

TerraGreen

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IN CONVERSATION

Ms Kathleen Scarboro,
American Mural Artist and Painter

SPECIAL HIGHLIGHTS

Predicting the Wave of COVID-19
in Communities

When Conservation and Art Meet!

Impact of COVID-19 Pandemic

on Environment and
Socio-economic Dynamics

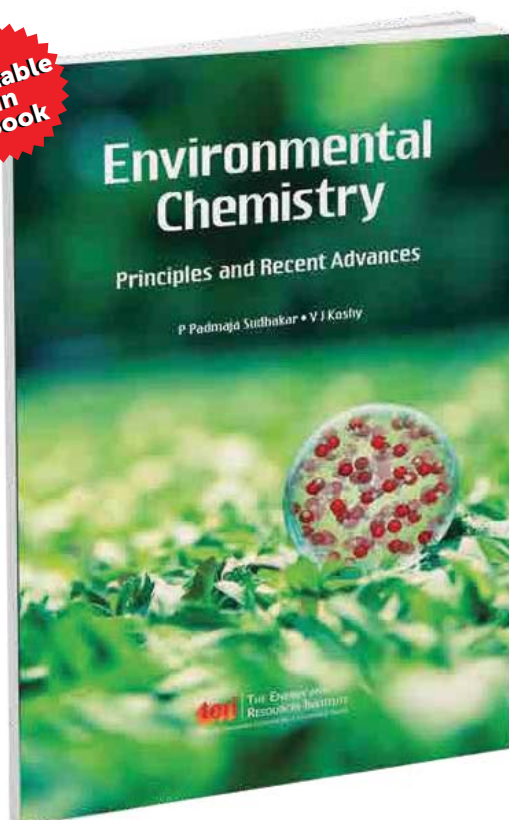
TERRA YOUTH

Social Emotional Learning
During COVID-19



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Environmental Chemistry: principles and recent advances discusses the various pollutants present in the atmosphere, including persistent and bioaccumulative chemicals, pesticides, nanoparticles, and chiral pollutants. Advances in treatment techniques and analysis and monitoring of pollutants are the other topics covered in detail. A chapter has been dedicated for a comprehensive discussion on green chemistry. The book also talks about the Best Available Techniques (BAT) adapted by industries for Preventing and Controlling Pollution and also provides information on the application of analytical techniques, such as GC, LC, IR, and MS for analysing and measuring aqueous, solid and atmospheric samples and for monitoring environmental pollutants.

The Energy and Resources Institute
Attn: TERI Press
Darbari Seth Block
IHC Complex, Lodhi Road
New Delhi – 110 003/India

Tel. 2468 2100
Fax: 2468 2144
India +91 • Delhi (0)11
Email: teripress@teri.res.in
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EDITORIAL



“ This month’s cover story dwells on the environmental, social, emotional, economic, and health-care related issues caused by the pandemic and the lockdown, as well as the challenges it has brought about for law enforcement agencies and for care givers. ”

As per media reports, Delhi logged fewer than thousand COVID-19 cases for the first time in seven weeks on July 20. Delhi heaved a momentary sigh of relief as the daily log of new COVID-19 cases fell below 1000 for the first time in July 2020, after a seven-week surge. However, other states and regions are still witnessing a surge in coronavirus positive cases. The only option, even before those states testing more than others, is to keep on testing.

The management of coronavirus pandemic has put enormous strain both on the government machinery as well as on all people all over the world. It calls for large-scale testing of the infected people, providing them informational, safety, psychological, medical and moral support, and ensuring that they are able to adjust with the society after their recovery and society is also supportive as they seek to rebuild their lives.

This month’s cover story dwells on the environmental, social, emotional, economic, and health-care related issues caused by the pandemic and the lockdown, as well as the challenges it has brought about for law enforcement agencies and for care givers. It also highlights that the immune system is affected by the environment the person lives in. Traditional knowledge and ancient wisdom, while not providing a cure for the coronavirus may be useful in enabling a public acceptance between an ailing and failing body.

In this month’s feature article, ‘Predicting the Wave of COVID-19 in Communities’, the authors, while highlighting wastewater as an important monitoring tool in predicting the wave of COVID-19 in communities, say that the ongoing pandemic situation can be utilized to test whether wastewater-based epidemiology (WBE) can act as an effective technique to observe and manage public health globally. WBE can be an important tool as most infections are thought to be asymptomatic or undiagnosed infections. WBE can provide critical knowledge on identification of hotspots and understanding the dynamics of the infection. Using reverse transcriptase quantitative polymerase chain reaction (RT-qPCR) of the extracted RNA in wastewater from wastewater treatment plant (WWTP) would suggest if there is a chance of COVID-19 spread from the same WWTP. To curb the secondary impact on the well-being of any community during the recovery phase, safe management of sewage treatment plants, WWTPs and provision of WASH services are of highest importance. If not managed properly, particularly for endemic diseases the secondary impact can further increase the risk of spreading water-borne diseases.

We hope that you enjoy reading this issue of *TerraGreen* while staying healthy and safe while taking care of your loved ones. We all should strive to extend helping hand to others as much as possible in such challenging times. Helping the needy in such an hour of crisis will go a long way in bonding us together.

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

Ajay Mathur
Director General, TERI



The Feature article of the July 2020 issue makes for an absolutely interesting reading. The authors have ignited the discussion on sustainable future to understand the various shapes sustainability can take in the new future. With COVID-19 pandemic, in the immediate future, governments are focusing more on the measures to tackle the strains on health care systems and hence, prioritized segments might belong to social health and financial aspects which further represent important pillars of sustainability namely, social and economic. Whereas, in the long run, world sustainability might share spaces on top priority list along with others.

Kapilesh Pahuja
Guwahati, Assam

I enjoyed reading the July 2020 issue of *TerraGreen*. The In Conversation section with Neha Sinha is very interesting. She rightly says that to get a full picture of issues in conservation, whether it is human-wildlife conflict or rights over forest produce, you need inclusion. You need the female perspective as also the perspective of various other minorities. When you speak to people in the field, you realize that men and women often have different priorities and different ways of looking at a situation. A woman will be deeply concerned about the needs of her household and her children.

Rama Bhattacharya
New Delhi

The cover story on building pandemic resilient cities in India is very apt under the present circumstances. The authors have highlighted that while washing hands and maintaining adequate hygiene has been advocated as the need of the hour, COVID-19 exerts the need to reassess the adequacy of the WASH infrastructure in slums and low economic settlements. They rightly emphasize on the need for WASH infrastructure improvement to face pandemics in urban areas. The Special Report by Mr Rajshekhar Pant is also very stimulating.

Jyoti Manjrekar
Mumbai, Maharashtra

Editor-in-chief
Ajay Mathur

Editorial Board
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Design & Illustration
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Production
Aman Sachdeva

Marketing, Sales & Distribution
Sanjeev Sharma

Head office
TERI
Darbari Seth Block, IHC Complex
Lodhi Road, New Delhi – 110 003
Tel. +91 (11) 2468 2100 or 7110 2100
Fax +91 (11) 2468 2144 or 2468 2145

Regional centres
Southern Regional Centre
TERI, CA Site No. 2, 4th Main, 2nd Stage
Domlur, Bangalore–560 071
Email: teriscrc@teri.res.in

North-Eastern Regional Centre
Chachal Hengrabari, Express Highway
Guwahati- 781 036
Tel: 0361-2334790, Fax: 0361-2334869
Email: terine@teri.res.in

Western Regional Centre
House No. 233/GH-2, Vasudha Housing Colony, Alto-
St Cruz, Tiswadi, Goa-403 202
Tel: 0832-2459306, 2459328
Email: teriwrcc@teri.res.in

Affiliate institutes
TERI North America
1152 15th Street NW Suite 300
Washington, DC 20005
Email: terina@teri.res.in

TERI Europe
27 Albert Grove, London SW20 8PZ, UK
Email: ritukumar@aol.com

Overseas representation
TERI Japan
C/o IGES
Nippon Press Centre Building (8th Floor)
2-2-1, Uchisaiwai-cho, Chiyodi-ku
Tokyo, Japan - 100-0011, E-mail: teris@igesor.jp

TERI South-East Asia
Unit 503, 5th Floor
Menara Mutiara Majestic
15 Jalan Othman, Seksyen 3, 4600 Petaling Jaya,
Selagor Darul Ehsan, Malaysia
Email: nimtech@tm.net.my

TERI Gulf Centre
Flat No. 105, Dalal Building, Al Qusais,
Dubai, UAE

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22 COVER STORY





Kashmir's Saffron Gets GI Tag

Kashmir Valley's Saffron has got the much-awaited geographical indication (GI) certification from the central government in a fillip to the homegrown spice, which is likely to fetch higher prices in the international markets. Jammu & Kashmir's Lieutenant Governor (L-G) GC Murmu expressed happiness at the Centre's decision and said that this is the first major step to put Kashmir Saffron on the world map, thanks to the GI tag. The recognition would help Kashmir Saffron to acquire more prominence in the export market and would help the farmers get the best remunerative price, L-G Murmu said. The L-G complimented Altaf Aijaz Andrabi, director of agriculture, J&K, for his relentless pursuit for the GI tag for the homegrown Kashmiri spice.

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

Celebrating International Tiger Day 2020

Global Tiger Day is observed every year on July 29 to raise awareness about tiger conservation. Also known as International Tiger Day, it was created in 2010 at the Saint Petersburg Tiger Summit. On the occasion of Global Tiger Day 2020, Environment Minister Shri Prakash Javadekar shared a piece of good news, revealing that India 'has 70 per cent of world's tiger population'. The tiger population across the world dropped sharply since the beginning of the 20th century but now for the first time in conservation history, their numbers are on the rise. International Tiger Day 2020 was celebrated with hundreds of photos and videos of these magnificent animals on social media.

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



Delhiites Will Add 9 Years to Life if Air Pollution is Checked

Indians on average lose 5.2 years of their life due to increased air pollution, and Delhi and Kolkata stand to gain the most if air pollution, particularly concentration of $PM_{2.5}$, meets WHO standards, according to the annual Air Quality Life Index (AQLI) brought out by the Energy Policy Institute at the University of Chicago (EPIC).

While Delhiites stand to gain 9.4 years if $PM_{2.5}$ concentration drops to 10 micrograms per cubic metre—the WHO standard—Kolkata residents would gain almost nine years, the report stated. If the country meets its own standard of 40 micrograms per cubic metre of $PM_{2.5}$ concentration, the overall gain will be 2.3 years, it said.

Source: <https://indianexpress.com/>



Gurugram Records Huge Increase in COVID-Related Waste

The quantity of biomedical waste related to coronavirus disease (COVID-19) in Gurugram district in Haryana has increased by 585 per cent over the past three months, showed data compiled by Biotic—the concessionaire for biomedical waste management for Municipal Corporation of Gurugram (MCG). In April 2020, Gurugram amassed an average of 500 kg of COVID-related biomedical waste per day. In June 2020, this number exceeded more than 3000 kg per day, coinciding with a surge in the number of cases and deaths. Close to half of the city's total medical waste now comes from the diagnosis and treatment of COVID-19 patients.

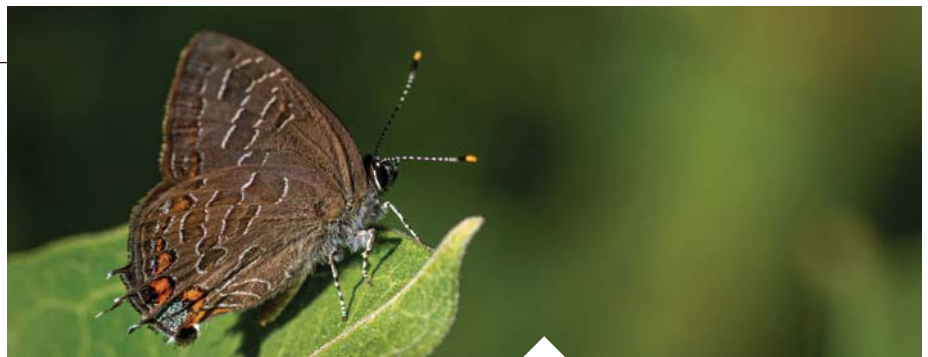
Source: <https://www.hindustantimes.com/>

Delhi's Old Drainage System Unable to Cope With Heavy Concretization

The Capital's decades-old drainage system is unable to keep pace with unplanned construction, and much of its stormwater management features are either blocked or have disappeared, leading to a few hours of heavy rain triggering widespread chaos, according to several urban experts.

A K Gosain, professor of civil engineering at the Indian Institute of Technology, Delhi, said the problem lies in three distinct issues: increase in paved area means less volume is absorbed by the ground and rains lead to heavier water run-off; stormwater drains are being used for sewage; and most of these stormwater drains do not let water flow freely.

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



Lepidopterists Discover the Striped Hairstreak and Elusive Prince in Arunachal Pradesh

Lepidopterists in Arunachal Pradesh have helped add two species to India's expanding list of butterflies. One of them, the Striped Hairstreak, was first recorded by Japanese entomologists in Hainan province of China. The other, Elusive Prince, has a Vietnamese connection and was thought to be the more familiar Black Prince found in the Eastern Himalayas. 'Our team has added the two butterfly species, which has been published in the April-June edition of the *Bionotes* journal. India now has 1327 species, up from 1318 in 2015,' said Minom Pertin, deputy director of SEED. The Striped Hairstreak (*Yamamotozephyrus kwangtugensis*) was located in Vijaynagar bordering Myanmar while the Elusive Prince was found in Miao on the periphery of the Namdapha National Park.

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



New Fabric Could Help Keep You Cool in the Summer

Air conditioning and other space cooling methods account for about 10 per cent of all electricity consumption in the US, according to the US Energy Information Administration. Now, researchers reporting in *ACS Applied Materials & Interfaces* have developed a material that cools the wearer without using any electricity. The fabric transfers heat, allows moisture to evaporate from the skin and repels water. Yang Si, Bin Ding and colleagues have developed a personal cooling fabric that could efficiently transfer heat away from the body, while also being breathable, water repellent and easy to make. The researchers made the new material by electrospinning a polymer (polyurethane), a water-repelling version of the polymer (fluorinated polyurethane) and a thermally conductive filler (boron nitride nanosheets) into nanofibrous membranes.

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



Polar Bears Could Disappear by 2100

Polar bears have long been the poster child of the consequences of climate change. A new study now suggests the Arctic species is at risk of being starved into extinction by the end of the century. As sea ice continues to vanish due to warming temperatures, polar bears are increasingly struggling to find the food they need to survive, says the University of Toronto-led study published in the scientific journal *Nature Climate Change*. There are an estimated 22,000–31,000 polar bears in the wild, according to the World Wildlife Fund, although precise numbers are hard to determine due to their remote habitat. The species is listed as vulnerable.

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



Artificial Intelligence to Identify Individual Birds of Same Species

Humans have a hard time identifying individual birds just by looking at the patterns on their plumage. An international study involving scientists from the CNRS, Université de Montpellier and the University of Porto in Portugal, among others, has shown how computers can learn to differentiate individual birds of a same species. The results were published on July 27, 2020 in *Methods in Ecology and Evolution*. The researchers have for the very first time identified individual birds with the help of artificial intelligence technology.

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





Soil Animals are Getting Smaller with Climate Change

The biomass of small animals that decompose plants in the soil and thus maintain its fertility is declining both as a result of climate change and over-intensive cultivation. To their surprise, however, scientists from the Helmholtz Centre for Environmental Research (UFZ) and the German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig have discovered that this effect occurs in two different ways: while the changing climate reduces the body size of the organisms, cultivation reduces their frequency. Even by farming organically, it is not possible to counteract all negative consequences of climate change, the researchers warn in the trade journal *eLife*.

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



Masks Made From Banana-Tree Species Could Help Cut COVID Plastic Waste

Fibre from a relative of the banana tree could replace plastic in millions amid the coronavirus pandemic. Plastic used in face masks and hospital gowns the world-over has been found to be a major polluter in the fight against the coronavirus.

The World Economic Forum has found that 'coronavirus waste has become a new form of pollution as single-use personal protective equipment (PPE) floods our ocean. COVID-19 has had a number of unexpected impacts on the environment, curtailing recycling and increasing the use of plastic around the world.' Abaca, a fibre from the Philippines used in teabags and banknotes, is as durable as polyester but will decompose within two months, said Philippine fibre agency head Kennedy Costales.

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

Thawing Permafrost Reveals Woolly Mammoth Skeleton in Russia's Arctic Lake

Russian scientists are poring over the stunningly well-preserved bones of an adult woolly mammoth that roamed the earth at least 10,000 years ago, after local inhabitants discovered its remains in the shallows of a north Siberian lake. Part of its skull, several ribs and foreleg bones, some with soft tissue still attached to them, were retrieved from Russia's remote Yamal peninsula above the Arctic circle on July 23, 2020. Scientists are still searching the site for other bones. Similar finds in Russia's vast Siberian region have happened with increasing regularity as climate change warming the Arctic at a faster pace than the rest of the world has thawed the ground in some areas long locked in permafrost.

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



Towards Green Steel

In this article, **Will Hall** and **Thomas Spencer** highlight that at TERI they have developed a robust understanding of the factors that drive the transition towards cleaner technologies through their Energy Transitions Commission India work programme. In January 2020, they published a report presenting an initial overview of the Indian steel sector and the options to mitigate its impact on the environment, through reducing emissions. Here, they discuss the recommendations from this report, which have been organized into three pillars.

Steel is a material of vital importance to the Indian economy, as with all economies. If the living standards of Indian citizens are to increase, then the use of steel will also need to increase substantially. With this increase in steel demand comes a myriad of challenges and opportunities, not least amongst them the impact this would have on the environment.

At TERI, we have developed a robust understanding of the factors that drive the transition towards cleaner technologies through our Energy Transitions Commission India work programme. Whilst much work has been carried out in the power sector, we are just beginning to understand what such a transition might look like for the highest energy consuming sectors of the Indian economy; the heavy industry sectors, chief amongst them being steel.

In January 2020, we published a report¹ presenting an initial overview of the Indian steel sector and the options to mitigate its impact on the environment, through reducing emissions.

Our recommendations from this report are organized into three pillars.



Pillar 1: Improve Energy Efficiency, Resource Efficiency and Material Circularity

Today, the Indian iron and steel sector is relatively energy intensive compared to international benchmarks. However, on reviewing a large number of possible energy-efficiency measures, we have shown that the average plant could lower energy consumption per unit output between 24 per cent and 38 per cent, depending on the production route.

This would have important benefits in lowering aggregate energy consumption and CO₂ emissions, where adoption of best available energy-efficiency technologies could reduce overall emissions by up to 15 per cent by 2050, versus the *Baseline* (where some energy-efficiency measures are adopted).

Reducing steel consumption through resource efficiency can have a substantial benefit in terms of more efficient aggregate resource use across the Indian economy. Indeed, certain structural trends like the emergence of ride-sharing (Uber/Ola), the emergence

¹ Towards a Low Carbon Steel Sector: Overview of the Changing Market, Technology, and Policy Context for Indian Steel (2020)

of the gig economy, teleworking and coworking suggests that the future Indian economy, even in the absence of further policy measures, may in fact be less steel intensive than the Baseline Scenario presented before. If we also consider policies to actively promote resource efficiency, steel demand could be 25 per cent lower by 2050, compared to our Baseline Scenario. Production of energy intensive primary steel can be avoided by increasing the collection and use of domestic scrap steel, which is 85 per cent less emissions intensive than primary steel today. In addition, India already imports substantial quantities of scrap and there may not be much scope for increasing scrap imports. In a low-carbon future, demand for scrap in developed countries is likely to increase, given the reduced emissions through the secondary production route. A scenario combining resource efficiency and increased circularity could further reduce emissions by 20 per cent by 2050.

Pillar 2: Implement Transition Strategies by the 2030s and Deep Decarbonization Options by the 2040s

Even with the above-described energy and resource-efficiency measures, the iron and steel sector would still emit around 500 Mt of CO₂ by 2050. Theoretically, substituting natural gas for coal could further lower emissions, but this option can be discounted as a majority solution given the lack of domestic gas and the expense of imported gas in India. A more promising transition option would be the HIsarna process, which can reduce emissions by 20 per cent, compared to the traditional Blast-Furnace Basic Oxygen Furnace route (BF-BOF). If the resulting pure stream of CO₂ from the blast furnace route is captured using the Carbon Capture Use and Storage (CCUS) route, then emissions could be reduced by up



to 80 per cent. This technology is already being trialled in Europe by Tata Steel, the owner of the technology.

By the 2040s, it is expected that more radical decarbonization technologies, which are currently being demonstrated, would be commercially available. Of particular interest is the hydrogen route, which involves the substitution of coal or natural gas as a reducing agent with hydrogen. If hydrogen is produced from emissions-free electricity, the total iron and steel emissions can be reduced by 94 per cent.

Pillar 3: Promote International Collaboration, Innovation and Technology Diffusion and Develop a Domestic Low-carbon Steel Strategy

India should actively promote international innovation, technology learning and diffusion, and become a major driver of the push to zero-carbon steel. Due to the rapid expected demand increases and lack of available domestic resources (such as natural gas and coal), it stands to be the major beneficiary.

Secondly, India should develop a domestic pathway towards a low-emissions iron and steel sector by 2050,

and zero emissions shortly thereafter, ideally by 2060. The long-term low emissions development strategy that India will submit to The United Nations Framework Convention on Climate Change (UNFCCC) provides an opportunity to do so, as does the India 2047 vision being developed by NITI Aayog. Domestic policy frameworks to promote energy and resource efficiency already exist in the form of the Perform, Achieve and Trade Scheme, the Steel Scrap Recycling Policy and the Draft National Resource Efficiency Policy. These can be implemented and strengthened over time. They should also be complemented with policies to promote innovation and technology demonstration for crucial technologies such as HIsarna, CCUS, and hydrogen-based steel production. This could include proactively pushing for international collaborative research, development and demonstration (RD&D) programmes, engaging in international consortia, and seeking funding and technology from international donors. In this regard, developed countries also need to realize that the climate policy agenda has to shift towards promoting industry decarbonization and supporting India in its endeavours to deploy low-carbon technologies out to 2050. ■

Will Hall, Associate Fellow, Industrial Energy Efficiency Division, TERI and Thomas Spencer, Fellow, CGER, TERI.

COVID-19 Lockdown

Fifty Per Cent Global Reduction in Human-linked Earth Vibrations

The lack of human activity during lockdown caused human-linked vibrations in the Earth to drop by an average of 50 per cent between March and May 2020. This quiet period, likely caused by the total global effect of social distancing measures, closure of services and industry, and drops in tourism and travel, is the longest and most pronounced quiet period of seismic noise in the recorded history.

A new research, led by the Royal Observatory of Belgium and five other institutions around the world including Imperial College London, showed that the dampening of 'seismic noise' caused by humans was more pronounced in more densely populated areas. The relative quietness allowed researchers to listen in to previously concealed earthquake signals, and could help us differentiate between human

and natural seismic noise more clearly than ever before.

Co-author Dr Stephen Hicks, from Imperial's Department of Earth Science and Engineering, says: 'This quiet period is likely the longest and largest dampening of human-caused seismic noise since we started monitoring the Earth in detail using vast monitoring networks of seismometers. Our study uniquely highlights just how much

human activities impact the solid Earth, and could let us see more clearly than ever what differentiates human and natural noise.' The paper was published in July 2020 in *Science*.

Anthropause

Measured by instruments called seismometers, seismic noise is caused by vibrations within the Earth, which travel like waves. The waves can be triggered by earthquakes, volcanoes, and bombs—but also by daily human activity like travel and industry. Although 2020 has not seen a reduction in earthquakes, the drop in human-caused seismic noise is unprecedented. The strongest drops were found in urban areas, but the study also found signatures of the lockdown on sensors buried hundreds of metres underground and in more remote areas.

Human-generated noise usually dampens during quiet periods like over the Christmas/New Year period and Chinese New Year, and during weekends and overnight. However, the drop in vibrations caused by COVID-19 lockdown measures eclipse even those seen during these periods. Some researchers are dubbing this drop in anthropogenic (human-caused) noise and pollution the





‘anthropause’. Dr Hicks says: ‘This is the first global study of the impact of the coronavirus anthropause on the solid Earth beneath our feet.’ To gather the data, researchers looked at seismic data from a global network of 268 seismic stations in 117 countries and found significant noise reductions compared to before any lockdown at 185 of those stations. Beginning in China in late January 2020, and followed by Europe and the rest of the world in March to April 2020, researchers tracked the ‘wave’ of quietening between March and May 2020 as worldwide lockdown measures took hold.

The largest drops in vibrations were seen in the most densely populated areas, like Singapore and New York City, but drops were also seen in remote areas like Germany’s Black Forest and Rundu in Namibia. Citizen-owned seismometers, which tend to measure more localized noise, noted large drops around universities and schools around Cornwall, UK and Boston, USA—a drop in noise 20 per cent larger than seen during school holidays. Countries like Barbados, where

lockdown coincided with the tourist season, saw a 50 per cent decrease in noise. This coincided with flight data that suggested tourists returned home in the weeks before official lockdown.

Listening in

Over the past few decades, seismic noise has gradually increased as economies and populations have grown. The drastic changes to daily life caused by the pandemic have provided a unique opportunity to study their environmental impacts, such as reductions in emissions and pollution in the atmosphere. The changes have also given us the opportunity to listen in to the Earth’s natural vibrations without the distortions of human input.

The study reports the first evidence that previously concealed earthquake signals, especially during daytime, appeared much clearer on seismometers in urban areas during lockdown. The researchers say the lockdown quietening could also help them differentiate between human-caused noise and natural signals that might warn of

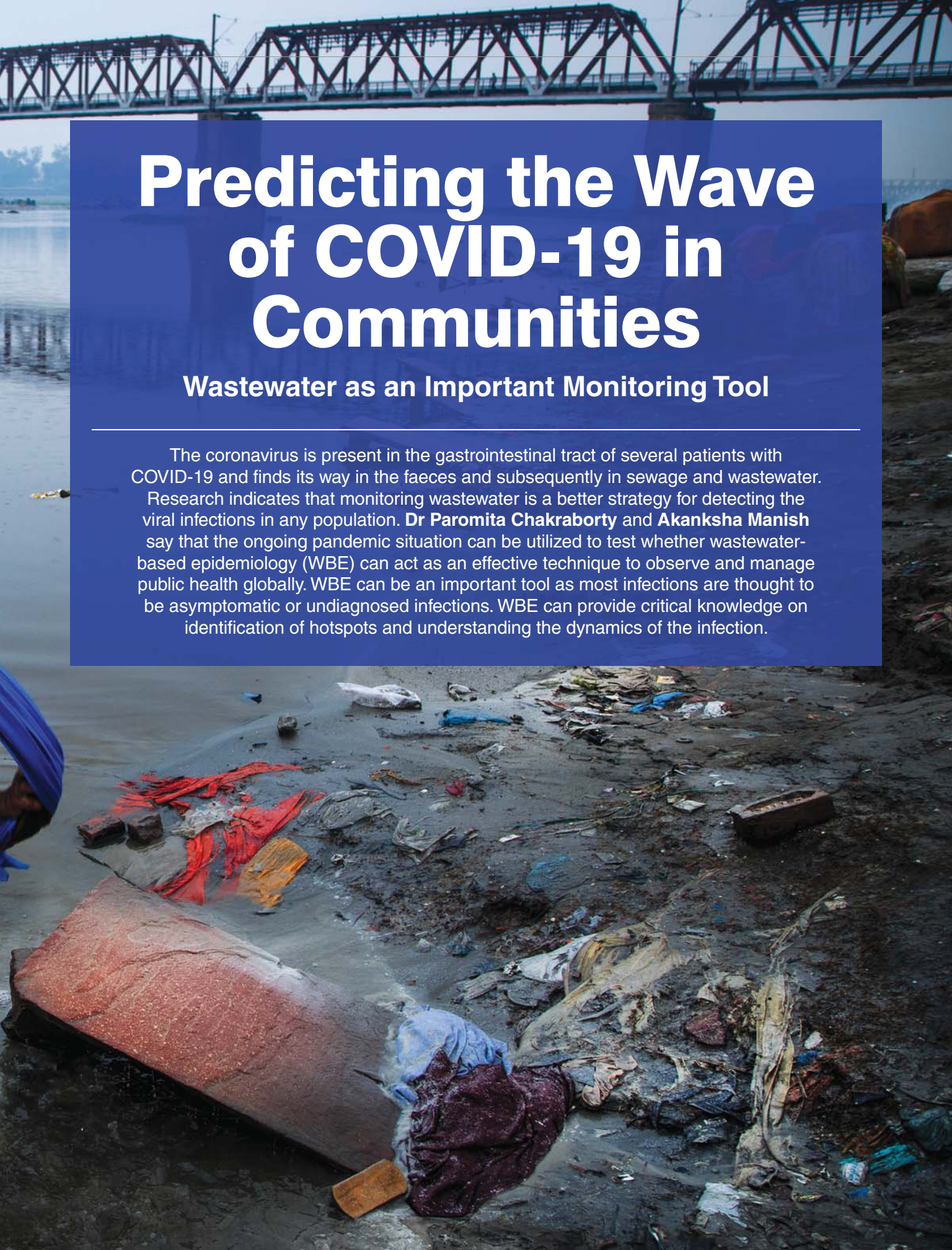
upcoming natural disasters. Lead author Dr Thomas Lecocq from the Royal Observatory of Belgium says: ‘With increasing urbanization and growing global populations, more people will be living in geologically hazardous areas. It will therefore become more important than ever to differentiate between natural and human-caused noise so that we can ‘listen in’ and better monitor the ground movements beneath our feet. This study could help to kickstart this new field of study.’

The study’s authors hope that their work will spawn further research on the seismic lockdown, as well as finding previously hidden signals from earthquakes and volcanoes.

Dr Hicks further said: ‘The lockdowns caused by the coronavirus pandemic may have given us a glimmer of insight into how human and natural noise interact within the Earth. We hope this insight will spawn new studies that help us listen better to the Earth and understand natural signals we would otherwise have missed.’ ■

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





Predicting the Wave of COVID-19 in Communities

Wastewater as an Important Monitoring Tool

The coronavirus is present in the gastrointestinal tract of several patients with COVID-19 and finds its way in the faeces and subsequently in sewage and wastewater.

Research indicates that monitoring wastewater is a better strategy for detecting the viral infections in any population. **Dr Paromita Chakraborty** and **Akanksha Manish** say that the ongoing pandemic situation can be utilized to test whether wastewater-based epidemiology (WBE) can act as an effective technique to observe and manage public health globally. WBE can be an important tool as most infections are thought to be asymptomatic or undiagnosed infections. WBE can provide critical knowledge on identification of hotspots and understanding the dynamics of the infection.



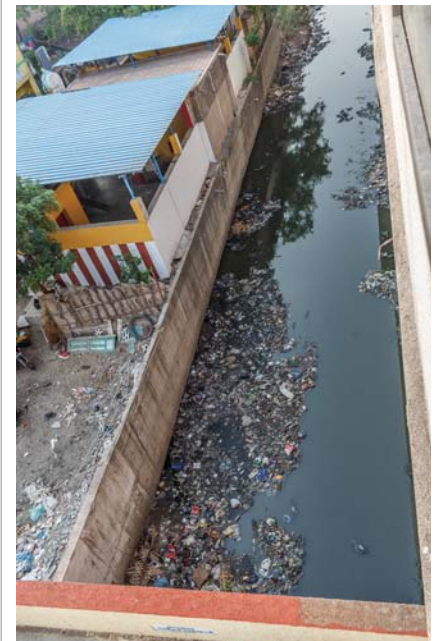


Severe Acute Respiratory Syndrome coronavirus 2 (SARS-CoV-2) has triggered the current global pandemic. Infection induced by this novel virus made of 4 proteins and a strand of ribonucleic acid (RNA) leads to coronavirus disease 2019 (COVID-19), thereby, impacting the global ongoing efforts towards achieving many of the Sustainable Development Goals (SDGs). Breaking human transmissibility of this new virus comes down to the practice of good hand hygiene. Frequent disinfection is a must for arresting the contagion from spreading. The countries with least resilient water, sanitation, and hygiene (WASH) infrastructure were observed to be the worst affected. The joint monitoring report of WHO-UNICEF (JMP 2019 Update) has revealed stark realities that globally around 2.2 billion people lack safe drinking water, 4.2 billion people live without access to adequate sanitation, and 3 billion people lack basic

handwashing facilities at home. Major percentage of the 3 billion stems from South Asian and Sub-Saharan African countries which houses 85 per cent of the world's poor population with fragile health systems along with the absence of trained personnel. Worse still, majority of this population consists of elderly, disabled, displaced and indigenous people making them the most vulnerable lot (WSSCC, 2020). As per the National Family Health Survey (NFHS), in India the population without handwashing facilities has been 39.8 per cent (NFHS-4, 2015–16).

Viable viral RNA can find its way to wastewater stream via bodily excreta, viz., saliva, faeces, and sputum. Major transmission route of contamination of this virus is inhalation via person-to-person and aerosol/droplet transmission, fomite and hand contamination. Studies surrounding the virus have indicated that an in-depth knowledge about

wastewater acting as potential point sources is needed since sewers mirror the health profile of the surrounding communities. However, there lies a



paucity of data on the presence of human coronaviruses in surface or groundwater sources. It could, however, remain infectious in water contaminated with faeces for days to weeks. Yet, there is a paucity of data on faecal–oral transmission of the COVID-19 virus (WHO, 2020).

A number of measures can be taken to improve water safety, starting with protecting the water source, treating water at the point of distribution, collection, or consumption; and ensuring that treated water is safely stored at home in regularly cleaned and covered containers. In the absence of centralized water treatment, several household techniques, viz., boiling, appropriately dosed chlorine, ultrafiltration, nano-membrane filters, solar and ultraviolet (UV) radiation can be used as effective removal measures for the virus. Ensuring the viability of critical supply chains of soap, disinfectant, point-of-use water treatment supplies, etc., as well as lifting of import/export restrictions on critical equipment needed by utilities or households, would strengthen measures towards fighting COVID-19.

The COVID-19 Virus

SARS-CoV-2 has a lipid bi-layer envelop with spikes that form a ‘crown’-like structure resembling the solar corona. Distinct spike protein in SARS-CoV-2 helps it to bind to the cell membrane more effectively than the SARS-CoV making the former more threatening. While there is significant lack of studies on the survival of COVID-19 in water, wastewater or sewage, there lies a likelihood that this virus can get inactivated significantly faster than non-enveloped human enteric viruses with known water-borne transmission (such as adenoviruses, norovirus, rotavirus, and hepatitis A). Higher temperature, acidic/basic condition, solar radiation, and disinfectants (such as chlorine) were observed to facilitate die-off. For example, a study confirmed the



survival of surrogate human coronavirus in dechlorinated tap water and in hospital wastewater at 20°C with 2 days incubation period. On the other hand, 99.9 per cent die-off was recorded for transmissible gastroenteritis coronavirus and mouse hepatitis virus between 2 days and 2 weeks incubation period.

Wastewater as a Tool for Early Signalling of COVID in Communities

For several patients with COVID-19, the novel coronavirus is present in their gastrointestinal tract, and thus finds

its way in the faeces and subsequently in sewage and wastewater. Research indicates that monitoring wastewater is a better strategy for detecting the viral infections in any population. Using reverse transcriptase quantitative polymerase chain reaction (RT-qPCR) of the extracted RNA in wastewater from wastewater treatment plant (WWTP) would suggest if there is a chance of COVID-19 spread from the same WWTP.

Scientists from the Netherlands National Institute for Public Health and the Environment in Bilthoven have suggested that routine surveillance of wastewater would help quantify the





scale of infection in a community and this could be used as a non-invasive early signalling tool to alert communities to new COVID-19 infections as per experts. (Nature, April 2020). Furthermore, The University of Queensland (UQ) and Australia's national science agency CSIRO researchers have developed an early warning surveillance system designed to detect the presence of SARS-CoV2 in Australian untreated wastewater (Ahmed *et al.*, 2020). Wastewater containing viruses excreted from infected or carrier individuals can end up in a catchment (Sinclair *et al.*, 2008; Xagorarakis and O'Brien, 2020). Although certain control measures, such as social distancing might suppress the current pandemic, however, there have been several evidences regarding the return of the virus with the relaxation of the measures. This gives the public health officials another layer of data on the extent of the outbreak. Worldwide, scientists are tracking

wastewater for the novel coronavirus SARS-CoV-2 to check if the virus is re-emerging in communities.

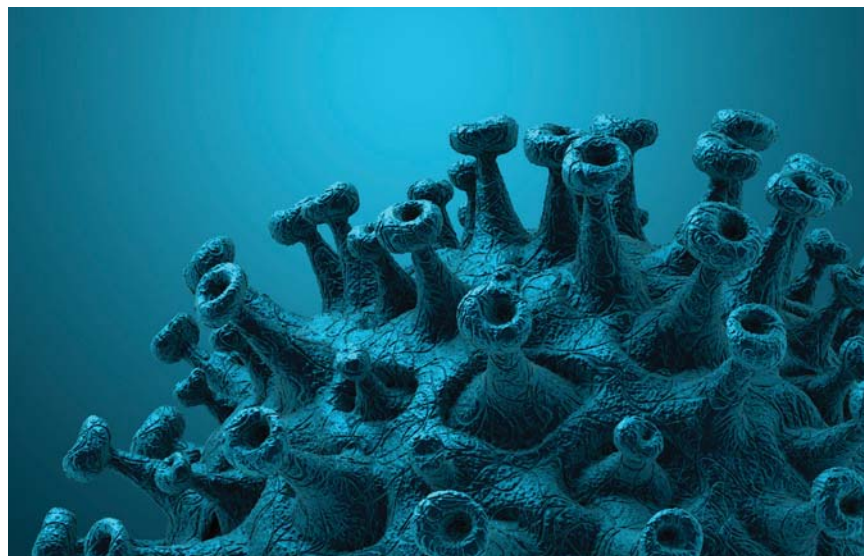
Challenges of Wastewater Treatment

To curb the secondary impact on the well-being of any community during the recovery phase, safe management of sewage treatment plants (STPs), WWTPs and provision of WASH services are of utmost importance. If not managed properly, particularly for endemic diseases the secondary impact can further increase the risk of spreading water-borne diseases.

The status of wastewater treatment in India is not very encouraging as many of the STPs are either partially functional or non-functional. A report by the Central Pollution Control Board (CPCB) published in 2014–15, carried an examination of the present state of STPs in India. It states that about 33 per cent of wastewater is treated in India and the remaining is discharged in the surrounding water bodies. Furthermore, only two-thirds of the STPs in India are operational, leaving 64 per cent of the country's wastewater directly in the aquatic ecosystem. There are several problems as far as STPs are concerned, and unless the issues are addressed collectively, the gap between

the amount of sewage generated and treated will keep increasing. Out of all the issues, expensive maintenance costs of STPs is the most damaging aspect rendering them non-operational.

Majority of the STPs installed in Uttar Pradesh, Bihar, New Delhi and West Bengal were observed to be in poor operating conditions. The main issue underlying poor working conditions was due to infrastructural maintenance leading to improper aeration and flow disruption, consequently affecting the performance of the STPs leading to their closure. In addition, lack of skilful labour and trained personnel in STPs and WWTPs was also found to aggravate the present problem. This is often attributed to agencies which take over the responsibilities of operation and management of STPs with similar aforementioned issues. Furthermore, improper maintenance, fluctuation in power supply, excess loading of existing facilities and lack of operation and maintenance (O&M) funding were also found to aggravate the problem. STPs are generally not self-financing and given that urban local bodies (ULBs) are often in poor financial condition, STPs depend on unreliable State government funds. The reluctance of State governments to support with more funds in the maintenance of STPs plays a big role in



agencies given contracts to maintain them. Most of these are dependent on charges levied by the maintenance agencies on residents' associations or industries. The fee collected from these is never enough to pay skilled STP workers, as a result of which lowly skilled workers are hired that add to the problems of an ill-functioning STP.

Opportunities for India in the Post-COVID-19 Era

The Government of India is now working on the next phase of the Swachh Bharat Mission (SBM 2.0) and is rightly focused on the next set of related and critical outcomes for safe sanitation and hygiene. These include: ensuring sustainability of the significant progress made on toilet access, ensure continued usage of facilities created and usage; providing sufficient water and connections for sanitation systems to work; and perhaps most importantly, proper collection, containment, treatment, disposal or recycling of faecal waste accumulated in septic tanks and pits. With SBM-2.0, India is on course to deliver safe and hygienic sanitation to all its citizens. The National Urban Sanitation Policy (NUSP), National Water Policy (NWP) are also being updated in 2020. This is a great opportunity to recalibrate systems' thinking and upgrading the wastewater treatment facilities and WASH systems in India. This is also an opportunity to develop a robust Conceptual Framework and strengthen sanitation and hygiene in WASH systems' thinking and approaches. This would require us to leapfrog to the next steps towards deploying disruptive toilet-to-treatment technologies, strengthening municipal capacities, driving behaviour change efforts and building local community ownership models towards safe sanitation and hygiene. Equally important is to channelize more funds for sanitation and hygiene. This, along with the continued political will is the future path to sustainable WASH outcomes.



India's urban growth is highly uneven due to the wide prosperity gap between large cities and their neighbouring peri-urban areas. The larger cities are growing faster at their peripheries; for example, expansion of New Delhi was approximately two folds lower when compared to Gautam Budh Nagar (neighbouring district) with a 4 per cent annual expansion (Ellis and Roberts, 2016). Cities are also patchy within, with denser edges and thinner cores. Additionally, 'the proportion of built-up area outside a city's official boundaries exceeds that within its boundaries' (Ellis and Roberts, 2016). Such uncontrolled urbanization has led to several problems associated with delivering basic services. The intensely dense urban areas with fragile WASH services, which was occupied by migrant labourers have recently witnessed a huge change due to the reverse migration amidst lockdown. This is an opportunity to recalibrate our urban spaces and make them more liveable for organized living.

Recommendations

A multi-stakeholder inclusive approach is needed to achieve sustainable sanitation for all at all times. The government, regulators, funding agencies, and private sector need to work together to address

the current gaps around implementation and create replicable approaches and models. The current capacities of government functionaries and private service providers are limited and need handholding support. To prevent the spread of COVID-19, educating the masses regarding safe sanitation cannot suffice. Investments in promoting hand hygiene, coupled with sanitation and water must be for the long haul.

The ongoing pandemic situation can be utilized to test whether wastewater-based epidemiology (WBE) can act as an effective technique to observe and manage public health globally. WBE can be an important tool as most infections are thought to be asymptomatic or undiagnosed infections. WBE can provide critical knowledge on identification of hotspots and understanding the dynamics of the infection thereby alerting the public health community to take up effective preventive measures. Real time data on wastewater would induce proper policy setting and would hence help to curb the economic crisis substantially caused due to COVID-19-related lockdowns. ■

Dr Paromita Chakraborty, Associate Professor, SRM Institute of Science & Technology, Chennai, and Akanksha Manish, Student, Grade XII, The Shri Ram School Aravali, Gurugram.

Life Through Art and Art Through Life

American mural artist and painter, **Kathleen Scarboro**, educated in the arts both in the US and France, is the co-founder of the Friends of Community Public Art, Illinois, USA. Her public art includes mural paintings, mosaics and life size sculptures in various cities in the US. In an interview with **N Kalyani**, for *TerraGreen*, the artist shares the making of her art and more.

Please tell us about your recent book *Vagabond Soul*. Your paintings blend various components such as flora, fauna, water bodies, draperies and human figures in an aesthetically enchanting way giving your works as much spiritual, social and emotional significance as environmental importance.



Kathleen Scarboro in Manapakkam in Chennai

Vagabond Soul, a bilingual in English and French, published in France and released this year, features forty of my India-centric paintings made over the last 20 years, as also poems and texts from Indian writers. The basic role of a work of art is communication. My mural experience taught me to concentrate on grand themes and pulled me to a situation where I was no longer interested in my own personal trajectory, but with our shared story. So, thanks to my public art orientation, my eyes, rather than looking inside, were directed towards the outside, towards other people and their ways of life.

You have portrayed flora and fauna in almost all your India paintings either in a realistic or stylized way. There is a variety of plant species as also animal species, both terrestrial and aquatic, that one can find in your works. So one can find the heliconia, plantain, lotus and rose; the elephant and peacock; insects like the butterfly and dragonfly; water birds; and sea creatures. Please share your views on creating such works.

In my paintings I constantly allude to what I consider to be one of the main problems of humanity. We as a species have somehow concluded that we are outside of nature, looking at it, and manipulating it with more or less success. The presence of landscapes, water bodies,

birds and animals, trees and flowers, that is, nature, in my work, which blend in varying levels of transparency with the figures, are intended to show that we are not exterior to our environment, we are one with it, part of it. Mentally separating ourselves from nature could be fatal to humans and other species. I try to bring back, for myself and others, a oneness between ourselves and the natural world. I try to show how the figures/characters and the world in which they live are totally inseparable.

Water bodies specifically. You have shown in your paintings water bodies like the river, well, sea, and the Ganges, and their use by humans. What are your views on portraying water in your works?

Rivers are symbols of paths taken that lead us forward. The ocean appears to us as a symbol of freedom and infinity. Water is a universal symbol, and central to life. In India, as well as in the West, water as a symbol has spiritual significance. In India, people go to the Ganges and immerse themselves for purposes of purification. Water as a subject to paint is rich and varied. Waves, droplets, the effect it has on drapery when soaked, all these are exciting visual subjects.

You depict in your paintings various natural scenes and life in India. Since when have you been visiting India?



Bricks Carried

And which places have you visited?

I have visited various places in India, and witnessed the natural beauty and heritage of the country as also the places of historical and architectural importance. I have been on the Ganges taking a boat ride at dawn on the river at Varanasi. I have also been to the backwaters of Kerala.

I have visited the big cities—Delhi, Chennai, Mumbai, Hyderabad, Kolkata and Jaipur—and the art museums in these cities. I have also seen the caves of Ajanta, Ellora, Konark, Bhubaneswar, the caves of Udayagiri, Rabindranath Tagore's home in Kolkata, the site of Hampi, the frescoes of Mattancherry, the Taj Mahal, and the temples of Akshardham, Trichy and Mahabalipuram. These are just some of the places I have been to. I visited all these places to include elements of the natural, historical, architectural and cultural heritage of India in my paintings. And I enjoyed my travels immensely, taking as much time as I could for each discovery.

Life as a complex whole—humans in their multifarious activities as also nature and environment—is also reflected in the poems and prose pieces of the 35 Indian writers past and present included in *Vagabond Soul*. There are poets, writers, thinkers and spiritual luminaries as well as



The Lal Bagh Tree

contemporary writers. How did you zero in on the poets and writers and their works?

It took me two years of reading Indian poetry to find the texts I finally chose. It was a sort of treasure hunt. I also visited my friend Catherine Servan-Schreiber (who has penned the preface to my book) who has an impressive library of Indian literature in her home. I also sought France Bhattacharya's help as she is the Rabindranath Tagore translator here in France. Choosing the painting-poetry format for the book allows us to

give 'teasers' to the European audience to entice them to read Indian writers who are not known here as they should be.

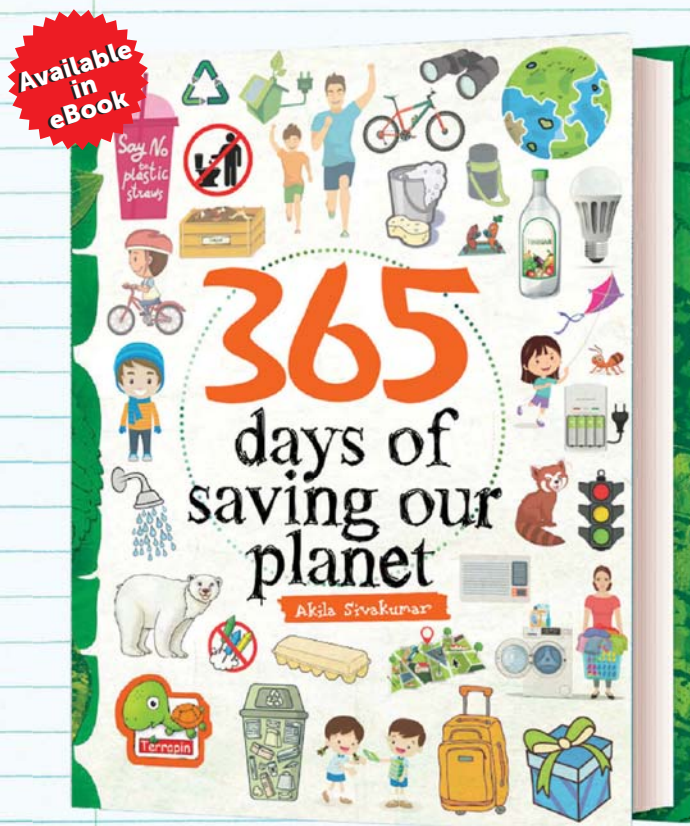
The preface to *Vagabond Soul* mentions that you cultivate a 'wonderful flower garden in the village of Talmontiers, in the Pays de Bray'. Please share with us something about your interest in gardening.

I live in France, and the garden referred to in the book is in Normandy where my country house is. I also have a garden next to my studio in Paris that I tend with a neighbour. I also lend a helping hand to friends when they need help in their garden. As regards gardening, I feel we can each, on an individual level, create a small paradise where we can relax and enjoy the poetry of nature. It takes very little financial investment, but does take a lot of dedication and care. I collect my own seeds every year, or reproduce plants by taking cuttings, and have propagators to nurture and protect them until they are strong enough to face the challenges of the outdoors. I also built a studio/greenhouse in the country so I could also enjoy indoor varieties. ■



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Impact of COVID-19 Pandemic

on Environment and Socio-economic Dynamics

The coronavirus pandemic has resulted in global lockdowns, sharply restraining economic activity. The pandemic also had significant impact on socio-economic dynamics. Through this article, **Dr Saba Noor**, **Dr Shama Parveen** and **Prof. Sher Ali** wish to sensitize us to fine-tune our civility and act as responsible global citizens avoiding superstition and complacency. We must refrain from unsustainable practices that could harm the environment further. There should be efforts from our side to extend helping hand to others as much as possible in such pressing times. We must also prepare to face the aftermath of this pandemic to rebuild the society, our nation, and the world.





Currently, the coronavirus pandemic has caused global upheaval, impacting everyone on the earth. Humans have committed unprecedented atrocities on nature and are responsible for large-scale deforestation, contamination of water bodies, habitat destruction, and overexploitation of the earth's resources. It is still not too late for us to mend our ways and protect our environment, arrest its rampant contamination, recycle domestic and industrial waste, and undertake large-scale plantation to restore the forests and green belts.

Environment for us is like the soul in our body because it supports, nourishes, and sustains us. However, humans have been highly irresponsible and have destroyed all the bounties of nature in the name of progress. The industrial revolution has propelled the rate of consumption and we have started collecting things that we do not need or need in only small quantities. All such activities directly or indirectly put pressure on the environment. Despite much debate on the origin of the coronavirus, it is largely agreed that it is a zoonotic disease and has originated from animal(s). Some pathogens share symbiotic relationship with their animal hosts and survive without encroaching upon other living systems. When the survival of

these pathogens is at stake, they look for another host. Darwin's theory of 'survival of the fittest' remains operative all the time. If the newly found host happens to be human, that pathogen invariably proves to be virulent. Alternatively, it becomes an integral part of the human genome. If this relationship is favoured evolutionarily, the virus becomes a permanent guest. The coronavirus pandemic has raised several environmental, social, emotional, educational, economic, and health care-related questions. In addition, it has also posed a challenge to law enforcement agencies and



care givers. Despite many departments that are affected, the health care system is able to provide some respite from this dreaded disease (Figure 1).

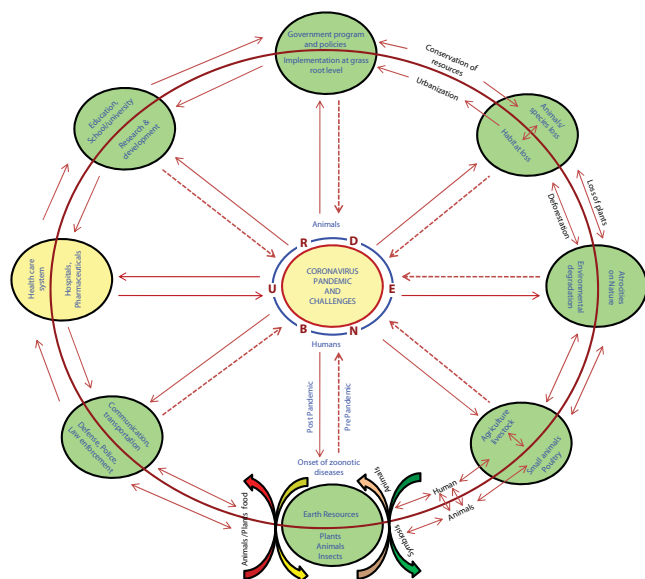


Figure 1: The illustration shows that coronavirus contagion has affected almost every department/sector in the country. The only department that has a big role to play is human health care systems (two solid arrows). This includes hospitals and pharmaceutical industries. The discontinuous arrow means that such departments have negligible effect to contain the coronavirus pandemic though they are equally affected. The coronavirus pandemic in the middle circle (which signifies the globe) shows its prowess as it has access to every corner of the world clearly signalling that we must mend our ways if we want to live peacefully on the planet earth.

Coronavirus and Human Infection

Coronavirus Disease 2019 known as COVID-19 is caused by severe acute respiratory syndrome Coronavirus-2 (SARS-CoV-2). The fact that it is highly contagious makes the war against this virus even more challenging. In the present scenario, humans can be divided into susceptible and resistant groups. This is because not every individual is affected with similar severity. Similarly, not every individual dies due to this infection. More than 80 per cent recover and of the remaining 20 per cent, 5 per cent die but rest also recover slowly. The infection and recovery are not only related to epidemiology but also associated with our immune system. However, the immune system fluctuates rapidly

and may be augmented by medicaments, food, clean environment, and a healthy lifestyle.

The human genome has close to about 3.5 billion haploid sequences and 20,000 genes. If a person is already suffering from diseases and he is also infected with coronavirus, such person would prove to be a sitting duck for this contagion. However, this may not be true for everyone because a strong immune system may protect a person from the perils of coronavirus infection. Thus, protecting an individual from the onslaught of the viral load may be the smart way to protect him/her from the infection. In this context, physical distancing makes more sense than relying on herd immunity. This is because herd immunity will first kill many and then protect some later whereas physical distancing will protect many and kill some later, largely those who violate rules of the game. The immune system is affected by the environment the person lives in. Thus, a polluted environment and unhealthy lifestyle will cause many avoidable diseases. A happy and contented person has a more robust immune system than that of an unhappy one.

In the Indian AYUSH (Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy) system and traditional Chinese medicinal (TCM) systems, several herbs are known to be strong immunomodulators. A popular herb tulsi (*Ocimum sanctum*) is known to help during respiratory stress. It has anti-microbial, anti-inflammatory, and expectorant properties, providing much-desired optimum respiratory support during cough and cold. Ashwagandha, Meshashringi, and Chandraprabha are safe and known immunomodulators but unfortunately not many people seem to be aware about these herbs. These medicaments available





commercially are not the cure for coronavirus but would surely augment the sagging immune system of a person providing resistance to the infection. Traditional knowledge and ancient wisdom may also be useful to establish a scientific correlation between an ailing and failing body. A healthy body maintains the optimal functioning condition 'homeostasis,' which is the key to good health and resultant happiness. These alternative medicines largely originating from the plants affect human physiology, reproductive biology, metabolism, endocrinology, genetics, neurology, and immunology.

Plants and Environment

Plants on the earth are 400 million years old, and humans, only 100 million but the significance of plants is all too well known to us. Humans have played havoc with the ecology disregarding the fact that nature maintains a very delicate balance to support and sustain the life processes. If this natural balance is disturbed, life on earth would become torturous. Like humans, other species also depend on one another for their survival and remain part of the ecological chain. The sordid saga is that during 1990–2016, humans have cut down 46 per cent of the trees on earth clearing 1.3 million square kilometres of the forest depriving the environment from the natural source of oxygen.¹ Trees can reduce

particulate matter (PM) from 7–24 per cent and a single tree can produce 250 pounds of pure oxygen per year.² Trees are wonderful filters for dust, smoke, and harmful gases. Tree leaves cool the atmosphere through evapotranspiration providing moisture which in turn protects the forests from fire. A single tree can provide shelter to about 80 different species of birds and store up to 800 pounds of carbon dioxide (CO₂) per year through carbon sequestration. A single oak tree can transpire up to 40,000 gallons of water into

² <https://www.bbc.com/news/science-environment-37813709>; and <https://www.thoughtco.com/how-much-oxygen-does-one-tree-produce-606785#:~:text=%22On%20average%2C%20one%20tree%20produces,for%20a%20family%20of%20four.%22>



¹ Song XP, Hansen MC, Stehman SV, Potapov PV, Tyukavina A, Vermote EF, Townshend JR. August 2018. Global land change from 1982 to 2016. *Nature* **560** (7720): 639–643. doi: 10.1038/s41586-018-0411-9. Epub 2018 Aug 8; and <https://www.nationalgeographic.com/environment/global-warming/deforestation/>

the atmosphere in one year. These are few examples signifying the relevance of the trees in our lives. Trees offer medicine, rubber, food, flowers, wood and shelter to a large number of species which includes microbes, algae, fungi, insects, reptiles, amphibians and many small and large mammals.

The four Vedas—Rig Veda, Sama Veda, Yajur Veda, and Atharva Veda teach us a natural and simple lifestyle for our sustenance. Air, water and plants permeate the universe and are essential for the existence of life on earth, says the Atharva Veda. Yajur Veda says none should kill the animals useful for humans and one should protect the oceans as they are treasure troves. The tradition of harmony has been maintained since the time of Puranas. In essence, Vedic civilization was rooted in the judicious use of natural resources. Despite the availability of this valuable information, we remain largely ignorant or knowingly arrogant.

Atrocities on Nature

No species has caused environmental damages as much as humans. Massive environmental degradation and large-scale atrocities on nature committed by humans have resulted in serious consequences. Global warming, food shortage, depletion of local germplasm, extinction of species, an outbreak of newer unknown diseases, and loss of forests are a few examples. Similarly, rampant use of polythene and plastics and their unscientific disposal allowing them to reach the water bodies have choked the entire system affecting the marine and aquatic species in a major way.

Nature has remained a silent spectator, tolerating the arrogant and defying attitude of the humans for much too long. But when this hegemony and high handedness reached the brim, nature could not take it anymore and now has started paying in the same coin. Some animals are used as food in a civilized manner. However, humans have also started consuming those animals that harbor different types of pathogens. Bushmeat is meat from wildlife species that are hunted for human consumption. The practice of bushmeat consumption has started showing the negative consequences. The current coronavirus infection that has gained gigantic proportions, is one such example caused due to our own follies. This pandemic must be seen as a wake-up call in a larger perspective. We had contagions earlier also but not to this unprecedented scale and not with such severity. In Western countries, the apparent environmental filth may be a lot less but the rampant use of plastic and packing materials have choked the water bodies affecting marine lives



in a big way. Because of our arrogance, we have not only committed the atrocities on nature but have also depleted the earth's resources by mining lands for minerals, coal, metals, and heavy earth materials. Thus, we brought many perils to the environment little realizing that we cannot ever defeat nature. This fact is now and warrants us to protect nature for the sake of humanity and future generations.

Nature and Civility

Respecting nature and protecting environment does not require rocket technology. It only needs honesty, planning, will power, and a sense of responsibility and civility. A country should not be evaluated just by its technologies but by the character of its people. In the end, our worth depends upon our values and our greatness depends upon our goodness. We need to augment our sense of civility which comes handy in crisis. During the complete lockdown in the country, large number of daily wagers and labourers tried to walk back home but faced enormous difficulties and many died in the process. Many people came forward to help them while some others also tried to exploit their deplorable situation.



Management of Coronavirus Pandemic and Aftermath

The management of coronavirus pandemic has put enormous strain both on the civilians and government machinery the world over. It calls for large-scale testing of the infected people, providing them medical and moral support and ensuring that they are able to adjust with the society after their recovery. However, in the absence of sufficient infrastructure and hospitals set up, many affected ones are unable to get the care they need. Further, the sagging economy has added additional woe to this scenario.

There are several counties in Africa where no protective gear and mask is available. Social distancing is almost impossible because poor people have to fend for themselves for basic things such as clean water, food, and shelter. Since governments in those countries have been running on ad hoc basis, they could never ever develop roads, hospitals, schools, colleges, universities, and trained manpower. Logically, affluent countries should have been better off to deal with this pandemic. However, the overall death rate belies this fact and shows that they are no better. The way to go is to ensure large-scale testing, providing health care to the affected individuals, and support poor citizens so that the wheel of the economy keeps moving. In the present situation, the governments all over the world need to be innovative, sensitive, and generous.

The Burden on Corona Warriors

World over, caregivers, ambulance drivers, and police forces have received limited support. Many caregivers lack basic protective gear, gloves, masks, sanitized transportation, and mandated hassle-free access to food in a safe and secure environment. It is clear that coronavirus is not going to go away until we are

mentally, emotionally, and behaviourally sanitized. We must live with it and be prepared to face the forthcoming unexpected challenges. Governments world over must take stock of the situation and in retrospect assess both its achievements and failures. They should strive to fix the judiciaries, reform police system and criminal justice system, upgrade medical facilities, spend money on masses, particularly focusing on poor and elderly people, allow only those industries which show respect for the environment, and make tough laws against environmental pollution. It must be made mandatory to reuse, recycle, replace and arrest environmental degradation and get connected with nature. Needless to mention, nature includes plants, animals, mountains, oceans, rivers, ponds, lakes, deserts, insects, birds, and marine organisms. Therefore, the conservation of biodiversity is more important now than ever before. This would arrest the spread of future zoonotic diseases.

Laws, Policies, Social Justice, Implementation, and Enforcement

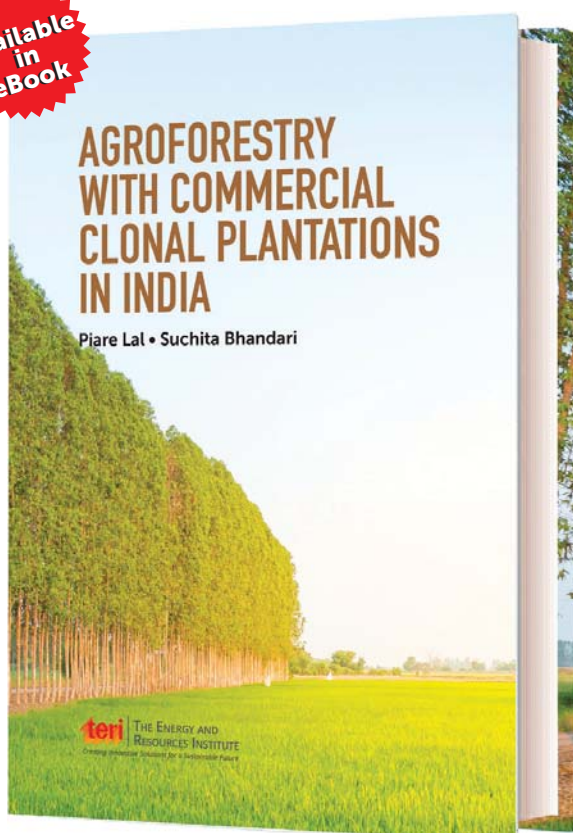
A communication gap amongst different agencies is a recipe for disaster that became clear during the migration of labourers and daily wagers from Delhi to UP, Bihar, West Bengal, and other parts of the country. The lack of coordination culminated in the colossal loss of lives and many died in road accidents. In addition, unexpected rude behaviour was shown by the police on daily wagers and labourers. On many occasions, police personnel played highly positive roles by looking after the distressed, old, and helpless people providing them food, medicine, and moral support, all free of cost. The current overall infrastructure in every sector must also be augmented only to ensure that we remain fighting fit on all fronts all the time. Similarly, citizens too have to act in a more responsible manner, sacrificing their own comforts and maintain harmony in the society, use earth's resources only as much as needed for survival. We need large-scale reform in the society including judicial, medical, industrial, educational, environmental, and banking systems. The ultimate aim and duty of the government must be to provide sense of security and overall happiness even to a common man in the society. If this is achieved, sustainable development of the society will automatically take place. ■

Dr Saba Noor, Research Associate; Dr Shama Parveen, Associate Professor; and Dr Sher Ali, Professor and Director, Centre for Interdisciplinary Research in Basic Sciences, Jamia Millia Islamia, New Delhi.



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When Conservation and Art Meet!

Nature is Art for Conservation

With climate change gradually becoming one of the most immediate global issues of concern, the pressing question exists as to how creators from different sectors react to climate change and environmental issues. In this article, **Biba Jasmine** stresses on how art can facilitate a transition process towards a more sustainable future. And how would the diffusion of experience and South-South cooperation provide added value to the construction of more stable societies.

Changing climate is one of the most immediate global issues of concern. It is at the core of discourse across countries and industries, a conversation that is often mediated by decision-makers and scientists. Changing climatic regime has been a hot topic in public sentiment and the news, but it is still an abstract notion for most individuals. Climate change impacts call for unique and innovative strategies from both civilized society and governments. It advocates for a change to the way we operate and ask some doubts, such

as how is this transformation possible without the need for a change in culture? How can we obtain a broader understanding of climate change through a trans-disciplinary stance?

From participation circles to circles of influence, there has been an increasing loop of contribution to climate change and environmental issues in the cultural sectors of Asia. In India, government funding and schemes such as 'Scheme for Young Artists' in different cultural fields by the Ministry of Culture, support regional initiatives and platforms, such

as 'Centre for Cultural Resources and Training (CCRT)' and 'National Gallery of Modern Art, Delhi', which forge a link between education and culture. The circles have certainly grown in Asia where initiatives tend to be smaller, artist-driven and with a focus on local environmental challenges, which is in contrast to the often more abstract concepts favoured by European artists.

In order to strengthen formal pan-Asian societal networks in the cultural sector, there is a need for attaching greater voice of the arts and culture in the climate and sustainability discussions. Several measures are also being taken by environmental non-governmental organizations (NGOs), which use art as a mechanism to express their ideas and understandings. One such NGO is the Dakshin Foundation, Bengaluru, whose Art, Community and Engagement Programme uses design thinking and cross-disciplinary narratives to make awareness more apparent and to converse with a wide range of audiences in useful and interacting ways. Such distinctive initiatives assist dialogue on global problems, such as climate change





and environmental sustainability. What is essential now is to widen interaction loops to leverage circles with greater voices from artists specifically on appropriate cross-sectoral international forums as well.

Land Degradation and Climate Change

Land is inseparable from water. As a tropical and sub-tropical region, we have long grappled with the challenges of water availability and access. Some of the earliest technologies of water use and storage developed in India. Today, water and the land–water nexus are a major challenge that the world faces. Droughts, flooding, waterlogging, seawater ingress, suboptimal use of rainwater and unsustainable groundwater extraction are some of the challenges which we are facing in the context of land–water nexus. Drier landscapes will also lead to more

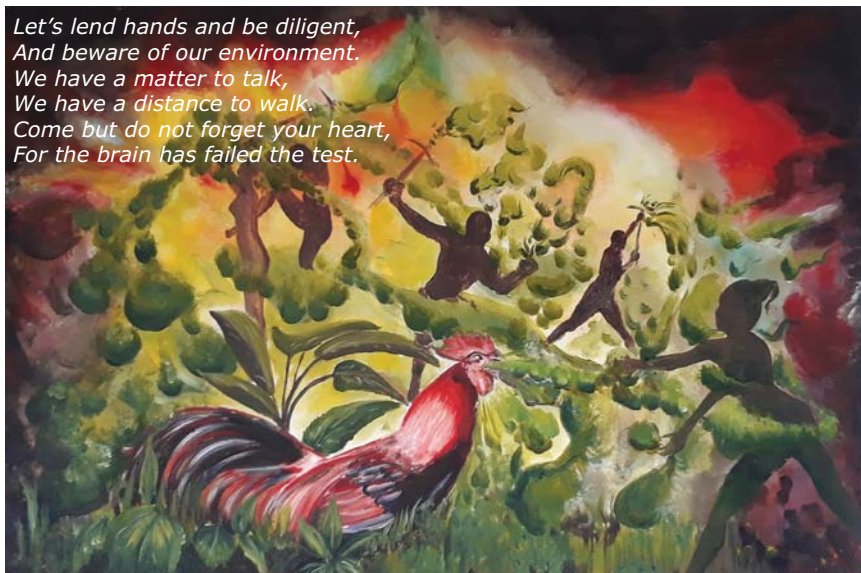
wildfires and perpetuates degradation, climate change, and biodiversity loss. To our understanding, degradation of land and natural resources is also an economic threat. Estimates suggest that land degradation and climate change may force 50 to 700 million people to migrate by 2050. Globally, the estimated annual costs of land degradation is estimated to range between \$18 billion and 20 trillion. The loss of ecosystem services due to land degradation costs between \$6.3 and 10.6 trillion annually, representing 10 per cent to 17 per cent of the world's GDP. Avoiding land degradation and restoring degraded lands makes sound economic sense, resulting in increased food and water security, increased employment, improved gender equality, and avoidance of migration due to distress.

Halting land degradation, and reversing degradation over time from the severe, to the less severe, and moderate categories, will require substantial knowledge, technology, and investment.

We have to devise innovative ways and means of cooperation and support, as per our respective comparative advantage, capacities, and capabilities.

In this regard, India as part of its global commitment hosted the Fourteenth Conference of Parties (COP) to the United Nations Convention on Combating Desertification (UNCCD) in 2019. The conference highlighted the relevance of grassroots organizations and sound procedures in place and noted how the government plays a crucial role in locating and enacting solutions. Over 5000 delegates from more than 197 nations from national, regional and local government agencies, education and research communities, the corporate sector, international organizations and NGOs and all forms of art addressed the question of tackling desertification, land deterioration, and drought throughout the two-week event. The event called for collective actions to harness synergies in environmental programmes by aligning

*Let's lend hands and be diligent,
And beware of our environment.
We have a matter to talk,
We have a distance to walk.
Come but do not forget your heart,
For the brain has failed the test.*



investments in land, forests, water resources, and climate change for long-term sustainability.

India's own national challenges and endowments with respect to land and other natural resources are significant. With only 2.4 per cent of the world's land area, 4 per cent of the world's freshwater resources, using 6 per cent of world's primary energy, it supports 18 per cent of the global human population and one of the largest cattle populations in the world. At the same time, India is a megadiverse country, both biologically and culturally. We have four global biodiversity hotspots, 7 per cent to 8 per cent of all recorded species, the world's largest tiger and Asiatic elephant populations, 10 bio-geographic and 15 agro-climatic zones, 37 UNESCO world heritage sites and 22 official languages with several local dialects.

Intrigue, Curiosity, and Wonder Making it an Endearing Experience

Mr Habteweldi Habte from Eritrea, a northeast African country, is one of the ingenious minds around, who works closely on environmental matters and showcases his visual art in the form of paintings. He exhibits on themes

that have a huge implication on the environmental and health issues. He, through his art, is devoted to shedding light on the profound role of nature that could create a new chapter to address the problems that are threatening us all. Mr Habteweldi Habte at COP14 depicted importance of trees and their significance in the fight against global warming. His art pieces reflected the issues faced by today's youth in general and learners in particular. He also touched upon the importance of conserving natural resources in the present times of climate change. Mr Habte opened up an idea that nature and engagement with nature can set off a sense of love for oneself and the environment and should be promoted. He said, 'I have been close to nature and felt nature in different ways, and the idea of the spirit of biodiversity and environment *per se* had stayed with me into adulthood and become something that I understand differently than when I was younger. For me, the relevant difference in mindset is that I realize that life finds you. When you look for something too hard or try and orchestrate a result, the journey might not be as fulfilling as if life is allowed to lead the way. And with this emotion, global audiences strongly bond with his paintings that unravel one chapter

leading to the next in a very organic manner.

Promote Art Nature Collection

Expressive art images are as natural as nature itself, as they are left unanswered by photography technology. The interaction with the photographs unlocks the mind of the viewer to curiosity, interest, and imagination, making it an alluring experience. The educational aspect of this fine art nature exhibition was to efficiently transform and empower citizens and relevant institutions. Aesthetic visual representation with an inventive style of delivery put together the science and other valuable information of each artistic picture. This spread a new spirit of citizen science across the venue. The skill to convey a comprehension of terms including scarce, disappearing, erosion, deterioration, and so on, in the form of art and to relate to a greater audience is a true talent! Mr Habte's work was not just a painting tour, it was an emotional journey around the COP14 fences that struck a chord with participants and influenced their belief and aroused questions related to the environment, climate change, and biodiversity. His journey was purely based on an instinct that 'nature needs protection'.

Art Should Mesmerize You!

Art work should be captivating and uncomplicated. For an artist that alone is a reason to preserve and encourage the masses to realize what they possess presently before it is too late—is a creditable task. Damage is taking place globally; climate change is in force. The ice caps are melting, sea levels are rising, ocean temperatures are rising, coral reefs are declining, pollution is damaging the ocean, animals are declining—therefore, the time has come to alter. The need of the hour is an understanding

and conscious awareness that this is unfolding now, and quicker than predicted. What we know is—humans are resilient and there are a large number of people out there who care enough and we can turn things around, but only if we all start today. And this when done through art in any form, empowers masses to be informed of environmental issues and act proactively. No, there is no word that I know of, that rightly describes the forceful, awe-inspiring beauty of Mr Habte's depiction towards nature and its varied elements.

Peaceful Co-existence and Connectedness

Traditional Indian rituals underline the need for peaceful co-existence between man and the natural environment. *Vasudhaiva Kutumbakam* terms all forms of life on planet Earth as one family and also enhances the notion of connectedness. Before the popularization of Earth Day (April 22) in the modern age,

the Vedas and Upanishads considered Earth to be our mother and human beings as its offspring. Well before environmental problems occurred, our forefathers forecasted that the thought of environmental protection would be passed on to subsequent generations as Earth's caretakers.

Respect for Nature—From an Artist's Lens

Since the early 1990s, civil society has developed as a central agent and collaborator in the quest for environmental sustainability, and more recently, the involvement of artists and cultural workers as catalysts for change in society has been extensively discussed in the context of climate change. The need of the hour, therefore, is for innovative platforms of exchange between governments and civil society; as well as between different actors within civil society, including academics, scientists, artists, businesses, and the social sector. Therefore, while acknowledging the imminent threat of climate change, it is important to recognize the opportunities for a multi-stakeholder dialogue afforded by this common challenge. And by doing so, we would not just be addressing one of the most pressing challenges of our times but also reaffirm culture as the fourth pillar of sustainability.

Capacity for Change

There has been expanding appreciation of the participation of tradition and the arts to locating alternative solutions to global challenges. Society and policy actors are beginning to realize the border-cutting value of culture and, as a result, its relevance for sustainable development, the environment, literacy, health care and social cohesion, among other fields.

We applaud artists all over the world who are reflecting the advancement of an atmosphere and environmental awareness that will help in global changes in lifestyle resulting in a

drop in carbon emissions. While spreading awareness of the role of art in sustainability, artists have also been mainly interested in expanding innovative and cross-disciplinary frameworks.

There is a need to construct and facilitate art that enables the layperson to communicate environmental jargons easily. It is also important to bring together practitioners from various industries, including politics, the arts, technology and innovation, to resolve the pertinent issues from their new perspectives. Community dialogue requires to be engendered through a variety of settings, involving artistic projects, forums and evaluation and policy meetings. The projects, in effect, not only will cultivate cross-disciplinary relations between society and other stakeholders but will also help to guide feedback to governments on the significant role of the art and culture in dealing with the most urgent issues of our times.

The recently celebrated World Environment Day on June 5, 2020 and the World Day to Combat Desertification and Drought on June 17, 2020, are not mere celebrations. But they were platforms that will, going forward, help us define our stance on relevant environment matters and provide us with an opportunity to broaden the basis for a learned opinion in preserving and augmenting the environment. To tackle issues of such magnitude it is important to get on board all the possible stakeholders as well as artistic minds that over and over help us relive, remind and ignite the value of environmental issues which are not purely technical issues, but real moralistic issues and a gesture for the future generations. ■

Biba Jasmine is a Nehru-Fulbright-Nehru Scholar with a Major in Sustainable Development and Conservation Biology from the University of Maryland, College Park, USA. She was one of the participants at the COP14 of the UNCCD held in India in 2019. She is currently working on a Gol-GEF-UNDP Project.



Mumbai Lockdown

Pollution Levels Dip, Fauna Gets Space

In this article, **Gajanan Khergamker** talks about the positive effects of COVID-19 lockdown on Mumbai as pollution levels took a sharp dip and fauna got the much-needed space to thrive.

During the complete lockdown in the country, man and machine did the disappearing act in public spaces to ensure social distancing and 'flatten the COVID-19 curve'. Within days of the first lockdown, towards the beginning of April, the air in pollution-ravaged Mumbai suddenly seemed easier to breathe and sparrows, pigeons and black kites began to swoop down till street levels in urban zones. After a long time, Mumbaikars saw swarms of pigeons, crows and sparrows flying in traffic zones, some even sitting on roads making their noisy presence felt. 'I am seeing sparrows after years,' says local

singer Philly Fernandes. 'I thought the poor ones would be extinct by now. But, I guess, now with the lockdown in place, they're thinking we've become extinct,' she quips, jokingly. Towards the end of April when the second lockdown began, arrived the peacocks in Walkeshwar—close to the green Hanging Gardens in South Mumbai sending Netizens in a frenzy as they shared images of India's national bird atop parked cars in full bloom, chasing peahens all over the zone.

An analysis published by the System of Air Quality Weather Forecasting and Research (SAFAR) maintained that traffic pollution levels fell by three-fourths

across Mumbai for the period between March 24 and April 25 as compared to the preceding period of February 20 and March 20. The analysis maintained that the month-wise comparison of air quality levels for four cities—Mumbai, Delhi, Pune and Ahmedabad—also revealed that the highest reduction was witnessed in nitrogen dioxide (NO₂) levels for Pune at 70 per cent, followed by Mumbai (69 per cent). Also, the average NO₂ concentration fell from 23 parts per billion (ppb) before lockdown to 7 ppb during lockdown for Mumbai, and 24 ppb to 7 ppb for Pune. 'Drastic NO₂ decline in Mumbai and Pune



indicates that vehicular emissions play a major role in contributing to overall air pollution. Stringent restrictions imposed during the lockdown helped in bringing down the pollution level. Even industrial emissions were lower. However, in Delhi and Ahmedabad this was not the case because under minor influence of external emissions, mild dust storms allowed pollutant particles to be suspended closer to the surface,' said SAFAR director Gufran Beig.

According to the Central Pollution Control Board (CPCB) analysis of Mumbai's air quality between March 16 and April 15, the city witnessed a 40 per cent reduction in $PM_{2.5}$, 43 per cent decline in PM_{10} (larger coarser particles), 77 per cent reduction in NO_2 , 59 per cent fall in average benzene levels, and 50 per cent drop in sulphur dioxide. Attributing, 'the absence of non-essential vehicles, combustion activities in industries and commercial construction sites during the period,' to the decline, the CPCB analysis maintained, the lowest 24 hourly average for PM_{10} was $54 \mu g/m^3$ against the safe limit of $100 \mu g/m^3$, $PM_{2.5}$ was $20 \mu g/m^3$ against the safe limit of $60 \mu g/m^3$, and NO_2 levels at $5 \mu g/m^3$ against $80 \mu g/m^3$ safe limit.

Marine Drive residents sighted the Indian Ocean humpback dolphins in the Arabian Sea coastline off Marine Drive in South Mumbai during the period generating viral posts on the same. Now, while the Indian Ocean humpback dolphins have been visible to the Mumbaikars since time immemorial, it was the complete lockdown which had residents locked up in their homes and looking out of their windows, into the waters of the Arabian Sea off Marine Drive, Bandra-Worli Sea Link and Versova and spotting the pods of dolphins now. 'It is the absence of water traffic and the concurrent human interaction in the zones that has led to the dolphins coming closer to land,' says Chowpatty resident and interior designer Ashish Ramani. 'The dolphins are now visible everywhere in the waters. I see them



frolicking in the waters off Marine Drive almost daily.'

Why, even in Mumbai's wet dock Sassoon Docks, where all commercial fishing activities have come to a halt, the dolphins continue having a blast in the waters almost teasingly. 'Till today, I had not seen dolphins so close at hand,' says Banjara fish-cleaner Vasumati Pawar. In the absence of commercial activities in Sassoon Docks, the entire zone is cleaned out and free of encumbrances and pollutants. Why, the waters that were layered with oil spills and fish waste are now a lot clearer too in the lockdown.

And, the Sanjay Gandhi National Park (SGNP), the only national park that lies 'within' a city, has 'come alive' according to Chief Conservator of Forests and Director of SGNP Anwar Ahmad. 'The lockdown has infused the much-needed life here,' he says. On any normal day, there are as many as 5000 footfalls in the park which grows multi-fold on holidays and festivities. Little wonder then that the 251 species of birds, 38 species of reptiles, 5000 species of insects and 40 species of mammals stay deep in the jungle at a distance from the sea of humans swarming the park. It was not easy to spot leopards, cheetals and

sambhars during a visit to the park. But now, with humans having disappeared from the park owing to the lockdown, the fauna of the park has reclaimed its lost space. The birds appear to be enjoying the liberation and space that was taken away by humans; the leopards have emerged too. Anwar also claims to be 'sighting leopards frequently on the road connecting Bhandup and the other road connecting the Kanheri Caves even during daytime.' The shy animals 'would never come anywhere near the roads when vehicles plied or there was human traffic.'

Sambhars and cheetals have been feasting on the gulmohar flowers sprinkled on the roads near the toy train station and the main entrance gate at Borivali (east). And, apart from the leopards, wild cats, civets, hogs and others too are being sighted at the Park. In the second week of May, in the middle of the lockdown, a 'deer' fell from the roof of a hut in Powai, near the SGNP, much to the surprise of the residents watching TV. 'The large herbivore ended up in a tough spot after a suspected chase from its predator, a leopard, in a slum adjacent to IIT Powai,' said Resqink Association for Wildlife Welfare (RAWW) founder and an



honorary wildlife warden Pawan Sharma. The deer was rescued from the house by a seven-member team from the Mumbai Range of the Forest Department and RAWW.

The Current Scenario (Relaxations and Unlock)

With the monsoons upon us and the lockdown now easing into the phased relaxations, most parks including the SGNP will be the eye of cynosure for those who have been bound at home since March 25. After watching nature unfurl its grandeur throughout the lockdown and the air get cleaner, Mumbaikars will be a wee guarded with their freedom. 'I for one, like most of my friends, have pledged to be a lot more environment-friendly with the city. It doesn't take much to care for nature but, once in ruins, it is nearly impossible to salvage things. The lockdown has been a boon in disguise for the harried Mumbaikar. We've seen Mumbai like never before,' says home-maker Vidhya Malvankar.

And, even as India stayed still under the lockdown, flamingos flocked to Mumbai in record numbers. Bombay Natural History Society's (BNHS) assistant director Rahul Khot offers that flamingos typically migrate to Mumbai from September through May. Flamingos have also been sighted by residents in the mudflats of Thane Creek, a first of sorts.

They are being reported from places where they have earlier been reported less in number 'because there is no human activity there now,' adds Mr Khot.

Oddly, zones like the Thane Creek and the Talawe wetland where the flamingos have been spotted in large numbers, usually register a lot of construction and fishing activities that would normally deter their movement. Not now though as the lockdown has sent both industries into a limbo, leaving the zones open for the birds. BNHS was in the middle of tracking and banding flamingos when the lockdown in India came into effect. They maintain there has been a 25 per cent increase in flamingos this year—a rise from 134,000 flamingos last year to more than 150,000 flamingos in 2020.

The Sorry State of the Abandoned Animals

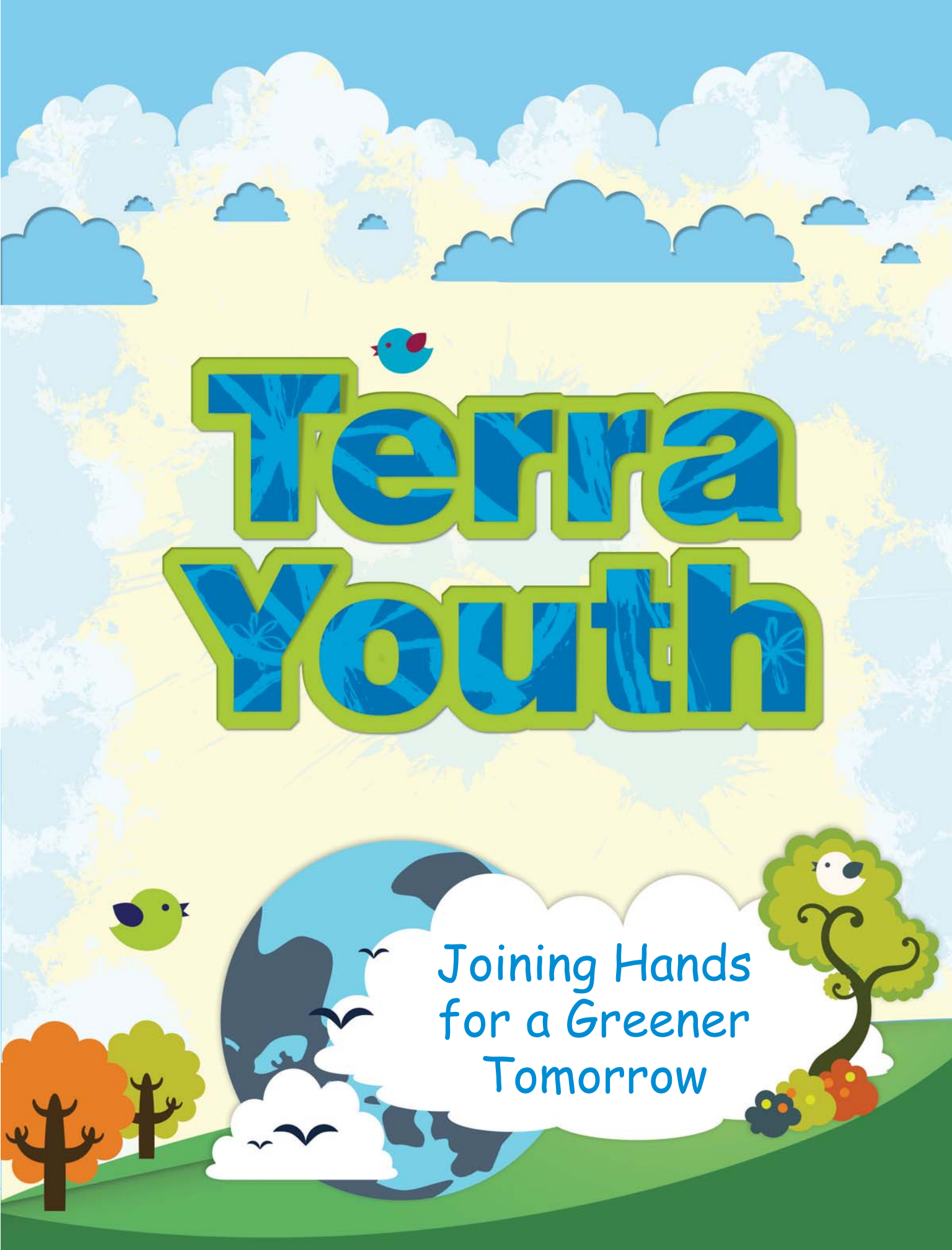
'When the lockdown was announced many owners left animals and birds locked in their shops to starve and suffer. Violators must be dealt with strictly in accordance with the provisions of the law,' said Meet Ashar, associate manager, emergency response team, PETA India. Among the range of effects that the coronavirus and the ensuing lockdown has had on nature, abandoned pets were hit the worst. The city witnessed, in certain zones, pedigreed dogs abandoned and wandering about to fend for themselves. Unable to

fend for themselves like their sturdier counterparts—street animals, most of the 'pets' either meet with accidents from speeding 'essential service vehicles' or due to starvation.

The Department of Animal Husbandry, Government of Maharashtra, has issued directives to all district collectors, to ensure pet shops, dog breeding centres and marketing centres, file for fresh registrations before the Maharashtra State Animal Welfare Board (SAWB), at the earliest, to ensure they remain functional. Those without valid licences in Maharashtra will not be allowed to remain open post lockdown. 'Based on the Prevention of Cruelty to Animals Act, 1960, amended in 2017 and 2018, to include latest guidelines, we have only registered eight pet shops and five dog breeders from Pune, while no other such centres across Maharashtra have been registered so far,' said Dr Prashant Bhad, assistant commissioner, The Department of Animal Husbandry, Maharashtra. Which means, all pet shops and breeding centres in Mumbai were functioning without consent. 'We have not received the inspection reports for any centres in Mumbai. Based on our clearance, valid centres can apply for registration,' he said. The directive incidentally follows an Animal Welfare Board of India's (AWBI) advisory to ensure pet shops avoid keeping exotic animals while breeding centres follow scientific norms to mitigate the spread of zoonotic diseases—particularly in the face of COVID-19.

This generation has now witnessed Mumbai in its full grandeur of the past existence, sans the modern-day vehicular, air and water pollution, one that had only been heard about. And, they must salvage it, this time around. ■

Gajanan Khergamker is Editor, Solicitor, and Documentary Filmmaker heading think tank DraftCraft International. He is the Founder Editor of The Draft. He writes across borders on Law, Diplomacy, Public Policy, and International Affairs. He tweets @IndiaRighter.



Terra Youth



Joining Hands
for a Greener
Tomorrow

Social Emotional Learning

During the COVID-19 Pandemic

This article offers a review of resources that have been put forth globally, with an emphasis on resources and the common threads among them that can inform how we approach education beyond the COVID-19 pandemic, with resources tailored to parents, children, and educators.

The COVID-19 public health crisis has presented our communities around the globe with unprecedented health, socioeconomic, and human rights challenges. While the virus does not discriminate, health disparities caused by poverty, racism, and other social ills has led to stark inequalities in terms of which communities have been most severely impacted by COVID-19. The constant flood of information on these compounding challenges add to our worry of being infected by the virus,

concerns over job security and economic upheaval, and loneliness caused by social isolation. This overwhelming multitude of fears and concerns can lead to major psychological risk factors, such as anxiety, depression, and so on.

India is one of the severely affected countries and is trying its best to overcome the crisis and adapt to the new reality. Nearly all the nations have responded to this public health crisis in part by closing their schools, affecting close to 80 per cent of the world's

school-going population, according to data from the World Bank. While children seem to be less vulnerable to severe illness resulting from COVID-19, staying away from school contributes to a tragic situation for children, particularly those who rely on schools as a safe learning space, for feeding programmes that provide a main source of nutrition, and for fulfilment of their social and emotional needs.

Education thought leaders around the globe have identified Social Emotional Learning (SEL) as a major priority for educators to focus on as education systems work to rapidly transition to remote learning while attempting to mitigate the widening of achievement gaps that result from existing digital divides (WHO, UNESCO). The challenge of providing SEL is all the more daunting in light of the reality that the teachers and adults who children turn to for social and emotional support are themselves likely to be struggling with their own mental health challenges during this time. Survey findings released recently by the Collaborative for Social Emotional and Academic Learning and Yale's Center for Emotional Intelligence showed that US teachers' most commonly cited emotions during this crisis are feeling anxious,



fearful, worried, overwhelmed, and sad. Teachers cited worry over themselves or loved ones contracting COVID, but also the anxiety they feel over trying to juggle caring for their own families at home while also trying to work full time from home and figuring out how to transfer their teaching practice to online platforms, which many have very little, if any experience of using.

While these challenges are difficult to process, let alone allow us the mental latitude to think of solutions, the present situation can be viewed as a wake-up call that we must heed as we re-imagine how our education systems can better support psychosocial well-being as a foundation for learning going forward.

For Parents/ Guardians

In addition to keeping themselves and their children physically safe amid the pandemic, parents are being challenged to take extra care of their emotional well-being as well. Extended responsibilities of home schooling and creating a positive learning environment, on top of professional commitments and household chores can take a huge toll on parents' overall health. When we practice and build our own social-emotional skills such as self-awareness, emotional management, and social awareness, we are better equipped to navigate stress and anxieties, and overcome challenges. The following are some of the fundamental skills with relevant resources which can be practiced by parents:



Personal well-being practices

One great way to support your own well-being during this crisis and beyond is to establish or grow mindfulness practice. Mindfulness can be defined as the state of being aware and focused on the present moment; accepting the present while being open and curious about what is happening around and inside us. Dedicating even just a few minutes of your day to incorporate mindful practices can help in calming your mind and build healthy coping skills. Below are some useful resources for mindfulness exercise and wellness routines:

- Mindfulness and Meditation Practices for Kids (and Adults)
- How Mindfulness Can Help During COVID-19
- Opening Doors to Mindfulness During the Time of Lockdown
- Anxiety Management Techniques
- Dealing with Coronavirus Anxiety
- Tips for Staying Active

Actively listening to your kids and addressing their queries

Understanding and listening to children's feelings and their questions patiently will help them better understand and process the situation, and also give parents an opportunity to address any misinformation or rumours they may be

hearing through their friends or social media. The following resources offer tips for having these conversations with your children:

- How to talk to your anxious child or teen about coronavirus?
- How to have reassuring conversations with kids?
- What parents can do to manage coronavirus stress in kids?

Establishing routines

Making a schedule for you and your children to engage in structured activities, even for free time will help to have an engaging day. Children can also help plan their own routines and take ownership over developmentally appropriate activities. These habits can be a small step towards children feeling a sense of normalcy, learning to regulate their own emotions and building their decision-making skills. Hopefully, they may also help give you a little break as well!

- Tips for creating structures
- How to turn your home into a school without losing sanity
- Sample schedules

Healthy work from home habits

Working from home, a new normal amid the pandemic can be quite hectic and challenging, especially if you are a



parent. It is important to create a healthy environment to work at home and the following tips can be useful in achieving this.

Some of the useful resources are as follows:

- Ergonomic work-from-home tips
- Work from home with kids
- How to make work from home easy?

Practice physical distancing not emotional distancing

Being physically isolated for a long period of time can have long-lasting psychological impacts. However, the present need for physical distancing does not have to mean that we cannot still connect with our loved ones using the new technologies as well as bringing back dying practices like letter writing.

- How to deal with social isolation?
- How to cope with loneliness during the coronavirus pandemic?
- How writing letters can help you through the coronavirus pandemic?

For Children

The sudden disruption of routines, lack of social and physical activities and constant worries of the pandemic situation can be stressful for kids. They might find it

struggling to express how they feel about it and can exhibit extreme behaviour like being sad, alone, irritated, and angry. By supporting children with their continuous learning can help in keeping a sense of normalcy and routine in their lives. Here is the repository of resources that can be useful based on one's needs and interests.

Knowing coronavirus through storytelling and discussion for SEL

Knowledge makes one feel empowered, but with the ongoing constant coronavirus updates this knowledge can be overwhelming as well. It is important for children to make sense of the current situation and feel heard and given the opportunity to get their questions answered. Below are some of the resources in child-friendly language, briefly explained through stories or comic strip format to provide them with accurate knowledge.

- My Hero is You
- Coronavirus: A Book for Children
- The Mystery of the Missing Soap
- Corona Comic Strip
- The Novel Coronavirus: We Can Stay Safe
- Questions about Coronavirus

Activities for increasing well-being

Being involved in creative activities can make children express themselves better and learn new things in a fun way. It overall creates a positive environment with a warm opportunity to spend time together as a family. Few ideas for such creative activities are given below:

- Art as Therapy during Pandemic & Eco Anxiety
- Art Activities
- Ten In-Home Montessori Activities
- List of ideas for being home with kids
- Activities for building social and emotional competencies (English and Hindi)
- Cartoons for building SEL skills (English and Hindi)

For Teachers

The complete shift to remote teaching can be overwhelming for teachers. With the constant juggling between taking care of the well-being of their own families, it also becomes prioritize caring for their student's emotional well-being, which is arguably more important than concern over academics during this time. Understanding your emotions and implementing SEL skills can help both teachers and children to overcome these challenging times. The resources compiled below may be helpful for teachers in easing this transition:

- Learning into Social-Emotional Learning Amid the COVID-19 Crisis
- What to do and What not to do while teaching kids at home
- Teacher- Student Mental Health: A Two-way Street
- Online Resources for Learning
- Designing Engaging online lessons and activities ■

Article contributed by Anchal Sharma. She has been working in Education Sector for the past 5 years now, earlier as a teacher, Assistant School Leader and now as a Research Assistant with TERI on a research project by Columbia University about the role of technology in Education.

Plant a tree, Plant Hope!

Sula Vineyards has taken another step to reduce the effect of global warming and deforestation by planting over 6000 saplings in the Vasali mountain forest area near Savargaon Village. This is a part of Sula's drive to plant 8000 saplings in 2020 in Nashik area. Around 2000 more saplings will be planted in Dindori by the winery that has most of its farms in the area.

These saplings included many native species, such as neem, arjun, etc. The brand not only planted the saplings but has also willingly undertaken the responsibility of digging pits, fencing of the entire area, and ensuring the safety of the plants for three years till they grow into self-sustainable trees. The plantation was done following all the social distancing norms and safety protocols. Sustainable practices such as mass plantations, use of solar energy, water harvesting and community service are at the heart of the organization's

initiatives. Sula Vineyards plays an active role in Nashik by not only increasing the green cover of the city but also providing livelihood to thousands of people involved with the winery and its resorts. It is also cultivating additional land across Maharashtra and Karnataka, to boost the agriculture sector. Additionally, the company also planted 75 native trees on World Environment Day (June 5, 2020) by a plantation drive with villagers from Savargaon.

In November 2017, Sula launched their first premium wine from their Karnataka vineyards aptly named K du which is India's first wine for a cause. Supporting tiger conservation with every bottle sold, it was also launched in Maharashtra recently. Leading the innovation story, in February 2020, Sula Vineyards has also launched India's first wine in a can—Dia Wine Sparkler, packed in a convenient and attractive can. This bubbly, and refreshing drink needs no

mixers, corkscrews, or swirling to enjoy; it is easy to carry and crack open straight from the fridge. Founder and CEO of Sula Vineyards, Rajeev Samant firmly believes in being a steward of the land and in sustainable business practices. Under his guidance, Sula is one of the most sustainable wineries in the world with more than half its energy coming from solar energy. From packaging that is 99 per cent recyclable to reusing and providing clean drinking water to people in the area. 'We believe in making wine keeping the future in mind. Businesses must realize the responsibility towards the environment and we take the full onus of our practices. Climate change is affecting everyone and it calls for immediate actions. Our journey towards a greener future will include many more tree plantation drives, more solar energy, and reduced water consumption, etc.,' says Rajeev Samant. ■



The Menagerie Around the House

While charisma, interesting behaviour and the challenges of a food chain are obvious in the wild, a lot of drama involving myriad life forms goes on in our immediate surrounds.

Jency Samuel says that a little time and careful observation would reveal a fascinating world, a self-contained ecosystem that would entertain and enthrall.

As a sweat bee peeked from its nest in the soil of a garden pot. It must have been bringing in pollen to the nest, to keep in each of the cells containing an egg. A few millimetres away, another sweat bee was digging a hole to make its nest. Suddenly, a third one flew towards them. While the first one was ready to chase the third one with its open pincer-like mandibles, the

second one tried to enter its neighbour's nest. It was fascinating to watch the commotion involving the three.

It is always interesting to watch the myriad life forms such as butterflies and damselflies around us, more so when we are confined to our homes because of the lockdown, implemented to check the spread of COVID-19 pandemic. The butterflies are visible because of

their colour and their nature of flitting between plants. But are these the only biodiversity around? Especially in a metropolitan city?

Life Cycle in Plants

Residing in the rear half of a house that is contiguous on three sides, I am building-locked and space-crunched; so I have a 14-pot garden on the low compound



A dragonfly helps maintain ecological balance

wall. On the other side of the wall I get to see my neighbour's yellow trumpet bush (*Tecoma stans*) tree and a few plants. The plants serve as feeding and breeding grounds for many insects.

Butterflies are easily identified when they are about to lay eggs, because instead of flitting between flowers, they flit between leaves. The tiny globules of eggs on the leaves then go through the caterpillar (larva)—chrysalis—butterfly phase. Often, when the plants served as hosts for lime butterfly (*Papilio demoleus*), common mormon (*Papilio polytes romulus*), biology lessons on metamorphosis and 'survival of the fittest' theory were on display.

Many of the larvae in my plants end up as tailor birds' food. Once two wasps were walking on a green worm! They were parasitoid wasps that lay eggs in host caterpillars. The eggs would hatch inside the caterpillar and the larvae would feed on the live caterpillar. Once they develop, the wasps emerge, killing the host. They differ from parasites because parasite hosts do not meet their end. Some caterpillars lose their journey after becoming a pupa, when ants attack them.

While chomping their way through leaves, some caterpillars denude the plants, as it happened with the turmeric plant. But the black-and-white butterfly that emerged was beautiful. Commonly



A red house spider

known as grass demon (*Udaspes folus*), it is considered a pest of ginger and turmeric plants. No wonder the turmeric plant was lost. Not only big butterflies, but even tiny insects could ring the death knell at times. There were a couple of tiny yellow insects in an oleander plant. Within a week, the insects had proliferated so much that the stem appeared to be yellow. The name of the insect is oleander aphid! Within a month, the army of aphids that measure about 4 mm, had sucked the sap clean, that the plant completely wilted.

Food Web within the House

The dramatic life of insects is not confined to the green space, but happens within the walls of our houses too. Our living spaces host many insects, without our noticing them. They complete full life cycles and generations thrive, despite our efforts to keep the house clean. The lockdown has made me nocturnal in habits, giving me glimpses of the food cycle of the menagerie inside the house. The other day, a small centipede moved so fast and disappeared in a small gap in a corner. Well, I was not the only one to have noticed it. When it emerged, a lizard was quick to make a meal of it.

I find their world so interesting, that I leave scraps of food near the bin so as to observe their behaviour. I discovered that the lizard liked mango, when I caught it tasting the peel. Then there was a jumping spider tasting spilt jam. A turf war has been going on in my kitchen between a cellar spider and a pair of red house spiders (*Nestocodes rufipes*). In the meantime, one of the red house spiders moulted, looking like a jelly fish after shedding its skin. When a pair of ensign wasps (*Evania appendigaster*) became

A cellar spider



co-habitants of the house recently, I wondered if they didn't belong to the outside. Well, they are also parasitoid wasps, laying eggs in roach egg cases. The wasps' larvae feed on roach eggs!

Ants are quite the cleaners. Swatted mosquitoes, a brown-banded cockroach (*Supella longipalpa*), a shiny fly—sometimes even when the said insects had not given up their breath and wriggling to get free—are some that the ants found as future food. Though the small black ants are tiny, the sound of a line of ants moving on a thermocol board is perceptible.

Cow bugs and ants have a mutually beneficial equation



The insect world with its sheen and colour



An Indian wasp moth laying eggs on the wall

A Mini Universe

Lynx spiders and jumping spiders abound in the potted plants. A white crab spider made a brief appearance during the lockdown and stayed in the *patharchur* plant (*Coleus amboinicus*) for two days. There have also been many visitors like the scoreid bug (*Cletus* sp) and several moths. An Indian wasp moth (*Amata passalis*) laid eggs on the wall! Once a common mormon caterpillar also found the wall a better place to pupate.

What appeared to be the brownish stamen of the trumpet bush plant's yellow flower was a constricted spider lying in wait when it pounced on a stingless bee that landed on the flower. A black insect that looked like a cross between an ant and a praying mantis, was in fact the young one of a praying mantis looking like an ant to escape predators.

Cow bugs and ants always seen together was mutualism at display. The ants offer protection from predators in exchange for the honey dew secreted by the cow bugs.

While we have to go to great lengths to get glitter and gloss, natural world has them in plenty. Long-legged green fly is commonly found in gardens, though

hardly noticed. A translucent yellow chrysalis suddenly turns shiny golden. I see sheens of blue, green, yellow in small bugs and flies in the potted plants that pay brief visits. A shiny red and blue jumping spider, the same shades of spider man's attire, landed on the lily plant and vanished within seconds just like the spider man, before I could take a proper picture.

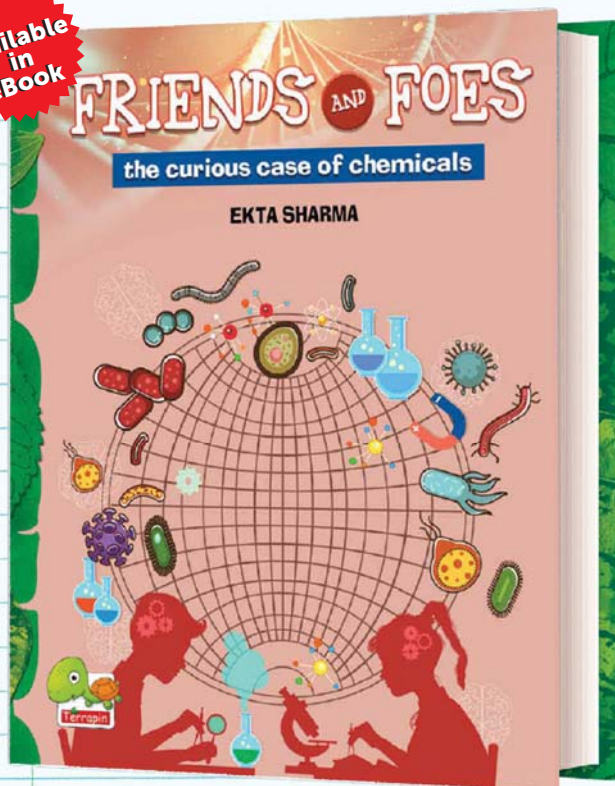
Either the lockdown brought insects out or I was noticing them for the first time. A small bright red young one of a bug (*Antiloclus conquebertii*) I saw for the first time, was in the jaws of a lynx spider within minutes. Often I see black ants, mosquitoes and house flies becoming prey to lynx spiders and damsel flies. It is a fine balance of predator and prey. It does not take long to realize that each living being helps maintain the ecological balance around us.

These observations also drove home a point. If a dozen plants can harbour such an interesting mini universe, we need to ensure that the greenery around is sustained so that the biodiversity continues to thrive—lockdown or not. ■

Jency Samuel is a civil engineer and a freelance journalist based at Chennai. Dreaming with eyes open led her to observe and photograph the myriad life forms around her.

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Building Resilience and Securing Livelihoods

in the Sundarbans

Laxmirani's chronicles are lessons in learning the interrelationships between resilience, food security, coping and adaptation in avoiding trade-offs, and creating synergies.

It is 11.30 a.m. and Smt. Laxmirani Sardar and her husband are carrying a basketful of vegetables from the nutrition garden in their backyard to the porch. The porch is coated with mud and cow-dung from the couple's livestock—a traditional practice. The livestock is among the other assets she has received as a part of WWF India's 'Smart Local Self-Government' (LSG) initiative. Scientific institutes for the very first time have come together and are working with the LSG or Panchayat to improve the capacity

of households to adapt and transform in the face of changing climate.

Laxmirani is one of the practitioners of an industry-standard agricultural practice known as Integrated Farming Systems (IFS); an innovation in farming that maximizes production through optimal use of local resources, effective recycling of farm waste for productive purposes, organic farming, and developing a judicious mix of income-generating activities such as dairy, poultry, fishery, goat-rearing, and vermicomposting.

Along with her, 79 other households were provided hands-on training on different aspects of IFS by subject matter specialists from Ramkrishna Ashram Krishi Vigyan Kendra (RAKVK), Nimpith—The Indian Council of Agricultural Research (ICAR) extension centre. Her village, Deulbari, falls within the remote block of Kultali, under 24-Parganas (South) district. About three hours from Kolkata, Kultali is one of the 52 inhabited islands of the Sundarbans and is one of the poorest blocks in South 24 Parganas. Around 46 per cent of households at Kultali are agricultural labourers while 21 per cent are engaged in cultivation as per the District Census Handbook of 24-Parganas (S), 2011. In the winter of 2018, Laxmirani participated in a meeting

at the Deulbari-Debipur Gram Panchayat (GP). She and her fellow neighbours were selected as beneficiaries for a project which included IFS through a process carried out by WWF India in association with Baikunthapur Tarun Sangha (BTS) and support from Discovery India. The objectives of this project are directed towards increasing income opportunities from livelihood assets and strengthening the capacity and knowledge base of forest-fringe communities to develop adaptation measures in a changing climate. The adoption of the climate-resilient model will help the community in coping with and adjusting to any changes in their climate regime or natural resource base.

Changing Family Roles

'You know,' Laxmirani begins, 'I have been a resident of Deulbari for the longest time. It has been about two decades now. And at this time, I have seen my village change.' She recalls the change in weather patterns giving way to unforeseen high-intensity events such as floods and cyclones—remembering Cyclone Bulbul. This has had a significant impact on the agricultural productivity of the village. She, along with her fellow neighbours who cultivate high-yielding



varieties of paddy collectively agree that the varieties cannot withstand tidal inundation and salinity. Resultantly, a sizeable percentage of households are trapped in a remittance economy. At least ten of Laxmirani's neighbours, including her son, have migrated to urban areas working as unskilled labour. Her husband chose to stay back; venturing into the forest without the skill of a traditional fisherman. Such ventures only lead to increased instances of negative human-wildlife interaction.

However, the situation is gradually transforming now, and for the better. IFS has become the stepping-stone of which community members can integrate food security, soil health, and asset development. 'There is no time to spare as I have my farmland to look into. Who does not want to be valued inside the household and also as a contributor to the household economy? My husband calls me a 'Baigyanik', which means scientist. That is how I am known nowadays in the hamlet. I teach my fellow neighbours the process of collecting soil and sending these samples to a soil-testing centre at Nimpith. We usually get the range and if required the quantity of nutrients required for the desired crop in our fields,' Laxmirani beams. Soil testing was a component of the IFS training programme conducted by WWF India and RAKVK, Nimpith.

Building Livelihood Assets

The livelihood framework identifies five core capital assets (natural, social, human, physical, and financial capital) upon which the livelihoods are built. Now Laxmirani has a clear estimate of her natural capital in the form of her landholding, the water body and project facilitated assets (livestock, fish fingerling, vegetable seeds). With her natural capital in place, she has strengthened her existing skills and technical know-how through the IFS training programme. She then channelizes her physical capital

to build infrastructure and equipment needed for IFS by building a livestock shed and creating bunds on her vegetable garden. Added income streams compound this from poultry-rearing and vegetable production. However, her biggest takeaway was her increased social connections within the community and with civil society partners who now support her in the sale of her organic vegetable produce.

Now, on any given day, Laxmirani's routine includes looking after her vegetable garden. She will clean the garden, check for any disease or pest attack, apply organic manure and water the plants. She also looks after the paddy field. Her husband and her daughter-in-law join her; they plant new fruits and vegetable saplings such as okra, leafy vegetables, onions, cucumbers, French beans and radish for the forthcoming harvest. Her husband either sells the produce within the village or at a nearby market. She proudly says, 'Our expenditure on buying fertilizers and pesticides has reduced by 50 per cent.' Nowadays, she chuckles; her husband always consults her for all household-related matters after learning that she is a community leader. The beneficiaries' aim now is to maximize production and sell it at a fair price.

Laxmirani's assets are now securing both food supply and income. Given any climatic variabilities such as cyclone Bulbul, her diversified asset-basket acts as a safety net. She, along with her neighbours, is also gaining a stronghold towards accessing support systems of the GP and extension centres of ICAR. She recalls how her neighbours Biraja and Kanai were among the first to initiate engagement with *Prani Mitra* (a block-appointed animal healthcare extension agent) after a handful of beneficiary farmers complained of disease outbreaks in cows. The beneficiary households have democratically chosen (hamlet-wise), team leaders who contact experts during urgent situations. These same experts also imparted training on IFS.



Development planning with community. Picture Courtesy: WWF India

Towards Resilience

'The farmers are adopting nature-based solutions and essentially contributing to the Sustainable Development Goals 2, 13 and 15' says Sri Prasanta Chatterjee, Senior Scientist and Head, RAKVK, Nimpith. 'Women like Laxmirani are therefore like the pillars of resilience; strong actors in natural resource governance and advocacy who will ultimately bridge the gap with policymakers.'

Chronicles like Laxmirani's are lessons in learning the interrelationships between resilience, food security, coping and adaptation in avoiding trade-offs, and creating synergies. 'It is not about the monetary gains that I can earn from IFS. It is about the inner strength that I have built,' says Laxmirani. 'I understand the ecosystem services of the forest in its entirety,' she continues. 'Sometimes, the benefit outweighs the risks involved. But then I remember what my friend Binota once said. She said, 'a shongshar (family) is hard to build yet easy to lose in a setting like Sundarbans'. I am now empowered enough with technical skills to make alternative livelihood choices to help my family prosper. I will not trade this opportunity for anything! There is no turning back from here on,' she concludes. ■

Article contributed by Debopriya Mondal, Soma Saha and Ratul Saha, WWF India.



Pigeons

Skilful and Intelligent Beings

Maneka Sanjay Gandhi says that the bird is both bright, hardy as well as beautiful and, given a choice, she would make them mascots of the city. She urges us to feed them.

While we all know that crows are very bright, few people know about the abilities and intelligence of the pigeon. Pigeons can multitask—do more jobs at the same time—than humans. In an experiment by scientists at Ruhr-Universität Bochum a test groups of humans and pigeons were trained to do jobs like pressing a keyboard once a light bulb came on. They were also put in situations wherein

they would need to stop working on one job and switch over to another. Humans and pigeons switched between jobs at the same speed. In the tests where the subjects had to wait one second before switching jobs, pigeons were much quicker.

A 2015 study revealed that pigeons can identify cancer and distinguish between malignant and benign growths. Researchers at University of

California Davis Medical Center put pigeons in a room with magnified biopsies of potential breast cancers. If the pigeons correctly identified them as either benign or malignant, they got a treat. According to *Scientific American*, 'Once trained, the pigeons' average diagnostic accuracy reached an impressive 85 per cent. But when a 'flock sourcing' approach was taken, in which the most common answer among all subjects was used, group accuracy climbed to a staggering 99 per cent, or what would be expected from a pathologist. The pigeons were also able to apply their knowledge to novel images, showing the findings were not simply a result of rote memorization.' They ride the metro to get to their feeding stations, getting off at the same place every day. Which means they can count, remember fellow passengers and where they get off and landmarks. They recognize people who are nice to them and avoid people who are mean according to an experiment done in Paris in 2011. Researchers of a similar age, build and colour either scared pigeons away or gave them food. They repeated



this for several days. The pigeons knew the feeder from the chaser—even when they swapped outfits—and would flock or run away accordingly. The study team led by Dr Dalila concluded: 'The fact that the pigeons appeared to know that clothing colour was not a good way of telling humans apart suggests that the birds have developed abilities to discriminate between humans in particular.

Pigeons have extraordinary vision and can distinguish between nearly identical shades of colour. They can also read the alphabet if taught. In a 2016 study, scientists showed that pigeons can differentiate between strings of letters and actual words. Four of the birds built up a vocabulary of between 26 and 58 written English words. The birds could even identify words they had not



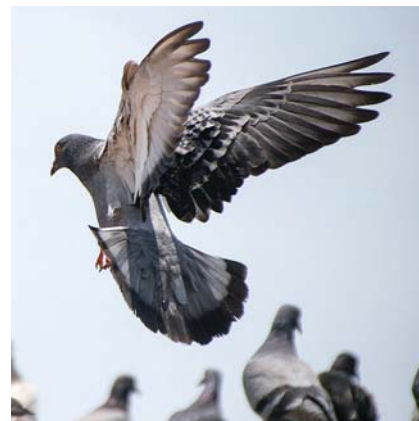
seen before. They understand abstract mathematical concepts, differentiate between number-like objects, order pairs, and accurately judge amounts—an ability that they share with only rhesus monkeys.

In the 1950s, psychologist B F Skinner taught his pigeons to play ping pong—a game that requires a great deal of spatial understanding and dexterity. In 2017, research published in *Current Biology* showed that pigeons understood the concepts of space and time.

Japanese psychologist Shigeru Watanabe and two colleagues trained pigeons in 1995 to recognize the paintings of Claude Monet and Pablo Picasso and distinguish between the painters. The pigeons were even able to use their knowledge of impressionism and cubism to identify paintings of other artists in those movements and watercolour paintings from pastels. In a 2009 experiment, pigeons were shown almost two dozen paintings made by students at a Tokyo elementary school, and were taught which ones were considered 'good' and which ones were considered 'bad.' He then presented them with 10 new paintings and the avian critics managed to correctly guess which ones had earned bad grades from the school's teacher and a panel of adults. Like humans, pigeons categorize on the basis of colour, texture, and general appearance. Pigeons can differentiate between photographs and even two different human beings in a single photograph.

Pigeons have been found to pass the 'mirror test', the ability to recognize its own reflection in a mirror. The pigeon is one of only 6 species, and the only non-mammal, to have this ability.

They are also very good parents. They share equally in the nesting duty, dividing the responsibility of incubating their eggs to give the other a chance to eat and rest. You will never see a baby pigeon because pigeon parents keep their children in their well-hidden nests until their young one reaches near-maturity.



The pigeon parents only reveal their babies to the world once they practically look like adults. They mate for life and it is a love that endures. If one is sick, the other will wait by her in public, no matter what the danger to its life.

These swift and smart birds are blessed with navigational expertise, have an exceptional memory for topographical details, and excellent hearing and vision. When they come down to eat at places where people leave food they don't push and shove each other. You never see them fight. They eat in harmony and everyone gets something. Apart from impressive acrobatics to avoid being eaten, pigeons also do backflips in the air just for fun!

Charles Darwin was fascinated by their intelligence. He kept them as pets, joined pigeon clubs, and wrote about them extensively. Today they survive in tough cities, endure being starved and killed by ignorant and vicious municipal corporations, persecuted and crippled by passers-by and traffic, they carry on wanting to live with humans with a grim persistence. They eat the rubbish we throw and the chasing of our children, the kicks and the blows. And still they come forth to make friends. They could find their way in the countryside—like most birds who have abandoned our urban areas but they choose to stay.

Left to me I would make them the mascots of the city. Feed them. They represent your soul, bewildered and yet resilient. ■

Feni

A Goan Panacea

Feni holds a special place in the Goan culture and society. Families come together and put tremendous effort to produce feni for personal and commercial use. **Manu Shrivastava** says that the heritage drink that started in Goan homes has come a long way. Feni is gradually gaining popularity among tourists—domestic and international. It is one of the last few enterprises that are still owned and managed by families giving the ‘industry’ a characteristic personal touch.

From March to May every year, a characteristic smell permeates through the air in Goa—of fermenting cashew fruit juice. The intoxicating ‘aroma’ gets stronger as one heads closer to the houses preparing the traditional liquor that has been an integral part of Goan culture and cuisine

for more than 400 years—feni.

Feni, incidentally, was the first alcoholic spirit in India accorded the Geographical Indication (GI) status in 2009. This meant the liquor made from cashew fruit can only be called feni if it is made in Goa through the traditional specific process. In 2016, the Goa

government introduced an amendment to the state excise duty law elevating feni to the status of a ‘heritage drink.’

In Arambol, a quaint bohemian town in North Goa, the tourist season wraps up by late February or early March, marking the beginning of the feni season. A short diversion from the arterial road tapering down to the beach opens into a forested, hilly settlement. The narrow road is flanked by unevenly-spaced traditional houses with big verandas, clothes drying on jute lines and elderly women seated on parapets cleaning and drying fish. And then, there are houses all the way up the hill in myriad directions. On one open plot abuzz with activity is the Kundaykar family preparing the patch for making feni.

The Kundaykars have been making and selling feni in Arambol for more than four decades. ‘This work is very difficult,’ says Ana Kundaykar, the 59-year-old family head who initiated the familial custom. ‘My father never made feni. I started producing feni for personal consumption and a few years later my wife began helping me too.’ Over time, as the demand of feni grew in the area, Ana decided to scale up production. ‘With just my wife and daughter to help in the family, I was left short staffed. So, nine



The Kundaykar and Nanoskar families at work making feni



years back, our neighbours decided to join us in making and selling feni.'

Upholding community values, still prevalent in the rural belts in Goa, the Nanoskar family helps the Kundaykars during the feni season. 'We have a simple arrangement; we share the work and then the profit too. It is better to work with your neighbour than an 'unknown' partner,' explains 45-year-old Priya Nanoskar whose family, two daughters and a son, help their mother as well. Ana's daughter Tulsi, unlike many girls her age, helps her parents without qualms. Together, the four of them help their families in preparing feni from scratch: Clearing the land of the dense green plants and climbers that cover every object around them during the rains in Goa; gathering cashew fruit or 'apple' as is commonly known; crushing and juicing the fruit in a *colmbi*, a crushing area for de-seeded cashew apples; fermenting the juice for a couple of weeks before the final distillation process. 'We make

enough money by selling feni to sustain both families during the rest of the year. We store feni in 40-litre cans and in one-litre bottles,' says Tulsi, proudly displaying a bottle of a self-produced feni.

A little further of Arambol, there is a lot of movement at an open plot

of land near Keri (Querim). The heady, pungent smell, an aromatic mix of fermenting cashew fruit and burning fermented juice, signals the presence of a feni-producing unit. Under a make-shift structure with thatched roof, Peter Alphonso and his 65-year-old mother, Apolina, supervise a bunch of migrant labourers from Karnataka. 'I rent a small patch of land and manpower for three months to produce feni. My family's tryst with feni tradition goes all the way back to my great grandfather and today my brother Clyde and I handle the business,' says Peter.

The seasonal migrants come every year in mid-February to work for medium-scale feni producers, like Peter. 'It is a family-run business only but due to shortage of helping members and to keep up with the demand, I now bring in labourers to assist in the production,' says Peter. His mother keeps a close eye on the entire process to ensure the distillate meets her standards. 'My mother oversees the distillation process as if she is cooking some exquisite dish for her family. She is totally involved and is very particular about every minute detail to ensure the perfect flavour.'

President of Cashew Feni Distillers and Bottlers Association and second-generation owner of Cazcar heritage



Peter Alphonso making feni



Another view of the Kundaykar and Nanoskar families at work making feni

distillery Gurudatta Bhakta maintains, 'Feni has always been a family-run enterprise in Goa.' It was his father Damodar Bhakta who established the distillery in 1969 now run by Mr Bhakta and his wife Rupa Bhakta. He reminisces, 'Those days, cashew apples would arrive in bullock carts and feni was stored in copper pots and glass jars called *garrafões*. After school, I would go to the distillery with my father to crush the apples. It was tiring but a lot of fun! My association with feni goes as far as childhood when, as a 12-year-old school-boy, I would assist my father to oversee its production. Today, I enjoy it particularly during the rains as it keeps colds and flu at bay.'

'Feni is probably the only liquor industry that is still entirely family-owned. Till today, every feni brand is owned by a family and not a conglomerate, making it so special. These few families have been the pillars of the industry and have taken it from being a cottage industry to where it is today,' says Hansel Vaz of Cazulo

Premium Feni. Goans from all walks of life have a childhood Feni story to tell. Renowned actor Meenacshi Martins recalls with excitement the time when she 'as a five-year-old would visit the family-owned plantations in Bardez with her grandmother, holding a basket each, to pluck cashew apples. I would even plant saplings on the field with my father and regularly water them as well.' It was a family activity where all including the children were 'involved hands-on. We just loved jumping in the stone tub to stomp cashew apples to release juice for our precious reward, Niro—the sweet-tasting last lot of the broth that oozes out slowly after the crushing left for children.' Not a regular consumer of feni, Ms Martins uses feni mostly for its medicinal value. 'I always keep feni at home and, since childhood, have been using it to cure cough and cold, stomach ache, tooth ache, etc.'

There are primarily two types of feni: coconut feni and cashew feni. The former is older, made from coconut toddy by

the natives. It was the Portuguese who introduced cashew tree in Goa and soon cashew feni was produced and consumed by Goans. The first distillate of cashew fermentation, called urrack, contains 12–14 per cent alcohol content and is much milder than feni, the third distillate with 43–45 per cent alcohol content.

Creative Head for the Wendell Rodricks label, Schulen Fernandes says, 'I was introduced to urrack at my ancestral home much earlier during family summer holidays. I truly started enjoying urrack as a 'summer' drink after I moved to Goa from Mumbai four years ago. I like to spice it up with khus syrup, fresh kokum juice, etc.'

The feni culture and etiquettes have also evolved with time. 'Earlier, there were 'taverns' that sold only feni, coconut and cashew, not even food or snacks. And, feni was consumed 'neat' in small feni glasses,' recalls Mr Bhakta. Today, feni has many more takers and tourists from around the world visit the state to taste the Goan heritage drink at affordable costs.

Noted author and historian Prajal Sakhardande says, 'It is a common man's drink and part of the Goan ethos. It is a medicinal produce for the Goan. I still remember I would be given hot feni as a child whenever I fell sick. It is important for the government to protect and preserve the Goan heritage.'

The heritage drink that started in Goan homes has come a long way. Not only are there an increasing number of small, medium and large family-owned Feni producing distilleries but feni is gradually gaining popularity among tourists—domestic and international. It is one of the last few enterprises that are still owned and managed by families giving the 'industry' a characteristic personal touch. ■

Ms Manu Shrivastava is a Media-Legal Researcher with think tank Draft Craft International. She writes widely on environment, climate change, women laws, and policy perception.

Operationalizing Smart Faecal Sludge Management

Some Challenges and Solutions

According to the report, 'Inventorization of Sewage Treatment Plants, 2015', released by the Central Pollution Control Board, there are about 816 municipal sewage treatment plants (STPs) across states in India, out of which only 64 per cent or 522 are functional, 79 STPs are non-operational, 145 STPs are under construction, and 70 STPs are proposed. Why these numbers are important is because this implies that the treatment capacity that is available in the country is only 37 per cent of the total 62,000 million litres per day of human waste that is generated in urban India.

In the present day scenario, on-site pit latrines and septic tanks account for a substantial proportion of toilets in urban India and according to the 2011 census, 47 per cent of urban Indian households right now, depend on on-site facilities. This proportion has only continued to increase in the last decade. As the urban households without toilets now are beginning to obtain facilities under the Swachh Bharat Mission, it is actually quite likely that many of them will end up acquiring on-site arrangements like that of pit-latrine and septic tanks at locations within cities wherein sewerage systems are not readily available. This implies that while the containment of human waste will be achieved largely under the Swachh Bharat Mission, its

treatment still continues to pose a monumental challenge.

Indian cities are already suffering consequences of lack of adequate safe and sustainable sanitation. Health ailments and serious pollution of water and soil resources are rampant and this is due to the fact that limited attention has been given to proper construction and maintenance of on-site sanitation systems, as well as the management and safe disposal of faecal sludge and septage that comes in from septic tanks and pit latrines. Limited capacities and resources with urban local bodies (ULBs) have also resulted in little regulation

of maintenance as well as cleaning of septic tanks and pits, and the supply of dislodging services if any, is quite inadequate. The reason why faecal sludge management (FSM) is so important is that if the septic tanks are not emptied regularly, the effluent and septage with high levels of organic pollutants, nitrogen and pathogen are disposed of without proper treatment. This can have a detrimental impact on environment and the health of living organisms that come in contact with this untreated septage and effluents.

Faecal sludge management in large urban cities is faced with considerable



challenges—the emptying vehicles often do not have access to pits; traffic congestion prevents emptying and haulage in an efficient manner and lastly, the emptying services are actually quite poorly managed. The FSM service chain comprises of household-level users, private collection and transport businesses that take the trucks from on-site septic tanks and then transport the sludge to the treatment facilities. This process is complicated when you consider facts like the distance between the customer and the service provider. Furthermore, another major concern here becomes serving as many customers, as possible in the shortest time, are using vehicles that are available. This means that optimizing travel cost is the most pressing concern for collection and transport business.

The fact of the matter is that FSM collection and transportation system is quite different from traditional logistics and solid waste collection systems. When it comes to FSM, the collection points are dynamic which means that everyday customers are different, the demand can be diverse and the need for the services can be immediate. There is no denying that the need for the emergence of operational guidelines and urban reforms for FSM is the need of the hour. If one looks at the technological options to choose from across the sanitation value chain for implementation of smart FSM one has to take into consideration the following factors:

- Type and quantity of the product that is to be transported
- The distance to be covered
- Accessibility
- Topography
- The characteristics of soil and groundwater of the area
- Financial resources available
- The availability of a service provider
- Management considerations

Geographic information systems (GIS) has been used successfully in a wide variety of applications, such as urban planning, transportation, natural resources management, natural disaster prevention, and so on. GIS can be used in order to calculate the route in real-time which would help in operationalizing FSM. It is capable of providing significant economic and environmental savings to the reduction of travel time, distance, fuel consumption, and also pollutant emissions. By minimizing the travelling distance and the number of vehicles used keeping in mind considerations like multiple customers, the capacity of septic tanks to be served, vehicle capacity, limit serving time window, etc., it can also enable vehicles to go in for multiple trips, if necessary. The actual requirement of effective applications that can generate viable routes that optimize the cost without compromising on the service can be met through GIS. Collection of faecal sludge in urban environments is complex due to multifarious road networks. This

is an important fact as even a small improvement in the collection part can end up making significant savings in the overall costs. Therefore, the analysis of such a collection system can help in optimizing the operation of existing systems and develop data and advanced techniques to be able to design and evaluate new systems for cities. GIS system can also ensure that trucks collecting the waste are dumping the sludge at proper treatment site using geo-fencing and IoT-based monitoring. Since the country has limited treatment plants, the sludge disposal at appropriate site can also be ensured for cluster of towns using GPS and GIS technology. Mobile technology can be utilized to eliminate paper-based documentation and real time monitoring of trucks disposing the sludge.

India needs a long-term solution to cater to the massive deficits in urban and peri-urban sanitation as well as treatment capacities over time will have to increase in a drastic manner. Even though to keep in line with Sustainable Development Goals (SDGs), programmes like Swachh Bharat and Atal Mission for Rejuvenation and Urban Transformation (AMRUT) are looking to tackle the issues at hand. It is still a grim reality that the disposal of millions of litres of untreated septage continues to wreak havoc on India's ecosystem and natural habitats, massively polluting the various water bodies and supplies. Hence, it is important that India begins to deploy a slew of strategies and urban reforms that develop an effective regulatory and licensing framework, along with technological interventions that can improve the quality of planning. Tactics like increasing innovative funding mechanisms, developing quick-win projects, rapidly investing in public-private partnerships and looking at technological innovations, are a step in the right direction to be able to operationalize FSM effectively in India. ■

*Article contributed by Amarsh Chaturvedi,
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