed region can be broadly divided into two—the higher slopes and the descending valleys. Shola-grassland ecology dominates the higher slopes with various types of land uses such as tea cultivation, vegetable farming, villages and non-native tree plantations dominating the descending valleys.

The descending valleys are covered with several dams and hydroelectric structures. The Kundha Hydro-Electric Power Scheme is one of the largest hydropower generating installations in Tamil Nadu with 10 dams, several kilometres of underground tunnels and a capacity of 585 MW. This system is now getting two more dams and a series of tunnels to set up a pumped storage hydropower facility to generate an additional 500 MW. With the level of destruction that extreme precipitation events are bringing to the Kundha watershed, it is disastrous to add more large dams and tunnels. The intensity of floods has turned so strong that even the largest dam complexes in the world face threats of being breached.

Safeguarding the last remaining zones of ecology and biodiversity from threats of direct destruction is crucial. Concurrently, the larger worldwide urban-industrial-agricultural complex, from where the climate crisis stems from, needs drastic change. The constant incursions into more and more ecological spaces in the form of new dams, roads, and buildings are also connected to this complex. Whether it is the landslides in the grasslands of the high elevation plateaus in southern India; the melting glaciers of the Himalayas in northern India; the dying coral and rising sea levels elsewhere in the planet; the COVID-19 pandemic that has brought about unimaginable changes—we have to understand the interconnectedness of these dire effects and learn from nature. DTE

(Godwin Vasanth Bosco is an ecologist working to restore shola and grassland ecology in the Nilgiri Biosphere. He is the author of the book Voice of a Sentient Highland *on the Nilgiri Biosphere.)*

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Working the *chakki* improves spine health, helps reduce fat and is a good alternative to going to the gym

Grounded in wisdom

TRADITIONAL MINI FLOUR MILLS MAY NO LONGER BE IN VOGUE IN OUR HOMES, BUT THEY HELP PREPARE NUTRITIOUS FOOD

VIBHA VARSHNEY

THIS IS a story from the times when each house had an *atta chakki,* or a flour mill. Grains like wheat, maize and pearl millet would be ground fresh each day and all women in the family would take part in this daily ritual to ensure that healthy *rotis* could be served to everyone.

While there are various types of traditional mills in different parts of the country, the *chakki* in my maternal grandmother's house in a village near Aligarh, Uttar Pradesh, was made up of two flat, round grinding stones placed one on top of the other. This was fixed

on a slightly raised platform in an airy but windowless room at the back of the house. The top stone had a rectangular piece of wood (*galua*) fixed at the centre in which a metal rod (attached to the stone at the bottom) was adjusted to provide the pivot for stones to move over each other. Grains would be poured from the top and a fancy wood-carved handle—placed on the top—was used to turn the top stone clockwise to make flour. Bigger the stone, faster would be the process and finer the flour. But the fact that it has to be turned by hand is a limiting factor. Usually the diametre of the stone is less than the length of a person's arm. Two persons can sit facing each other and move the *chakki* handle together to ease the work. The processed *atta* falls off the lower stone into the *bhir*—a circular receptacle below the *chakki*, which is made of mud and coated with *multani mitti* (fuller's earth).

The flour prepared through this method is healthier, unlike machine ground flour and it does not heat up during the grinding process. The texture of the flour can also be adjusted to personal preferences. This choice is a big plus in this world of ultra-processed food.

My grandmother also had a smaller version of the *chakki*, which could be moved around the house. It's called *chakula* and used to prepare *daliya* from a variety of grains and for splitting whole pulse to *dal*. The smaller diametre of the stones ensured the grain was only broken, not turned to flour. It was religiously washed before the fasting season to grind *kuttu* (buckwheat) and *sendha namak* (Himalayan pink salt).

These semi-processed products are part of Uttar Pradesh's cuisine. While wheat *daliya* is quite common, *daliya* can also be prepared from *makki* (maize), *bajra* (pearl millet) and *jowar* (sorghum). *Daliya* is healthy and often the go-to food when people want to eat something light yet filling. It is faster to cook than whole grain and is digested more slowly than products made from flour. It is also versatile—you can prepare its sweet or savoury versions. *Daliya* needs to be roasted first and then boiled to soften, but as the pieces are small, this does not take much time. To prepare the sweet version, milk and sugar are added; and to prepare the savoury, *khichri*, vegetables and spices of choice can be added. A dry version can also be prepared, just like *poha*. Hand-processed *daliya* is rarely available in the market now as consumers find grains cuts with blades more uniformly sized and attractive.

The *chakula* can be adjusted to process pulses so that each grain breaks into two pieces, but the manual process is crude and sometimes the seed shatters into many pieces, and sometimes, it passes through unharmed. It all depends on the expertise of the person who adjusts the *chakula* and it is not good to get too much of either. The shattered pieces are called *chuni* and have pieces of the seed coats which add to the nutrition. *Chuni* is soaked in water and then wheat flour is added to make it into a dough from which nutritious *rotis* or crisp *parathas* can be prepared (*see recipe*). Just like split pulses, *chuni* can be stored to be used later. The home-processed *dals* are unpolished and though unpolished *dals* are easily available in the market now at a premium price, these are processed by machines only.

Daliya and *chuni* provide healthy choices along with some wholesome exercise. Working the *chakki* is often prescribed to pregnant women to ease childbirth. *Chakki chalanasana* is part of yoga with improves spine health and reduces backache. It also helps reduce belly fat and is a good alternative to going to the gym.

Unfortunately, *chakki* has now become synonymous with serving a jail term as prisoners are mandated to make flour. But time has come to bring *chakki* back to its rightful place in homes. Nowadays, a much-carved version of the appliance is available as a decorative item in high-end markets of Delhi. People who install this at home would get both nutritious food as well as exercise. DTE

@vibhavarshney

RECIPE — MUNG KI CHUNI KA PARATHA

INGREDIENTS

Chuni: 1 cup
Wheat flour: 2 cups
Desi ghee (for each *paratha*): 1 tbsp
Green chilli (chopped finely): 2
Salt to taste
Spices like asafoetida and coriander are optional and can be used according to personal preferences

METHOD

Soak *chuni* in a small amount of water for an hour. Add wheat flour, salt, chopped chilli and spices to it and prepare the dough. Take some dough according to the size of the *paratha* you want to prepare and roll it. Smear *ghee* over it and fold it multiple times to create layers. Roll again and transfer to a skillet. Shallow fry on both sides, liberally smearing *ghee*. The flame should be medium to ensure that the *ghee* does not burn. When cooked, remove from skillet and crush softly to open the layers. Enjoy with fresh yoghurt and pickles.

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Nature's purifiers

TWO ALGAE SPECIES ABUNDANT IN HIMALAYAN UTTARAKHAND CAN EFFICIENTLY CLEAN THE GANGA AND GENERATE BIODIESEL

DEEP GUPTA, SUDHIR KUMAR GAUR AND SIDDHARTH JAIN

ALL THE major cities of the world are generally found on riverbanks. In India, the Ganga is one of the rivers that host a huge population—over 338 million by some estimates—with about 100 cities and many of the country's busiest and largest commercial and industrial hubs situated on its banks. But these dense urban centres and industries have also been the reason the water quality of the Ganga shows a sharp decline as soon as it leaves Rishikesh, located on the foothills of the Himalayas, and enters the plain. The quality only gets worse as it passes through Uttar Pradesh due to domestic sewage as well as industrial effluents from surrounding towns.

Though conventional methods are being used to reduce the pollution load in wastewater before it is discharged into the river, they are less effective in removing all types of contaminants, are expensive and require high energy input. They also produce large amount of sludge that requires further handling. In view of this, bioremediation of wastewater with the help of algae has gained attention in recent years as an economic and eco-friendly method. Studies show microalgae,



Phytoplanktons offer a chemical-free, low energy way of treating wastewater

PHOTOGRAPHS: DEEP GUPTA



Hydrodictyon reticulum algae can help remove heavy metals, pesticides and pathogens from water bodies

which are typically unicellular photosynthetic plants, can not only remove inorganic and organic pollutants, heavy metals, pesticides and pathogens from the wastewater, they can also be used to generate biofuel. But which of the diverse groups of microalgae can offer the optimum result? Researchers at the College of Engineering Roorkee (COER) in Uttarakhand recently conducted studies to find out the answer.

They have found that two algal species—*Hydrodictyon reticulum* and *Chlorella vulgaris*—are highly effective in accumulating heavy metals and pesticides and in removing pathogens from water. The algae can be found in any type of water or moist land. To measure their potential, the researchers collected samples of wastewater from four nullahs that empty into the Ganga, and the algae from Roorkee and Haridwar region. The physico-chemical parameters of wastewater (biochemical oxygen demand or BOD, dissolved oxygen, alkalinity, acidity, turbidity and hardness) were different at all locations. The efficacy of the two algae species was studied at different pH levels (denoting acidity or basicity) with variable weight and under different environmental conditions. The algal samples (50g per litre) were analysed after 14 days of biosorption and the study concluded that the algae were able to reduce BOD, turbidity and acidity from a minimum of 55 per cent to a maximum of 81 per cent.

The study also found that the algae raised the pH value (denoting a reduction in acidity), alkalinity and total hardness in some wastewater samples by utilising organic components like nitrogen and phosphorus as food source during photosynthesis, by consuming bicarbonates and by increasing biomass. Increased algal growth added dissolved oxygen into the treated water, making it suitable for aquatic life. There was also a reduced sludge formation. Overall, *H reticulam* was found to be more effective of the two algae species. The study was published in the *International Journal of Advanced Research* (IJAR) in May 2020.

Since microalgae can grow rapidly and have high lipid content, they have been investigated in recent years as a substitute for conventional fuels by researchers all over the world. But extracting the lipid, held within the hard cell wall of microalgae, is not easy. COER researchers have conducted experiments to find out the ideal conditions and catalysts that can ensure maximum diesel yield at low cost. They chose *Hydrodictyon* algae because of its availability in Uttarakhand and high lipid content. It was then treated in an electric oven to obtain zero per cent moisture content and blended with an alcohol (methanol) in different ratios. Catalysts (one acidic and one basic) were also added to eliminate certain stages of biofuel production and thereby lower the energy cost. Total 17 experiments were conducted for each acid (H_2SO_4) and base catalyst (NaOH) at 50°C and for 60-120 minutes. The mixture was then subjected to "transesterification", a chemical extraction process. The yield was a maximum of 89.583 per cent for acid catalyst and 87.421 per cent for the base. "It has been observed that parameters have positive influence on the outcomes. The higher yields obtained at higher percentage of catalyst and complete the reaction in less time. The results on methanol-to-dry-algae ratio show that yield escalates when methanol increased but if methanol is added excessively the yield drops," the researchers note in another study published in the journal *Fuel* in March 2019. While more innovation is needed to turn microalgae into a commercial fuel, they certainly hold a win-win solution towards a clean and sustainable future. DTE

(Deep Gupta is head of the department, Agriculture Sciences; Sudhir K Gaur is professor, School of Management; and Siddharth Jain is associate professor, Department of Mechanical Engineering, at College of Engineering Roorkee. Gupta is author of the study published in IJAR *while Jain participated in the study published in* Fuel*)*

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A new low for labour

THE COVID-19 pandemic has severely impacted the labour market. But what is worrying is the decline in labour productivity, or output per labourer. This has a direct link to the per capita income of a worker. Moreover, economists say the future does not look bright as the global economy was already in a decade-long phase of decline in labour productivity since the global financial crisis of 2007-09. However, as a recent report by the World Bank points out, more than financial crises and wars, the increasing frequency of natural disasters—which includes "biological disasters" like the current pandemic—will impact labour productivity adversely in the immediate future. The Bank's report *Global Productivity: Trends, Drivers, and Policies*, considered to be the first of its kind to evaluate COVID-19's impact on labour productivity, has compared the impacts of various adverse events like wars, conflicts and natural disasters.

The report concludes that even though wars and conflicts might have severe impacts on labour and overall productivity, the number of climate disasters has increased exponentially and this will have a much bigger impact on labour markets and productivity. "While wars inflict particularly severe and long-lasting damage to both, capital and total factor productivity, the high frequency of climate disasters increases their importance as a source of damage to productivity."

Between 1960 and 2018, the number of natural disasters was 25 times that of wars, and 12 times that of financial crises like the one in 2008. Within the natural disaster category, climate-related disasters like cyclones and extreme weather events emerge as the most frequent one to strike the world and thus, the economy and labour productivity.

"Climate-related events were the most frequent type of natural disaster, with a doubling of their frequency after 2000," the report says in its evaluation. In this period, climate-related disasters accounted for 70 per cent of all natural disasters. And they occurred twice as often as biological disasters like the pandemic. During this period, climate disasters have reduced labour productivity by 0.5 per cent annually, which is almost a fifth of the impact of a war on labour productivity.

But the number of climate-related disasters is so high that cumulatively, they result in higher losses in labour productivity. In other words, climate-related disasters have long-term impacts on labour productivity.

"After three years, severe climate disasters lower labour productivity by about seven per cent, mainly through weakened total factor productivity," the evaluation says. "Severe disasters can also trigger other types of adverse events such as financial crises and wars, thus compounding the corrosive effects on productivity," it adds.

Outbreaks such as SARS, MERS, Ebola and Zika reduced productivity by 4 per cent even after three years of the episode, says the World Bank

Biological disasters like epidemics too have caused severe reduction in labour productivity. In the last two decades, we have experienced four major epidemics—SARS, MERS, Ebola and Zika. Going by the World Bank assessment, these outbreaks reduced labour productivity by 4 per cent even after three years of the episode.

In this historical context, the COVID-19 pandemic would have a much bigger impact on labour productivity. The current pandemic is the widest to hit. It is estimated to reduce per capita incomes in 90 per cent of countries in 2020. "The COVID-19 pandemic may be significantly worse than most past disasters because of its global reach and the unprecedented social distancing and containment measures put in place to slow the spread of the virus," the report says. The crisis in the world of work is just unfolding. This must force us to re-imagine labour productivity in a post-COVID world. DTE

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