

TerraGreen

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Impact of Coronavirus on the Indian Energy Sector

The Short-Term and
Long-Term Impacts

SPECIAL HIGHLIGHTS

Malnutrition and Susceptibility
to Viral Infections: Role of
Traditional Indian Medicine to
Boost Immunity

War Against Novel Coronavirus:
Weapons to Win this Battle

IN CONVERSATION

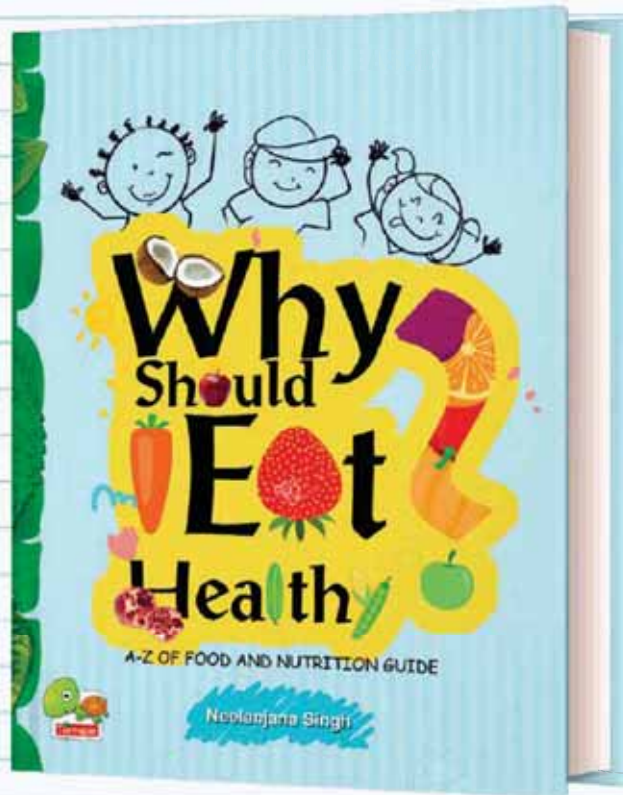
IN CONVERSATION

Georgekutty Kariyanapally,
Altering Lives, the Green Way

A Much-Needed
Break for Nature



A to Z of Healthy Eating!



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How many times have you been told to avoid cheesy pizzas and yummy burgers so that you stay healthy? When was the last time you reached out for a packet of potato chips and your mom didn't scold you?

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EDITORIAL



“We need to create a balance between the environment and the economy.”

The COVID-19 pandemic has changed life for all; worldwide, people have been advised to stay at home. The resulting closure of industries, transport networks and businesses has reduced pollution, but it has also brought to the fore, the tussle between lives and livelihoods.

The strict control measures (lockdown, travel ban, school closing) are not sustainable over long period of time because of associated social repercussions and financial impact on economy. This month's cover story 'Impact of Coronavirus on the Indian Energy Sector' analyses both the short-term implications of the response to COVID-19 on the energy sector and some of the possible longer-term impacts that are yet to materialize.

We also remember that during the 2008 financial crisis, emissions were low, but quickly reached all-time highs when the economy recovered in 2010. Post the COVID-19 pandemic, it needs to be seen if humans will seize the opportunity and invest in renewable energy. We need to create a balance between the environment and the economy.

The COVID-19 has affected more than 210 countries and territories around the world. While most patients usually experience mild to moderate severity of the illness, it is the older patients and patients with pre-existing medical problems who are more likely to be serious and the disease may even prove fatal for them. In this issue, we have included two special reports. The first Special Report 'Malnutrition and Susceptibility to Viral Infections' discusses the relationship between malnutrition and susceptibility to viral infections, especially among young children. In India, 36 per cent children are underweight; and 58 per cent are anaemic; amongst adult women, 22 per cent have low body mass index and 53 per cent are anaemic. In this context, the report assesses the status of malnutrition and susceptibility to viral infections through the lens of other similar viral diseases and epidemics.

In 2017–18, the Government of India spent only 1.28 per cent of its gross domestic product (GDP) on public health, with a plan to increase this share to 2.5 per cent by 2025; by comparison, the global average is 6 per cent. Nearly all of the budgeted amount in India is spent on maintaining and expanding the health system, with a focus on curing illness, and treating the diseased. Protecting public health through prevention is seldom emphasized in budgetary provisions. In India, the doctor: patient ratio is close to 1:10,000, as opposed to 1:1000 recommended by the WHO. Our second Special Report 'War Against Novel Coronavirus', opens new discussions on funds for the health sector, the equity in availability of resources across urban and rural India, and their adequacy within the communities. The article delves whether the new world order of protective and preventive action would last beyond the virulence of COVID-19.

The Feature of this month 'Acknowledging Our Biodiverse World' discusses the need to recognize the various ways in which our ecological diversity can be saved against exploitative anthropogenic activities, outbreaks and pandemics related to the emergence of deadly viruses, and more. The emphasis on linking biodiversity with our economic future and our livelihoods has never been more important than now. The current pandemic demonstrates the close relationship, and underlines the need for integrating bioresources in our development trajectory, instead of viewing biodiversity as a constraint or show-stopper.

A handwritten signature in black ink, appearing to read 'Ajay Mathur'.

Ajay Mathur
Director General, TERI



I read the online version of the April 2020 issue of *TerraGreen*. The content is useful and also very relevant to the current times. The author of the cover story rightly says that why do we limit ourselves with acts of conservation and related events only on that day? Why don't we take it ahead and do it every single day of the year? With the global pandemic of Coronavirus disease (COVID-19) engulfing the entire world, the need to protect and take care of the planet's inhabitants and the environment is more than ever. I expect more such relevant articles in the forthcoming issues of *TerraGreen*.

S K Singh
New Delhi

I thoroughly liked reading the article 'Lessons from the COVID-19 Response' appearing in the April 2020 issue of *TerraGreen*. I agree to the views of

the author that the global COVID-19 pandemic has transformed lives all over the world. Nations have been closing their borders and there are lockdowns in many countries and restrictions on public gatherings in others. The world economy is entering a recession. The authors discuss a few lessons that should be learnt globally from the present crisis engulfing the whole world. Creation of enhanced healthcare capacities is clearly a necessity across the world, including India.

Monisha Kumar
Jaipur, Rajasthan

The coronavirus crisis has proved global air quality can be dramatically improved and that too fast. The change has been created by lockdowns all over the world that have stopped many transportation routes and shut factories. But environmentalists warn it could be temporary. Many are questioning whether the world will just go back to business-as-usual scenario when it recovers from the pandemic. Anyhow, I felt nice to read in *TerraGreen* that this complete lockdown has resulted in improvement of air quality in our cities, particularly Delhi and Mumbai. The lockdown in the country has provided us a blessing in disguise to reassess our activity patterns and also shown us the possible impacts of these strategies on air quality.

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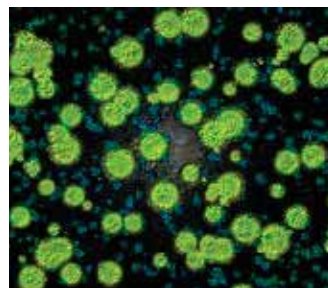
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This website serves as a hub to bring together a collection of resources in response to the COVID-19 outbreak. These resources are generated by public supported research institutions in India and associated programs. The content presented here relies on the best available scientific understanding of the disease and its transmission.

Infographics



Science-based Website on COVID-19 Launched

Scientists and engineers in the country are collaborating at an unparalleled scale to understand all the aspects of the COVID-19 pandemic. To bring the scientific and factual aspects of the COVID-19 pandemic outbreak on to public domain, a multi-institutional, multi-lingual science communication initiative, called 'CovidGyan' has been created. The topics covered range from the exact behaviour of the novel coronavirus (SARS-CoV-2), transmission dynamics of the corona flu and its diagnostics to innovative technologies to scale up the fight, means of coping up with physical distancing, and critical assessment of communications. The initiative is the brainchild of Tata Institute of Fundamental Research (TIFR), Indian Institute of Science (IISc), and Tata Memorial Centre (TMC). Several other prominent partners have since joined this noble effort including Vigyan Prasar, IndiaBioscience, and the Bangalore Life Science Cluster (BLiSc).

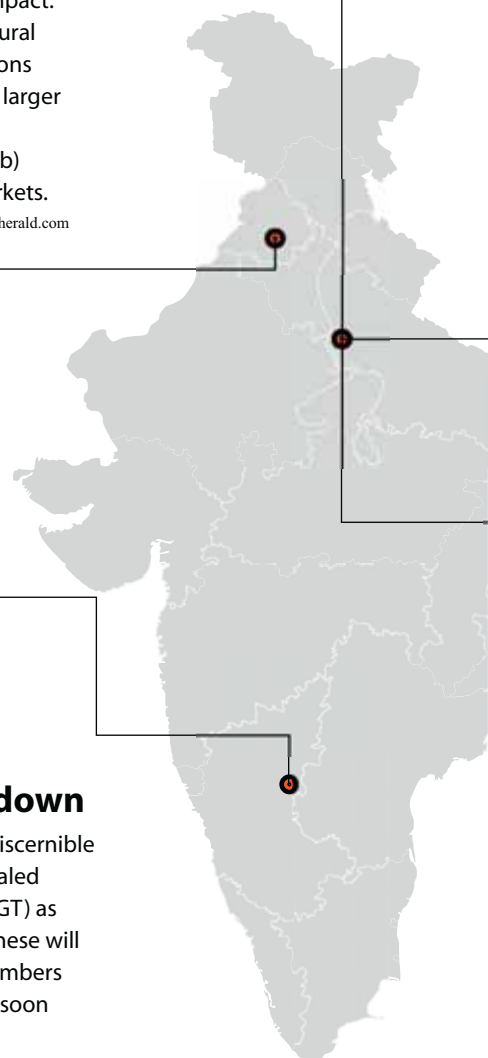
Source: <https://pib.gov.in>

COVID-19 Impact on Agriculture: Varied and Devastating

The impact of COVID-19 on the economy is no doubt devastating. No sector has escaped its impact. Its impact on agriculture is complex and varied across diverse segments that form the agricultural value chain. Even among the different segments, its impact varies widely among different regions and among producers and agricultural wage labourers. This impact will reverberate across the larger economy and will linger longer than a few months.

The problems in agriculture at the moment are primarily related to: (a) labour availability and (b) inability to access markets for produce due to issues in transportation as well operation of markets.

Source: www.deccanherald.com



Nature Works its Magic on Bengaluru Lakes Amidst Lockdown

The lockdown has come as a blessing in disguise for Bengaluru's water bodies. And there are discernible signs that two of the city's notoriously polluted lakes—Varthur and Bellandur—are getting healed naturally. These pleasant changes have caught the attention of the National Green Tribunal (NGT) as well as the expert committee on Bellandur and Varthur lakes. The stakeholders worry that all these will go to naught as soon as the lockdown is lifted. Keeping this in mind, the expert committee members are planning to request the government to restart the stalled works on rejuvenating the lakes soon after the lockdown is lifted, giving no scope for pollutants to enter the water bodies.

Source: www.newindianexpress.com



Noise Pollution Falls as Lockdown Rings in Sound of Silence

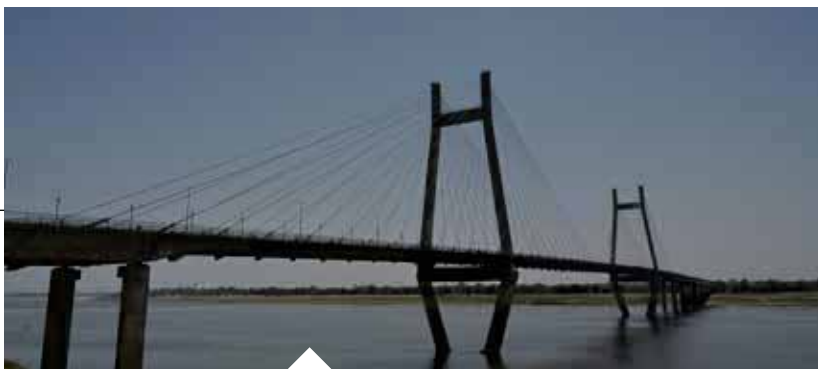
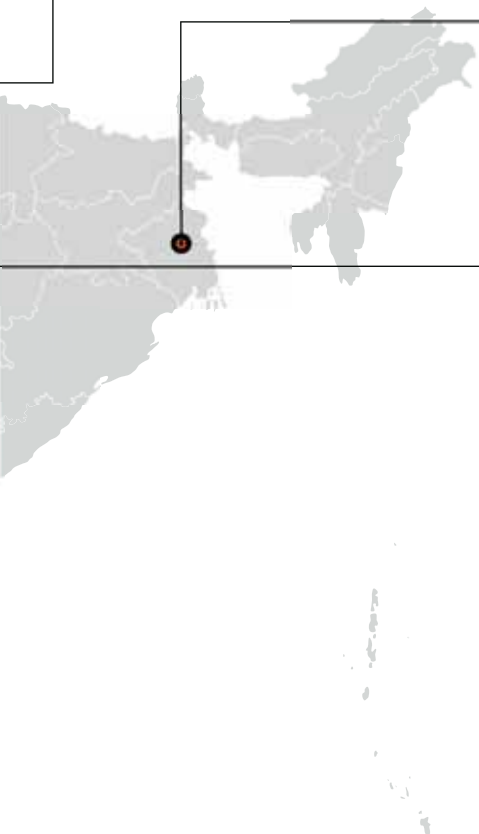
For nearly a month since the lockdown was clamped, Delhi's citizens have been waking up to the chirping of birds. Like the now clear water of the Yamuna and the clean air of the city, Delhi's noise pollution has drastically fallen, thanks to closed factories, mostly empty roads, and an absence of commercial events. While the diurnal decibel level limit in residential areas in normal times is set at 55 dB (A) and 45 at night, chances are the current figures range between just 30 and 40.

Source: www.timesofindia.indiatimes.com

IIT Kharagpur Among World's Best for Achieving UN Goals

The Indian Institute of Technology (IIT) Kharagpur has been ranked 57th globally among higher education institutes for its research in areas related to the UN's Sustainable Development Goals (SDGs). The University of Auckland topped the ranking, followed by the University of Sydney. The list includes 766 universities across 89 countries and regions. IIT Kharagpur's rank is the best for any Indian institutes. The 17 SDGs are a to-do list for tackling conflict, hunger, land degradation, gender inequality, and climate change by 2030.

Source: www.hindustantimes.com



Yamuna Water Quality Improves During Lockdown: Government Report

The quality of water in the Yamuna has improved along the Delhi stretch during the nationwide lockdown, compared to April last year, according to a report by the Delhi Pollution Control Committee (DPCC). An increased flow of water in the river has also contributed to less pollution, the report said. But the report noted that the Yamuna has still not met the 'water quality criteria'. According to the report, the pollution has reduced by 21 per cent at ITO Bridge, 20 per cent at Nizamuddin Bridge, and 18 per cent at Okhla Barrage. Also, pollution has reduced in five out of the six major drains, which flow into the Yamuna, that the DPCC measured.

Source: www.thehindu.com



Milan Announces Ambitious Scheme to Reduce Car Use after Lockdown

Milan is to introduce one of Europe's most ambitious schemes reallocating street space from cars to cycling and walking, in response to the coronavirus crisis. The northern Italian city and surrounding Lombardy region are among Europe's most polluted, and have also been especially hard hit by the COVID-19 outbreak. Under the nationwide lockdown, motor traffic congestion has dropped by 30–75 per cent, and air pollution with it. City officials hope to fend off a resurgence in car use as residents return to work looking to avoid busy public transport. The city has announced that 35 km of streets will be transformed over the summer, with a rapid, experimental citywide expansion of cycling and walking space.

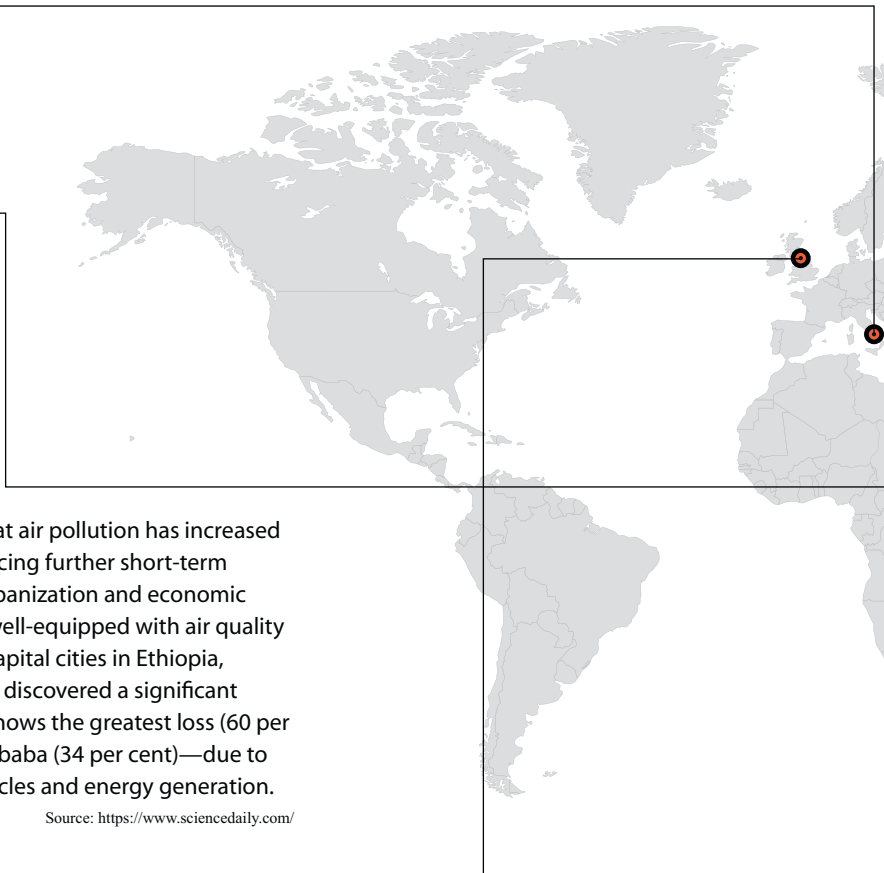
Source: <https://www.theguardian.com/>



African Cities Suffering Major Air Pollution Increase

Falling visibility in three major African cities reveals that air pollution has increased significantly over the last 45 years—leaving citizens facing further short-term increases in man-made pollution due to increasing urbanization and economic development, a new study has revealed. Africa is not well-equipped with air quality monitoring, so scientists have used visibility data for capital cities in Ethiopia, Kenya and Uganda as a substitute measurement. They discovered a significant reduction in visibility since the 1970s, where Nairobi shows the greatest loss (60 per cent), compared to Kampala (56 per cent) and Addis Ababa (34 per cent)—due to increased particulate matter (PM) emissions from vehicles and energy generation.

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



Transport Usage Will Change after Lockdown

The number of people using public transport in Britain's cities could be 20 per cent lower than normal after the end of the coronavirus lockdown. In London, commuters using buses and tubes could fall by as much as 40 per cent from pre-lockdown levels. Rail use could drop by 27 per cent, a poll for transport consultants SYSTRA has found. The survey results capture people's current attitudes about returning to work, but some changes may be carried on into the long term. It suggests that of those expecting to reduce their use of buses and trains, 24 per cent said they plan to work from home more, which will reduce emissions.

Source: <https://www.bbc.com/news/business-52414376>





Climate Change May Push Some Species to Higher Elevations

A new WCS-led study reveals that mountain-dwelling species fleeing warming temperatures by retreating to higher elevations may find refuge from reduced human pressure. A new study published in *Nature Communications* shows that nearly 60 per cent of all mountainous area is under intense human pressure. Most of the pressure is at low elevations and mountain bases, which tend to be easier places for people to live, grow food, and build roads. The scientists then used climate models to make predictions about how species would move under climate change. Based on their predictions, they found that species tend to move to higher elevations, and that these higher elevations tend to have more intact land for species because there is less human pressure.

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



Silence is Golden for Whales as Lockdown Reduces Ocean Noise

In cities, human lockdowns during the coronavirus pandemic have offered some respite to the natural world, with clear skies and the return of wildlife to waterways. Now evidence of a drop in underwater noise pollution has led experts to predict the crisis may also be good news for whales and other sea mammals. Researchers examining real-time underwater sound signals from seabed observatories run by Ocean Networks Canada near the port of Vancouver found a significant drop in low-frequency sound associated with ships.

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

Digital Agriculture Paves the Road to Agricultural Sustainability

In a study published in *Nature Sustainability*, an ecosystem scientist and an agricultural economist outline how to develop a more sustainable land management system through data collection and stakeholder buy-in. The researchers believe the path begins with digital agriculture or, the integration of big data into crop and farmland usage. Digital agriculture, is where agriculture, science, policy, and education intersect. Putting that data to use requires an effective balancing of competing economic and social interests while minimizing trade-offs.

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



Electric Vehicles

The Future of Mobility

In this article, **Rudhi Sundar Pradhan** highlights the fact that the recent shift in global automotive technology and an increasing uptake in electric vehicles (EVs) is likely to pose a challenge to the existing automotive market if the country does not plan its transition towards newer mobility solutions and develop the required manufacturing competencies and infrastructure to uplift the market.

Industrialization and developing economy are hard pressing on the rising levels of air pollution, particularly in our metropolitan cities. To add to the woes, energy security is also of major concern. Electric vehicles (EVs) emerge as the way to combat the ill effects of bad air that we breathe, and also to subdue the concern of energy security. The global automotive industry is at the tip of paradigm shift from internal combustion engines (ICEs) to zero emission EVs. India has announced to shift all the fleet to EVs by 2030. The government has expressed intent to push manufacturers to get into mass manufacturing of EVs to reduce dependence on imported fuel and control environmental pollution.

Drivers for India's Electric Mobility Initiatives

Energy security

India's crude oil imports have risen exponentially and the demand for oil grew by 5.1 per cent in 2016, higher than world's largest net importers, the US (0.7 per cent) and China (2.9 per cent). India's crude oil deficits stood at \$52 billion in 2017 and accounted for almost 50 per cent of the total trade deficit of \$109 billion.

Pollution levels

India ranks as the third-largest carbon-emitting country in the world accounting



for 7 per cent of the global carbon dioxide emissions from fuel combustion. According to the Greenpeace and AirVisual analysis, 22 out of the 30 most polluted cities of the world are in India.

Changing Trends in Global Automotive Market

The Indian auto industry is the 4th largest in the world with a growth rate of 9.5 per cent in the year 2017. The recent shift in global automotive technology and an increasing uptake in EVs is likely to pose a challenge to the existing automotive market if the country does not plan its transition towards newer mobility solutions and develop the required manufacturing competencies and infrastructure to uplift the market.

Impact of EVs in Automotive Ecosystem

Electric vehicles would certainly change the dynamics in the automotive ecosystem. It will transform the business approach of the entire value chain. The following are the impacts of EVs in automotive ecosystem:

- **Automakers:** Surge for the EVs is paving the way for new internal power centres and external relationships
- **Dealers:** The dealer business model will undergo changes as EV maintenance costs are expected to be lower than those of conventional cars
- **Suppliers:** They will need to reinvent themselves to be relevant to the future
- **End customers:** Customers prefer vehicles that are fun to drive and packed with latest technologies

Two-wheelers (2Ws)	Three-wheelers (3Ws)	Passenger vehicles (PV)	Commercial vehicles (CV)
2Ws are expected to be one of the early adopters of electrification. High-vehicle utilization and easy home or workplace charging would drive the uptake in the commercial 2W segment	3Ws are expected to be one of the early adopters of electric mobility given e-rickshaws have a head start in this space due to their low running cost and emergence of independent assemblers.	High vehicle utilization, route predictability and workplace charging would help corporate PV fleets take off earlier than private cars. Retail customers are expected to go for EVs only once battery prices come down and EVs achieve economies of scale	Intra-city buses are likely to be electrified early, driven by the support provided by government-run transport undertakings, route predictability and ease of charging at bus depots. Light and small commercial vehicles are likely to be early adopters in the truck segment.

- **Government regulations:**

Government can bank on EVs to meet their climate goals.

Cost of Ownership

The cost dynamics of running an EV for commercial purposes, with high vehicle utilization, are quite favourable with almost a similar total cost of ownership for ICEs as well as EVs. For a commercial user, the differential in acquisition cost can be recovered in around 5 years due to lower operational expenses. However, for a private user, the cost of ownership for an EV remains much higher.

After the implementation of BS VI norms in April 2020, petrol and diesel vehicles are expected to get costlier by 8–15 per cent, thereby further reducing the differential cost between ICEs and EVs, making electrical cars viable for retail customers as well. In the two-wheeler (2W) category, acquisition cost of ICE scooter is 24 per cent less than the EV 2W, however the operational cost is 60 per cent higher.

Role of Different Stakeholders to Successfully Deploy EV Ecosystem

There is a need for a long-term policy framework that allows for continuity and attracts desired investments required for EV deployment. Following the government's announcement of complete vehicle electrification by 2030,

different stakeholders are providing pioneering efforts in the same direction.

Demand-side incentives

- Providing policy clarity fiscal and non-fiscal benefits
- The government should pace the speed of changing all its fleet to EVs
- Non-fiscal benefits: Special EV driving lanes, parking spots, and so on

Supply-side incentives

- Incentivize development of local technology
- Incentives on EV R&D investments
- Exploring the possibilities of tradable carbon credits to original equipment manufacturer (OEM)
- Exploring the opportunities of retrofitting the ICE to EV.

Charging infrastructure

- Mandate fuel stations to install charging points
- Promote and incentivize R&D for charging technologies
- Incentivize power rates for charging such as special time of use rates or pay per use.

Supply chain

- Encourage local EV design and software development
- Encourage investments in manufacturing battery, semi-conductors, controllers, and microprocessors for EVs
- Setting up policy framework for recycling and reuse of batteries.

Way Forward

There is no denying that e-mobility and its growth could impact auto component manufacturers in India in a big way. The vehicle manufacturers should develop and operationalize—a future mobility strategy to position the business in the evolving market landscape. The component suppliers should re-align their business model to support the EV ecosystem. Battery manufacturers should explore the tie ups with charging operators for battery swapping. They should access the opportunities to indigenize their operations.

The utilities should develop smart grid capabilities such as smart metering and vehicle to grid charging. They should incentivize the power rates such as special time of use rates for charging or pay per use. They should also explore the opportunities to set up independent line for charging stations.

Electric vehicles represent a big challenge for the nation as they can disrupt the whole power system, but are inevitable for a sustainable future. It comes up with a basket of opportunities for academia, regulators, and manufacturing industries. What we have visualized till now is only a fraction of this behemoth revolution and we are hoping the best outcome is yet to arrive. ■

Rudhi Sundar Pradhan, Associate Fellow, Industrial Energy Efficiency Division, TERI, New Delhi.

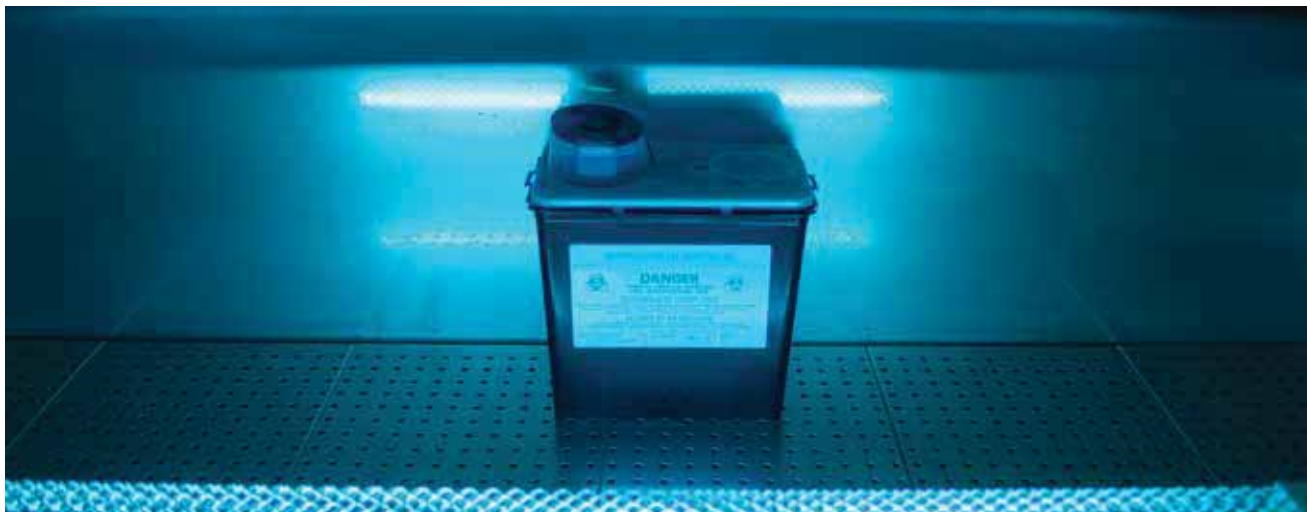
Ultraviolet LEDs

Prove Effective in Eliminating Coronavirus from Surfaces

As COVID-19 continues to ravage global populations, the world is singularly focused on finding ways to battle the novel coronavirus. That includes the UC Santa Barbara's Solid State Lighting & Energy Electronics Center (SSLEEC) and member companies. Researchers at SSLEEC are developing ultraviolet LEDs that have the ability to decontaminate surfaces—and potentially air and water—that have come in contact with the SARS-CoV-2 virus.

Researchers at UC Santa Barbara's Solid State Lighting & Energy Electronics Center (SSLEEC) are developing ultraviolet (UV) LEDs that have the ability to decontaminate surfaces—and potentially air and water—that have come in contact with the coronavirus. 'One major application is in medical situations—the disinfection of personal protective equipment, surfaces, floors, within the HVAC systems, etc.,' said materials doctoral researcher Christian Zollner, whose work centres on advancing deep UV light LED technology for sanitation and purification purposes. He added that a small market already exists for UV-C disinfection products in medical contexts. Indeed, much attention of late has turned to the power of UV light to inactivate the novel coronavirus. As a technology, UV light disinfection has been around for a while. UV light shows a lot of promise: SSLEEC member company Seoul Semiconductor in early April 2020 reported a '99.9 per cent sterilization of coronavirus (COVID-19) in 30 seconds' with their UV LED





products. Their technology currently is being adopted for automotive use, in UV LED lamps that sterilize the interior of unoccupied vehicles.

It is worth noting that not all UV wavelengths are alike. UV-A and UV-B—the types we get a lot of on the Earth—have important uses, but the rare UV-C is the ultraviolet light of choice for purifying air and water and for inactivating microbes. These can be generated only via human-made processes. ‘UV-C light in the 260–285 nm range most relevant for current disinfection technologies is also harmful to human skin, so for now it is mostly used in applications where no one is present at the time of disinfection,’ Zollner said. In fact, the World Health Organization warns against using UV disinfection lamps to sanitize hands or other areas of the skin as even brief exposure to UV-C light can cause burns and eye damage.

Before the COVID-19 pandemic gained global momentum, materials scientists at SSLEEC were already at work advancing UV-C LED technology. This area of the electromagnetic spectrum is a relatively new frontier for solid-state lighting; UV-C light is more commonly generated via mercury vapour lamps and, according to Zollner, ‘many technological advances are needed for the UV LED to reach its potential in terms

of efficiency, cost, reliability, and lifetime.’ In a letter published in the journal *ACS Photonics*, the researchers reported a more elegant method for fabricating high-quality deep-ultraviolet (UV-C) LEDs that involves depositing a film of the semiconductor alloy aluminium gallium nitride (AlGa_N) on a substrate of silicon carbide (SiC)—a departure from the more widely used sapphire substrate.

According to Zollner, using silicon carbide as a substrate allows for more efficient and cost-effective growth of high-quality UV-C semiconductor material than using sapphire. This, he explained, is due to how closely the materials’ atomic structures match up. ‘As a general rule of thumb, the more structurally similar (in terms of atomic crystal structure) the substrate and the film are to each other, the easier it is to achieve high material quality,’ he said. The better the quality, the better the LED’s efficiency and performance. Sapphire is dissimilar structurally, and producing material without flaws and misalignments often requires complicated additional steps. Silicon carbide is not a perfect match, but it enables a high quality without the need for costly, additional methods. In addition, silicon carbide is far less expensive than the ‘ideal’ aluminium nitride substrate, making it more mass production-friendly, according to Zollner.

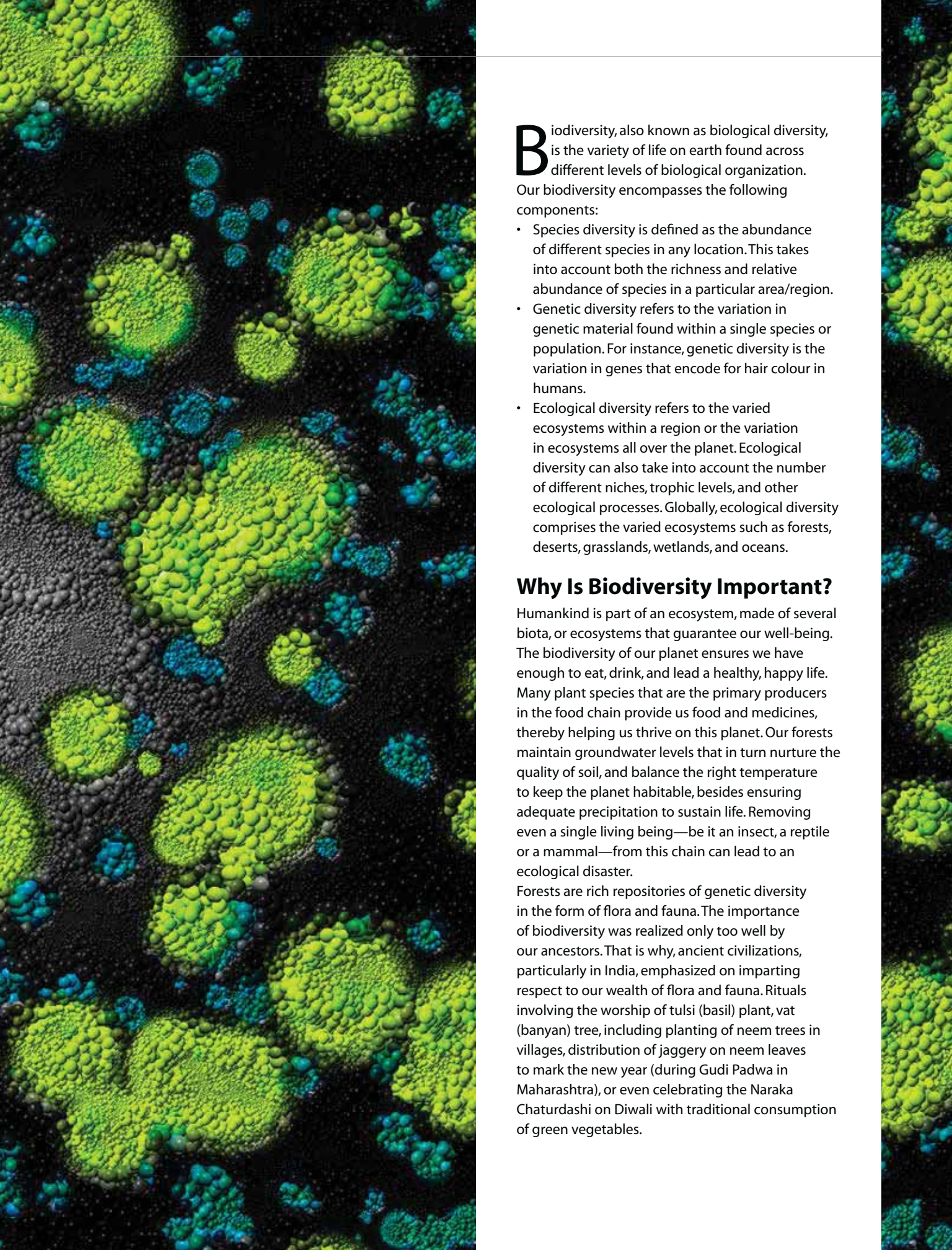
Portable, fast-acting water disinfection was among the primary applications the researchers had in mind as they were developing their UV-C LED technology; the diodes’ durability, reliability and small form factor would be a game changer in less developed areas of the world where clean water is not available. The emergence of the COVID-19 pandemic has added another dimension. As the world races to find vaccines, therapies and cures for the disease, disinfection, decontamination and isolation are the few weapons we have to defend ourselves, and the solutions will need to be deployed worldwide. In addition to UV-C for water sanitation purposes, UV-C light could be integrated into systems that turn on when no one is present, Zollner said. ‘This would provide a low-cost, chemical-free and convenient way to sanitize public, retail, personal, and medical spaces,’ he further said. For the moment, however, it is a game of patience, as Zollner and colleagues wait out the pandemic. Research at UC Santa Barbara has slowed to a trickle to minimize person-to-person contact. ‘Our next step, once research activities resume at UCSB, is to continue our work on improving our AlGa_N/SiC platform to hopefully produce the world’s most efficient UV-C light emitters,’ he said. ■

Source: www.sciencedaily.com

Acknowledging Our Biodiverse World

Possible Links Between Biodiversity, Deforestation, and Pandemics

How much have we, the human race, neglected our biodiverse world? In this thought-provoking piece, **Dr Rina Mukherji** discusses the need to recognize the various ways in which our ecological diversity can be saved against exploitative anthropogenic activities, outbreaks and pandemics related to the emergence of deadly viruses, and more.



Biodiversity, also known as biological diversity, is the variety of life on earth found across different levels of biological organization.

Our biodiversity encompasses the following components:

- Species diversity is defined as the abundance of different species in any location. This takes into account both the richness and relative abundance of species in a particular area/region.
- Genetic diversity refers to the variation in genetic material found within a single species or population. For instance, genetic diversity is the variation in genes that encode for hair colour in humans.
- Ecological diversity refers to the varied ecosystems within a region or the variation in ecosystems all over the planet. Ecological diversity can also take into account the number of different niches, trophic levels, and other ecological processes. Globally, ecological diversity comprises the varied ecosystems such as forests, deserts, grasslands, wetlands, and oceans.

Why Is Biodiversity Important?

Humankind is part of an ecosystem, made of several biota, or ecosystems that guarantee our well-being. The biodiversity of our planet ensures we have enough to eat, drink, and lead a healthy, happy life. Many plant species that are the primary producers in the food chain provide us food and medicines, thereby helping us thrive on this planet. Our forests maintain groundwater levels that in turn nurture the quality of soil, and balance the right temperature to keep the planet habitable, besides ensuring adequate precipitation to sustain life. Removing even a single living being—be it an insect, a reptile or a mammal—from this chain can lead to an ecological disaster.

Forests are rich repositories of genetic diversity in the form of flora and fauna. The importance of biodiversity was realized only too well by our ancestors. That is why, ancient civilizations, particularly in India, emphasized on imparting respect to our wealth of flora and fauna. Rituals involving the worship of tulsi (basil) plant, vat (banyan) tree, including planting of neem trees in villages, distribution of jaggery on neem leaves to mark the new year (during Gudi Padwa in Maharashtra), or even celebrating the Naraka Chaturdashi on Diwali with traditional consumption of green vegetables.

Our harvest festivals celebrated the significance of flora and fauna and such festivals acknowledged the role played by them in providing sustenance and keeping us healthy. Forests, as repositories of biodiversity, would be showered with love and care. Hermitages presided over by venerable sages were considered instrumental in conserving floral and faunal biodiversity.

However, the discipline and regard for nature have been overcome by our greed in recent times. It has led to extreme exploitation of many floral species, and made us destroy wildlife habitats. For instance, the uncontrolled accumulation of medicinal plants for Ayurvedic herbal formulations has caused the near-extinction of many species, rendering several as critically endangered. In India, the government was therefore, compelled to issue a standardized set of rules to be followed in the matter of usage of medicinal plants.

Besides economic considerations, there is a scientific aspect to the role of forests, since forests define ecosystems. Deforestation can transform whole ecosystems, and affect disease transmission in various ways. Deforestation results in loss of habitat for living creatures and brings them in

close contact with humans. There are a number of pathogens, and vectors that have a benign existence in the guts of birds and wild mammals. But the moment we come in close contact with wild animals, these pathogens and vectors enter the human body. As a result, they end up mutating into deadly forms, causing death and disaster, as evident in the past outbreaks of the Ebola, Nipah and other viruses.

When such 'spillover' events happen frequently enough, animal microbes begin to adapt to our bodies and eventually evolve into human pathogens. Similarly, avian influenza viruses, which originate in the bodies of wild waterfowl, rampage in factory farms packed

with captive chickens, mutating and becoming more virulent. The H5N1 strain, for example, kills more than half of the infected population.

This happens because when forests are cleared up, many forest-dwelling species are rendered homeless. These creatures then seek refuge on trees in our backyards, or in wooded parts of the villages, putting human health at risk, especially when they come in contact with the food we consume. Consequently, pandemics start occurring at regular intervals, endangering populations all over the world.

Pandemics and Beyond

The first pandemic in the modern age was the Spanish flu of 1918, which killed thousands during World War I. Decades later, we had to contend with the 2008–2010 swine flu pandemic, where for the first time, the World Health Organization had to declare a 'public health emergency of international concern.' During 2013–2016, we had to deal with the Ebola outbreak that began in West Africa and spread to many parts of the world. There have been epidemics caused by the Zika virus in South America, and the Nipah virus in South and Southeast Asia, affecting many, and killing a few. But none have matched the scale and monstrosity of the current coronavirus (COVID-19) pandemic. As indicated in a recent report by the Intergovernmental Science-Policy



Platform on Biodiversity and Ecosystem Services (IPBES), such zoonotic diseases provide evidence of the link between us and our ecosystem, our forests and biodiversity, and climate change. While pointing out that about 1 million of the 8 million known species are endangered, even as about 6 million hectares of forests have disappeared worldwide every year since 2000, the report has cautioned that if greenhouse gas emissions are not drastically reduced, and if the increase in global average temperature is more than 1.5 degrees Celsius above pre-industrial levels, then a virus more contagious than corona could emerge, thereby putting human race to greater danger and health risk.

Loss of Forest Cover and Zoonotic Diseases

The link between deforestation and pandemics emerges more clearly when

specifics are delved into and examined. According to the World Bank, between 1990 and 2016, the world lost 1.3 million km² of forests. As per a 2015 study published in *Nature*, 17 per cent of the Amazonian rainforests in Brazil were destroyed over the past 50 years, and losses continue to be on the rise. The Amazonian rainforests cover a total of 800 million hectares, while the Congolese rainforests cover 300 million hectares, and account for a major part of global forest cover. In the Democratic Republic of the Congo (DRC), between 1990 and 2015, every year saw 0.20 per cent deforestation of its rainforests, amounting to an eventual loss of 311,000 hectares of forest cover. Is it any surprise that two of the deadliest viruses—Ebola and Zika—emerged in these regions of the world?

Ebola, which first made its appearance in the DRC and South Sudan, was associated with bats and found likelier to

occur in Central and West Africa, where deforestation has taken place in recent times. Most of us are aware that the HIV virus spread after Belgian colonizers established large-scale plantations and railroads, and promoted urbanization in Kinshasa—the capital of the DRC. Here, clearing of forests meant illegal felling of trees, increased removal of wood, and poaching for bushmeat, thereby resulting in huge loss of biodiversity.

As per an article published in *Science Advances* titled, 'Congo Basin forest loss dominated by increasing smallholder clearing,' annual rates of small-scale clearing for agriculture in primary forests and woodlands doubled between 2000 and 2014, mirroring increased population growth. While smallholder clearing in the DRC was responsible for two-thirds of total forest loss in the basin, selective logging contributed to 10 per cent of the gross disturbance in the region. This has translated into habitat



loss for the mountain gorilla and the okapi (mountain goat) both of which are native to these parts.

As for the loss of Amazonian rainforests, the first warning came in the 1990s from Amy Vittor, Assistant Professor of Medicine, University of Florida, who, while researching the link between deforestation and spread of malaria in the Peruvian Amazon, found that clearing of forests for agricultural purposes increases sunlight exposure and disrupts small streams. This further creates pools of warm water perfect for mosquito breeding. Since such deforestation activities cause lands to become infertile and farming unsustainable, people abandon such lands, resulting in shrubbery to take over, which is conducive to mosquito breeding. Vittor's subsequent research proved that the malaria-carrying mosquito species (*Anopheles darlingi*) in a deforested area of Peru bit 278 times more frequently than the same species in an untouched forest.

The analysis of data compiled from published field studies for 87 mosquito species from 12 countries revealed that about half of the species (52.9 per cent) were associated with deforested

habitats. Of these species favoured by deforestation, a much larger percentage (56.5 per cent) are confirmed vectors of human pathogens. Moreover, species that serve as vectors of multiple human pathogens were all favoured by deforestation, including several *Anopheles*, *Aedes*, and *Culex* species. In one region, after a road was built into a pristine forest and people began clearing the land for agriculture, malaria cases rose from 600 to 120,000 per year (Sources: doi.org and www.ncbi.nlm.nih.gov)

The Zika virus, the cause of birth defects in Brazil, is another example. It emerged in mosquitoes in the Zika forests of Uganda in the 1940s, but there were only a few human cases until 2007. *Aedes aegypti*, the mosquito species that carries Zika and many other diseases, first spread to Asia where it likely mutated, and consequently gained a foothold in the Brazilian Amazon. The mosquitoes carrying the disease flourished in much warmer places such as Recife, a Zika hotspot and a city that had its hottest three months on record late last year. Deforestation contributed to the worst drought in Brazil, which led to more people storing water in

open containers, contributing to a rise in mosquito population. Besides, when temperatures go up, mosquitoes require more blood and they bite more.

Similarly, Ebola first emerged in the DRC in Central Africa, and moved into Sierra Leone and Liberia in West Africa, where deforestation had taken its toll over the years. While the DRC has undergone considerable deforestation over the years, the rates of deforestation have been particularly sharp in Sierra Leone and Liberia, owing to civil war, logging, poaching, and demand for bushmeat.

Liberia, for instance, is a sorry case. According to the Food and Agriculture Organization (FAO) of the United Nations, between 1990 and 2010, Liberia lost an average of 30,000 hectares or 0.61 per cent of forest cover per year. Thus, a total of 12.2 per cent of its forest cover, amounting to 600,000 hectares was lost between 1990 and 2010. Liberia is home to 881 known species of amphibians, birds, mammals, and reptiles (according to figures from the World Conservation Monitoring Centre), of which 0.8 per cent are endemic. Presently, 4.2 per cent of its species remain threatened, despite 1.3 per cent being protected.





outbreaks, as in the case of the Nipah virus, which first made its appearance in Bangladesh, followed by an outbreak leaving many dead in Kerala, a similar trend is noticeable. According to a study titled, 'Deforestation in Kerala over a quarter century (1993–2017) and the outbreak of Nipah virus: an analysis using remote sensing technology and GIS approach' by Bedanga Talukdar et al. (published in March 2019), habitat change negatively impacts ecological integrity and biodiversity by disrupting the food web structure of the 'flying fox' (*Pteropus*). The extraction of food resources results in nutritional and

In Sierra Leone, a 2015 study titled, 'War and Deforestation in Sierra Leone' by Robin Burgess et al. (Source: iopscience.iop.org) found that the average secondary forest cover dropped from 47.2 to 37.6 per cent between 1990 and 2000, although the primary forest cover remained constant at 20.3 per cent during the civil war period. Besides, out of a total of 151 chiefdoms, 98 chiefdoms lost cover.

Apart from such pandemics, if we were to look into comparatively smaller



psychological stress for bats, bringing them closer to human habitation. Hence, it increases the chances of transmission of the Nipah virus, with bats' exposure to food consumed by humans. Satellite data used for the study showed that the four districts in Kerala, namely, Wayanad, Kozhikode, Malappuram, and Kannur, that were ravaged by Nipah in 2018 had undergone a decline of 203,939 hectares of forest cover during 1993–2017, which amounted to 27 per cent loss in the affected area.



Habitat Destruction of Natural Predators

Deforestation results in habitat destruction leading to disastrous effects. In the US, for instance, expansion of suburban areas into the forests has driven out opossums, which are natural predators of ticks, leading to the spread of Lyme disease, which first made its appearance in 1975. Similarly, the decline of bird populations in North America due to habitat loss has contributed to the spread of the West Nile virus, the carrier of which are migratory birds.

Wildlife Trade and Demand for Bushmeat

An important aspect of the spread of zoonotic diseases is the demand for and consumption of the meat of wild animals for 'medicinal' purposes and as delicacies, especially in Southeast Asian and East Asian countries. (Source: www.traffic.org). These include seahorses, pangolins, bats, and a plethora of other wild animals.

Illegal wildlife trafficking is currently the fourth most lucrative transnational crime. This industry is valued at up to US\$23 billion a year. The United Nations Office of Drugs and Crime (UNODC) has described illegal wildlife trafficking as a transnational organized environmental crime which drives species to extinction. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) entered into force on July 1, 1975. More than 30,000 species of fauna and flora are protected under this Convention. Interestingly, all 10 members of the Association of Southeast Asian Nations (ASEAN) are the signatories.

In 2005, a Regional Action Plan on Trade in Wild Fauna and Flora or ASEAN Wildlife Enforcement Network

(ASEAN-WEN) was launched as a regional intergovernmental law-enforcement network to combat illegal international trade in endangered flora and fauna in the region. Additionally, the World Wildlife Fund (WWF) and the International Union for Conservation of Nature (IUCN) also collaborated with TRAFFIC, a wildlife trade monitoring network for conservation of biodiversity and sustainable trade in species. Conserving our biodiversity holds key to the future of humankind. It is about time we all acknowledged this universal truth and came together to defeat the virus. ■

Dr Rina Mukherji is an independent journalist with more than 25 years of experience. She holds a doctorate in African Studies and has several media and academic awards to her credit.

Altering Lives, the Green Way

Mobile kitchens launched in a certain civic body in Kerala, have helped women gain employment and connected families. Moreover, steered by electric vehicles that are powered by solar energy, makes them a clean venture. **Georgekutty Kariyanapally**, the man who initiated the move, tells **Sapna Gopal** (in an exclusive interview for *TerraGreen*) that this is just the beginning of a huge paradigm shift.

What prompted the launch of mobile kitchens? What was the driving force behind this initiative?

When my domestic help fell sick, she sent her daughter to work for us. Through my wife, I came to know that she (our domestic help's daughter) is a commerce graduate. I was saddened that despite being a graduate, she had no source of employment. Since I am a dealer of electric vehicles (EVs), I had designed a stainless steel kitchen with facilities such

as a *banmarie* (to keep food warm as is done in star hotels), a *dosa* plate/burner, a *paratha* and a chapati desk fitted on my EV and created a concept called 'food on electric wheels'.

When councillors from the Kalamassery municipality (in Kerala) visited my showroom, they decided to put the idea to good use. Furthermore, they accepted my proposal of providing an alternate living to street vendors, since this would mean clearing pathways in the

city without a problem (this is because most pathways are occupied by street vendors). Till date, we have supplied nine vehicles to Kudumbashree members with financial support from Bank of India.

In which part of Kerala was this initiative launched? How has the response been?

Cochin is a metropolitan city, whereas Kalamassery is a nearby municipality enjoying all the benefits of a modern



city. Usually, the street vendors start their business by 6 p.m., mostly to cater to office goers who leave their workplace by around 7 p.m. to 8 p.m. While going back, they are hungry and need a small bite while waiting for their bus or train or even while riding back home. This gives an opportunity for the roadside food stall business to thrive. One of our beneficiaries jokingly told me that she had no time to quarrel with her husband since they both were busy in preparing their vehicle, equipping it with pre-cooked food and driving it to the city junction to start their business.

Which are the other districts where this initiative is likely to be launched? Have you got inquiries from government bodies and private organizations outside Kerala as well?

We do have inquiries from various municipalities and city corporations. Kudumbashree is an organization spread all over Kerala in almost 14 districts. Major cities such as Cochin, Calicut, Trichur, Kottayam, Kollam,



Thiruvananthapuram, Palghat have a population of above 5 lakh and most of it is moving population. Just like Mumbai and Delhi, cities in South Indian states have also inculcated a culture of eating from street vendors, more so by office goers and shop owners in these cities.

How have families and women benefited from this venture?

Indeed, there has been a paradigm change that I have witnessed in their lifestyle—this is what I see when I go to conduct classes or to evaluate their financial stability. Being a businessman, I feel I am serving the society and local community by guiding them to establish their MSME model eatery. The entire family is involved in preparing food and its sale thereafter, while the extra food is consumed by the family members as their dinner. This has helped in the eradication of poverty and malnutrition in a family. Children are also keen to help their parents because they will also get pocket money for their daily expenses. When the woman is earning and has a control on the finances, it means the family is financially safe. This is because women spend judiciously whereas men end up spending it on liquor, often forgetting about their children in the

process. I am happy that all these nine families now live in great satisfaction and happiness. It is essentially a self-employment venture by an unemployed woman to find her dignity—where the husband and children are partners as well. It is also a training ground for their children and will enable them to survive.

How do you prepare women and their families for this venture?

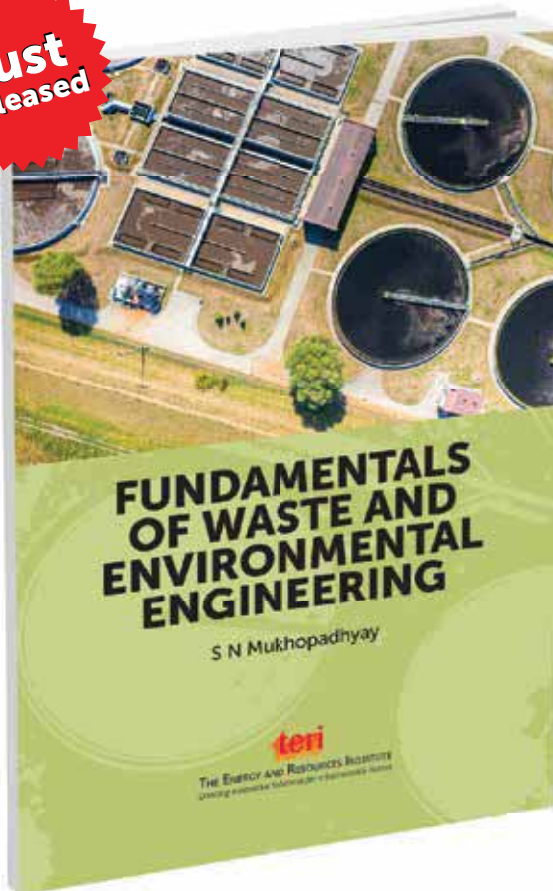
Municipality councillors find the beneficiaries—those struggling to feed and educate their children. Then, we call all of them to the municipality office and explain about our 'Food on Wheel' project. Once they fill the NULM application form, we help them raise ₹20,000 to deposit in the bank as their first contribution to this ₹330,000 project. The bank pays us the total amount and this money is used to equip the vehicle—it helps cover the cost of the battery, the solar unit, utensils, and stainless-steel kitchen units. We then call the beneficiaries to attend training classes and execute this project in a successful manner. ■

Sapna Gopal is an independent writer on environmental concerns and renewable energy. She can be reached on sapnagopalmd@gmail.com.



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Impact of Coronavirus on the Indian Energy Sector

The Short-term and Long-term Impacts

The coronavirus pandemic has caused a radical slowing of economic activity across India, as industries scale-back production, employees work from home, and communities enter lockdown. As a result, we have seen significant impacts on the Indian energy sector. In this article, **Will Hall** covers both the short-term implications of the response to COVID-19 on the energy sector, as well as some of the possible longer-term impacts that are yet to materialize.





The first case of coronavirus was reported in China towards the end of November 2019. Soon after, the Chinese Government locked down the most affected areas, as a domino effect of lockdown measures was felt in other countries. India entered lockdown on March 25, 2020 which has now been extended till May 17, 2020.

Most estimates suggest that the pandemic will last until beyond the summer of 2020, resulting in an immediate impact on the economy and energy system lasting several months.

Short-term Impacts

Over the course of the lockdown, we have seen significant impacts on the energy system and the energy sector more broadly. In the months to come, we are likely to see reductions in all major fuel use, as a result of the restrictions. An overview of fuel use by sector (Table 1) illustrates how consumption is likely to fall across the economy, apart from the residential sector. As individuals spend a greater share of their time at home, domestic electricity and gas use is likely to increase, as a result of lighting, cooking, and appliances.

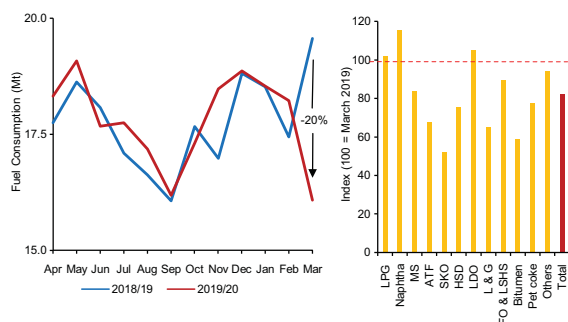
Table 1: Impact on fuel demands by sector

	Transport	Industry	Commercial	Residential	Agriculture
Oil	↓	↓	NA	NA	↓
Coal	NA	↓	NA	NA	NA
Gas	↓	↓	↓	↑	↓
Electricity	↓	↓	↓	↑	↓

Source: TERI analysis. Red arrow = decrease in demand; green arrow = increase in demand; NA = largely non-applicable

Most obviously, the travel restrictions have meant that there has been a significant reduction in the use of public and private transport. As a result, fuel demand for transport has dropped significantly. Compared to March 2019, the total consumption of petroleum products has dropped by nearly 20 per cent for March 2020. Within these products, we can see that demand for aviation turbine fuel for aeroplanes has dropped by over 30 per cent and the range of fuels used for road transport have all fallen between 20 per cent and 30 per cent (Figure 1). Were we to have data just showing the period since lockdown, we can expect the difference to be much greater.

Figure 1: Consumption of petroleum products, 2018/19 versus 2019/20



Source: TERI analysis based on (PPAC, 2020). LPG = liquefied petroleum gas, MS = motor spirit, ATF = aviation turbine fuel, SKO = superior kerosene oil, HSD = high-speed diesel, LDO = light diesel oil, L&G = lubricants and greases, FO & LSHS = furnace oil and low-sulphur heavy stock

Within industry, we are also likely to see significant reductions in output, as facilities close and demand for products reduces. Taking the cement sector as an example, with the construction industry coming to a halt, demand for cement is likely to contract sharply in the coming months. CRISIL research estimates that this could see a demand reduction of 10–25 per cent over the course of this year, depending on the length of the lockdown and the severity of the outbreak. This will cause significant reductions in the amount of coal,

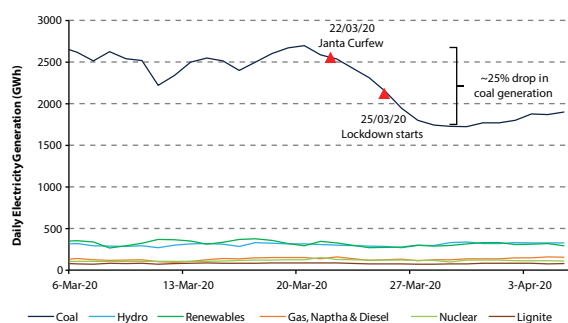


and other raw materials, being demanded. In terms of electricity demand, whilst the continuous occupation of homes by its occupants has had a large impact on residential consumption, this has not been large enough to offset the opposing reductions from the rest of the economy. There has also been a significant drop-off in industrial and commercial electricity consumption, with employees working from home or restricted from entering their usual places of work. Since the start of lockdown, total electricity demand is around 25 per cent lower than the same period last year.



In terms of electricity generation, the drop in demand has impacted coal generation the most. As renewables enjoy 'must-run' status on the Indian electricity grid, a result of their zero marginal cost of generation, they have continued to generate as normal, forcing coal generation to drop further. If we compare the three weeks preceding the lockdown, with the data since March 25, 2020, there has been approximately a 25 per cent drop in coal generation. This has seen coal's share of generation fall from around 73 per cent to 66 per cent, with renewables and hydro both rising from 9 per cent to 11 per cent. Figure 2 shows daily electricity generation by source in India, from March 6 to April 5, 2020.

Figure 2: Daily electricity generation by source, March 6–April 5, 2020



Source: TERI analysis based on (POSOCO, 2020). Renewables = solar, wind, biomass & others

This has resulted in a slight 'greening' of our electricity supply, with CO₂ emissions falling by just over 25 per cent during this period on a per unit basis. Whilst this won't remain the case in the months to come, once the lockdown ends and electricity demand increases, it shows the impact that energy efficiency and demand reduction measures can have on emissions in the context of the Indian generation mix.

Impact of the 'Nine-Minute Lights-Out' Event

On April 3, the Prime Minister of India, Shri Narendra Modi, requested that the nation switch off all lights for 9 minutes to show support for essential workers on the following Sunday (April 5, 2020). During this period on April 5, the electricity grid registered a drop in demand of 32 GW, or nearly 30 per cent of demand at the time. Officials were only expecting a drop of 12–14 GW given the estimated lighting demand in the country. With the final drop more than twice this estimate, it is probable that households also switched off many appliances.

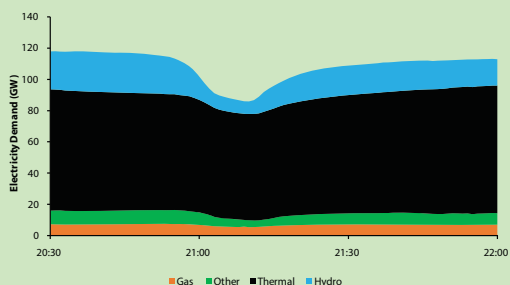
As a result, the National Load Despatch Centre had to respond quickly to the rapid change in demand, shutting down power supply where possible. As can be seen in Figure 3, around the





switch-off period of 21:00-21:09, hydroelectric sources accounted for most of the drop in generation, with thermal generation (largely coal), also providing some flexibility.

Figure 3: Electricity demand during the 'nine-minute lights-out' event



Source: TERI analysis based on (POSOCO, 2020)

This was a particularly extraordinary case of a change in demand, but it highlights the technical ability of the electricity grid to manage large swings. Whilst the measures taken are a result of significant efforts from the grid operator to manage the event smoothly, it shows that

the Indian electricity grid can integrate a large amount of variability. Going forward, as India increases renewable deployment, a greater share of its electricity supply will come from variable sources, which can change at short notice. Learning from events such as these will be important as India pursues the most cost-effective path to further decarbonization of the power sector.

As a result of many of these shorter-term impacts, one of the most widely cited positives, is the resulting effect the reduction in fuel use is having on air pollution. The Central Pollution Control Board (CPCB) recorded data for Delhi on the day of the 'Janta Curfew' (March 22), comparing it with the days prior. The reduction in the number of on-road vehicles, as well as the reduction in industrial activity, contributed to a 51 per cent reduction in nitrous oxide levels on this day. Whilst there are other meteorological factors that also played a small role, this analysis gives an idea of the air quality benefits of reducing fuel combustion in metro areas, something which may be achievable in future with a shift to cleaner forms of mobility (such as electric vehicles, cycling, and walking).



Long-term Impacts

Whilst it is difficult to know the longer-term impacts of the coronavirus pandemic on the Indian energy system, a few impacts look likely.

Most importantly, it is likely that there will be a longer lasting economic impact, instigated by the coronavirus, which may result in a recession. In the case of an economic recession, demand for key fuels will remain lower than they would have been otherwise, as economic activity is limited. In relation to an economic recession, we may also see negative effects on the availability of finance to supply capital-intensive energy projects. Renewables, for example, rely on significant levels of capital, paying back over a number of years. If the government is to meet its ambitious target of 450 GW of renewables, then measures may have to be taken to provide sufficient capital.



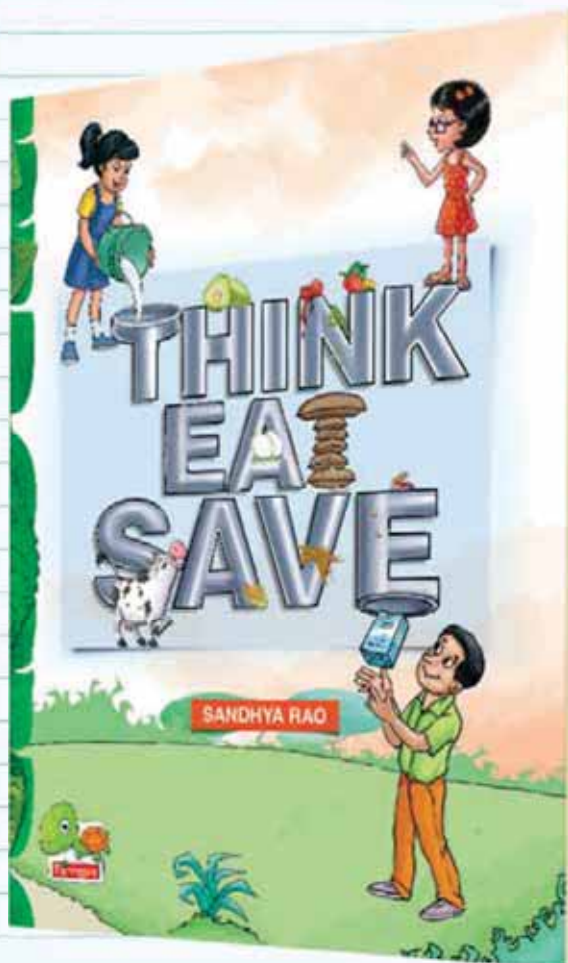
An impact that we are already seeing as a result of the restrictions between countries, is the limits placed on the trade of certain goods. Up to 3 GW of solar projects have been delayed as a result of trade restrictions on goods coming out of China. With international travel currently limited and potential slowing of economies, there may be negative impacts on supply chains that are important for the energy industry, again impacting the rate at which clean energy projects can be deployed.

Nonetheless, some of the changes we see today could result in positive impacts for the energy system and a transition to a greener way of living. Companies and their employees are familiarizing themselves with remote working arrangements, which if retained to some extent, would reduce the amount of travel and the energy used in commercial buildings. Moreover, metro areas are witnessing the benefits of reduced fossil fuel combustion on the local air quality, which have provided communities with a glimpse of the future, if they are to pursue cleaner forms of transport.

The coronavirus outbreak and resulting lockdown undoubtedly represents a significant shock to India's energy system and an even greater shock to our normal way of lives. Nevertheless, during this time, there are important lessons that we can learn, which have the potential to help us as we plan for a greener way of living. ■

Will Hall is Associate Fellow, Industrial Energy Efficiency Division, TERI, New Delhi.

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Malnutrition and Susceptibility to Viral Infections

Role of Traditional Indian Medicine to Boost Immunity

In this article, **Vaishnavi Barthwal, Roshni George, and Dr Anjali Parasnis** try to understand the relationship between malnutrition and susceptibility to viral infections, especially among young children in India. They also discuss the role of traditional Indian medicine to boost the immunity and curing viral infections. During the present COVID-19 crisis, the Ministry of AYUSH, Government of India has issued an advisory to the states suggesting ‘add-on traditional medicine interventions to conventional care’.

The whole world is currently reeling under the impact of a pandemic, a viral infection caused by the COVID-19 or more commonly known as the coronavirus infection. Infected persons usually show respiratory or flu-like symptoms such as cough, fever, shortness of breath, and so on, within 2–14 days after exposure to the virus. The good news is that most patients usually experience mild to moderate severity of the illness and recover without requiring special treatment. However, older patients and patients with pre-existing medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to manifest serious symptoms and the disease may even prove fatal. The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes. As there are no specific vaccines or treatments available currently, the only ways to reduce the spread of the disease are practising respiratory etiquette, observing social distancing, maintaining hygiene, washing hands thoroughly, and so on.

As researchers around the world desperately try to develop the vaccine for the infection and develop the prophylaxis for it, governments have been working on a war footing to control the spread of the virus and minimize the number of fatalities resulting from it. Although too early to confirm, the virus shares certain similarities with other virus strains such as severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome coronavirus (MERS-CoV). As scientists are still working on the exact nature of the similarities, certain common precautionary measures have been advised to the general public.

However, it would be noteworthy to assess the status of malnutrition and susceptibility to viral infections through the lens of other similar viral diseases/epidemic/endemic case studies. As the COVID-19 is a newly discovered virus, confirmed information available about



the virus is limited; a study of similar experiences with previous episodes of infections would help develop possible measures to ensure preparedness for the future.

Malnutrition and Immunodeficiency

Malnutrition is a major factor responsible for increased morbidity and mortality burden in a population. Malnutrition usually results from disordered nutrient assimilation or recurrent infections and chronic inflammation, which could be the result of an underlying immune defect. Studies have shown that immune dysfunction can be both a cause and a consequence of malnutrition. Immune dysfunction can directly drive pathological processes in malnutrition, including mal-absorption, increased metabolic demand, dysregulation of the growth hormone, and greater susceptibility to infection.

Malnutrition is not just a result of inadequate food intake but also improper nutrient intake and poor diets leading to consequences such as obesity and diabetes. Characterizing pathogenesis across the spectrum of malnutrition is essential to underpin novel therapeutic approaches to support international goals to improve nutrition, health, and well-being. Even common infections could be fatal to undernourished children implying that mortality is related to underlying immunodeficiency even in mild forms of undernutrition. Infections are also more common and more severe in people with obesity. Immune dysfunction can also arise before birth via developmental pathways, compounded by environmental and behavioural factors, particularly those experienced during early life.

Co-relation Between Micronutrient Deficiencies and Susceptibility to Infections

Malnutrition can be a consequence of energy deficit (protein-energy malnutrition or PEM) or a micronutrient deficiency and in both cases is still a major burden in developing countries and is considered the most relevant risk factor for illness and death, affecting particularly hundreds of millions of pregnant women and young children.

A seemingly healthy child might also be more susceptible to viruses if suffering from micronutrient deficiencies which often go unnoticed. Together, infections and micronutrient deficiencies can induce immunodeficiency in otherwise healthy children, increasing their susceptibility to viral infections as well as other ailments. A sick person's nutritional status is further aggravated by diarrhoea, mal-absorption, loss of appetite, diversion of nutrients for immune response, and so on, all of which lead to nutrient losses and further hinder the body's defence mechanisms, with fever also increasing both energy and micronutrient requirements. Malnutrition thus magnifies the effect of disease and vice versa.

Malnutrition is the leading cause of immunodeficiency in human beings. Multiple studies have proven that the immune system cannot function optimally if malnutrition is present.¹ There is a direct relationship between malnutrition and immunodeficiency as reflected through the susceptibility to infections caused by influenza and Zika viruses.

¹ <https://www.longdom.org/open-access/protein-energy-malnutrition-and-susceptibility-to-viral-infections-as-zika-and-influenza-viruses-2155-9600-1000489.pdf>



Case Study 1

Vitamin A helps maintain the integrity of the epithelium in the respiratory and gastrointestinal tracts and its deficiency increases the risk of diarrhoea, *Plasmodium falciparum* malaria, measles, and overall mortality. Measles, estimated to kill 2 million children per year, is closely linked to Vitamin A deficiency. The children who are already deficient in vitamin A are at a much greater risk of dying from measles. Thus, vaccination against measles often includes a high dose of vitamin A. Furthermore, measles also depletes the body's supply of vitamin A and is likely to aggravate any other existing nutritional deficiencies. Studies have shown that Vitamin A deficiency also increases the risk of developing respiratory diseases.²

Alarming, according to World Health Organization (WHO) an estimated 250 million preschool children are vitamin A deficient and it is likely that in vitamin A deficient areas a substantial proportion of pregnant women are vitamin A deficient.³

² <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6164133/>

³ <https://www.who.int/nutrition/topics/vad/en>

Case Study 2

Zika virus or the Zika fever causing virus, is an arthropod-borne viral disease, first discovered in Uganda in the late 1940s. Zika virus transmitted to people through the bite of the infected mosquitoes belonging to the *Aedes* species.

It was found that the virus first spread rapidly in the countries that suffered from high rates of malnutrition that was a result of energy deficit (protein-energy malnutrition) or a micronutrient deficiency. In 2007, the first documented outbreak of Zika virus disease was reported in Yap State, Federated States of Micronesia when about 73 per cent of the population below 3 years of age was estimated to have been infected.⁴ Subsequent outbreaks occurred in Southeast Asia and the Western Pacific. The virus spread to different regions of Africa and Southeast Asia, in addition to diverse Pacific Islands, South America, and the Caribbean.

⁴ https://www.who.int/docs/default-source/coronaviruse/who-rights-roles-respon-hw-covid-19.pdf?sfvrsn=bcabd401_0



Recommendations

1. Use of government mechanisms such as the Public Distribution System (PDS), Mid-day meal, and the Integrated Child Development System (ICDS) for the distribution of vitamin supplements, especially to the most vulnerable populations.
2. An extensive public awareness campaign implemented to generate awareness regarding the significance of sanitary hygienic practices to prevent the spread of the coronavirus was successfully carried out by the Indian Government, media, public figures, and so on. A similar outreach programme enlightening the public regarding the significance of good nutrition to improve immunity against the virus could also greatly help strengthen the fight against the spread of the infection.
3. The learnings from the current outbreak of the coronavirus should be used to tackle similar situations in the future by increasing our preparedness for the same, especially with respect to measures by the government (rapid testing, early detention and isolation, sufficient medical equipment, and so on) and the citizens (increasing personal immunity, improving the nutritional quality of available food, personal hygiene, and so on).

Nutritional Security as the First Line of Defence

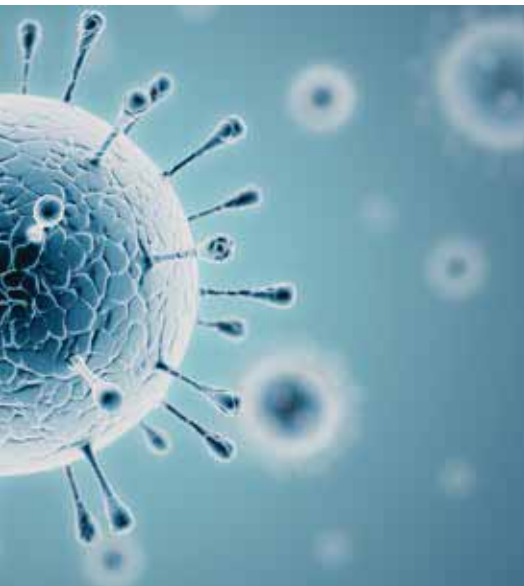
A malnourished person has more severe disease episodes, more complications, and spends more time ill for each episode. Thus, malnutrition and the susceptibility of a person to infectious diseases is not only closely linked but is also a vicious cycle of

infection, reduced immunity, and deteriorating nutritional status leading to consequences such as impaired child development, compromised immunity leading to infections and diseases, reduced productivity, poverty, impaired development of education and health system and socio-economic and political instability.

Role of Traditional Indian Medicine to Boost Immunity and Curing Viral Infections

Developing novel antiviral drugs is always an important on-going process. Traditional medicines using natural ingredients offer unique opportunities to explore medicines and its active principles. For example, the recent outbreak and spread of COVID-19 has led to research and development for vaccines and medicines to tackle the fast-spreading pandemic. Further, the on-going treatment is a hit and miss trial of numerous drugs being administered. These drugs are mainly effective only to reduce or cure certain symptoms rather than the viral infection. While the antiviral drugs and vaccines are being developed, the traditional systems focus more on building the immunity of the body and providing a holistic solution for the well-being of an individual as a coordinated strategy. The antiviral drugs are often very specific and can not only prevent infection but also treat illnesses.

In India too, the Ministry of AYUSH (Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy), Government of India, has issued an



Box 1: Self-care immunity boosting measures for COVID-19 by the Ministry of AYUSH, Government of India

- Drink warm water throughout the day
- Once a day inhale steam infused with mint leaves or caraway seeds (*ajwain*)
- Practice Yoga, Pranayama, and meditation
- Include spices, such as turmeric, coriander, cumin, and garlic in daily diet
- Once or twice a day drink herbal tea/kadha made using basil (*tulsi*), cinnamon (*dalchini*), black pepper, dry ginger, *munakka* (raisin), and jaggery or lemon juice
- Drink milk with turmeric powder (half teaspoon in 150 ml hot milk) once or twice a day
- Use 1 table spoon of sesame or coconut oil to swish in the mouth for 2 to 3 minutes, spit it off, and rinse the mouth with warm water

Read more at: <http://ayush.gov.in/event/ayurveda-immunity-boosting-measures-self-care-during-covid-19-crisis>

advisory to the states suggesting 'add-on traditional medicine interventions to conventional care'. It has also listed 40 national and international research papers that highlight the importance of traditional medicines. The traditional Indian medicine system—Ayurveda was developed around 2000 years ago and relies heavily on herbal medicinal products (HMPs). Approximately 80 per cent of India's population use Ayurveda in some form or another, through more than one-half million Ayurvedic practitioners.

Ayurveda also focuses on lifestyle practices and immunity for cure and prevention of diseases. For instance, consuming tea fortified with five Ayurvedic herbs, namely *Ocimum sanctum* (tulsi), *Glycyrrhiza glabra* (liquorice), *Withania somnifera* (Ashwagandha), *Zingiber officinale* (ginger), and *Elettaria cardamomum* (cardamom) is found to enhance innate immunity of the body. Similarly, herbs like *Ocimum basilicum*, *Allium sativum* (Garlic), *Embellica officinalis* (Indian Gooseberry), *Aloe vera* and Camphor and Eucalyptus oil have shown success in building immunity against the H1N1 virus and relieving swine flu symptoms.

Broad spectrum antiviral properties have been reported for plants such as *Taraxacum officinale* (Common Dandelion), *Allium fistulosum* (Welsh

Onion), *Ocimum basilicum*, and *Embellica officinalis*. Thus, in view of the current scenario of the COVID-19 pandemic, the Ministry of AYUSH, Government of India, has also issued a list of self-care immunity boosting measures (Box 1).

It may be argued that these systems do take longer time to cure as compared to modern medicines, but usually have the advantage of lesser side effects and cost effectiveness. Along with modern medicine, these systems could also be explored as a potential treatment/prevention for COVID-19.

The review of literature suggests that the traditional medicine system has the potential to cure and prevent infectious diseases. However, there is a need to strengthen and standardize the treatments while using traditional medicines. Further, the use of these traditional medicines not only helps cure symptoms but also helps improve immunity and reduce the risk of infections to a great extent. The potential of these plant-based remedies for curing and preventing the COVID-19 infection must be extensively explored to develop globally acceptable therapeutic remedies along with the modern medicines and vaccines. ■

Vaishnavi Barthwal, Project Associate; Roshni George, Research Associate & Area Convenor; and Dr Anjali Parasnis, Senior Fellow & Associate Director, NSEC, TERI, Mumbai.

War Against Novel Coronavirus

Weapons to Win this Battle

In this article, **Meena Sehgal** says that COVID-19 has opened new discussions on funds for the health sector, the equity in availability of resources across urban and rural India and their adequacy within the communities. She wonders whether the new world order of protective and preventive action would last beyond the virulence of COVID-19 and feels that pivotal change, required, would be a marked increase in public expenditure on health as percentage of GDP.

The number of novel coronavirus cases and deaths around the globe continue to shock us. The national preparedness or rather the lack of it haunts us. It is a concern, because we have a population of 1.3 billion in India, it is a bigger concern because nearly 900 million Indians live in 2 rooms or less, it is a still bigger concern because 15 lakh huddle up in the metro rail every day in a metropolitan city like Delhi.

Apparently healthy people could be carriers of the disease and this may prove lethal to their loved ones. The virus has no treatment, and the major weapons

are quarantine and social distancing. The rapidly emerging knowledge from across the globe, informs us that being older, already suffering from a disease, puts a person at higher risk for the worst symptoms.

The crisis from COVID-19 brings to fore an interesting and unprecedented community-level action. While the boon of digital connectivity has opened new vistas of information, and has filled the gap of critical information, however it has fuelled fear. Would the new world order of protective and preventive action last beyond the virulence of coronavirus 19?

COVID-19 has opened new discussions on funds for the health sector, the equity in availability of resources across urban and rural India and their adequacy within these communities. It lays bare the need for feedback loops which inform and determine on an on-going basis adequacy of the health care resources (for instance, India has a doctor: patient ratio of close to 1:10,000, as opposed to 1:1000 recommended by the WHO). This information is needed to strengthen a bottom up approach so that affordable health facilities are really 'available'.



The Legacy

In our favour, is the fact that we are a younger population (median age of 28 versus 45 in Italy, and 38 in USA), fairly compliant, and deeply sensitive people. What is against us, in India, amongst the children 36 per cent are underweight; and 58 per cent anaemic; amongst the adult women 22 per cent have low body mass index (BMI) and 53 per cent anaemic.

Rural and urban health workforce combined gives a ratio of 31.6 per 10,000 in Kerala to 1.5 for a population of 10,000 in Bihar, and 2.2 in Himachal Pradesh and Assam. The highest density of qualified allopathic doctors was in Maharashtra (8.7 per 10,000); in comparison, states such as Bihar (0.3 per 10,000) and Himachal Pradesh (0.1 per 10,000) had among the lowest densities of qualified doctors. The density of qualified nurses and midwives was highest in Kerala (18.5 per 10,000) and lowest in the states of Uttar Pradesh (0.5 per 10,000), Bihar (0.4 per 10,000), and Tripura (0.3 per 10,000). Needless to say there is inequity within the states, with better availability in urban than rural areas.

The Government of India spared just 1.28 per cent of its gross domestic product (GDP) in 2017–18 on public health with a plan to increase to 2.5 per cent of its GDP by 2025 as opposed to the global average of 6 per cent. Nearly all of this



is spent in developing a system which focuses on curing illness, and treating the diseased. Protecting public health through prevention is seldom emphasized. Surely, none of this can be a recipe for success of public health in India.

Our collective worries about preparedness are real and true for any epidemic, let alone a pandemic. Especially as it has no treatment in sight, the consequences this time could be harrowing—as the carriers could potentially roam around unaware and unsuspecting for a long time. COVID-19 is now a pandemic. The situation is complicated by the absence of definitive treatment and lack of vaccine, thus making containment of disease challenging.

The Government of India has adopted measures to control the increase of coronavirus cases. The required control measures such as behaviour change (wearing face masks, social distancing, and so on) are difficult to sustain and strict control measures (lockdown, travel ban, school closing) are not sustainable over long period of time because of associated social repercussions and financial impact on economy. Therefore, the appropriateness of these measures needs to be continuously reviewed.

The immediate need to deal with the peak will be to have testing kits, setting up of new isolation wards, including turning hospital beds into intensive care unit beds, infection prevention and control amongst essential service providers, and purchase of personal protective equipment (PPE), ventilators, and medicines, particularly for district hospitals and designated infectious disease hospitals. With the legacy of abysmally low healthcare provider to population ratios, this would be exceptionally tough in some of the states. Social distancing, lockdown, strict travel ban, contract tracking to flatten the curve are the only means to attenuate the burgeoning need for the ventilators or the required isolation beds. Needless to say patience is needed by those in lockdown.





Transition Is Required for All Viruses to Come

While we will successfully tide over this crisis, we need 4 A's in our quiver to ace this war or any other future war for protecting public health. The 4 A's would create more health care *actors* across all states, bring *agility* in the health system to respond proactively through tracking change in diseases, integrate *accountability* into the health care system to fill the gaps in health care provisions, and *attack* the disease before it gets a chance to become a public crisis, that is, prevent to flatten the burden on the health care providers for all disease linked to air, water or climate.

None of the A's is earth-shaking recommendation, or revelation. However, each needs to be considered deeply and acted upon as health crises are mostly preventable in India. Flattening the curve is required and plausible for nearly all diseases, if only we measure and track them.

Even more relevant, would be to question our practice and belief, that absence of data is absence of disease, be it effects of air pollution, or climate change. Would COVID-19 jolt us into re-aligning our priorities, in building infrastructure with ethos in protecting the people through cleaner

environment, freedom from toxic air, or contaminated water?

What Can We Learn from Our Past Experiences?

What is very apparent is that India is not shielded from disasters, whether, natural or man-made. What is uncertain is how seriously does India prepare for future threats and take action for better health protective infrastructure and policies, or puts deeper thought into tracking the healthy, and adopts transformative changes to protect its people. The 1918 influenza pandemic, showed that India had one of the largest number of deaths in any single country (10–20 million) as well as one of the highest percentage of excess deaths (4.39 per cent) in the world.

Testing times were also faced during September 1994 when plague struck Surat in Gujarat. Hospitals in a number of neighbouring cities of Surat were alerted for possible arrivals of plague-infected people. Government had to forcefully stem the exodus with the help of paramilitary forces and prevent the disease from spreading. Because the disease was diagnosed and suppressed quickly, the outbreak did not have the devastating impact originally feared, but it generated considerable anxiety worldwide. The plague outbreak is

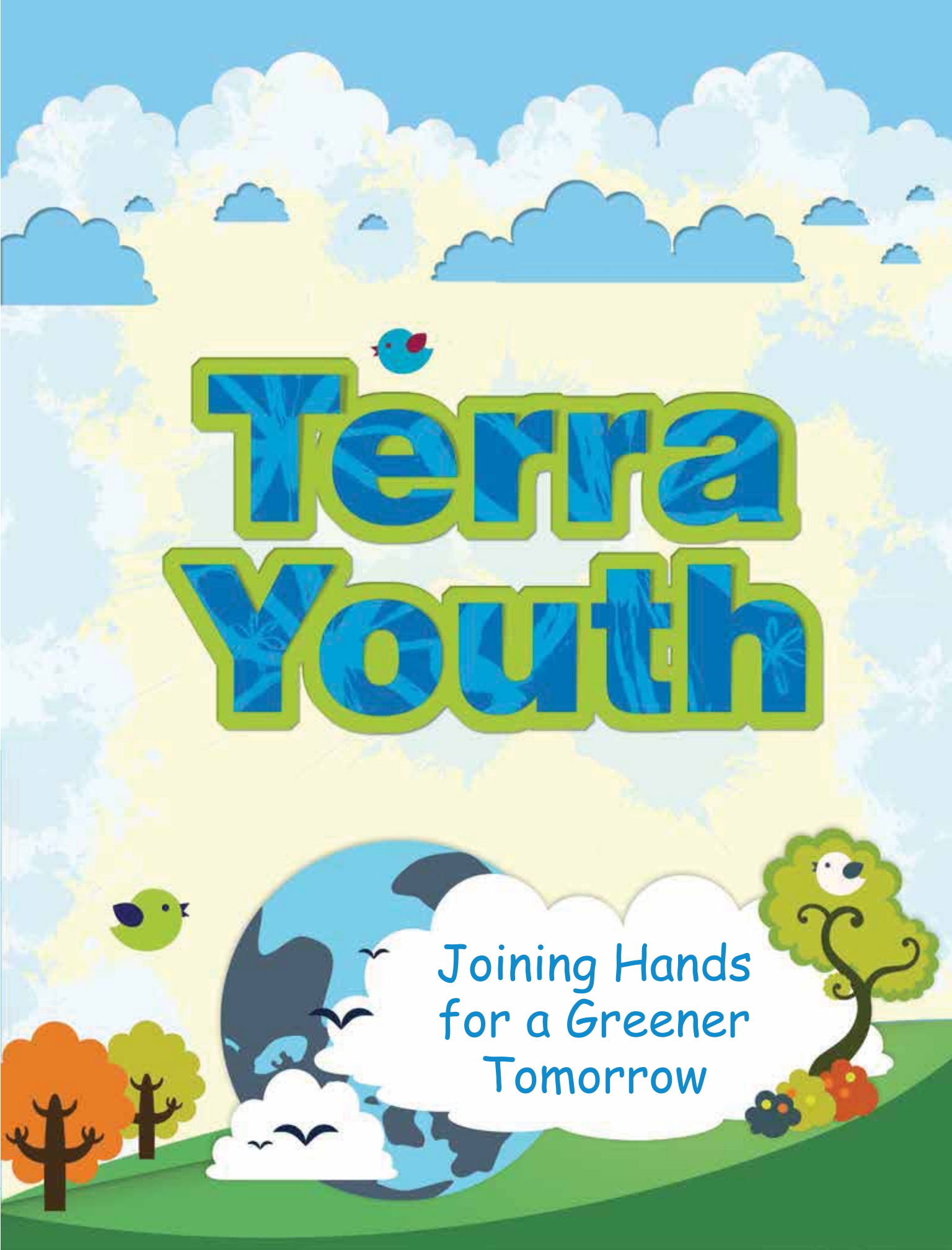
pegged to have resulted in a total business loss of over \$260 million in Surat. Since then, Surat's disease surveillance system has been ramped up, and infrastructure enhanced.

Not long ago, on October 29, 1999, a super cyclone with a wind speed of 300 mph had struck Odisha, making it probably the greatest cyclonic disaster ever recorded in the last century. Effects included a death toll of over 10,000 people, children were orphaned, people injured and livestock lost, over 13 million people were feared affected. In the aftermath of the super cyclone, the capacity of the Indian Meteorological Department was enhanced; knowledge network that includes the Indian Meteorological Department, Earth System Science Observation, the Indian Space Research Organisation, Central Water Commission, Geological Survey of India, and National Remote Sensing Centre has been created. This network is generating critical information to avert harm from future disasters.

What is uncertain is how seriously does India prepare for future threats and take action for better health protective infrastructure and policies, puts deeper thought into tracking the healthy, and adopts transformative changes to protect its people. Each disaster, has led to a better system, so would the COVID-19 crisis. Building social capital, investing in prevention, are long-term investments in people, in infrastructure for their health, building health system for sustainability networks of knowledge, would be a dream come true.

Health and economy could be so intertwined was not so easy to show until now! Impending disasters from hazardous levels of pollution, warming temperature, threatened nutrient supply linked to climate change, do not conjure up a healthy future for India. Pivotal change, required, would be a marked increase in public expenditure on health as percentage of GDP. ■

Ms Meena Sehgal, Fellow, CWM, TERI, New Delhi.



Terra Youth

Joining Hands
for a Greener
Tomorrow

A Much-needed Break for Nature

As Humans Have Slowed Down

It was 7 a.m. on day 20 of the nationwide lockdown and **Siddharth Edake** was enjoying a hot cup of tea on the balcony of his 8th floor apartment in Gurugram. On usual days, his view would comprise rows and rows of high-rise buildings that fade away into an increasingly graying horizon. But, what did he see instead that day? Read more to find out...

Today, I can see the forests of the Aravalli Biodiversity Park at the far end, under a light blue sky dotted with fluffy white clouds. The air is crisp and clear, and close to around 20 yellow-footed green pigeons locally known as *hariyal*, a rare sighting for Gurugram, are feasting on the fruits of the *shehtut* (Mulberry) tree in front of me. The sound

of traffic is replaced by the chirping of birds and the tinkling of wind chimes as they sway in the light breeze. For a nature lover and environmentalist, this is as good as it gets in a metropolitan city in India.

I can't help but think, while the world is going through a humanitarian crisis and the worst economic slowdown

since the World War II, nature is getting the much-needed break it deserved! As hundreds of countries impose various degrees of lockdowns due to the COVID-19 pandemic, industrial and human activity is at its lowest in more than a century, and nature is taking full advantage! Many global cities are reporting improved Air Quality Index for



several days in a row, and experiencing cooler weathers due to reduced carbon emissions that would otherwise raise temperatures. Some news channels even reported that the ozone layer is slowly repairing, and the rate of melting of the Arctic ice has reduced for the first time in the last 50 years.

Closer to home, reports suggest that some parts of the Ganga River are so clean that the water is fit for drinking! When nature was left to itself, it achieved in just three weeks, what human interventions and national government programmes could not in decades. With no pollution from sewage, industrial waste and plastic entering the river system, it revived itself and its aquatic biodiversity. The Yamuna too is showing improved water quality and quantity. For the first time in years, its surface is not covered in plastic and froth, but reflects the sky and scenic beauty around.

Wildlife everywhere is enjoying this sudden change in the pace of human life. Last night, I spotted a dusky eagle owl—a relatively shy woodland bird seldom seen in cities—sitting peacefully on my air conditioner unit and pruning its feathers. Some days ago, a friend from Coimbatore city next to the Western Ghats, shared a video of an elephant herd nonchalantly walking through a residential colony. In Navi Mumbai, lakes and wetlands are covered in pink, as a record number of flamingoes flock them, undisturbed by urban life. WhatsApp is abuzz with videos of a common leopard entering a farmhouse in Chandigarh, spotted deer roaming freely on the streets of Haridwar, rhinos trotting along residential colonies in Assam, and dolphins jumping out of water on the Mumbai coast. In other times, this close proximity of wildlife with human settlements would have been a cause for concern as it would result in conflict. But with slowed human activity, wildlife is getting a chance to reclaim their land, albeit for a brief period. With national parks shut in India and other parts of the world, our endangered wildlife is experiencing lesser stresses.



Marine life, too, is benefitting from little to no fishing and other industrial activities, therefore not dying from being caught in fishing nets.

There is no arguing that these are short-term improvements and would not have a lasting impact once we go back to business-as-usual. But what the lockdown has shown us, is how quickly nature can bounce back if it is given a chance. The anecdotal evidence of thriving nature coming from different parts of the world can be a huge learning for world leaders, politicians, and conservationists. It shows us what can be achieved if all the climate and environment negotiations being discussed for so many years are actually implemented.

The year 2020 had a busy calendar of global meetings and conferences to address biodiversity loss world over. These included the World Conservation Congress, World Ocean Conference, and a World Nature Summit, all culminating in the agreement of a decade long Post-2020 Biodiversity Framework. With the end of the pandemic nowhere in sight, these conferences are also currently on hold. But when the time comes to

resume these negotiations, I hope that our world leaders remember what nature achieved for itself when humans stopped interfering for just four weeks. The lesson to draw from this experience is that nature has tremendous capacity to heal itself. All that we humans have to do is find ways of using its resources sustainably and live in harmony with it.

In India, nature has always been an intrinsic part of human civilization. The Sanskrit phrase, *Vasudhaiva Kutumbakam*, is the essence of Indian culture and philosophy of life. Literally translated, it means 'the Earth is family'. But somewhere along the path of industrialization and urbanization, we lost touch with our roots. This pandemic has provided us—governments, corporates, and individuals—the opportunity to slow down and reflect upon where we lost our way. I hope that each of us seizes this moment to make changes in how we live and consume, so we are true to our traditional beliefs—that all life on earth is one single family. ■

Siddharth Edake, Fellow & Area Convener,
(Centre for Biodiversity & Ecosystem Services),
TERI, New Delhi.



1. Polar animals are at risk as their icy natural habitat is melting down faster than ever before. Polar bears need sea ice to be able to hunt, raise their young ones and as places to rest after long periods of swimming. Where are polar bears commonly found?
2. Which disease has been completely eradicated from the world because of effective vaccination?
3. Meghalaya means 'land of the clouds'. As per the 2018 data of the Indian Meteorological Department, which place in Meghalaya received the highest rainfall?
4. Which nodal agency is in the administrative structure of the Central Government for planning, promotion, co-ordination and overseeing the implementation of India's environmental and forestry policies and programmes?
5. The Central Potato Research Institute (CPRI) is a governmental organization in India; they undertake basic and strategic research for developing technologies to enhance productivity and utilization of potato. Where in India is the CPRI situated?
6. Wheeler Island was originally named after English commandant Lieutenant Wheeler. On September 4, 2015, the island was renamed as Dr Abdul Kalam Island to honour the late Indian President and scientist, Dr APJ Abdul Kalam. Where is the island situated?
7. Besides Africa, this National Park in Gujarat is the only place in the world where you can spot Asiatic Lions in the wild. Name the National Park.
8. Name a flightless bird found in New Zealand, which happens to be the only bird in the world to have its nostrils at the tip of its long beak.
9. Organic agriculture sustains health of soil, ecosystems, and people. In year 2018, which Indian State became world's first totally organic agriculture state?
10. This country has 187,888 lakes and takes into account for about 10 per cent of the total land. Name the country which is also known as the 'Land of Thousand Lakes'.

Answers

1. Arctic circle
2. Small pox
3. Mawsynram
4. The Ministry of Environment, Forest and Climate Change
5. Shimla
6. Bay of Bengal
7. Gir Forest National Park
8. Kiwi
9. Sikkim
10. Finland



Sharnarthi Sewa is a registered Non-Profit Organization founded by Mr Purshottam Sharma with the vision to help needy and helpless people.

As the name suggests, the organization is not only dedicated to serve humanity but also dedicated to the welfare of other living beings such as birds and animals.

Sharnarthi Sewa is now focused on making the country hunger-free and helping underprivileged people. They have been actively serving the society since 2012 focusing on child

development, women empowerment, and care for elderly people. The core areas of the organization include working for slum-dwelling underprivileged people and children. They have been working to fight against hunger by distributing free meals and celebrating hunger-free days.

The organization's vision is to establish the Sharnarthi Sewa Relief Centers not only in India but also across the world. The organization is working on its long-term vision so that they could extend their presence throughout the world.

Sharnarthi Sewa's Role during COVID-19 Crisis

The organization has braced itself to fight against the COVID-19 pandemic crisis by making the country hunger-free. They believe that the most affected section of the society in this crisis is the poor, daily wage workers, and the underprivileged people. The following are the support services that they have been providing to the underprivileged people:

- They are distributing free dry ration kits to the underprivileged sections of the society to ensure a reliable supply of food in the absence of employment because of the lockdown.
- They are also serving cooked meals to the ones who don't have resources to cook food. ■

For any other information, please visit online <https://sharnarthisewa.org/>



THE TELLY HAS STORIES TO TELL

This too shall pass, he said
Calm and rational, I was still
In my home, my fears quelled
hear whispers, 'All is not well'
My mind races and hopes fell
The telly has stories to tell

Out on the streets, my brethren
Fearful and paralysed, hungry and forlorn
Gazing at the exodus, I discern
Inequality overpowers penury, then I groan
Yes, everything did ring a bell
The telly has stories to tell

Torment and torture on the move
Long walk continues, I wake up
With guilt and shame, I disapprove
Shouts of dissent didn't cheer up
Young or old, not a rebel
The telly has stories to tell

Sun sets, the gloom sets in
Verily, 'negative' is the new positive
Fear of isolation and abandonment begin
To eat souls, rational and sensitive
Lights turned off and darkness fell
The telly has stories to tell

Plunderers and greedy intruders let up
Mother Earth bounces back with vigour
Distracted by rustles I sit up
Garden boughs sway and leaves murmur
On me, flowers cast a spell
The telly has stories to tell



Elephants walk their lands with ease
No fear of humans, their insanity
Otters venture, their fun never cease
We behold, coexistence an eternal verity
Far away I hear a yell
The telly has stories to tell

Penguins, they waddle their way around
Glances and colours, reflecting and enchanting
Ecstatic calls that celebrate freedom abound
Reverberate throughout the world, a yearning
To savour moments of beauty swell
The telly has stories to tell

From the foothills of Great Orme
Horned white beauties traverse the streets
Sounds of trotting hooves, humans affirm
Bay leaves disappear, hear no bleats
To the headland, the herd travel
The telly has stories to tell

Wild boars descend, Sika deer scamper
Mortals are away, animals at play
Barcelona will wait, Let Nara slumber
Ducks in the canals, they slay
City of love! Gape and marvel
The telly has stories to tell

In silence puffs explore the sea
No takers for Bouillabaisse, Marseille stares
Overlooking the Mediterranean, boats sway lazily
Wild orchids blossom, their beauty allures

Is this all a bit surreal!
The telly has stories to tell

Unkempt lawns are good as havens
Our chubby winged friends buzz eternally
Waggle dance, journey to the heavens
Feathered friends fill the sky perpetually
No smiles, monkeys fight a battle
The telly has stories to tell

To heal and to be healed
Yea! To breathe and let breathe
Emotions and feeling, so tightly sealed
For good, withdraw into a sheathe
Lift the veil, what a pell-mell!
The telly has stories to tell

Free dogs seek out for cynophiliasts
Bingo! Feeder passes come in handy
The benevolent lot persist and insist
Rescuing the starving, our bounden duty
Yet, hunger and death we smell
The telly has stories to tell

The din of human voices disappear
Roaring machines halt, noise die down
Mother Earth rightfully regains her composure
Amid great tribulations, an undoer's moan
Nature re-creating herself, the new normal
The telly has stories to tell

- Contributed by Dr Elsa Lycias Joel.

Is Nature Healing Itself?

At Least Breathing Peacefully for a While

The coronavirus, needless to say, is proving to be deadly to humanity. However, it did open our eyes to the fact that there are more deadly viruses that we have been perpetrating on the environment. **Namrata Gulati Sapra** says that we have tormented Mother Earth for a long time, but now due to the worldwide lockdown following the scare of the COVID-19 pandemic the nature is breathing peacefully for a while.

Not yet termed as a 'pandemic' by the United Nations, global warming, animal exploitation and trade, noise and light pollution, Australian bushfires, locust invasion in Kenya, are some of the greatest environmental pandemics that we have been constantly witness to and responsible for. These emergencies, which call for an equally severe lockdown and restraint, however, have not been able to send a shiver down our spine, because they have had no drastic measurable affects as such on mankind.

While we blamed and cursed COVID-19 for shutting our lives down for a while, we failed to realize that all these decades, we have tormented Mother Earth the same way, not allowing her to breathe in peace, compelling her to slap a mask on her face. But for a change, there was a role reversal due to the outbreak of the virus, which shut us behind doors and let Mother Nature breathe peacefully for a while, and here's how.

Dignity for Animals

Amid the outbreak, issues relating to animal cruelty and trade, which are conveniently brushed under the rug were finally brought to the surface. The

belief that humans are invincible and superior to animals was shaken to the core as the very source of COVID-19 was reportedly traced to a market that slaughtered wild animals live for human consumption. Most of these were exotic animals that were transported in pitiable circumstances. The animals were locked in cages together with barely any place to move. As a result, the animals were stressed and excreted pathogens. Once in human contact, these animal bodily fluids gave birth to new diseases and viruses. Many countries are guilty of following such practices that torment animals. Illegal wildlife trade is a booming industry that is worth huge amount of money today.

Just as close contact with humans poses a threat to wildlife, humans are also put at risk when in close contact with animals. Over the years, there has been an increased contact between animals and humans. Left with little option for their habitats following the conscious burning down of forests, deforestation and climate change, animals make home wherever possible. Besides, activities like mining, destruction of natural habitat to accommodate humans are other factors that contribute to this contact between

humans and animals.

However, with the onslaught of coronavirus, things are beginning to change slightly as animals, especially the endangered species are venturing out to reclaim their space as humans are in the confines of their home. It was a pleasant surprise to sight the nilgai in NOIDA and olive turtles in Odisha.

Curbing Carbon Emissions

We can also credit COVID-19 for leading to a dramatic decline in the otherwise increasing levels of carbon emissions. If statistics are anything to go by, following the outbreak of the virus, which put air travel services to a halt, shut down factories temporarily and put a stop on mining activities, the global emissions have declined by about a whopping 200 mega tonnes of carbon dioxide. This is said to have a positive impact on the climate change.

Degrowth

Degrowth refers to a phenomenon whereby sectors that are detrimental for the environment, such as mining, oil refining and fossil fuel industries

consciously slow down growth in order to stay within the stipulated environmental limits. This warning is currently being heeded and followed seriously by developed countries, which could lead the world on the trajectory of green economies.

Besides, with more and more people working from home, there are fewer energy demands and people at home are truly ringing a new social order, albeit temporarily, by consciously conserving energy. Besides, there is no traffic congestion at all, which is good news for the environment. The air quality has improved and noise pollution has reduced considerably during the lockdown period. The shutdown of businesses, factories and organizations has led to decline in demand for energy by around 15 per cent all around the world.

That apart, social distancing has curbed large gatherings, thereby causing a reduction of food wastage that often eventually ends up in landfills, consequently contributing to a peak in greenhouse gas emissions. Thus, one could safely assume that environmentally, the coronavirus has been somewhat of a blessing in disguise.

Better Air Quality

There has been a dramatic fall in the levels of nitrogen dioxide (a serious air pollutant) in Northern Italy and

China. In February alone, the number of good quality air days increased to a significant 21.5 per cent in China when compared with the same period in year 2019. The people of Jalandhar, Punjab were greeted by the view of the Dhauladhar Mountain Range on April 3, 2020. This is extraordinary because the mountain range hasn't been visible for many decades, thanks to the industrial pollution and smog. Its visibility was a result of cleaner air in the city because of the lockdown. In Beirut in Lebanon, a city known for its high levels of pollution, the skies have begun to appear much clearer than ever before.

The Ganga Becomes 'Pure' Again

Closer to home, the Ganga River, though considered pure and sacred by Indians since time immemorial, has been ironically used for purposes such as washing clothes, bathing, and immersion of idols. Unfortunately, the river has bore resemblance to a sewer, thanks to the massive dumping site that it has been transformed into by humans. Unfortunately, such grave challenges confronting the river have been swept under the rug for decades. The lockdown has been nothing short of a miracle for the River, which has healed greatly from the pollution that it has been subjected to. As per a report, a halt in industrial projects, absence of the influx of pilgrims,

absence of pollutants that can be traced to *dharamshalas* and hotels have led to a colossal 500 per cent decline in the total dissolved solids (TDS). The water has become so pure that marine life is visible in its waters. At the same time, migratory birds have also been spotted near the Ganga River. The lockdown has imbued life once again into the waters of the Ganga and that is something to hail!

In Italy, the Venice Canal was once again a sight to marvel over as its water was cleaner and brighter than before. Surprisingly, dolphins, various types of fish never seen before and swans have begun to appear in the waters around the world out of nowhere!

Migratory Birds Are Making a Comeback!

Amidst the lockdown, Navi Mumbai woke up to a spectacular view in the backwaters near the housing complex in Nerul. People could not believe their eyes as they saw a big bunch of flamingos flocking around the water body. Several people took to social media to report this development and posted pictures in unprecedented numbers. It was heart-warming that several of them voiced their support for the pink friends by asking authorities to rescue the wetlands so that they (pink flamingos) could grow in numbers.

Some Unanswered Questions

All said and done, the vexing question that arises is—will it take a lockdown and a virus infection for the environment to heal? Will it need human beings to be locked in the confines of their homes for the animal kingdom to survive and thrive in what is their natural habitat? There are no answers to these questions. Only time will tell. ■

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Community-based Forest Management

and Biodiversity Conservation in Arunachal Pradesh

For communities living around the forests of Mandala Phudung, non-timber forest produce trade provides an additional and a financially rewarding incentive for biodiversity conservation.

The forests of Arunachal Pradesh harbour a rich bounty of flora, many of which are also commercially highly valued species of non-timber forest produce (NTFP), mainly medicinal, aromatic, and spices plants. The Monpa tribe resides in the western part of the state and the community is highly dependent on the forests and the natural resources for their livelihood. The local community enjoys de facto custodianship of the forests. They also share strong religious ties and place immense cultural value on their natural surroundings.

In exercising their rights of collection of NTFP, whatever is collected is sold in local markets, or to traders, and this is

mostly done in an unorganized manner. In the absence of a proper mechanism, however, the potential value of these NTFPs has remained untapped, and their price uncertain. Moreover, there is little or no control over the amounts being harvested. The economic benefit of local villagers through the sustainable collection of NTFPs can provide a strong incentive to ensure long-term durability of the Community Conserved Areas (CCAs) that the villagers have demarcated and notified for the conservation of natural resources over which they have traditional rights.

As part of the strategy to ensure economic benefit to villagers managing the Mandala Phudung Khellong

Community Conserved Area (MPKCCA), WWF-India, Sony India and the GB Pant Institute of Himalayan Environment and Sustainable Development are working together to explore the potential of NTFPs collected from the CCAs. Of the six NTFPs identified as having market potential, Khagei or Zabrang (*Zanthoxylum* sp.) has been prioritized to develop a sustainable collection protocol and establish the market linkages at pilot scale.

Zanthoxylum, locally known as Khagei or Zabrang, is an essential condiment in the Monpa-dominated area of western Arunachal Pradesh. It is part of the local diet and consumed as chutney and pickle. 'We were selling



Zabrang being sun dried, Picture courtesy: Manisha Kumari

Zabrang in local markets or to traders. Prices varied between ₹200 and ₹500 per kg. With this new initiative, we will receive a fair rate on the collected products,’ said Pem Chojjang from MPKCCA.

In 2017, after an assessment of the availability of Zabrang in the wild and the amount that could be collected sustainably, WWF-India commenced its efforts to establish market linkages. Based on the evaluation which was discussed and endorsed by the MPKCCA, locals collected 6734 kg of Zabrang. Through several stakeholder consultations, a linkage has been created with a leading fast-moving consumer goods (FMCG) company. To ensure that a fair rate is provided for the collected NTFPs, the MPKCCA management committee and the company agreed to formalize a partnership under the guidance of the Bomdila Forest Division, Government of Arunachal Pradesh, and WWF-India. A mechanism to ensure proper sharing of benefits among the villagers with the inclusion of corpus from the total earnings was prepared in consultation with villagers and members of the CCA management committee.

For the legal trade of NTFPs, a transit permit was issued by the Arunachal Forest Department, in addition to



an advalorem of ₹31 per kg, which is paid by the MPKCCA management committee. This amount has been included in the price negotiated with the FMCG company for the collection and transportation of Zabrang to its unit in Tezpur, Assam. In order to streamline the collection and transportation, the WWF-India team also held a number of consultation meetings with the Divisional Forest Office to have a single transit permit issued to the management committee instead of individual permissions.

Kamal Medhi, Coordinator of WWF-India's Western Arunachal Landscape, said, 'Roles and responsibilities, such as Zabrang collection from each household, storage, and transportation of products to the unit, have been defined among the stakeholders. A system for price negotiation has also been created to ensure fair transactions between the community and the company.'

The collection of Zabrang was organized between October and November 2019 in the settlements of Phudung, Dungmanba, Menchang, Khellong, and PampuKheri. A total of 119 households of all settlements under the MPKCCA collected 6734 kg

of Zabrang. The MPKCCA management committee then sold 6395 kg to the company at a rate of ₹475 per kg. The remaining Zabrang was retained for local consumption. After the delivery of the first consignment of 4000 kg, the total earning of 119 households was ₹18 lakh in addition to the advalorem payment to the Forest Department along with the management fee of MPKCCA. The second consignment of 2200 kg was ready for delivery by end of March 2020. It promised to provide an additional income of ₹9.9 lakh to 119 households and ₹4000 as corpus to the management committee. With a total earning of ₹27.9 lakh, the families received an additional amount of ₹24,500 per household.

In a historic first, for the state of Arunachal Pradesh, communities have marketed and sold NTFPs collected from their forests through a legal mechanism. With the development of market linkages between community institutions and a prominent company, this partnership is being highlighted at various platforms, including the State Wildlife Board Meeting, which was chaired by the chief minister of Arunachal Pradesh in January 2020. ■

Article courtesy: WWF-India.



Zabrang seeds, Picture courtesy: Sanjay Kumar



Strange Ways to Earn a Living

People forget that they have only one life. In the pursuit of money, they spend their days doing the strangest, often most dreadful, things. **Maneka Sanjay Gandhi** gives you a few examples.

What are the strangest jobs that involve wild animals? Every morning when I get to Shastri Bhavan (my office), I hear the sound of a man hooting. He hoots off and on the entire day. His job is to scare away monkeys. They run when they see him but whether it is his voice or the large stick he carries is a moot point. As soon as he moves away they come back and sit on the ledges of the upper stories of the building and outside my window where I feed them. Illegal langur kidnappers go from building to building (less so now because I arrest them) and tie up their langurs on the gate to keep rhesus monkeys at bay.

Snake milkers are people who extract venom from snakes and other reptiles for medical applications for the treatment of minor heart attacks and preventing blood clots and for anti-venom serums that can be used if a person is bitten by a snake. A lot of venom is needed every year and the milker has to spend all day catching and squeezing a snake's mouth open so that he can push snake



fangs into a plastic container in order to milk them. Being bitten is not unusual. In India, the Irulas in Tamil Nadu who were snake hunters for snake skin were taught by Romulus Whittaker and Harry Miller to collect venom and sell it to the snake institutes. In 1978, a Snake-catchers Co-op owned and operated by the Irula tribals was formed with Romulus as the Technical Advisor and permissions were given to catch snakes and bring them to the Snake Park in Guindy where they are milked.

Brazil mosquito researchers fighting malaria must study the biting habits of the mosquito that spreads this deadly disease. In order to study these insects, Brazilian scientists offer themselves as bait. In the early evening, when mosquito activity is the most, a mosquito researcher sets himself up inside a mosquito-netting tent with a gap at the bottom. Mosquitoes fly in and get trapped inside, where the researcher sits. As they bite the legs he or she draws them into a mouth tube and then into a container catching up to 500 in 3 hours

(which means at least 3000 bites). Many researchers get malaria.

An Avian vomitologist is employed by entomology laboratories to collect vomit samples from sick birds to analyse the avian flu pattern. This means moving through fields and forests in search of vomit. In 2014, the Giant Panda Protection and Research Center in China's Sichuan announced its worldwide search for panda cub caretakers. Contenders faced several elimination rounds before getting the job. The ad stated 'Your work has only one mission: spending 365 days with the pandas and sharing in their joys and sorrows.'

Better that, than working in China's bear bile centres. Bears have a permanent tube fastened to their gall bladders and the bile gatherers have to make sure the bile comes out and the bear though in extreme pain does not die. The bile is collected in jars and sold for the quack medicine industry. Or even the rabbit hair puller-outers. The Chinese and French grow rabbits in tiny cages. Every six weeks the hair pullers get them out, spread eagle them on a table with straps and then pull out bunches of hair while the rabbit screams. Amusement comes from hitting the rabbit to make it shut up.

Movies that need insects employ an insect wrangler. These individuals grow ants, cockroaches and flies for films and exhibitions and get more exotic insects depending on the movie order. The wrangler directs the insects during filming by motivating them with food or pushing them away with air, and so on. He has trained them to respond. In Thailand there is a whole industry of jewellery made of butterfly wings (you can see them on sale at the airport). There are people who actually tear the wings of live butterflies and quickly push them between plastic covers edged with a gold lining. Add a hook and voila – earrings!

That is in the same league as snakeskin catchers who pin a live snake to the board and then strip its skin off. This is made into shoes/wallets for the very rich and stupid people.



Crocodile skimmers do the same. Their job is to catch the mouth of a baby crocodile and bind it. Hammer a nail into the neck which paralyses it and then strip the skin off.

For every guy who eats a live grasshopper on reality shows as disgusting as *Fear Factor* and *Survivor* there are people who are paid to do the same thing in real life. These masochists are called Gross Stunt Testers and their highly paid job includes doing everything that is gross like eating worms or cockroaches. The film and television industry employs them to test disgusting items such as bugs and fluids to make sure it is safe for others to consume on camera in order to avoid lawsuits.

Professional elephant painters and dressers are hired to paint and decorate elephants during the festivities in Kerala. Sri Lanka has official outfitters for the elephants taking part in festivals. Each elephant has to be measured and custom-made outfits are made for the body, trunk, ears and tail of the animal. The drapery has to fit snugly to the

elephant's hide instead of being tied on with rope. The elaborate creations take around two months to make. The outfits are bought by wealthy families and donated to the temple. Captive elephants are transported across the country to take part in these festivals. Every year at least ten elephants revolt under the heat of these dresses, the noise and the beating of the mahouts and run amok. They are either killed immediately or punished for months with beating.

Till a few decades ago, leeches were collected to draw blood from patients for therapeutic reasons. Leech-gatherers waded through dense leech-filled areas and allowed them to latch onto their legs and suck, losing tremendous amounts of blood. When they were covered with leeches they waded back and took them off.

One short life and look how we waste it. A very enlightened Guru told me thirty years ago that Earth was the designated hell for all the sinners of the Universe. One look at these jobs that we create and I can believe it. ■

COVID-19 in a Water-Stressed Nation

The Challenges and Solutions

During the present COVID-19 pandemic, we are advised to wash hands frequently with soap and that too for a minimum of 20 seconds. But, have you thought what effect will it have on a water-stressed nation such as India? In this article, **Niyati Seth** and **Sonia Grover** highlight that currently, the challenge for the government is not only to combat the pandemic but also of rising water demand during peak summer months. Perhaps, a simple initiative of closing the tap while not in use during washing hands can reduce water wastage; such simple steps undertaken at an individual level can bring about a change which is much needed to face such critical situations.

Sustainable Development Goal (SDG) 6 aims to ensure access to safe drinking water and sanitation to all and we are still far behind to reach this target by 2030. Additionally, the Government of India launched its flagship programme on access to functional tap water in 2019—Jal Jeevan Mission with an aim to provide access of safe drinking water to each and every household in the country by 2024. Statistics show that by March 31, 2020, only 20.81 per cent of rural households have received functional household tap connections. In cities also, there are many areas or unauthorized colonies which do not get tap water. There is an everyday struggle to fetch water from common taps or tankers. India, a water-stressed nation with per capita annual availability of 1441 cubic metres in 2015 is soon proceeding towards water scarcity (1100 cubic metres), and therefore needs to manage its resources judiciously.

During the present coronavirus pandemic, where we are advised to wash hands frequently and that too for a minimum of 20 seconds, do these figures support our fight against this enemy? The average flow rate of a household tap is 4–6 litres per minute

(lpm), and considering a person washing hands for at least 6 times a day, leads to a consumption of 9–10 litres. A simple initiative of closing the tap while not in use can reduce this usage; such simple steps undertaken at an individual level can bring about a change which is much needed to face such critical situations. Moreover, people have started to sanitize and disinfect their homes more often than the usual which would have an additional impact on the demand. Probably we would overcome this pandemic but it does leave us with some important lessons to be prepared for another unprecedented event.

Another important aspect from the point of view of water demand is that it increases rapidly during the peak summer months; looking at the current situation, the domestic water demand is growing in the months before the peak season which may affect the limited reserves available for the upcoming months. This may lead to a more vulnerable situation for the upcoming summer months. If the current situation of the pandemic does not improve, people will have to move out from their homes to fetch water which may defy the need for social distancing.



The other side of the story is the wastewater which is coming out from the households in cities that may have higher amount of chemicals such as disinfectants. This wastewater and the grey water is expected to have different composition than usual because of the use of disinfectants in recent months. Another challenge faced by our nation would be the safe disposal of wastewater with poor wastewater infrastructure present in the country.

Currently, the challenge for the government is to combat the COVID-19 pandemic which might trigger the upcoming challenge of rising water demands during peak summer months, which is another challenge for the government. The stressed water resource will make people more vulnerable in the coming months when the demand will continually rise. During the summer season in 2019, Chennai in Tamil Nadu faced acute water crises in which the major water bodies dried up due to failed monsoons in the previous two years leaving people with no water to drink. Every summer there is demand supply gap and the resources are continuously depleting. For example,



the city of Hyderabad had a gap of 130 millions of gallons per day (MGD) in 2018 which needs to be addressed for providing access to water for all. It was also observed that this gap further increases as the demand increases in the consequent years (2021 and 2024) while the supply remains the same. The increase in water demand over the years can be directly linked to the increase

in population in Hyderabad and its surrounding areas. Moreover, in 2019, as per the NITI Aayog report, 21 cities in India will run out of their groundwater resources. Therefore, it is likely that by the time government is able to combat the pandemic, another challenge is already waiting in the wings to grab attention.

Water is a basic requirement and situation like this has taught us the





importance of this pristine resource. We need to be well prepared now before any other calamity affects us. We have targets to align ourselves to but there are simple steps that need to be taken at the earliest for ensuring better preparedness. Even the changing climate needs us to be more efficient in managing the resources and coronavirus pandemic is giving us some hard lessons.

There is a need to conserve water at both macro and micro levels. Governments have their programmes for conserving water—National Water Mission, Integrated Watershed Management Programme, and so on. But at micro level each individual needs to take responsibility by taking small measures at their level like installing water-efficient faucets and fixtures, dual flushing systems, closing taps whenever not in use, reusing wastewater wherever possible, undertaking rainwater harvesting at households, institutional buildings, and so on.

The pandemic has led to closure of the industries which has lowered the water consumption and the wastewater generated from them that has helped in improving the water quality of the rivers to some extent. But as soon as

the situation comes back to normal, all things shall run in the same manner as before. Therefore, industries can look for options of updating/upgrading their technologies which are water efficient apart from other interventions, such as wastewater reuse and recycle as well as zero liquid discharge (ZLD) systems, rainwater harvesting, groundwater recharge, and plugging of leakages.

Further, in the domestic sector as well, there are huge leakages and losses and the focus of urban local bodies (ULBs) should be on reducing them. These water delivery systems are very inefficient due to several reasons including improper operation and maintenance, lack of revenue generation (poor metering, low tariff), and most significantly, wastage due to leakage and pilferage, and so on. Nearly 40 per cent of the total flow in the distribution system is lost on account of water loss through leakages in main pipes, communication and service pipes, and leaking valves. A leak detection system should be in place so as to curb or minimize these losses.

The agriculture sector is the largest water consumer but the least efficient in both conveyance and application, mainly due to the practices followed by

the farmers and ageing infrastructure. There is a need to be more efficient so as to have minimum impact in situations like the present pandemic. The use of efficient irrigation practices and technologies such as micro-irrigation system (drip and sprinkler systems), mulching, laser levelling, ICT-based operation, etc., can help to reduce the water demand in this sector and enhance water use efficiency.

We, therefore, need to strengthen our water and wastewater infrastructure to fight against such situations (like the current pandemic of coronavirus). This will not only improve the treatment facility in the country but help in curbing the indirect transfer of diseases. Moreover, there is a need to move from centralized to de-centralized options which are able to provide customizable solution. Each individual has a role to play in improving the water situation in the country. Further, there is also a need to expedite the progress towards the set targets for Jal Jeevan Mission and be better prepared for any challenges in the future. ■

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Redefining Sustainability in the Era of COVID-19

Time to Ponder and Act Accordingly

In this article, **Megha Jain** and **Saurabh Jaiswal** say that sustainability will have to be redefined in the era of COVID-19 and if we continue to treat the environment like we have done in the last few decades, then such virus outbreaks will rather teach us the ill-effects the harsh way.

It is quite rare yet remarkable that a pandemic such as coronavirus outbreak could prove to be a social reforming measure. The lockdown has come as a blessing in disguise for our environment as the skies are clearer and air seems fresh once again. The evidence of decreasing pollution can be seen at night also. One can see a much clear sky that speaks volumes about the current situation. Many global cities are reporting improved air quality for several days together. This has been made possible by a complete shutdown of the human activities and other related actions. But, can it be considered as a permanent phenomenon? The answer is 'No'. Recent research by National Aeronautics and Space Administration (NASA) (April 2020) called it a 'short-term measure' to contain air pollution. Ironically, the 'problem of many' is proving to be a sustainable solution to the planet Earth. Surprisingly, as per the recent World Health Organization (WHO) report, severe air quality index could have greater fatalities in comparison to any virus outbreak such as coronavirus.



Due to the current lockdown, our national capital city Delhi has witnessed 80–90 per cent reduction in the particulate matter (PM)_{2.5} exposition from 503.94 (maximum) in December 2019 to a record low to 37.04 (maximum) in April 2020 (Table 1).

Table 1: Delhi Air Quality Index (AQI) statistics

Month	Max. AQI in a month (PM _{2.5})	Average AQI of the month (PM _{2.5})
Nov.19	599.53	236.94
Dec.19	503.94	244.29
Jan. 20	389.3	182.49
Feb. 20	208.78	124.17
March 20	176.46	68.01
Apr. 20	37.04	32.75

Source: Extracted from the Central Pollution Control Board (CPCB), Thursday, April 09, 2020

According to the study, COVID-19 patients in areas that have had a record of high degrees of air pollutants are much more likely to succumb to the contamination than those in states with relatively better air quality. Unfortunately, those who are predisposed to bad air quality remains even more vulnerable to catch COVID-19 infection. The principal reason behind the same is that PM_{2.5} are fine particles that have the potential of penetrating deeper into the bodies of people suffering from cardiac disorder, hypertension, breathing problems, and diabetes, which might pose severe

complications for virus-infected ones. Not just this, these particles could further impact the immune system overall and respiratory tract as well. As per a study by Harvard University, 'an increase of only 1 µg/m³ in PM_{2.5} is associated with approximately 15 per cent increase in the COVID-19 death rate'.

As per global statistics, India has

some of the most polluted cities in the world, however, the scenario seems to see a reversal in its usual trends since the air has been way too clean in recent weeks due to the nationwide lockdown imposed due to the pandemic. The Centre for Research on Energy and Clean Air (CREA) experts have detected that even a single-day lockdown has caused the average nitrogen pollution level to drop down to the lowest, especially in urban areas of the country during the spring season. Other Indian cities such as Mumbai, Chennai, Kolkata, and Bengaluru too have witnessed a huge drop in the overall air contamination. The green impact is not limited to



just air contaminations rather water correlates (such as oceans, rivers, lakes, coasts, and so on) too have recorded pertinent improvements in the form of a reduction in toxic industrial wastes. Before we reach any sort of concrete solution to tackle the twin-edged sword problem to deal with climate change on one hand and virus on the other, it is essential to answer some of the trailing fundamental questions.

Does the outbreak of any virus such as corona carry the potential of changing the entire dynamics of global climate change?

One of the studies indicates that every second, 310 kg of toxic chemicals are released into air, land, and water by industrial facilities around the world. This is equivalent to approximately 10 million tonnes (over 21 billion pounds) of toxic chemicals (substances that can cause severe illness, poisoning, birth defects, disease, or death when ingested, inhaled, or absorbed by living organisms) released into the environment by industries each year. Astonishingly, standalone air pollution possesses the capacity to kill an estimated 7 million people globally annually. It seems that together different sectors due to lockdown such as transport, industries and businesses have contributed their respective share to witness a worldwide drop in the overall emissions. As per the studies conducted in 2018 by Zurich (Switzerland) and Kyoto (Japan) universities, under such conditional restrictions, people tend to shift perpetually to sustainable lifestyles (like working from home, and so on) if kept for a longer period of time. Unexpectedly, all

major nations have registered a gigantic plunge in the air pollution levels in comparison to the levels at the beginning of the year 2020. For example, the USA is able to curtail the pollution level by 50 per cent, China by 25 per cent, and many such countries including Spain, Italy, and so on with the overall expected drop of 0.3 per cent in the global emissions in the current calendar year. The WHO statistics depict that 9 out of every 10 people tend to breathe air containing high levels of air impurities. Fortunately, reasonable efforts by the WHO in the same direction to contain and improve the air quality are taken in mutual collaboration with many nations.

Climate has remained the top policy agenda till February 2020, but will the scenario continue?

Climate as a key 'policy agenda' is worth exploring even now because air pollution is even a bigger threat to humankind and therefore, poses a gigantic environmental risk. By reducing air pollution levels, nations can diminish the burden of diseases from stroke, heart disease, lung cancer and both chronic and acute respiratory disorders (including asthma). Lower the levels of air pollution, the better the cardiovascular and respiratory health of the population, both in the long run and short run. In 2016, 91 per cent of the world population was living in places, where the WHO air quality minimum standards were not met. The pollution level has decreased significantly after lockdown (due to coronavirus outbreak) as most of the factories and the manufacturing sectors halted their respective air-polluting activities that further led to decrease in noise pollution and even the water pollution (due to the industrial solid and gaseous waste disposal into rivers and water bodies). A decrease in the use of vehicles and closure of many construction sites has led to a substantial amount of decrease in the pollution levels all around the world.

Indeed, the human race owes this

much in return to the planet Earth due to deliberate polluting. And of course, the citizens now can't shy away from the problems that they are facing due to global pollution. Policies and investments supporting cleaner transport, energy-efficient homes, power generation, industry, and better municipal waste management would reduce the major originators of outdoor air pollution. Amidst dark, a ray of hope that entire nation is experiencing is quite commendable—a contemporary new style of working for many, that is, work from home, just announced after the nationwide lockdown by all corporates and major offices (people have set-up their offices at home) that is responsible to lower down the traffic, fuel, and energy consumption in commercial buildings. The major drop in traffic has a lot to do with the cleaner air that we have been breathing. The last resort to solve and preserve it for the present and future is to rethink our behaviour at each level.

Since we are experiencing after-effects of historical pollution driven activities by nations today; similarly we shall realize the temporary cleaner air impact in the near future after the pandemic. If human ignorance and casual attitude to treat the environment and its correlates continue, such virus outbreaks will rather teach us the ill-effects the harsh way. Such unfortunate virus outbreaks would force humans to lower the pollution and safeguard the environment by quarantine of half the population of the planet Earth, and force the other half of the population, to remain indoor by the lockdown imposed by the government.

We should also be concerned about the fact that if corporates/businesses around the globe decide to have double shifts once the lockdown is over, the emissions could resume to their usual levels. We shall leave it to time to decide that whether COVID-19 shall be treated a 'boon' or 'bane' in the times of global concerns such as rising air pollution and the need to maintain sustainability. ■

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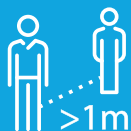
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- ☐ TERI Analysis ☐ Environmental Research ☐ Feature
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- ☐ Brilliant ☐ Design is not a priority, content is
☐ Average ☐ Needs improvement

4. In your opinion, what aspect(s) of TerraGreen need(s) improvement?

- ☐ Choice of stories ☐ Handling of issues ☐ Language
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5. Please rate TerraGreen on a scale of 1–5 (5 being the best).

- ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

6. What issues would you like TerraGreen to cover?

.....
.....

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..... ☐ None

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.....
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