

TerraGreen

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Why Don't We Celebrate Earth Day Every Day?

Small Steps Could Go a Long Way



IN CONVERSATION

Nida Mahmood,
Sustainable Fashion
Designer

SPECIAL HIGHLIGHTS

Lessons from the
COVID-19 Response

COVID-19 Lockdown: Showing
Possibilities of Change

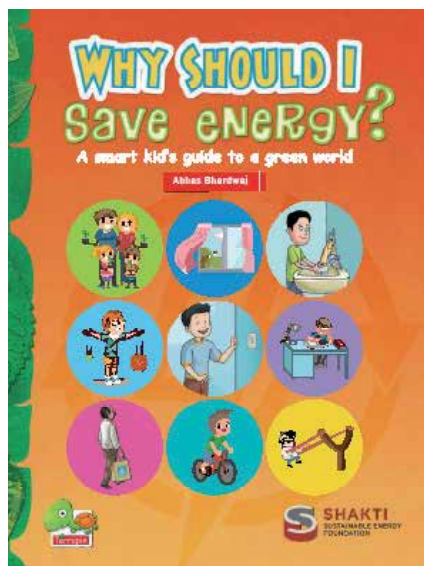
TERRA YOUTH

Sustainability
and
Responsible
Tourism





An Imprint of TERI



WHY SHOULD I Save eNERgy?

A smart kid's guide to a green world

Abhas Bhardwaj

- 2020 • 210 x 280 mm • 56 pages
- Hardback • ISBN: 9788179935798
- Genre: Pictorial-Reference • Price: ₹250.00

Ages: 12+ years

Did you know that energy consumption by humans has increased by at least 30,000 times in the last 5000 years? In Delhi alone, there are over 80,000 trucks that run on the city roads every night. They emit un-burnt fossil fuels from their exhausts. Isn't it terrifying that over 1 million seabirds and 100,000 sea mammals are killed by pollution every year?

Why Should I Save Energy? is a comprehensive book that will introduce children to different forms of energy, history of fossil fuels, great scientists and their inventions, and more importantly, to the problems our planet faces with depletion of natural resources. Filled with eye-opening facts, beautiful pictures, multiple activities, and a quiz that helps reinforce learning; this book is the perfect guide to help you become an energy saver.

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- Energy Here, Today, Tomorrow, and Forever • Made Yesterday, Here Today, Gone Tomorrow?
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- Exploring Alternate Renewable Sources of Energy • Activity 1 • Activity 2 • Activity 3 • Quiz • Glossary

About the Author

Abhas Bhardwaj has studied botany and economics. Currently, he works as a market researcher. He has an avid interest in the environment and likes to share his enthusiasm with young minds. In his inimitable style, he likes to approach serious questions with humour.

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**KNOWLEDGE BOOKS ON ENVIRONMENT, WHICH SUPPLEMENT
THE ENVIRONMENT EDUCATION CURRICULUM**

EDITORIAL



“ Not only is this pandemic costing invaluable human lives, but its impact on economies and living standards will likely outlive the health emergency phase. ”

We are all under quarantine amidst the national lockdown to control the COVID-19 pandemic. It is also going to have a long-term impact on all aspects of our lives, well beyond the lockdown period. Not only is this pandemic costing invaluable human lives, but its impact on economies and living standards will likely outlive the health emergency phase. It is, therefore, essential that the time to recover is shortened and all of us support the government and all stakeholders in every way we can. TERI has also taken measures to safeguard the health and safety of the organization and is following the strategic preparedness and response plan issued by the WHO along with the operational planning guidelines to support country preparedness and response.

When we come out of this phase, we will be in a newer world, and yet in several ways the challenges, especially those posed by climate change, will remain. The Earth Day Network, the global organizer of Earth Day, will mark the 50th anniversary of Earth Day, a global digital mobilization on April 22 to address the most urgent threats to people and the planet. The goal of Earth Day is to unite people around the world to persuade world leaders to act on environmental degradation and climate change. Amidst the coronavirus (COVID-19) global pandemic, Earth Day will take a new turn this year by relocating to the Internet. Due to the global coronavirus pandemic, events for the 50th anniversary of Earth Day on April 22 will be digital.

This month, our cover story titled, 'Make Everyday Earth Day' focusses on the small steps that we could all take in our daily lives that could prove to be the catalyst that spurs an unparalleled global collaboration for protecting planet Earth. The article raises an important question that why do we limit ourselves with acts of conservation and related events only on one particular day! Why don't we take it ahead and do it every single day of the year? Let us plant as much trees as we can. Let us divest from fossil fuels and make our cities as much sustainable and eco-friendly as we can. Let us be a part of global campaign aimed at educating people about environmental issues and factors responsible for environmental degradation. If you have knowledge about what you can do to safeguard the environment, then you should use that knowledge and share it with others in your community. And that, in the long run, can make a big difference. The bottomline is — it is not just about governments, administrators, businesses or sectors that need to showcase responsibilities towards the Earth and climate change. Indeed, we all have a collective responsibility of safeguarding the planet Earth. And the onus lies on each one of us to minimize the impacts of our activities on the natural systems that sustain all of us. Nevertheless, there will be remarkable amount of learnings from the current times and the world should use them to fight the imminent doom of climate change and global warming, in addition to helping vulnerable groups in recovering their livelihoods quickly. While the world was caught unawares on the novel coronavirus front, but we still have time to prepare — in every part of the world — for the climate crisis.

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

Ajay Mathur
Director General, TERI



TerraGreen magazine gives me a good glimpse into the world of environment and sustainable development. The cover story on water published in the March 2020 issue of the magazine talks about water management in the Central Himalayan region. Conservation and optimal use of soil and water resources assume prime importance in any region, particularly in the mountains. I have read a review of published literature on micro-scale (run-off-plot level) and meso-scale (watershed level) studies on hydrology in the Indian Himalayan Region which suggests that although all the land uses have been attempted, only forests and a few microwatersheds in the Central Himalayan region have been investigated in some detail.

C P Misra

Dehradun, Uttarakhand

I read the March 2020 issue of *TerraGreen* and particularly liked reading the feature story on deforestation. The author rightly

sheds light that forests are bearing the brunt of selfish human deeds, demanding urgent attention. The cover story is also very succinct and relevant to our present times.

Satish Singh

Bhopal, Madhya Pradesh

Some years ago I attended a conference on water conducted by an NGO from my school. I was inspired to write a poem on water. I want to share it with your readers to give the message of the importance of water conservation for sustaining Indian agriculture.

STOP WATER DROP

Never drop the drops

Because, if drops are dropped

The drops will drop.

Then, the crops will also drop.

When crops drop,

The drops will drop to droop.

Stop the drop and drooping crops,

We have to stop water from dropping,

So, never drop a drop of water.

P Ramachandra Reddy

Science Teacher

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Gachibowli, Hyderabad

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Locusts Pose Severe Threat to Agriculture in India

Armies of locusts swarming across continents pose a 'severe risk' to India's agriculture, the UN has warned, prompting the authorities to step up vigil, deploy drones to detect their movement and hold talks with other countries, the most likely gateway for an invasion by the insects, on ways to minimize the damage. Locust attacks are known to cause a considerable drop in agricultural output. Authorities at the national plant protection office said the country was prepared and deploying a wide range of measures. But large-scale invasions could still prove challenging given that India lacks equipment like large sprayer aircraft, experts said.

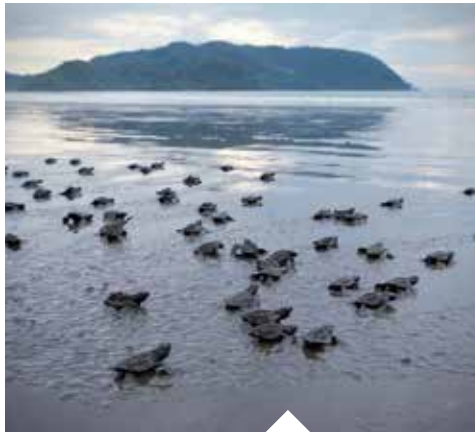
Source: <https://www.hindustantimes.com/>

CMS COP13 Concludes in India

The Thirteenth Meeting of the Conference of the Parties to the Convention on the Conservation of Migratory Species of Wild Animals (CMS COP13) concluded in Gandhinagar, Gujarat, on February 24, 2020 with the adoption of a number of significant resolutions and decisions to address the conservation needs and threats facing migratory species around the globe.

CMS COP13 was the first of a series of international nature-related meetings in 2020, which will culminate in the UN Biodiversity Conference at the end of this year, when a new global biodiversity strategy for the next decade will be adopted: the Post-2020 Global Biodiversity Framework.

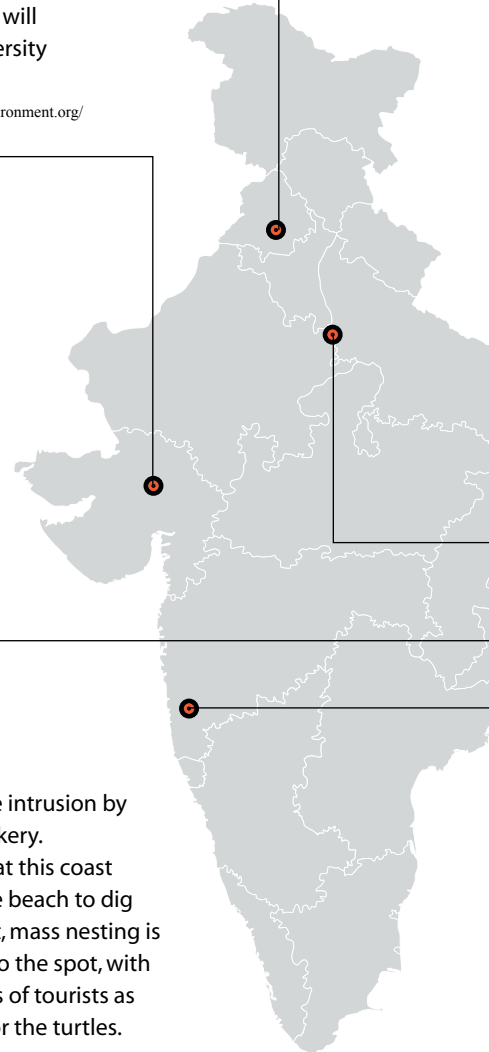
Source: <https://www.unenvironment.org/>



Undisturbed Mass Nesting of Olive Ridleys at Odisha's Rushikulya Rookery

Restrictions in place for the Covid-19 threat is saving lakhs of Olive Ridley turtles from possible intrusion by humans, especially tourists, while they are continuing mass nesting at Odisha's Rushikulya rookery. According to the Forest Department's enumeration, over 278,502 mother turtles have nested at this coast till March 25, 2020. Since the evening of March 24, over 72,142 Olive Ridleys have arrived at the beach to dig nests and lay eggs. As a large number of mother Olive Ridleys are still in the sea near this coast, mass nesting is expected to continue for some more nights. This event normally attracts hundreds of people to the spot, with Forest Department personnel spending considerable time and effort in controlling the crowds of tourists as well as locals. But this year, the COVID-19 lockdown has ensured no such disturbance occurs for the turtles.

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





India's Reservoir Surface Area Has Potential to Generate 280 GW Solar Energy

Reservoirs with cumulative (surface) area of 18,000 square kilometres in India have the potential to generate 280 GW of solar energy through floating solar photovoltaic, a report has said. The report 'Floating Solar Photovoltaic (FSPV): A Third Pillar to Solar PV Sector?' has been produced by The Energy and Resources Institute (TERI) as part of Energy Transmission Commission (ETC) India.

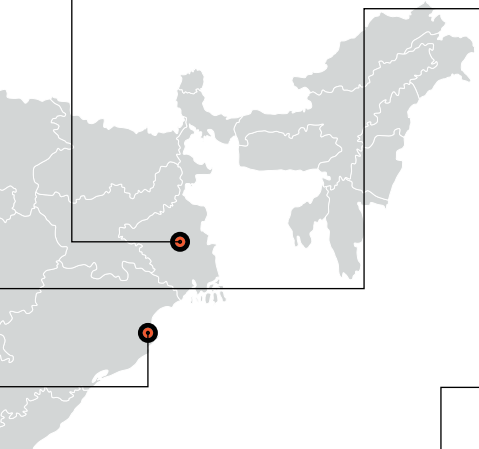
Source: <https://economictimes.indiatimes.com>

Clean Energy Gets INR1.34 lakh Crore Investment in Last 3 Years

Renewable energy projects have attracted investments of about INR1.34 lakh crore between April 2017 and January 2020. 'Based on standard capital cost per MW, an investment of around INR1.34 lakh crore is estimated to have been made in the renewable energy sector during last three years, that is, 2017-18 to 2019-20 (up to January 2020),' New and Renewable Energy Minister Shri R K Singh said in a written reply to the Lok Sabha.

He said most of the grid connected renewable energy projects are being implemented by private sector developers selected through transparent competitive bidding process. India has set an ambitious target of having 175 GW of clean energy by 2022 which includes 100 GW of solar and 60 GW of wind energy.

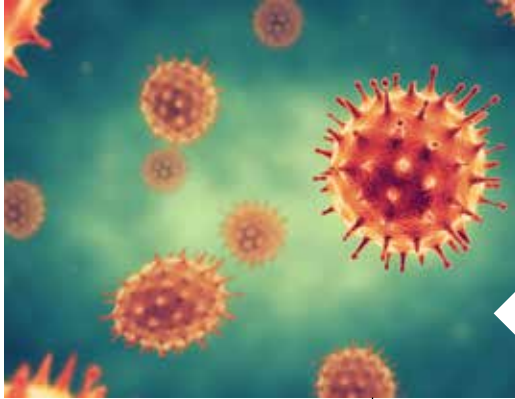
Source: <https://economictimes.indiatimes.com>



Maharashtra has the Maximum Green Buildings in India

Maharashtra has been ranked first in the list of India's top 10 States for Leadership in Energy and Environmental Design (LEED), a global green building rating system. The list was released by Green Business Certification Inc. Maharashtra tops the list, followed by Karnataka, Haryana, Tamil Nadu, and Uttar Pradesh, respectively. In a change from last year, Haryana has moved up in the list, edging out Tamil Nadu for the third spot. The Top 10 states for LEED are home to more than 843 million Indians, and together include more than 48.3 million gross square metres of LEED-certified space.

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



NASA Images Show a Decrease in China's Pollution Related to Coronavirus Shutdown

Satellite images released by NASA and the European Space Agency have revealed that air pollution over China has gone down since the coronavirus outbreak. Production in many factories was halted and transportation was restricted to prevent spreading the virus.

From January 1 to 20, 2020 the images show higher levels of nitrogen dioxide over China, but from February 10 to 25, 2020 traces of the gas were hardly visible. Nitrogen dioxide is a yellow-brown gas emitted by motor vehicles, power plants, and industrial facilities. It can cause respiratory problems, such as coughing, asthma, and difficulty in breathing.

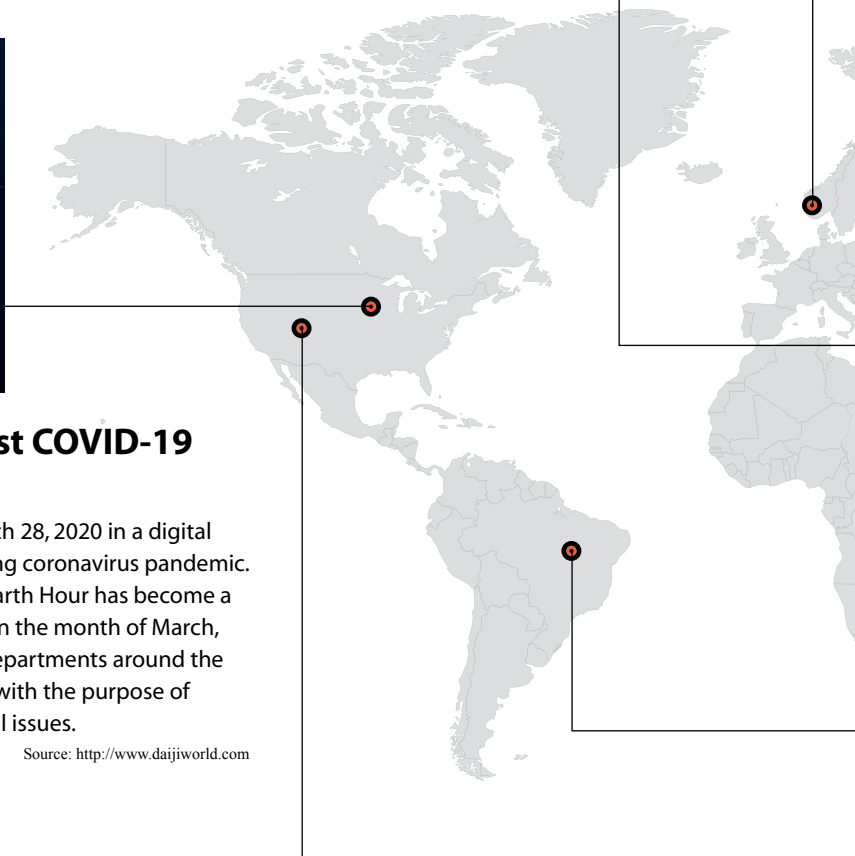
Source: <https://edition.cnn.com>



Earth Hour Marked Digitally Amidst COVID-19 Pandemic

The annual observation of Earth Hour took place on March 28, 2020 in a digital form in various places across the world due to the ongoing coronavirus pandemic. Initiated by the World Wildlife Fund (WWF) in 2007, the Earth Hour has become a popular movement worldwide. Held every last Saturday in the month of March, individuals, communities, enterprises and government departments around the globe are encouraged to turn off their lights for an hour, with the purpose of inspiring reflections and actions regarding environmental issues.

Source: <http://www.daijiworld.com>



A Solar Cell that Can Work at Night

Researchers at the University of California, Davis, have come up with a solar cell that can work at night. Well, it might come as a surprise to many, but thanks to these scientists, it's now true. The researchers, Jeremy Munday and Tristan Deppe, have designed a unique solar cell that can generate up to 50 W of solar power per square metre under ideal conditions at night. This is about a quarter of what a conventional solar cell can generate during the daytime. The researchers are currently working on developing prototypes of solar cells that can generate small amounts of power during the night time. They are also focusing on increasing the power output and efficiency of these cells.

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

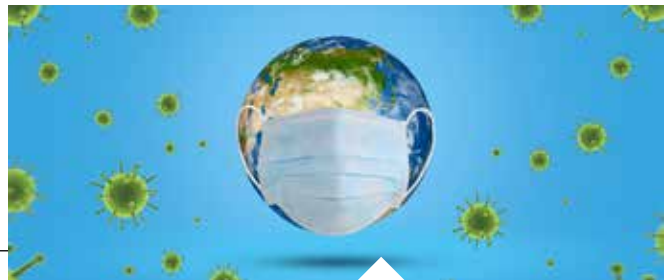
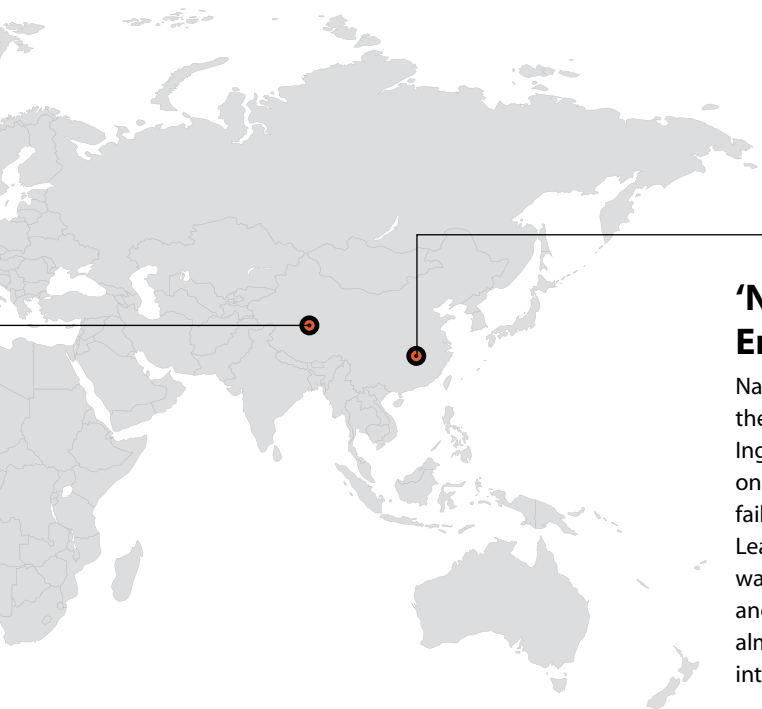




Volvo's Bus Plant in Borås Solely Powered by Renewable Energy

Volvo's bus plant in Borås has now become one of the first bus production facilities that relies solely on renewable energy. All the energy that the factory uses comes from renewable sources, such as hydropower and biofuels. The factory's overall energy consumption has also been reduced by 15 per cent in just the past few years. Since the Volvo buses production plant in Borås now solely relies on renewable energy for its operation, it has been certified by Volvo as a 'Renewable Energy Facility'. The certification was issued following a number of steps designed to minimize the factory's climate footprint.

Source: <http://www.volvobuses.com>



'Nature is Sending Us a Message,' Says UN Environment Chief

Nature is sending us a message with the coronavirus pandemic and the ongoing climate crisis, according to the UN's Environment Chief, Inger Andersen. He said humanity was placing too many pressures on the natural world with damaging consequences, and warned that failing to take care of the planet meant not taking care of ourselves. Leading scientists also said the COVID-19 outbreak was a 'clear warning shot', given that far more deadly diseases existed in wildlife, and that today's civilization was 'playing with fire'. They said it was almost always human behaviour that caused diseases to spill over into humans.

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

Close to Tipping Point, Amazon Could Collapse in 50 Years

The Amazon rainforest is nearing a threshold which, once crossed, would see one of the world's largest and richest ecosystems morph into arid savannah within half-a-century. Another major ecosystem, Caribbean coral reefs, could die off in only 15 years were it to pass its own point-of-no-return, the scientists reported in the journal *Nature Communications*. Each of these so-called 'regime changes' would have dire consequences for humanity and other species with which we share habitat, they warned. In both cases the projected tipping point for irreversible change results from global warming and environmental damage — deforestation in the case of the Amazon, and pollution and acidification for corals.

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



Boats Ride into the Lithium Battery Age

TERI's Novel Intervention

Nowadays, hand-oared rides have become increasingly rare, especially at major tourist attractions where the fleet is dominated by diesel-powered boats. In this article, **Kishor Choudhary** and **Jitendra Tiwari** discuss about a hybrid solar-powered model devised by TERI, which involves the use of just one lithium-ion battery weighing not more than 30 kg for each boat. These storages have much higher capacity, lesser weight, fast charging rate and high energy density in comparison to lead-acid batteries

Remember that first boat-ride in a hand-oared small vessel that slowly took you into the river, and gave you a glimpse of the bank you could have only had from the middle of the water, and filled you with extraordinary joy. Boat-rides are almost always worth it. The hand-oared rides, where you could hear the parting of water, in the company of fresh wind and picturesque view, are increasingly rare, especially at major tourist attractions where the fleet is dominated by diesel-powered boats.

These vessels, when they began replacing traditional boats long ago, presented two great benefits of saving

time and human energy. Diesel engine could carry riders deep into the water in no time, lending them the thrill of speed. The boatman had no need to exert his muscles and could take home more money than he probably could have with his craft earlier.

The diesel drive, however, also took away much of the original pleasures of a boat-ride. Remember complaining of the stink and smoke from the engine in a voice that had to be raised abnormally high to go over the rattle of the engine and understood by the person sitting next to you. And if you have tried using your smartphone to capture a video of

the historical *ghats* in Varanasi, Chitrakoot or some other place, from your boat, the most noticeable and irritating voice in your video probably was that of the diesel engine.

So, when boatmen started experimenting with solar/battery-powered boats, it felt riders could have the best of both worlds: the speed of diesel-engine boat but without its smoke, stench, vibration, and the noise. The transition, however, wasn't going to be easy: heavy, rigid solar panels mounted on top of boats with weighty traditional lead acid batteries required heavy capital investment but came with technological limitations. Panels faced damage from the strong and wet winds on the river while design flaws limited efficient utilization of the power generated.

Given the immense attraction of boat rides at tourist destinations across the country and the charm of the new technology, experiments on marrying the alternative energy with boats have been underway at many places.

In one such experiment, in 2016, an e-boat project was launched at Varanasi by a local NGO, in association with boatmen. These boats were to run on lead-acid batteries, charged by the grid





electricity at a centralized charging point. The advantages over diesel-powered boats were apparent: it did not emit heat, noise, fuel, and lubricant residue. In short, it didn't contaminate a tourist's experience with unpleasant sound, sight or smell. And yet, it remained unpopular among the boatmen. The cost of obtaining and the drudgery of transporting four lead-acid batteries weighing more than 200 kg to the nearby grid electricity charging station were hard for boatmen to accept. Longer charging hours, lesser energy density, and large space that these batteries occupied made them unattractive.

A consultation with boatmen and other stakeholders helped TERI identify the problem: a lasting, reliable supply to trolling motor via a lightweight fast-charging battery was essential to operate such a boat; and an economically-sustainable business model was needed to keep boatmen's interest alive in this intervention.

TERI set out to solve the problem. The solution had to be technologically effective while being economically sustainable. It devised a hybrid solar-powered model, which involves the use of just one lithium-ion battery weighing not more than 30 kg for each boat. These storages have much higher capacity, cycle life, lesser weight, fast charging rate and high energy density in comparison to lead-acid batteries. These batteries

are charged at a centralized hybrid solar charging station, located on the bank of the river.

Under the TERI's intervention, traditional boats are retrofitted with a trolling motor. Boatmen can rent batteries and recharge these at hybrid solar charging station operated and managed by the boatmen association. The business model involves renting batteries by boatmen who don't have to bear any capital cost. The expenditure of retrofitting and those associated with the charging centre are financed by the Corporate Social Responsibility (CSR) fund mobilized by TERI. A local energy entrepreneur, selected by TERI, oversees installation of trolling motors and lithium battery in the boat along with the required after-sales services.

Under the model, a lithium-ion battery has the option to be charged by both solar and grid power. The battery, which takes about 2–3 hours to charge, is attached to a trolling motor connected to a propeller, which pushes the boat backwards or forward. A single charge lasts two and a half hours, enough for a boat to complete two trips on a 10–12 km stretch.

To make the business model work, TERI needed partners who could provide financial and technological support. TERI approached and convinced Indus

Towers, a passive telecommunication infrastructure provider, to come onboard. Indus agreed to support the project using their CSR fund. With support from Indus, installation of eight hybrid solar charging units (solar+grid), to supply power to 50 battery-powered boats, in Varanasi and Chitrakoot, has been made possible. Commissioning of 10 more such battery-powered boats and two hybrid solar charging stations at Chitrakoot are also underway.

In comparison to the traditional hand-oared boat, the initial investment for a battery-powered boat is certainly higher. But compared to boats run by diesel engine there is not much difference in capital investment. And once the initial hurdle is crossed, it is possible to earn much more in a cost-effective, drudgery-free, and environment-friendly manner. Given such advantages, boatmen in Varanasi and Chitrakoot have started shifting to battery-powered boats.

The shift also raises the possibility of a return to those quiet, pleasant rides for tourists where one could enjoy the company of their loved ones or just their own self on a boat surrounded by fresh winds. ■

Mr Kishor Choudhary is the Team Lead of the project and Mr Jitendra Tiwari is the technical brain behind this model.

Technical Details of Hybrid Solar Charging Station for Boats

Component	Technical Detail
Solar module at charging station	5 kW
Charging station	Input power (Solar + Grid) + MPPT charge controller Total 5 numbers of battery charging at one time 2–3 hours required for full charging of batteries
Lithium battery/boat	2.7 kWh
Trolling electric motor	DC motor: (1000 W), Input Power: 24 V DC/48 V DC
Propeller	Hydrodynamic weed less wedge propeller; 5-speed forward and 3-speed reverse; Maximum load thrust of 106 lbs
Accessories	Need-based

Microfibre Pollution

from Wearing and Washing Clothes

In a novel study, scientists from the IPCB-CNR and the University of Plymouth compared four different items of polyester clothing and how many fibres were released when they were being worn and washed.

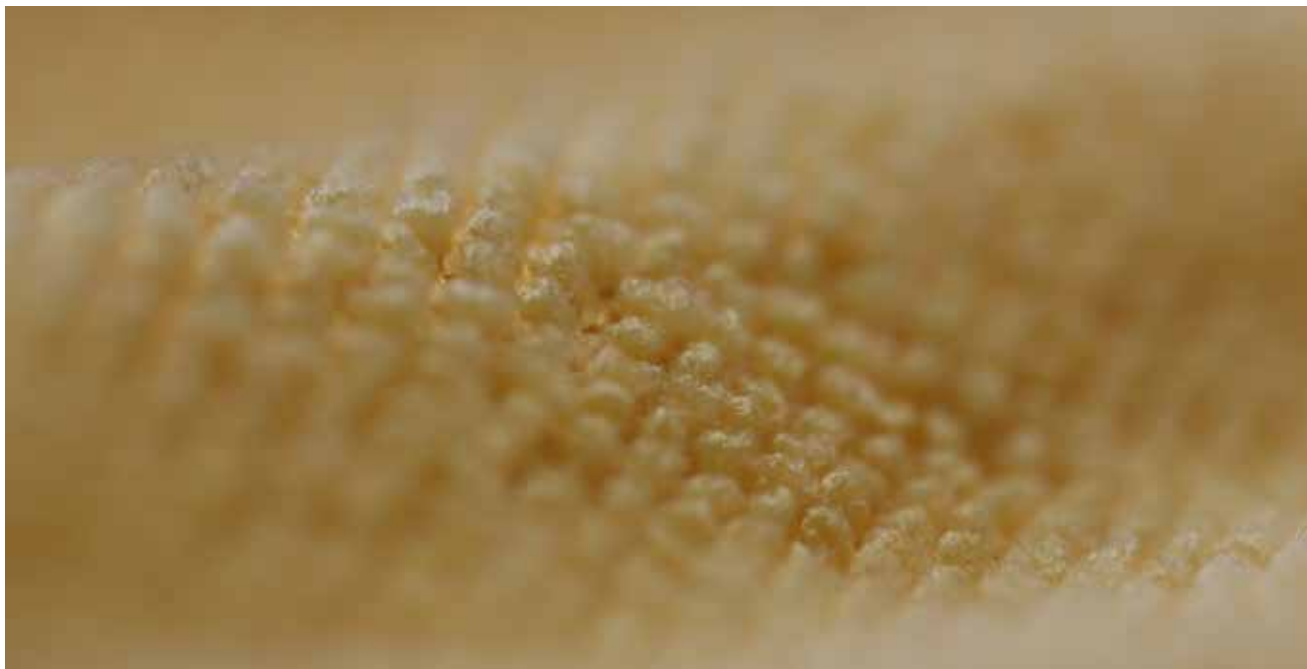
In a first-of-its-kind study, scientists from the Institute for Polymers, Composites and Biomaterials of the National Research Council of Italy (IPCB-CNR) and the University of Plymouth compared four different items of polyester clothing

and how many fibres were released when they were being worn and washed.

The results showed that up to 4000 fibres per gram of fabric could be released during a conventional wash, while up to 400 fibres per gram of fabric

could be shed by items of clothing during just 20 minutes of normal activity. Scaled up, the results indicate that one person could release almost 300 million polyester microfibre per year to the environment by washing their clothes,





and more than 900 million to the air by simply wearing the garments.

In addition, there were significant differences depending on how the garments were made, through which the researchers concluded that clothing design and manufacturer has a major role to play in preventing microfibres from being emitted to the environment. The research, published in the journal *Environmental Science and Technology*, was conducted by scientists at the National Research Council of Italy and the University of Plymouth. It builds on their previous studies which showed substantial quantities of fibres are released during the laundry process.

Dr Francesca De Falco, Research Fellow at IPCB-CNR and lead author on the current research, said: 'Recently, more evidence has been accumulating on the presence of synthetic microfibres not only in aquatic environments, but also in atmospheric ones. That is why we decided to design this set of experiments to study microfibre release by garments to both media. This is a type of pollution that should be mainly fought at its source, the fabric itself, but we investigated the influence of different

textile parameters on the release. Results have shown that textiles with a very compact structure like woven, with yarns highly twisted and composed of continuous filaments, can release less microfibres to both air and water.'

The study compared four different garments, which were washed at 40°C with any released fibres being collected. It showed that anywhere between 700 and 4000 individual fibres could be released per gram of fabric during a single wash. The researchers also created a dedicated clean lab used by multiple volunteers wearing each of the four garments separately and then performing a sequence of movements simulating a mix of real life activities. Any fibres emitted by the garments were then collected, with up to 400 being released per gram of fabric in just 20 minutes.

The polyester/cotton garment showed the greatest release during both washing and wearing, with a woven polyester one releasing the least quantity of microfibres. However, based on the overall results, the researchers say previous estimations of microplastic pollution have actually underestimated the importance of synthetic textiles

since they did not take into account the quantities released directly into the air.

Professor Richard Thompson OBE, Head of the University of Plymouth's International Marine Litter Research Unit, was a senior author on the current study and gave evidence to both the UK Government's Sustainability of the Fashion Industry inquiry and the recent OECD Forum on due diligence in the garment and footwear sector. He added: 'The key story here is that the emission of fibres while wearing clothes is likely of a similar order of magnitude as that from washing them. That constitutes a substantial and previously unquantified direct release to the environment. The results also show textile design can strongly influence both release to the air and release due to laundering; that is a crucial message highlighting the importance of sustainable design for the fashion industry. Indeed many of the current issues associated with the environmental impacts of plastic items stem from a lack of holistic thinking at the design stage.' ■

Source: www.sciencedaily.com



ABCs

An Emerging Hope for Sustaining Agriculture

Over 4500 farmers of Prakasam and Guntur districts in Andhra Pradesh have become self-reliant as they can bargain better price for their produce.

M N Kulkarni, V Suresh and S Gopal Reddy discuss the benefits Agri Business Centres (ABCs) have brought to the lives of the farmers as today they could get the agricultural inputs and equipments at their doorsteps on lower rental charges in their village. They can also hire costly equipments at nominal hire charges for completing agricultural operations on time.



Over 4500 farmers belonging to Prakasam and Guntur districts in Andhra Pradesh have become self-reliant as they can get inputs for agriculture at their doorstep, can hire costly equipments at nominal charges for completing agricultural operations on time, avail small loans easily, and bargain better price for their produce. Farmers from 24 villages in Guntur and 37 villages from Prakasam districts have organized into Agri Business Centre (ABC) concept and doing agriculture satisfactorily. This became possible as farmers showed interest to come together under the umbrella of ABCs and custom hiring centres (CHCs) in their villages. Farmers from these villages have involved actively in the project and organized themselves into 68 ABCs with the financial support from ITC Limited under its CSR activities. The BAIF Institute for Sustainable Livelihoods and Development in Andhra Pradesh (BISLD-Andhra Pradesh), state unit of BAIF Development Research Foundation, Pune, is implementing the project.

Continuing with agriculture is inevitable for small and marginal farmers as they constitute nearly 84 per cent among the farming community. However, the context of agriculture in Andhra Pradesh and Telangana is changing with increasing challenges, such as declining soil fertility, erratic weather and rainfall patterns due to climate change, frequent droughts, lack of premium price for the produce, lack of labour, and fluctuating markets. The present situation calls for community efforts to make agriculture a

successful venture and more profitable. Hence, the concept of ABCs is emerging as a new hope to bring the agriculture back on track and sustain in the long run. The ABC concept was introduced in India during 2002. The BISLD-Andhra Pradesh responded well to the situation and demonstrated the importance of mobilizing farmers into collective efforts.

The project area of ABCs includes Prakasam and Guntur districts of Andhra Pradesh and Sangareddy district of Telangana. Agriculture is the



ABC meeting in progress

primary livelihood for 75 to 80 per cent households in Guntur, Prakasam, and Sangareddy districts. The average land holding of these farming categories is less than two hectares. Hence, majority of farming is at a subsistence level. In the project villages, potential productivity of farming community is impacted by poor education, lack of access to knowledge, lack of awareness about various government schemes, and lack of timely availability of inputs and financial support systems.

The BISLD started the ABC concept in 2006 and continuing till date. To begin with, two ABCs were grounded, one each at Guntur and Prakasam district. As of today, 68 ABCs are functioning well in Guntur and Prakasam districts. About 4517 farmers have become members of these ABCs and availing various benefits such as availing crop loans, equipments hiring from CHCs, collective procurement of inputs, collective marketing, and covered under convergence activities to reduce cost of cultivation. The BISLD has organized various training and extension events to build the capacity of these ABCs so as to manage the ABCs in post project scenario.

How the ABCs were Developed

- **Organizing farmers:** First, farmers were made aware of the advantages of getting organized into ABCs for their own good. Once the farmers got convinced, they were organized into groups with a membership fee of ₹600 per farmer. After formation of groups, they usually select one sub-group leader from ten members. Then sub-group leaders together select one main group leader. The main group leader is responsible for the group activities with the support from the other members.
- **Capacity building:** The capacity of the ABCs was enhanced by regular meetings, awareness, and monitoring.



View of ABC office

Trainings, workshops and exposure visits to the successful ABCs in other places have contributed a lot over the years. During these events, the farmers are expected to acquire the knowledge of collective procurement, collective marketing, and managerial skills.

- **Entrepreneurship skill development:** Series of training programmes have been conducted over the years to develop the entrepreneurship skills among the farmers and encourage them to take small enterprises. Some of these include renting of agriculture implements, running of artificial insemination centres by the educated unemployed youth, etc.

Major Roles of an ABC Leader

- Coordinate with the ABC members
- Conducting monthly meetings
- Maintenance of ABC books and accounts
- Facilitate loan disbursement and recovery activities
- Facilitate CHC maintenance and monthly savings
- Negotiation with traders for collective procurement
- Facilitation with government

departments for getting schemes

- Facilitation for conducting yearly audits
- Facilitate for training programmes conducted at ABC level
- Facilitate the visit by sponsors and farmers from other villages.

Other major roles include:

Collective procurement: Timely access to the quality inputs particularly seeds, fertilizers pesticides, etc., has ensured the timeliness of operations in agriculture and also reduced the cost of production. The data for the last six years shows that the ABCs have procured 2918 tonnes of fertilizers and disbursed among ABC members. This has helped the farmers to save the cost of transportation, saved one day labour and middlemen charges, and reduced the drudgery.

Collective marketing: In order to enhance the profitability, the traders were invited to the villages to get the remunerative price for the farm products, save transportation cost, and reduce the losses due to wastages. At present, farmers are growing tobacco, red gram, pearl millet, chilly, and vegetables. Among these, tobacco is sold to ILTDA and red gram is sold in the local market. There is plan to establish a dal mill at ABC level for value addition of red gram.

Custom hiring centres: The main advantages of CHCs operated by ABCs are to overcome the problem of labour scarcity, ultimately leading to timely agriculture operations that increased the efficiency, reduced the drudgery and increased the availability of farm implements at reasonable rates. Irrigation pipes, weighing machines, sprayers, diesel engines, drums, etc., were maintained in the CHCs. The data from 2008–09 to 2018–19 shows that the ABCs have earned ₹48.16 lakh from hire of equipments. Now, this amount is available with them for internal lending and other useful purposes.

Savings and internal lending: All group members contributed the membership fees in the beginning to build sufficient funds. The members contributed ₹600 each to develop the corpus fund. The savings fund is used for lending to members for their agriculture-related requirements.

CHCs Helped Farmers to Improve Productivity

Before the CHC, farmers of Kurichedu village, Prakasam district, were facing

Transport of fertilizer



difficulties to complete agricultural operations on time. They used to pay higher rental charges for irrigation pipes (₹15/day) and had to travel 30 km to bring these pipes to their farms. Today, they could get the inputs and equipments at their doorsteps on lower rental charges as they have formed ABC and CHC in their village. Induri Subba Reddy, a medium farmer, Kurichedu village, hired 100 pipes for 30 days at rate of ₹7 per pipe per day. Without any hassle, he hired pipes from CHC, and used them for irrigation. He has irrigated 60

acres of red gram field and 10 acres of tobacco field. He feels that had he not used 100 pipes for red gram, the yield would have been 1–2 quintals per acre. Since he had used the pipes, the yield per acre was 3–4 quintals. The total yield for 60 acres was 300 quintals worth ₹1,350,000, otherwise yield would have been 90 quintals and income would have been ₹405,000. Similarly, other farmers are hiring equipments at nominal rent, completing agricultural activities and earning more income.



Women ABCs

After motivating male farmers for the ABC concept, BISLD is now focusing on the formation of women ABCs, so that women can also play an active role in sustaining the ABC concept. In Prakasam district, six women ABC groups (one is women nursery) were started. They conduct monthly meetings and discuss about problems facing agricultural activities. They have also started collective procurement of fertilizers for chilly cultivation. There are 292 women in six ABCs, who are doing savings and lending activities. As on March 2019, they have disbursed ₹38 lakh as loan and recovered ₹18 lakh.

Sustaining the ABCs

It is important that the ABCs become sustainable in the long run and provide service to more number of farmers in the village. Efforts are on to sustain and replicate the concept in other villages. Some of the strategies that are being followed for sustaining the concept are given below:

- Further strengthening of collective procurement, aggregation, and value addition activities on a large scale
- Mobilization of corpus fund through savings and common funds
- Increase in the credit flow and diversification of lending with 100 per cent recovery
- Generation of new business avenues
- Enhancement in bargaining power for bulk purchase of inputs and marketing of their produce for remunerative price
- Adopting cashless payment system
- Intensive training and capacity building for group leaders
- Rotation of group leaders

Impacts of ABCs

- Timely availability of inputs for agriculture through collective procurement has helped farmers to save time and money. Before

View of fertilizer supply from ABC



the ABCs, every farmer used to visit nearby towns for purchase of inputs, spending whole day for this purpose and losing one day labour, incurring cost of transport and food, etc. Today, the scenario has translated into a very favourable one.

- Remunerative price for the produce as ABCs can meet the traders and bargain for better price.
- Availability of tools and equipments for completing agricultural operations on time has resulted in increased yields, savings in terms of time and money. Before the ABCs, farmers used to get equipments at higher rental charges and sometimes equipments were not available because of high demand.
- There has been an improved access to government schemes and markets. Now the ABC leader can visit the departments and get information regarding schemes and benefits for the farmers. He shares the information during ABC meetings.
- Increased loan availability from banks to ABC members due to the good performance by ABCs — loan repayment, no defaulters, good record keeping, etc. Now banks are ready to give up to ₹50,000 per farmer as loan.
- Increased knowledge base among the ABC members regarding community

initiatives, improved agriculture, and other issues related to agriculture and ABCs.

The Way Forward

Motivated by the success of ABCs in Andhra Pradesh, the Karnataka unit of BAIF has also started formation of ABCs in Karnataka. Five ABCs in Yalaburga taluka of Koppal district and two ABCs in Indi taluka of Vijayapur district have been formed and functioning. There is also plan to expand ABC activities in other project areas in the coming days.

In the context of the impending doom of climate change and its impacts, there is urgent need for the farming communities in all the villages in India to get organized for collective efforts. The ABCs would definitely help the farmers to reduce cost of cultivation, timely completion of agriculture operations as these are important aspects to cope with the impacts of climate change. Further awareness needs to be created by government departments, NGOs and other stakeholders on the importance of establishing and strengthening of ABCs in all villages across India. ■

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‘Sustainable Fashion Is Limited to the Elite’

The marigold flower is fashion designer Nida Mahmood’s new muse that epitomizes all things ‘Indian’. Popularly known as the ‘Queen of Indian Kitsch’, **Nida Mahmood** talks to **Ipshita Mitra** about the core of her latest sustainable line of clothing ‘Madam Marigold’, the future of circular fashion, resurrection of age-old techniques and art forms in fashion to ensure sustainability, and why sustainable fashion continues to lag behind in the mainstream market among other things.

Tell us about 'Madam Marigold' (100 per cent swadeshi subsidiary). What makes it sustainable and what are the techniques involved?

Immersed in Indian culture and tradition, Madam Marigold is modern yet traditional, old-school yet new-age India. We believe in telling a story that is relevant today. The brand is free-spirited and spontaneous while being rooted in Indian culture. We are a brand that believes in a holistic approach to 'kindly crafted' products by integrating sustainable practices into our supply chain – from upcycled textiles to handlooms, ancient Indian printing and textile techniques to adopting vegetable dyeing methods. The brand reimagines Indian tradition to fit modern consumer needs. We celebrate the fabric of Indian culture.

During Amazon India Fashion Week Spring Summer 2018, your 'Deivee' collection, launched in collaboration with actor Milind Soman, showcased a sustainable 'athleisure' range. It was conceptualized with dry technology, there was 100 per cent recycled plastic, and it was anti-microbial too. What is the highlight of 'Madam Marigold' 2020?

Madam Marigold is an eco-conscious brand. For the brand, reinvention is key. Madam Marigold draws inspiration from India's design heritage and its people. One of our brand's touchstones is circular design, a concept inspired by the earth's ecosystem. Minimum waste is generated and all the resources are taken care of, as we constantly work towards minimizing the negative impacts on the environment. The brand works towards lower-impact fashion consumption, ethical sustainability being the key factor.

The present collection employs the age-old art of ajrakh printing from

Gujarat in natural colours. The process is sustainable as it uses dyes from natural elements such as turmeric, pomegranate, onion peels, tea leaves, coffee, paprika, red cabbage, beetroot, hibiscus, marigold, natural indigo, and the list goes on.

Apart from ajrakh, we have attempted to employ a 160-year-old unique (analogue) photography technique to expose prints on textiles and paper. It is an extremely tedious and a time-consuming technique which requires a lot of attention and care. Such techniques cannot be achieved without the heat and light of the sun.

Textile production mostly happens in areas of freshwater stress. As an environmentally conscientious designer, how do you ensure that textile waste does not end up in landfills or is incinerated?

The fabrics we use are naturally made, including handlooms and natural fibres, such as silk and cotton. Natural fibres are biodegradable. We employ methods and techniques that are environment-friendly by using post- and pre-consumer waste in our collection, and natural dyes that can go back into the soil without causing any harm to the environment.

How is sustainability in fashion related to ethical fashion?

Ethical fashion is an umbrella term which encompasses ethical fashion design, production, retail, and purchasing. It covers a wide range of issues, such as working conditions, fair trade, sustainable production, the environmental aspects, and animal welfare. So as we see, sustainable fashion is a subset of the larger term – ethical fashion.

How do you assess the life-cycle of an organic product – from the design, sourcing, and production processes,



A model showcasing the designer's latest creation

especially its recyclability and renewability, and the material's carbon footprint? What is the durability of sustainable fabrics?

An organic product is that which is made from materials raised and grown in compliance with organic agricultural standards. Organic clothing could be composed of cotton, silk, jute, ramie or wool.

Natural fibres have longevity in terms of both fibre strength and fashion relevance. Slow fashion – a new concept is becoming more and more popular where textiles are given the highest importance. Garments made from our rich textiles have the value of heritage and heirloom. Therefore, the focus

shifts from fast disposable fashion to durability of fashion where one buys less and uses more, thereby centring on less wastage and more utility, thus ensuring sustainability on multiple levels.

Sustainability in fashion focuses on lower carbon footprint as natural materials are used in weaving textiles and the dyeing methods are natural too. For instance, colours are made from materials such as turmeric, pomegranate, onion peels, cinnamon, tea, coffee, different kinds of flowers, etc. These materials are used to extract natural dyes post which the waste is disposed into the soil without harming the ecosystem. Such a practice adds to the essence of circular fashion.

Is eco-friendly fashion pocket-friendly? Can sustainable clothing be a mainstream option – how do you see the evolution of both the industry and clientele over the years in their awareness of sustainable development in fashion?

Sadly, at the moment, eco-friendly fashion is not entirely pocket-friendly in comparison to fast fashion.

Let us compare the fabric: the cost of mill-made fabrics, where thousands of metres can be produced in a single day, feeding huge fast-fashion-producing factories across the world, as opposed to handwoven textiles (a long and tedious manual process) – there is a marked difference in price.

The dyeing process of mass-produced fabrics is much cheaper as it uses cheaper dye substrates compared to dyes made from natural materials. The time taken to create natural dyes is also a manual process. Additionally, the process of natural dyeing is much more time-consuming. Printing, embellishments, etc., are other factors that are instrumental in defining the costs. In my opinion, we must put in necessary efforts to make sustainable fashion mainstream as this is the way forward towards saving our natural resources and protecting the planet. A lot needs to be done to make fabrics and natural dyes more affordable. Perhaps, the government/textile ministry can step in, in aiding the promotion of not only our textiles but also other related printing, dyeing, embellishment industries. Subsidies and incentives must be created so that the end product can be more affordable and accessible to more people.

Awareness has started to show its effect but until such time as the end product can be made more affordable, sustainable fashion will stay limited to the elite.

There are some brands that market their products as 'made with partially recycled materials'. Is your sustainable line '100 per cent recycled'?

We use recycled materials, post- and pre-consumer waste, handlooms, natural dyes, natural printing techniques, hand embroideries which have an authentic Indian history such as ajrakh printing from Gujarat (this season). We have positioned ourselves as 100 per cent *swadeshi* – modern but Indian in ethos, made with Indian crafts and techniques.

Please share your final thoughts on embracing 'tailored couture' for environmental preservation.

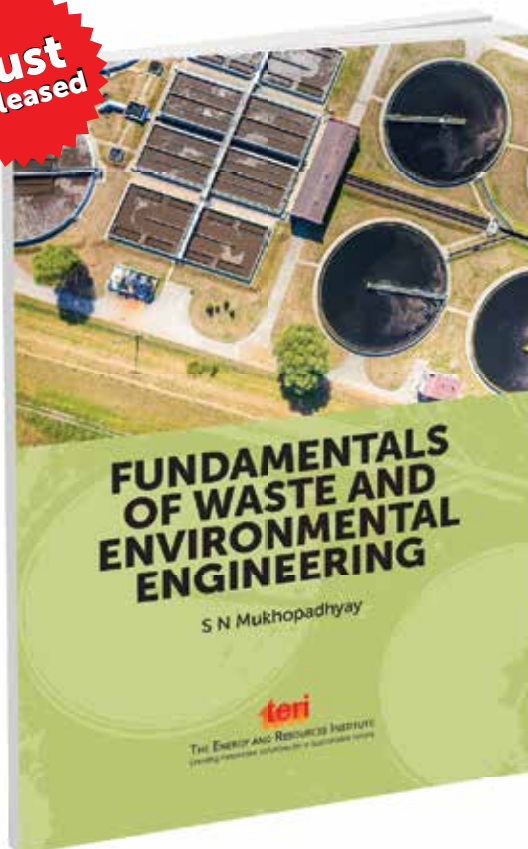
Environmental protection is supreme. (We are) invested in exploring new layers of social and commercial engagement, and Madam Marigold crafts contemporary design, focused through an 'eco-luxury lens'. ■



From the eco-sensitive brand Madam Marigold

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Why Don't We Celebrate Earth Day Every Day?

Small Steps Could Go a Long Way

Earth Day is celebrated on April 22 every year. This year will mark 50 years of Earth Day. The theme for Earth Day 2020 is climate action. This year we have two crises: one is the Coronavirus disease (COVID-19) pandemic and the other is of course climate change. In this article, **Anjali Prasad** says that by actually taking small steps in our daily lives, we can make everyday Earth Day. Earth Day 2020 can be the catalyst that spurs an unparalleled global collaboration for protecting planet Earth.

We talk about Earth Day every time April is around. And it has been like that since 1970. A lot of us around the world get together and celebrate on April 22. But, why do we limit ourselves with acts of conservation and related events only on that day? Why don't we take it ahead and do it every single day of the year?

With the global pandemic of Coronavirus disease (COVID-19) engulfing the entire world, the need to protect and take care of the planet's inhabitants and the environment is more than ever. Studies and scientists alike have warned of extreme consequences to human civilization if we carry on with the business-as-usual approach. Many different species are facing the threat of extinction and the only livable planet we know is changing rapidly.

However, the COVID-19 pandemic should not shut us down for a very long time. Instead, it reminds us of what's at stake in our fight for the planet. The Earth Day hopes that each and every individual of the planet should come forward and revisit their obligation towards nature. To begin with, it can be done in one of the simplest ways of just switching off all the non-essential lights for an hour. With the global COVID-19 crisis looming large, this

year the Earth Hour was celebrated digitally by World Wildlife Fund (WWF) between 8.30 p.m. and 9.30 p.m. on Saturday, March 28, 2020. Amidst the COVID-19 global pandemic, Earth Day will take a new turn this year by relocating to the Internet. Due to the global coronavirus pandemic, events for the 50th anniversary of Earth Day on April 22 will be digital. Not just that, a lot of celebrities, environmentalists and political leaders will offer their support online for nature and people.

And on our part, we could aid the situation by just taking really small steps in our daily lives, so that we can make everyday Earth Day. If we decide we won't ever pick up another plastic bottle or sort our trash into biodegradable or non-biodegradable trash, we would not just be doing ourselves a huge favour but also the only livable planet which we call home or Mother Earth.

The usage of fossil fuels should be decreased, which would lead to lesser release of greenhouse gases (GHGs). Because apparently, if things stay the same as they are today, the global carbon dioxide emissions are said to increase by almost 2 per cent every year. And we are talking till the year 2030. This will bring with it drought, floods, communicable diseases, and extreme weather.



Reduce

You must have read about the three R's. The 'Reduce, Reuse and Recycle' mantra has been doing the rounds forever now. So it wouldn't sound new or even remotely novel. But the fact remains that reduce is one of the primary ways to save the planet. Even if you have stockpiled organic stuff and your litter bin reeks of green products, please remember it is still overflowing.

All we need to do is buy less. Way less... And it really is not such a difficult thing to do. Picking up an e-book rather than the physical copy, downloading music from the right sources — we aren't encouraging piracy, mind you — rather than picking up the whole album off the shelf, and other small actions can go a really long way to make a difference in reducing.

Reuse

Jam jars, old clothes, used electronics, these can all be reused. Believe us, they can be reused. There are enough examples in the form of educational videos on social media and how you could actually make your things last longer, much longer. Once you put your old things to use, you will realize that you also need to buy a lot less; the older repurposed items are of great significance and need not be tossed out. So think about it before you decide to throw that linen tee!

Recycle

The third and final R is 'recycle' as most of you already know. And it might sound like a huge effort. But believe us recycling is what Mother Earth needs right now. Start with identifying the recycling services available in your locality. Some studies have revealed that 90 per cent of the items going in a landfill could be recycled, if only we had the resources in all areas, and made the effort. Next, you could actually look around your own space and see what all you do with all the things lying around. Books that you don't read could be donated or sold off. Shredded paper could be used for composting. Things like household batteries that could be detrimental to health should be definitely recycled. The list could go on but all we need to remember is that it wouldn't take too much effort but would go a long way in making a difference.

Don't Forget to Switch Them Off

You know about LEDs (light-emitting diodes) that are just as bright as bulbs, last virtually forever, and use hardly any energy at all. Just make sure you use LEDs regularly. Your home lighting scene needs LED lighting. Offering huge savings, these enlightening inventions can manage to pay for themselves fairly rapidly. Did you know that an LED bulb needs only a tenth of the electricity of a usual incandescent bulb? Not just that, it

also lasts about 25 times longer, and that lends itself to reduction in the materials that are used to manufacture these.

And as we have broached the subject of electricity, it will only make sense to remind each one of us how much pollution light causes. And how we can do better and restrict it. More than required artificial light not just disturbs animals and other creatures but also humans. We definitely can tone that down.

Cut Down the Meat—If You Can

Going off meat for just one day a week can have a massive impact on the environment. Cutting down the amount of meat you consume would mean cutting down on water, fuel as well as waste that goes in feeding and processing the meat. Not going down the preachy road, it definitely would do the environment some good if animals were allowed to live for a bit longer. Don't give up meat if you can't, but please do try to reduce the intake.

Water Water Not So Everywhere

There are certainly many ways to reduce the amount of water we use all across the globe. Don't let it down the drain if you aren't using it, like while shaving or while brushing your teeth. Turning off your wash basin tap and not letting it run while you are aiming for sparkling



teeth can go a long way and save so much water that roughly translates to almost 2340 gallons per year. A dual flush kit could also help you in the endeavour to save water. Also turning off the shower as you soap could save up to 230 litres. Use buckets instead of hose pipes to wash your private vehicles.

Stay Away from Everything Plastic

According to research studies, 1 trillion plastic shopping bags are swung around across the world and a lot of it even ends up in the ocean. Imagine what reusable bags could do to save the planet. And did you know that 12 million barrels of oil are required to manufacture those plastic bags. And each time, you pick up that plastic water bottle, please give it a thought. You could do better if you carry a reusable bottle.



Think Global But Please Buy Local

Buying organic produce might be a wonderful idea and a step but that doesn't really make them pesticide free. Also, if you're ordering organic pesticide-free pink guava from across the ocean, you aren't really doing anything too much favourable. Try going for the local produce — local farmers will thank you. As will the planet... Once you have reduced the distance your food has to travel to land on your dinner table, you automatically help Mother Earth. Also, eating and buying local means more currency stays within your community. Every rupee spent generates twice as much income for the local economy. Local produce is fresher and tastes better because it is usually sold within 24 hours of being picked.

Get the Drive to Not Always Drive

Just try to keep your private vehicle off the road for one or two days a week and notice the visible change. You will be contributing to much lesser GHG emissions.

Try carpooling, putting all your errands together or opt for work from home. With the novel coronavirus scare in the country many of India's largest corporations and technology multinationals asked their employees to work from home. Not only during such worldwide emergencies, but otherwise too, the 'work from home' work culture could pick up pace in the future to save cost of fuel and transportation.

You should also get your car/two-wheeler serviced regularly and get it repaired if need arises. Timely and proper servicing of automobiles not only limits harmful emissions but also improves fuel efficiency. If possible, avoid congested roads and also avoid driving during peak traffic hours. Replace old car batteries with new ones.

Plant the Seeds of Change

In an IPCC (United Nations' Intergovernmental Panel on Climate Change) report of 2018, it was suggested that adding 2.5 billion acres of forest to the world could limit global warming to 2.7 degrees Fahrenheit by 2050. You





could do your bit by at least planting one teeny-weeny sapling that is sure to serve the coming generations. One young tree is capable of absorbing almost 5 kg carbon dioxide, so what is stopping you from making a difference to the future of the mankind.

It is up to everyone to do their part, to rethink, re-evaluate and re-imagine the way we work and how we lead our lives. And imagine what can be achieved collectively if cities worked towards making each day Earth Day.

Cities that Have Changed for the Better

Have we ever given it a thought that over 90 per cent of the cities and urban areas lie near sea coasts? This in turn means that a lot of cities on the planet are enormously susceptible to the effects of the climate crisis as sea levels rise and ice melts in the polar regions.

Cities that focus on reducing emissions and improving the health of its residents are the ones that can help with increasing sustainability and go a long way in setting examples for the rest of the world. If collective efforts could lead to improving mobility while at the same time integrating transport, imagine what the climate solutions would be. Let us take examples of cities, such as San Francisco, Vancouver, and Stockholm and look at how they have turned the issue on its head.

San Francisco is home to some of the most innovative technology companies. The city has strikingly managed to cut its water consumption in the last few years. The city even has hybrid-electric buses driving down the streets and more than half of the rails are zero-emission.

Vancouver has a set of 10 goals which were supposed to come alive by 2020. This includes a significant increase in green jobs as well as reducing

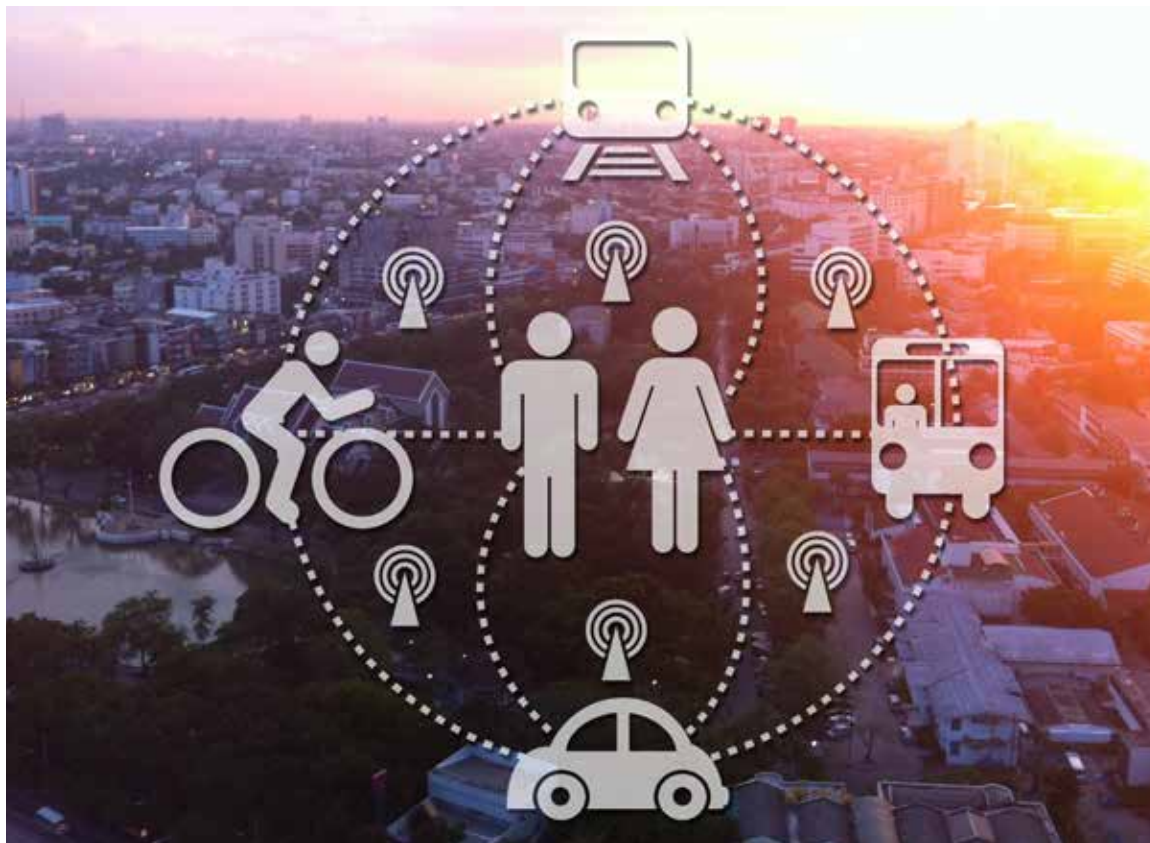
community-based GHG emissions. The Canadian city also plans to expand green buildings around the city.

Stockholm is a lovely city that aims to be as attractive for its citizens as it wants to be for newcomers. While at the same time, it is doing good for the planet too. It has been awarded the first 'European Green Capital' by the European Commission in 2010. And the city is looking to be fossil free by 2050. For this, the city has moved to district heating from oil. This essentially means that the whole country now uses heat from centralized sources, for example, a power station to more efficiently heat and cool its buildings. This way of heating accounts for over 80 per cent of heating and hot water in the country and one of the reasons how Sweden has reduced its GHG emissions over the last few years.

In Asia, Singapore has also increased its sustainability quotient by improving its transportation system. By limiting car ownership amongst its citizens, the country has drastically reduced pollution and traffic snarls on streets and highways. The city has also enabled its people to bike and walk through its navigable streets.

Having looked at what governments and cities can do, let us now look at what the financial sector can take up to help our planet. Because as much as we want to live in denial, we need to accept that climate change leads to financial crisis too.





The Role of Financial Sector in Mitigating the Effects of Climate Change

Climate change poses one of the main risks to the global economy. Not only does it affect the wealth of societies but also impacts the availability of resources, the cost of energy, and also the value of companies. Any wonder then that we need to relook and re-evaluate the manner in which we use energy. We definitely need to look at options and start utilizing them before it is too late.

So looking at the financial industry, it wouldn't be unfair to say that it has a two-fold role. While it needs to ready itself for the adverse consequences that climate change may have on its business as well as on its customers. It also on the other hand can immensely help alleviate the economic risks and enter the low-carbon economy by providing appropriate products and services. If the central banks could lead by example, they could be encouraged to integrate sustainability into their own portfolio management. They could also look at bridging the data gaps so that assessment of

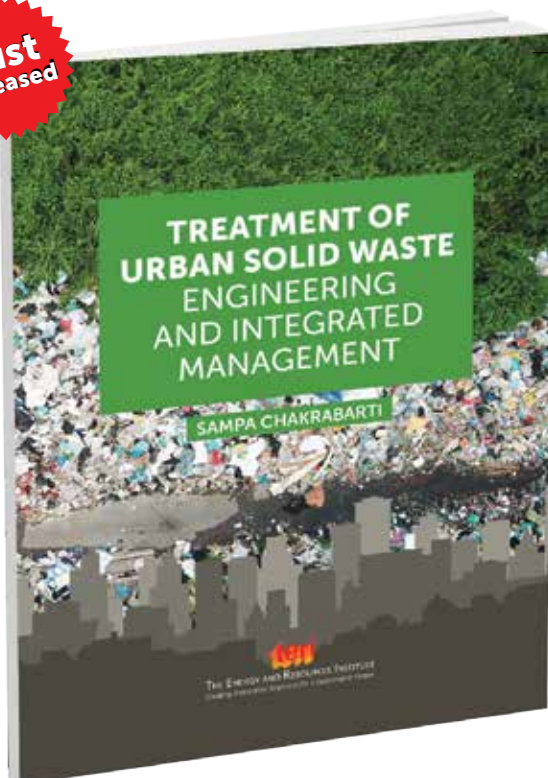
climate-related risks could be enhanced. According to the International Finance Corporation (IFC), a part of the World Bank Group, it is imperative to identify and report GHG emissions because it is increasingly fundamental to sustainability reports. And did you know, IFC Performance Standards apply to emissions of 100,000 tonnes CO₂ equivalent per year, about 7 per cent of investments during the tenure of a year. It is time we took a stand and did something substantial about it.

And at the end of the day, it is not just about governments, cities or sectors that need to showcase responsibilities towards the Earth and climate change. Indeed, collectively, a lot more can be achieved but what really matters is performance, not size. If we intend to meet the needs of an ever-growing population, we will need to look at the bigger picture and address large and small issues alike. And no matter what the issue is or how big it is, the onus would lie on each one of us to minimize their impacts on the natural systems that sustain us all. ■

Anjali Prasad is a voracious reader and a passionate writer. With a varied experience in writing for over 17 years, she has dabbled in everything from copy, scripts, blogs, and content.

CHALLENGES AND SOLUTIONS OF URBAN SOLID WASTE MANAGEMENT

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Treatment of Urban Solid Waste: engineering and integrated management describes the principles or steps of integrated solid waste management, especially in the Indian context. The Indian scenario of generating and treating urban solid waste is explained in the backdrop of international status. Latest technologies as well as current rules and regulations applicable in India are compiled for ready reference. It will be useful for the postgraduate students as well as for the practising environmental engineers engaged in the management of municipal solid waste.

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Lessons from the COVID-19 Response

The global Coronavirus disease 2019 (COVID-19) pandemic has transformed lives all over the world.

Nations have been closing their borders. There are lockdowns in some countries and restrictions on public gatherings in others. Businesses have been hard hit with the transport, tourism, hotel and restaurant industries being the worst affected. The world economy is entering a recession. In this article, **Ajay Shankar** and **TCA Avni** discuss a few lessons that should be learnt globally from the present crisis engulfing the whole world. Creation of spare healthcare capacities is clearly a necessity across the world. Managing communication would also be an increasing challenge.

Disaster management has usually meant responding to an extreme event in a limited geographical area; a tsunami, a severe drought, a flood, a severe hurricane, an earthquake, or an accident in a nuclear plant. But, this time governments and societies have had to respond to the global pandemic of coronavirus without being able to rely on past precedents. Most disasters, whether they are of geophysical, climatological, or metrological origin, have a limited geographical impact, allowing the damage caused to be mitigated through

mobilization of resources from other parts of the country and elsewhere. Experience has resulted in progressive improvement in responses. While a severe cyclone on the east coast of India would result in the loss of thousands of lives in the coastal villages earlier, timely advance warning on mobile phones and assisted evacuations have brought down loss of lives to negligible levels. Global epidemics – and even pandemics – too have had less severe impacts on the national economy and hardly any on the global economy in recent decades.

The initial delay in China in accepting the first report from the doctor who concluded that it was a new virus, the subsequent misinformation during the early stages of the spreading of the virus was avoidable and irresponsible. The subsequent handling of the situation by the World Health Organization (WHO), which gave contrary and at times conflicting advice to governments, has also been problematic. Governments themselves have veered considerably in their responses and continue to do so. The clear lesson for the future is the paramount importance of transparency and of not concealing or watering down of communication of what is actually happening. The other is more challenging: the need for more efficient processes for the best experts and minds globally to grapple with something unforeseen and try to arrive at consensual conclusions quickly and then keep improving these. The Intergovernmental Panel on Climate Change (IPCC) reports are a good example. But this is easier said than done especially when speed is important. After the initial delay, this is now happening. Better, cheaper and faster testing kits have emerged. Possible lines of treatment with combinations of existing drugs are being tried out and work on developing a



vaccine is moving faster than ever before. As government responses have varied there is ongoing learning of the efficacy of different responses on the basis of actual data.

One stark reality that is hitting people across the world is the absence of reserve capacities in the healthcare systems even in the the United States and Europe. New York and London are racing to create new hospitals with intensive care facilities. Ventilators are not available and their production is being ramped up. Even supply of protective gear such as masks and gloves for healthcare professionals is a challenge needing production to be scaled up. It is ironical that countries have strategic reserves of oil but not for health care. A clear lesson for the future is to have additional healthcare capacity as well as Standard Operating Procedures (SOPs) for ramping these up in a crisis like the present one. The Civil Defense mobilization capacities of an earlier period are a good example. India needs to increase its inadequate healthcare capacities manifold and that too on a war footing at the earliest.

The current crisis has shown that how difficult it is for India to deal with a crisis which is impacting the whole country and not limited to a region. The shortage of protective personal equipment for medical personnel and police personnel on duty in the current crisis has shown that there is need to create actively monitored reserves and redundancies for essential supplies and to maintain supply chains which are less vulnerable to regional disruptions. Procedures need to be in place to guide emergency responses. When a crisis is nation-wide, regions of normalcy may not exist to be able to supply essentials. Stock piles and infrastructure would need to be in place and maintained for such contingencies. Necessities which come to mind given the current crisis include the need to maintain sufficient stocks of essential medicines along with the capacity to scale up production manifold. A consequential necessity



is of ensuring that supply chains are maintained. Globalization has resulted in the Indian pharmaceuticals industry being fully dependent on the supply of Active Pharmaceutical Agents (APIs) from China. The key lesson is that for security of supply and production there needs to be an alternative geographical source of supply. This is true for other goods also. In the current crisis this meant that when China shut down, the supply chains of essential commodities the world over were disrupted. A key component of disaster preparation needs to be to ensure that supplies for essential commodities – at any stage of the value chain – are not monopolized by a single country. India should have systems in place to be able to ramp up production and movement of goods which are essential at the time of a crisis.

An additional peculiar challenge which has been seen in the current pandemic has been of information management. As news about the virus and its spread across the world became centre stage, there has been no let up in the deluge of information, misinformation, and analysis in the media and, more so, in the social media. This has heightened anxiety. Disaster management in the internet age will need to factor in the reality of social

media and global connectivity. In normal times, there is a hall of mirrors character of exacerbation in the social media. In the present crisis, there is greater fear and panic globally. Who could have imagined that stores in the US and UK would run out of toilet paper! The authorities have been communicating truthfully. Their real challenge has been how to moderate obsessive anxiety and bring perspective and balance. A headline which gave the total number of deaths in Italy on a particular day last year and the number of total deaths on the same day this year and the break-up this year between deaths caused by COVID-19 and by other causes would be useful but one has to search for this information.

Going forward a lot more scenario building for unforeseen 'black swan events' must be undertaken. For each of these, optimal responses may be drawn up. Something similar to war games and scenarios is required for disasters. These in turn need the engagement of the best minds. Creation of spare healthcare capacities is clearly a necessity across the world. Managing communication would be an increasing challenge. ■

Ajay Shankar is Distinguished Fellow, TERI, New Delhi and TCA Avni is Research Associate, DGO, TERI, New Delhi.

COVID-19 Lockdown

Showing Possibilities of Change

To stop the imminent spread of the novel coronavirus, the Government of India imposed a nationwide lockdown between March 25 and April 14, 2020. But, do you know that even during these testing times there is something to feel really cheerful about? **Shivang Agarwal** and **Dr Sumit Sharma** say that this complete lockdown has resulted in improvement of air quality in Indian cities, particularly Delhi and Mumbai. The 21-day lockdown in the country has provided us a blessing in disguise to reassess our activity patterns and also shown us the possible impacts of these strategies on air quality.

All of us have myriad reasons to loathe Coronavirus disease 2019 (COVID-19), and rightly so, but even in these testing times there is something to feel exuberant about. Looking in terms of air pollution levels in the urban centres in India, the lockdowns associated with COVID-19 have resulted in improvement of air quality in Indian cities. Delhi and Mumbai, two of the many non-attainment cities recognized by the Government of India, show poor air quality more or less throughout the year. Despite the efforts by central and state governments to reduce air pollution in these cities, the results were not very

dramatic. Pollution levels in these cities are so high that they routinely feature in the top polluted cities in the country. But the 'Janata Curfew' that was observed on March 22, 2020 and the subsequent lockdown for 21 days all over India have proved to be a breather for the cities. A hopeless fantasy was fulfilled and the claim of COVID-19 lockdown actually reducing the air pollution levels in these cities was substantiated when one looked at the bright stars in the night sky and clear sky during the day.

During the lockdown, the roads became void of vehicles. A host of industries from cement to heavy

engineering and from automakers to their ancillaries announced temporary shutdown. Fast-moving consumer goods (FMCG) firms were also shut amidst the lockdown and construction activities were put on hold. All this had a significant impact on air quality; pollutants, such as particulate matter (PM), NO_x , SO_2 , CO and benzene, showed significant decrease. Data of air quality monitoring stations (CPCB) of these cities was analysed and comparison of 10-day period before and after the lockdown, that is, from March 12–21 (before the lockdown period) and March 22–31 (during lockdown period, including Janata Curfew) showed a drastic contrast. Highest decrease was observed in NO_x (57 per cent reduction in Delhi and 73 per cent in Mumbai). NO_x is released when fuel is burnt at high temperatures, and in the cities, vehicles are the dominant users of combustible fuels in their engines. So, after the lockdown was announced, drastic reduction in vehicle movement resulted in such high reduction of NO_x concentrations. Both PM_{10} and $\text{PM}_{2.5}$ also reduced drastically (54 per cent and 39 per cent for Delhi, and 46 per cent and 32 per cent for Mumbai, respectively), the reasons being reduced diesel vehicles,





reduced resuspension of road dust, and the closure of industries, brick kilns in the neighbouring areas around the two cities. SO_2 was reduced by 17 per cent and 14 per cent for Delhi and Mumbai, respectively, which also shows the impact of reduced industrial activity. SO_2 was by and large not a problem faced by these cities, as it remains within the limit throughout the year, but even then, a significant reduction can be seen which can be attributed to shutdown of industries, which is the main source of SO_2 . Carbon monoxide (CO) reduced by 36 per cent and 44 per cent in Delhi and Mumbai, respectively, because of major decrease in number of gasoline vehicles and shutting down of brick kilns. Benzene is released by vehicle exhausts, specific industries and fugitively from the fuel pumps. The temporary closedown of these sectors reduced the benzene by 45 per cent in both the cities.

The numbers seem too good to be true, but this is what is observed since the lockdown was announced. Even though the lockdown proved to be a helping hand in achieving this, we can't rely on lockdowns related to COVID-19 to be the solutions for the air pollution control. The

pandemic has already caused enough socio-economic and health disruptions across the globe and needs to be resolved at the earliest, which means earliest possible lifting of the lockdowns. However, this can reverse the air quality change and bring back high pollutant concentrations in the cities.

Lessons to Be Learnt

There are certain lessons to be learnt with respect to the activities which can continue even after the nationwide lockdown is lifted. These activities which were more or less forced due to the lockdown may prove useful in reducing air pollutant concentrations in the cities, without impacting economic growth. Work from home, which was followed in a widespread manner during the lockdowns is something which needs careful evaluation for continuation even after this unprecedented period of lockdown. There is a need to think about encouraging e-shopping and e-commerce activities and to come up with a structure such that the employment patterns are not drastically affected, while travel demands are reduced. Reduced vehicular activity

has played an important part in reducing pollution, and hence a move towards more efficient public mode of transportation needs to be made. Electric buses should be poured in and metro connectivity should be enhanced with last-mile connectivity. Reduction in industrial production is something which is not desirable due to socio-economic reasons; instead we must look forward to make this more sustainable. Reducing emission intensities of production through penetration of cleaner fuels, end of pipe controls, and effective monitoring and enforcement is the key.

The 21-day lockdown in the country has provided us an opportunity in disguise to reassess our activity patterns and also shown us the possible impacts of these strategies on air quality. It could be very effective if these recommendations are evaluated and considered. There is a need for holistic approach and to be rational in our decision making by taking into account both the socio-economic development and clean air goals for the country. ■

Shivang Agarwal, Project Associate, Centre for Environmental Studies, TERI, New Delhi and Dr Sumit Sharma, Director, Earth Science and Climate Change Division, TERI, New Delhi.

Using Science to Fight Water Scarcity and Climate Change

Kumbharwadi's Inspiring Tale

Oddities and challenges could be hard to tackle sometimes, but the farmers of Kumbharwadi village did not succumb to issues of water scarcity and climate change risks. In this inspiring article, **Dr Rina Mukherji** tells us about farmers and villagers who eventually overcame adversity by adopting water-efficient ways of crop planning and agricultural practices.

Babasaheb Baburao Garge is a farmer who hails from Kumbharwadi in Sangamner taluka of Ahmednagar district, Maharashtra. The parched land of his native village bid him adieu when Garge decided to take up work at a brick kiln in Kolhapur to make ends meet. But after 11 years in Kolhapur, he returned home in 2011, thanks to the efforts of Watershed Organisation Trust (WOTR) and the farming community of Kumbharwadi. This year, in spite of a

delayed monsoon and limited rains in his village, he has grown *bajra* (pearl millet/ grain) and *jowar* (grain sorghum), along with maize and tomato. Now, Garge also engages in goat farming for meat, alongside raising some milch cattle.

Kumbharwadi's parched landscape has transformed into a farming-friendly one because of timely scientific intervention used to tackle risks of climate change. Situated along the Pune–Nashik highway, this hill village

comprising 140 families had a history of scanty rainfall. However, the years following 1980 saw a gradual drop in rainfall, with the last decade witnessing a very steep fall, as reflected through rain-gauge readings. The single well that provided drinking water to the villagers dried up every summer, compelling the dwellers to buy water from tankers. Consequently, a situation of chronic water scarcity hit the village and started affecting the farmers, all of whom



Office bearers of the Village Water Stewardship and Water Management Committees



Measuring rain using a simple rain gauge

were either marginal cultivators with farms ranging from 1–4 acres in size, or landless dependent on farm labour. The consequent migration of these distressed farmers to Kolhapur and other urban conglomerates to work in brick kilns and small enterprises became a common feature.

In 1998, the people of Kumbharwadi came across some watershed management projects being undertaken by villagers in neighbouring Darewadi, under the guidance of the WOTR. Eventually, they too decided on adopting a similar exercise in their own village by forming a Watershed Management Committee of 16 members.

Since Kumbharwadi was situated in the hills, with a rocky basalt surface, whatever rain the village received during monsoon months, would be lost as run-off. Hence, the technique of continuous contour trenches (CCT) was introduced to hold the water flow in these hills. With deep continuous contour trenches being resorted to in parts where there was a change in slope, as also at intervals after every 3–4 CCTs, the villagers began stocking water. Gradually, cement nullah bunds (CNBs) and mati nullah bunds (MNBs) were excavated, and a percolation tank was built through *shramdaan* (voluntary contribution) by villagers. While 80 per cent of the finances came through grants from WOTR, 20 per cent of the sum was contributed by the villagers themselves. Soon, several other initiatives followed, such as building of check dams and farm bunds, with grass being used to line farm bunds for controlling erosion. Plantation of saplings was also encouraged so that the water table could be improved and water was not lost in run-off. Farm bunding was also practised on fields and flood irrigation of crops was totally stopped. At the same time, grazing in common areas, and in the hills (which were common forest areas), amounting to 488 hectares, was banned, notwithstanding opposition from some villagers. By 2002, Kumbharwadi transformed itself from a water-scarce

village into a place of ample water resources.

However, this development also saw farmers changing their agricultural practices and methods, and hence, problems reared their ugly head again. It was around this time that community leaders put their heads together to set up a Water Management Committee and a Water Stewardship Committee in 2011, in keeping with the principles that governed the Maharashtra Groundwater (Development and Management) Act, 2009, which came into force in 2013. Using the principles enshrined in this Act, certain interventions in consonance with the problems brought about by climate change were introduced and necessary actions implemented. Under the aegis of these committees, a ban on water-guzzling crops, such as sugarcane, was imposed, and farmers were encouraged to settle for crops that could considerably limit the use of too much water.

In 2013, the village acquired two automated weather stations AWSs, a groundwater measurement tool, and three rain-gauges. Groundwater measurements helped map the aquifers in the village. Superimposition of such aquifer maps over the surface waterbodies in the village helped farmers have a fair idea of the water resources in their village, which in turn facilitated



Automated weather station in Kumbharwadi

the planning of crops by the Water Management Committee. This was further assisted by readings acquired from the AWSs that could forecast arrival of rains, wind patterns, and temperature levels. Moreover, the simplified rain-gauges informed villagers about the amount of rain received per shower.



Plastic mulching at Kumbharwadi

Presently, the villagers know that there are three aquifers spread over three different parts of their village, of depths in the range of 30–35 feet, 45 feet, and 90–95 feet. Water budgeting is done scientifically with every farmer being advised through *krushi sallas* (farmer advisories) as per precise estimates of water availability. Since weather patterns are well understood now, farmers can plan their agricultural schedules accordingly. 'For instance, when rains are expected, farmers do not resort to spraying of pest repellents. This prevents significant losses,' explain Rakhmani Bhikaji Varpe, Chairman, and Bhagwat Malhari Ghagre, Secretary, Water Management Committee. The time taken for percolation into aquifers has also been understood and analysed. 'In some parts, the percolation is immediate. In others, the water percolates down in around 10 days' time or so after a shower,' says Tabaji Rangnath Gharge, Vice President, Watershed Management Committee.

At Gram Sabha offices, farmers are now trained in organic farming techniques to prepare soil, and improve soil health using organic manure made with dung, neem, and biomass. WOTR experts have trained farmers on plastic mulching to prevent water wastage and subsequently control weeds. Flood irrigation has been banned by the Gram Sabha. In Kumbharwadi, drip irrigation



Continuous contour trenching in the hills to prevent water runoff and help groundwater percolation

has caught on over the last decade and more than 70 per cent of farming households are now equipped with drip irrigation sets. Farmers in the village are regularly informed about AWS forecasts through mobile SMSs. Thus, every farmer gets to know of wind speeds, rain forecasts, and temperature levels to plan their crops well in advance. Explaining how it helps, Rakhmani Bhikaji Varpe, says, 'When we know there will be rain, farmers avoid spraying on their crops, lest everything flows off. Harvests too can be planned likewise, and crop losses due to storms minimized.'

Around October every year, the stock of water resources in the village is assessed. On the basis of the total water available in the aquifers, the acreage to be allotted for various crops is planned,

and farmers are advised accordingly. When there is ample water, wheat is planted. If not, millets such as *bajra* and *jowar* are opted for in place of wheat. *Chana* (chickpeas) and green peas are preferred as well. So are fruits such as mango and pomegranate, since they require less water as compared to others. Though there is no compulsion to follow the advisories, farmers have learnt to do so, since it is in their best interests. 'The few occasions when farmers went against the community advisories, entire crops were destroyed due to the lack of ample water. They have thus learnt to pay heed to our advice the hard way,' says Tabaji Rangnath Gharge.

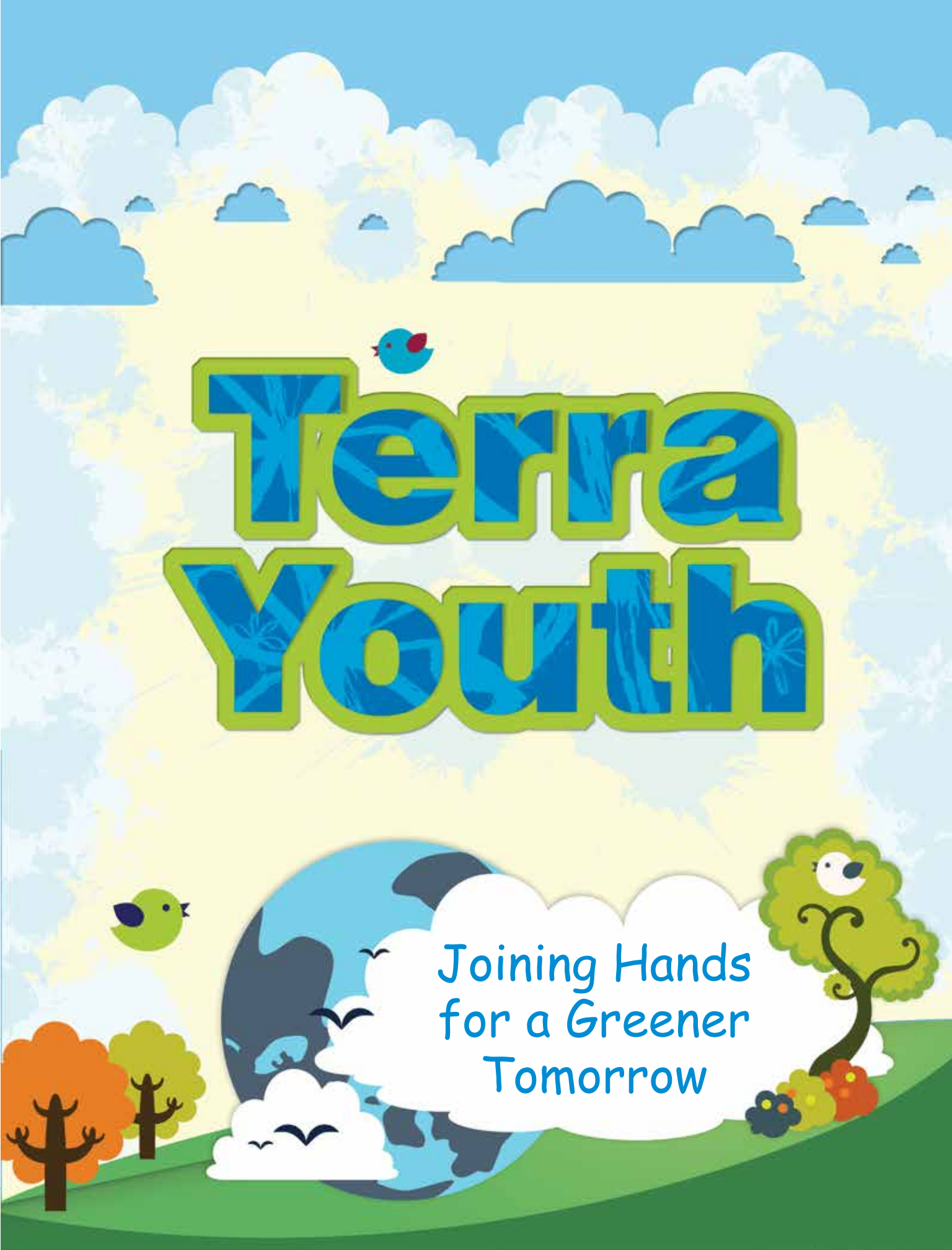
The sense of ownership, that water stewardship has achieved, shows its results extensively in Kumbharwadi today. The hills and farms are covered in green, although the aquifers are yet to be recharged. 'They continue to be at the same level as last year; the rains were just enough for our farms,' inform the farmers of Kumbharwadi.

Science and technology have combined to gift abundant greenery to Kumbharwadi's landscape, notwithstanding the risks of climate change. ■

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



Farm bunding to stop erosion



Terra Youth

Joining Hands
for a Greener
Tomorrow

Sustainability and Responsible Tourism

Duties of an Efficient Tourist Facilitator

Nowadays, a lot of people around the globe are talking about sustainability, though it is not clear that how many really understand it. Here, **Saurabh Somani** shares his observation from a tourist facilitator perspective where he handles and facilitates foreign tourists travelling to the Indian subcontinent. He has interpreted ways and methods how sustainability and responsible tourism go hand in hand. Tourism has a way of teaching to get adapted to sustainability by applying practical measures to make apt changes in our lifestyle and working patterns.

Every type of tourist activity has the opportunity to make more of a positive contribution to the destination. Tours managed responsibly can bring economic benefits to local communities and support conservation efforts but if enough care is not taken then tours can have a negative impact



on the people and places visited. Sustainability helps tourist facilitators to lead tours that create a more positive impact, learning from the experience of others who use responsible practices successfully within their work.

The foremost point is to ask about your clients' expectations, then manage it, and surprise them — look for small details that guests would not have thought about beforehand. Minimizing disruption is an important tool towards responsible tourism as other tourists may be put off from visiting an area of a market or restaurant because of the large size of your group which will lead to conflict among local enterprises and potentially limit their income.

At times tourists need to keep a low profile and blend in so that they don't disrupt people at work, those worshipping or other visitors' experiences. An experienced tourist facilitator shall lead the tourist group in such a manner that leaves minimum

to no disruptive impact on the local population and natural resources. It is important for community groups to have fair and equal opportunities and if they do not feel the same then it shall disrupt the flow.

It is important to work with local communities, business owners, and individuals on what shall be the best way to have a balance on what will work for them and agree on an approach accordingly. For example, while visiting local restaurants/eateries, it is important to agree which local dishes and activities are the most appropriate for promotion. Learning from the local chefs about their recipes and the fun-filled stories behind food is what excites the tourists.

Tourists can be engaged when they have the opportunity to interact with the locals. Despite language barriers, tourists manage to have greater understanding of local customs and culture, which is more useful than lengthy explanations. Such activities maximize direct spend to

local supplies. The same principle applies to artisans, shop owners, and other hosts and suppliers. In the author's observation, communities visited by tourists should be invited to give their opinion about what they would like to share with the guests and what will work in the interest of celebrating their traditions and respecting their beliefs and cultural practices. Further depending on the level of involvement between organization and community groups, it is important to always think on a long-term basis about the benefits and find ways to support communities in being self-sustaining. This could include how to invest income for the future to develop skills that will help them to work independently.

A thriving community that is keen to welcome visitors will make for a better client experience. Leading nature and wildlife-based tours will sensitively and appropriately limit disruption and damage and will thus help protect the natural environment. It is important for the tourist facilitator to review the tours, think creatively about how to make high-quality client experience that provides a greater local contribution. This could improve how to increase opportunities for local suppliers.

A very important role tourist facilitators can engage themselves is to raise awareness through fund raising dinners and exhibitions among influential locals of your town/place including foreign visitors to protect environment and wildlife. These areas directly impact the well-being of sustainability and responsible tourism. It is important to adapt activities and practices to have a lower environmental impact. Look at each tour from start to finish and consider all the ways by which the natural environment is affected by your activities. Identify multiple ways what you can do differently.

Remember the greater the contribution made by tourism the more secure the future of the region will be through improved livelihoods, conservation, and a high-quality tourism



product. Reduce the creation of waste, especially bottled water and disposable items. Try using re-usable crockery which improves the quality of experience and prevents unnecessary wastage. Promote souvenirs that cause minimal environmental impact to produce. Work with local businesses to find solutions to waste and packaging. There are tourists who do not want to feel responsible for their visit that cause problems for the destination. Local suppliers can use ways that create high-quality experience for visitors, for example, using natural byproducts for packaging and material serving food and drinks.

Remember tourists can read guide books, websites, and can look at pictures before their visit — so creating special experiences and weaving in extra details along the way is what makes difference to the tourists by adding greater value and creating meaningful experiences — ultimately benefiting everyone. It is important to make the guest/tourist part of the local experience in such manner that they feel honoured to have been part of it and to learn about the community. Things that are beyond guide books and Internet is where as a tourist facilitator of the group you create memorable experiences for tourists.

It is important for the tourist facilitator to be committed to continuous learning. To follow each of the principles and improve the client experience requires a commitment to continuous learning. There is always more to learn that you

can share with clients and use to build better relationship with people. A tourist facilitator has to be his/her own teacher.

Tourist facilitators are ambassadors of the organization they work for, and the region and country they belong to. Being a tourist facilitator is all about having strong communication skills. On a basic level, tourist facilitators should be great at projecting their voices across a group, and be able to do so in a clear and easy to understand way. On an interpersonal level, being great at knowing how to communicate well with people is a huge asset. They also need to be great storytellers. Some of the best tourist facilitators are locals themselves. What is great about this quality is that in addition to the planned facts and statistics, they can bring their own knowledge, experience, and personal anecdotes to the tour. They should be innovative and flexible with other cultures and places to do the job satisfactorily for a substantial amount of time and see to it that tourists keep coming. They should share new ideas with travel organizations, clients and communities for fair remuneration and changes trending in global markets. Sustainability and responsible tourism must become part of our standard operating procedures. ■

Saurabh Somani is a freelance writer who has been writing short stories and articles. His areas of interest include ecotourism, sustainable tourism, art and cultural heritage of India.

Bizarre Facts

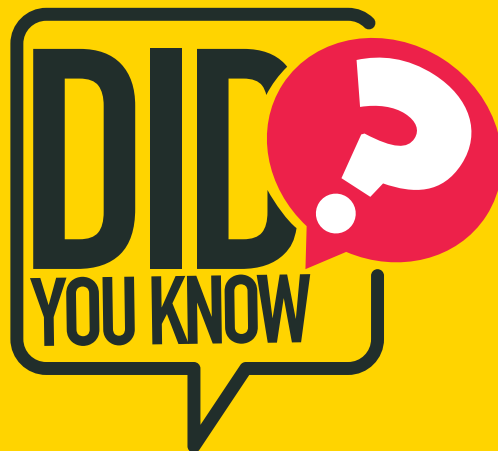


1. A snail can sleep for 3 years.
2. It is possible to hypnotize a frog by placing it on its back and gently stroking its stomach.
3. It takes a sloth two weeks to digest its food.
4. Bats always turn left when leaving a cave.
5. The average adult human has 2 to 9 pounds of bacteria in his/her body.
6. Starfish can regrow their arms.
7. The average hummingbird's heart rate is more than 1200 beats per minute.
8. In 30 minutes, the human body gives off enough heat to bring a gallon of water to a boil.
9. Goats have rectangular pupils.
10. Your tongue is the fastest healing part of your body.



Did You Know?

- You burn more calories sleeping than watching TV.
- An elephant's trunk can hold over 5 litres of water.
- Your foot is the most common body part bitten by insects.
- The average 4-year-old child asks over 400 questions a day.
- More people in the world currently suffer from obesity than from hunger.
- A blue whale's heart is large enough that you could swim through its arteries.
- The average person falls asleep in 7 minutes.
- The smallest bones in the human body are found in your ear.
- Koalas sleep around 18 hours a day.
- Sponges hold more cold water than hot.



M S Swaminathan Research Foundation

'150 Years of Science as Seen Through the Pages of *Nature*'

On March 6, 2020 in Chennai a panel of eminent scientists, emphasized on increased focus and investments in scientific research in the country. They were speaking at an event on '150 Years of Science as Seen Through the Pages of *Nature*' at the M S Swaminathan Research Foundation (MSSRF). Held as part of the 150 years of celebration of Nature Research Publishing in partnership with MSSRF, six eminent scientists spoke on various aspects of science in India.

Cautioning that India is described as a 'hot zone' for infectious diseases, Dr Shahid Jameel, CEO, Wellcome Trust/ DBT India Alliance highlighted the most recent coronavirus outbreak as an example of how we need to be prepared. Citing that severe acute respiratory syndrome (SARS) cost an estimated \$40 billion in losses, he said, 'It only costs a fraction of time for preparedness; however, we need to work when we don't have an outbreak. Most ingredients for active pharma industry are from China. With the corona outbreak, what will happen to our drug industry? National security is therefore, not just about arms and tanks but about health; health

security should be considered a national security,' he emphasized. Former DST Secretary, Prof. T Ramasami plotted the top 44 nations investing in science R&D showing how much more India needed to do. 'We need 1200 scientists per million population to invest into R&D. We have just about 200 scientists per million population. The number of scientists has to increase manifold if our investment has to match, say the US' he said.

The Chief Editor of *Nature India*, Ms Subhra Priyadarshini traced the 150 years of research and landmark publications that had come out from the *Nature* stable. Also, it had transitioned from its earlier mission of aiding 'scientific men' to now focusing on diversity and gender equality.

In a fascinating talk that traced the '150 years of genetics', Prof. M S Swaminathan, Founder MSSRF spoke of various milestones brought out in *Nature* scientific journal, and how all major discoveries had been recorded in *Nature*. He paid a special tribute to editors of the journal and called for increased emphasis on science communication. Prof. Nitya Rao, University of East Anglia, emphasized



on gender equality in science, and specifically focused on stereotypes. 'Technology has diverse social impacts on different groups of people: Product design keeps the male user in mind, Artificial Intelligence technologies can also include and introduce biases of gender and ethnicity,' she said. Prof. T Jayaraman, Senior Fellow Climate Change, MSSRF, emphasized on the need to have a realistic picture of the climate change scenario since many projections including carbon budgets have not been assessed. Dr Madhura Swaminathan, Chairperson MSSRF, moderated the panel and spoke of the increasing need for rationalism and science. Dr G N Hariharan, Executive Director, MSSRF, highlighted the seeds sown by Sir CV Raman in setting up the Foundation and the important connections to science including Nobel Laureates Norman Borlaug and James Watson's visits.

The event was well-attended by the scientific fraternity besides participants from various institutions. ■

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Celebrating Our Great Home

Earthenware As an Environment-Friendly Option

In this article, **N Kalyani** says that as we observe Earth Day we can take simple steps to protect our home, the Earth, and celebrate its beauty and richness. Using earthenware as an eco-friendly option is one such step.

Earth Day is celebrated each year on April 22, and 2020 marks the 50th year of the event. Earth is our planet, our home. Earth also refers to the soil that makes up the planet. And that is why the term earthenware is used to refer to items made of earth, using the term to mean clay.

Different kinds of soil have different composition in terms of clay or kaolin content. Earthenware is known variously as pottery, terracotta, and chinaware. Pottery is an art that dates back to centuries ago. In fact, pottery and shards are also used as the basis to fix the period of civilizations that come up from geological excavations. Potteries of certain types are identified with

certain eras of history and with certain civilizations such as black pottery, red pottery, and grey pottery.

In the face of the environmental crises that plague us today, attempts are being made to find sustainable and eco-friendly means for our various activities and to meet our multifarious needs. Reduce-reuse-recycle is a concept that is governing our choices of products, processes, and resource utilization. That the use of plastic, or rather the rampant and ubiquitous use of plastic, has become a bane to human life and the life of our planet, cannot be over-emphasized. From human health, to the health of almost all life forms, to soil and water quality, everything on planet Earth has been impacted adversely by the overuse of plastic and the generation of plastic waste. In fact in the year 2018 the theme of the World Environment Day was 'Beat Plastic Pollution', and India was the host country for the day's celebrations on June 5, 2018. Dr Mike H Pandey, India's celebrated filmmaker and well-known environmentalist, shares how the plastic waste generated by us has impacted life on earth. He explains that the contamination in our oceans is really a serious concern. 'Almost 50 per cent of the plastic produced is single-use plastic, and that is a staggering 160



million tonnes. We have produced over 10 billion tonnes of plastic since it was first created. Once disposed of, plastic reaches our landfills. This causes animals which eat the plastic to die. Also, there is a leaching of carcinogenic compounds from the plastic in the earth. Disposed of plastic also reaches our water bodies and finally our oceans. When plastic reaches water bodies it kills marine creatures. Plastic poisons our oceans; the oceans are turning acidic. Plastic also enters our food chain,' says Dr Pandey.

What seems innocuous, the plastic water bottle, for instance, that we carry around, thanks to its portability, is an item that is cause for the generation of a great deal of plastic waste. Plastic water bottles can easily be substituted by bottles made



of eco-friendly items such as terracotta, glass, and steel. This trend is now gaining popularity, thankfully, and there are units coming up to make and market such environment- and human health-friendly water bottles and containers.

In the past, people moved from the traditional occupation of being a potter, the *kumhar*, in pursuit of more lucrative professions and in search of urban areas from the villages, where the potters resided. Also, easy alternatives to pottery came in the form of plastic and non-breakable ware. There was thus a decline in the profession in terms of people who practised it and a decrease in the use of earthenware. One came across, for instance, a bearer in a hotel in a town or city who belonged to the *kumhar* community who said he had never practised the trade on the potter's wheel back in his village. There was a time when there was a move from the *kulhad chai* to tea served in plastic or paper disposable cups or then steel, though the porcelain

cup did not go out of fashion ever.

In an attempt to seek alternatives to plastic, many eco-friendly choices have now come up. Students and the youth are also taking interest in pottery. In a village in Telangana, for instance, in Kanha Shanti Vanam, of the Heartfulness Institute, the Kanha Pottery Studio offers not only students of the Heartfulness Learning Centre on the campus an opportunity to learn at the pottery unit, but also interested members who come to the campus.

Clay pots are amenable to be used for cooking. Cooking and storing food in clay pots is also healthy. A variety of pots and pans can be created with clay. Cooking was traditionally done in clay pots. Water stored in a *surai* in summers keeps the water cool, and this was, likewise, the traditional way to drink cool water during the hot season. Pottery has a whole spectrum of wares from the simple clay pot to high end porcelain. The Hungarian brand Herend, for instance, is known for



its upmarket creations.

Working with clay is not only about creating utility products but also art. Besides, by engaging in pottery and working with clay one is connected with and stays close to nature and the earth. 'Clay is tactile. It engages all your senses. It has a sheen to it when it is ready to use. Working with clay is like taking a journey inside yourself. It is meditative,' says Rekha Bajpe Aggarwal, a ceramic aggregator who is working to archive material on clay and pottery from across India and around the world to set up a museum.

India is home to a variety of beautiful ceramic and clay creations both for utility and as art. It is interesting that in the year 2019 when the Festival of India was on at Croatia, an exhibition of Indian ceramic works was organized at the Croatian capital city, Zagreb, and then in Slovenia. The organizer of the exhibition as part of an event called India Welcome, Hanibal Salvaro, a Croatian ceramicist, says, 'India Welcome is the beginning of a mine of creative and artistic rich collaboration between India and Croatia as also between India and Slovenia. The event will open many doors of communication.'

As we observe Earth Day we can take simple steps to protect our home, the Earth, and celebrate its beauty and richness. Using earthenware as an eco-friendly option is one such step. ■

N Kalyani is a freelance environmental journalist and writer who has been writing for various national newspapers, magazines, and journals. She has also done programmes for radio.





New Genetic Editing Powers Discovered in Squid

Revealing yet another superpower in the skillful squid, scientists have discovered that squid massively edit their own genetic instructions not only within the nucleus of their neurons, but also within the axon—the long, slender neural projections that transmit electrical impulses to other neurons. This is the first time that edits to genetic information have been observed outside of the nucleus of an animal cell. The study, led by Isabel C Vallecillo-Viejo and Joshua Rosenthal at the Marine Biological Laboratory (MBL), Woods Hole, has been published in the journal *Nucleic Acids Research*.

Source: www.sciencedaily.com

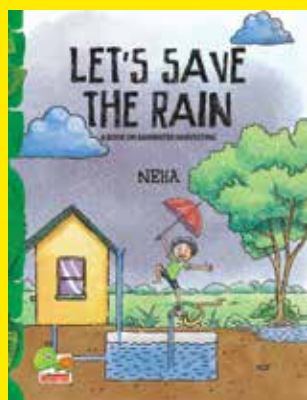
As the Ocean Warms, Marine Species Relocate Towards the Poles

Since pre-industrial times, the world's oceans have warmed by an average of one degree Celsius (1°C). Now researchers report in *Current Biology* recently that those rising temperatures have led to widespread changes in the population sizes of marine species. The researchers found a general pattern of species having increasing numbers on their poleward sides and losses toward the equator. 'The main surprise is how pervasive the effects were,' says senior author Martin Genner, an evolutionary ecologist at the University of Bristol. 'We found the same trend across all groups of marine life we looked at, from plankton to marine invertebrates, and from fish to seabirds.' The new study builds on earlier evidence for a prevailing effect of climate change on the distributions, abundance, and seasonality of marine species.

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LET'S SAVE THE RAIN A BOOK ON RAINWATER HARVESTING

Neha

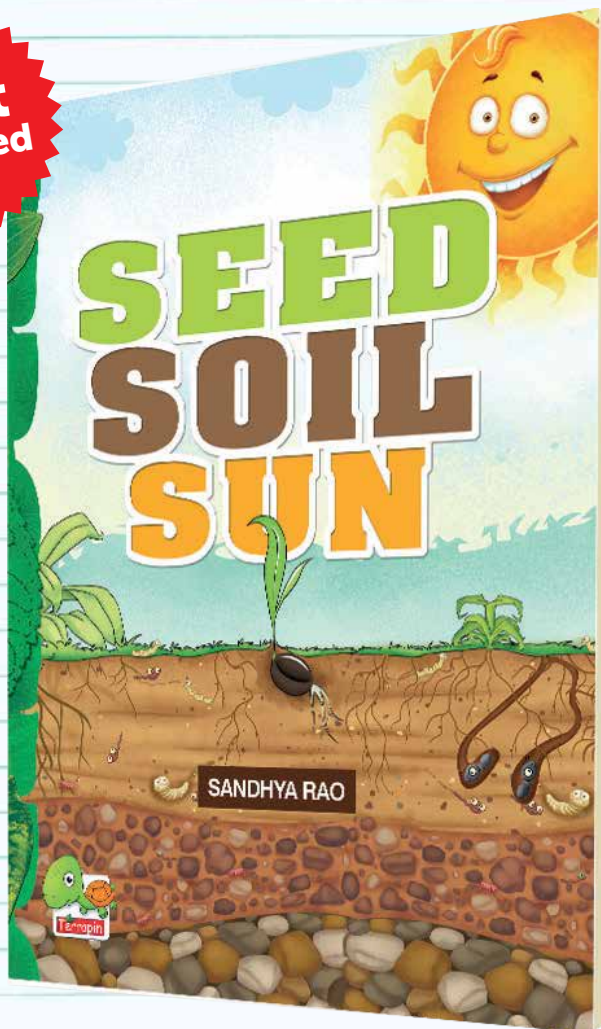
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Managing Meadows

How to Preserve Alpine Landscapes

Alpine pasture lands in the Himalayan regions of Uttarakhand are essential for ecological health and the preservation of fragile ecosystems. But, due to negligence in their conservation, the alpine meadows (or *bugyals*, as identified in local dialect) are under threat.

Chandra Prakash Kala highlights the need for adopting traditional practices and customary norms to protect these alpine landscapes from degradation.

Tucked between the treeline and the snow line in the Himalayas, the alpine meadows form a unique ecosystem that is maintained by natural forces comprising a cool climate and precipitation in the form of snow. Since heavy snowfall hampers the growth of trees, the alpine meadows are chiefly composed of herbaceous species and a few stunted shrubs. Though the climatic condition is stressful in the Himalayan regions, the alpine meadows are potential sources of nutritious fodder and valuable medicinal herbs for various ecosystems. However, over the years, unregulated human activities, with specific reference to tourism, have imposed tremendous pressure on these valuable ecosystems, which are fragile.

The Land of Fairies

The local people living in the adjacent areas of alpine meadows follow certain traditional practices. The evolution of these traditional practices could be associated with the philosophy of conservation through which an attempt was made to respect nature's bounty that makes human survival possible. In Uttarakhand, the alpine meadows, locally known as '*bugyals*', are considered sacred landscapes. Some of these traditional norms even discourage overnight stays in the alpine meadows owing to many stories and folklore in rural areas that inhabitants swear by even today. The alpine landscapes are believed to be the land of fairies, who are known to take punitive actions against those who either

disobey the customary norms or fail to abide by traditional practices. Many alpine meadows, such as the Panwali Kantha which is situated at an elevation of 3500 m above mean sea level in the Tehri district of Uttarakhand, are popular for similar haunting and mysterious fairy tales.

Preserving Floral Wealth through Traditional Norms

The flowering plant diversity of the alpine meadows is unique and well-known. The Valley of Flowers in Uttarakhand's North Chamoli is one such alpine meadow – a World Heritage Site – which attracts tourists from all over the world for its variety of flora and riot of colourful flowers. In view of safeguarding this wealth of flowers, certain traditional norms are framed for their harvesting. The flowers of the sacred Brahma Kamal (*Saussurea obvallata*), for instance, can only be plucked and collected till Nandashtami in August. The alpine meadows are a rich repository of medicinal and life-saving herbs. Despite their herbal properties and subsequent high demand by locals, these flowers can be collected only by knowledgeable herbal practitioners after performing certain traditional rituals.

According to various norms, people visiting the alpine meadows are also



discouraged to wear bright clothes. As a way of life, the pastoral communities that stay in the alpine meadows with their livestock during summer and monsoon believe in such norms and follow them religiously too. In every alpine meadow, inhabitants offer prayers to their local deities and respectfully follow the 'unwritten' customary norms of living in harmony with nature.

In the past, the pilgrims used to offer prayers at the shrines situated in the high-altitude Himalayan areas of Uttarakhand, which included Kedarnath, Rudranath, Tungnath, Madmaheswar, and Yamunotri. By evening, the devotees would return to the lower areas for night stay. This practice is still followed by pilgrims who visit the Hemkund shrine that is located at an elevation of 4300 m above mean sea level. The followers offer prayers during the day and retire for the night at Ghangaria, which is in the subalpine forested area and at an elevation of 3000 m.

Most of these customary norms would have evolved and been framed in view of striking harmony with nature and paying respect to natural resources. The traditional depiction of meadows as the 'land of fairies' in order to discourage people from overnight stays helps in keeping the landscape's pristine wilderness characteristics intact. Imposing a ban on collection of flowers, such as Brahma Kamal, after Nandashtami in August, ensures that its fruits and seeds are given sufficient time to ripen and regenerate. Dissuading visitors from wearing bright clothes is seen as a responsible act towards not distracting the wildlife, including birds and butterflies that play an important role in the dispersal of seeds and pollination.

The Present Scenario and the Way Forward

Presently, most of these shrines located in the alpine meadows, including Kedarnath and Badrinath, are surrounded

by concrete buildings and related infrastructure. Attempts are underway to expand the infrastructure for other places of worship as well. For the construction of temples and related sites of religious significance, there are eyes on Kagbhusandi, the famous lake, which is located above Raj Kharak in Chamoli district of Uttarakhand at more than 4200 m.

Besides the alpine meadows, the subalpine forests are equally important, which form the foundation for the survival of the alpine meadows. In recent decades, tourist activities have grown exponentially in these areas and the beautiful subalpine forests in Ghangaria are bearing the brunt of the ill-effects of heavy tourism.

With the passage of time, the traditional norms are slowly fading and rampant developmental activities are being carried out in the higher altitudes of the Himalayan regions without acknowledging or taking into account the adverse consequences of such activities on the fragile ecosystems. In order to save the Himalayan ecosystem from further degradation, the honourable High Court of Uttarakhand passed a landmark judgement on August 21, 2018 and directed the state government to remove all permanent structures from the alpine meadows within 3 months and further stated that no permanent structure would be allowed to construct structures in the alpine meadows.

In a series of mandatory directives, the honourable High Court directed the state government to "constitute Eco-Development Committees within 6 weeks in eco-sensitive zones, restrict the number of tourists (not more than 200) to the alpine meadows/sub-alpine meadows, impose a ban on overnight stays and commercial grazing of cattle on the alpine meadows/sub-alpine meadows, impose reasonable restrictions on the number of cattle in the alpine meadows/subalpine meadows, ensure removal of plastic water bottles, cans, etc., from the alpine meadows/subalpine



meadows within 6 weeks, ensure no encroachment in the alpine meadows in any form, conduct a systematic survey of its flora at the earliest to prepare a comprehensive manual within 6 months, as recommended by the experts; prepare a herbarium of important medicinal, rare, threatened, and botanically interesting plants for reference for every forest division, impose restrictions on the exploitation of medicinal plants, introduce rotational grazing of cattle in the alpine meadows/sub-alpine meadows, where alternative sites are available, and consider declaring all important high altitude valleys and alpine meadows/sub-alpine meadows with rich plants as high altitude National Parks or Sanctuaries within 6 months".¹

The aforementioned directions from the honourable High Court support the philosophy of traditional ecological knowledge and local customary norms that have evolved over centuries as a means for ensuring a harmonious coexistence with nature. It is important to understand the significance of such norms and directives so that nature's beauty and wealth could be nurtured and preserved for posterity. ■

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¹ Government of Uttarakhand. 2018. Bugyal Order, 28 August 2018. HoFF, Uttarakhand: Dehradun. Details available at http://forest.uk.gov.in/files/Bugyal_order28August2018.pdf, last accessed on 23 March 2020.



Know Your Eggs

Maneka Sanjay Gandhi says that the way an egg is handled before it reaches your plate could make it inedible. This is because the quality of the egg depends largely on the food given to the hen and the conditions she is kept in.

Eggs have always been considered to be a standard safe food. Few people realize that every egg is different, and some may not be fit to eat at all. An egg is made up of albumen, yolk, and a porous shell made of calcium carbonate. The internal ingredients of an egg can be altered so that the natural composition changes by manipulating the feed of the hens. For instance, in Japan Omega 3 and iodine have been introduced into the eggs. This means that the quality of the egg depends largely on the food given to the hen and the conditions she is kept in. It is affected by many factors, before and after its laying. Everything from the weather, type of feed given to the hen, amount of water consumed by her, cleanliness of the surroundings, number of hours that she spends in daylight and even the way she breathes can drastically change the composition of the egg.

On average, a chicken egg should contain about six grams of protein and six grams of fat. To produce this level it is essential that a laying hen receives a balanced diet with adequate levels of protein, carbohydrates, fat, vitamins, and minerals. Experts recommend a

balanced ration containing 16 per cent to 18 per cent protein and approximately 3.5 per cent calcium to promote strong eggshells. Laying chickens also require a constant supply of fresh, clean water as water comprises more than half of an egg's volume.

The fact that an egg's natural composition can be manipulated is well known to commercial poultry farmers. Chemicals are added to the food so that they produce eggs that are better looking and last longer. Baking soda and ammonium chloride are commonly added as dietary supplements to improve eggshell quality. Potassium chloride is mixed with their water as it makes hens thirstier.

The best eggs really come from hens that spend their days outdoors in a natural environment and scratch for insects, seeds, and earthworms in the soil. The eggs you buy do not come from these hens. To ensure high production with a minimum of money, all hens are kept captive in small crowded cages with a strict controlled environment, no sun, no fresh air and water, chemical food, and antibiotics. They are kept under

continuous lighting so that they lay more eggs daily. How nutritious would the product of such a stressed body be? India has particularly poor egg quality.

Indian poultry farms are known to be some of the worst in the world, with very low health and safety standards and little regard for public health concerns. Investigations at poultry farms show hens covered with sores, badly fed, sitting in their own faeces, covered with spider webs, full of mites and lice, fed cannibalistically with the dead bodies of their own kind, cardboard, marble chips, fish meal and grain laced with antibiotics and pesticides. This destroys the nutritional quality of the egg. Unhygienic rearing practices and lack of quality control measures is an open invitation for egg contamination. Despite India being one of the three largest egg producers in the world, with 47 billion a year, they do not meet international standards and Indian eggs are rejected for export due to chemicals in and outside the shells.

Thick albumen, plump yolks and hard shells are what you should look for superficially. Because a thin shell means

that the mother has been ill. Diseases like infectious bronchitis, Newcastle disease, avian influenza, and egg drop syndrome affect the shell quality. Infectious bronchitis virus causes soft/rough shelled eggs, discolouration, and wrinkling of the shell. The egg as a result of disease has pale egg yolks, runny egg whites, and rough shells. A deformed eggshell means the chicken has had a number of serious diseases.

The shell is formed by the activity of cells lining the oviduct and uterus. When the egg layer is under stress, the secretions of these cells become acidic. During summer, the hen, already in a small stuffy cage, reacts by panting in order to cool herself. This produces a condition termed 'respiratory alkalosis'. The pH of the blood becomes alkaline and the availability of calcium for the eggshell is reduced. The eggshell becomes thin shelled. The thickness of the shell plays a vital role in preventing bacterial penetration, therefore, eggs with thin shells are more prone to microbial attack.

An egg should have phosphorous, zinc, Vitamins A, B 6, B 12, folic acid, thiamine, and Vitamin D. During heat stress hens eat less and calcium intake is reduced as a direct consequence of reduced feed intake. This causes an elevation of phosphorous in the blood. Calcium and phosphorus balance is critical for proper eggshell quality. But

high levels of phosphorus in the blood inhibit the formation of calcium. When the calcium and phosphorus ratio is out of sync, zinc and manganese decreases. Vitamin D decreases in a sick bird. So the egg is left with very little in it. Due to the lack of exercise in these caged birds, the fat component increases and then, the fatty acid composition in the yolk changes from healthy to unhealthy.

In free range poultries – which simply means that they are not in cages but crowded on the floor, chickens have a hierarchy. Those down the chain often lay whiter shelled eggs with poor internal quality due to the stress that they are under. Many studies show that tap water containing sodium chloride has an adverse effect on eggshell quality. What hens eat is of crucial importance. Every hybrid layer bird should have a specially devised diet. In India, feed nutrients are used by poultry owners without any knowledge of their nutritive value. They feed the cheapest food to their hens. If soyameal is expensive, they will replace it with cotton seed defatted cake and guar gum. Nothing of these has any nutritional value.

When you eat eggs sourced from poultry raised on antibiotics and growth promoters, you ingest antibiotic-resistant bacteria. Heat cannot break down the antibiotic residues that remain within the eggs. When you fall sick, no antibiotic will be able to work on your disease. India has

the largest number of people resistant to antibiotics and the main reason is that our chicken/eggs carry them.

After leaving the farm, the entire supply chain poses additional risks of contamination to the egg. Cracked eggs (about 6 per cent) are particularly susceptible to outside contamination. A 2005 study in Punjab found residue of hexachlorocyclohexane (HCH) and dichlorodiphenyltrichloroethane (DDT) in eggs. These are both banned pesticides, and their presence on eggs is extremely dangerous to human health. Large-scale egg handling invites salmonella and aflatoxin contamination. While most nations take measures to sterilize the egg surface from contamination, especially from *Salmonella enteritidis*, no measures are taken in India.

In a recent study done in and around Hyderabad, eggs were collected from urban retail outlets and directly from poultry farms. Salmonella bacteria was commonly found on shells and inside the eggs collected from urban retail outlets. Salmonella infection is a bacterial disease that affects the intestinal tract. It is linked to contaminated water or foods, especially meat, poultry, and eggs. Salmonella bacteria is abundantly found in poultry sheds, water tanks, drinking water, and feed in poultry premises. The internal contamination of eggs by Salmonella is either because the shell is thin enough to be penetrated or that the egg was contaminated by the infected reproductive organs of the hen. The FSSAI laws state that the eggshells must be free of blood rings, must not be soiled or have faecal matter and they must not be cracked. They have laid down the hygiene parameters that must be observed during production, processing, and handling which includes sorting, grading, washing, drying, treatment, packing, storage, and distribution.

In India you have no idea where the egg comes from. Egg consumption is encouraged by the government. This makes their quality and contamination a major food safety issue. ■



Where Agroforestry Enhances Livelihoods

Telangana Cotton Farmers Take Up Alternative Crops

In an innovative and new agroforestry project aimed at improving green cover and restoring land, cotton farmers in Warangal district of Telangana have taken up mango and teak plantation on their lands. **Nitin Jugran Bahuguna** tells us about the project, launched by Krishi Vigyan Kendra (KVK), a farm science centre of the Indian Council of Agricultural Research (ICAR), based in Jammikunta district and Centre for People's Forestry (CPF), a local NGO with support from Central Research Institute for Dryland Agriculture (CRIDA) and WWF-India is encouraging farmers to get an additional crop by taking up mango plantation, which also checks soil erosion and crop damage.

Project's cotton farmers in the district who face soil erosion because of the surrounding slopes



Farmer Gampa Chandra Shekhar, 45, of Bommanapally village in Karimnagar district of Telangana has been cultivating cotton as a monocrop on half of his six acres of land for 18 years. His expenditure per acre is between ₹25,000 and ₹30,000 and when a severe outbreak of pink bollworms occurred in his village in 2016, a significant portion of his cotton crops was destroyed.

'It was the first time we witnessed this pest infestation in our cotton crops on such a large scale,' he recalls. 'The yield and income loss to farmers from pink bollworm was significant.' It was then he realized that relying on one crop was a risky proposition given the changing adverse weather patterns and rising incidence of pink bollworm attacks on cotton plants. The input costs of growing cotton were also high. 'I have to spend a lot for chemical fertilizers, pesticides, and insecticides besides the additional cost for hiring labour,' he explains. In addition, Gampa Shekhar's land is situated upstream from the Bommanapally

cheruvu (tank) and slope. 'With the heavy rains, the fertile soil is eroded and this has become a regular feature. I lose fertile soil every year and we farmers generally add tank silt (desilted from the tank bed) every two years to stabilize the fertility of the soil.'

When Gampa heard of an innovative new agroforestry project encouraging cotton farmers in the district to start mango plantation on their lands as a means to check soil erosion as well as give them an additional crop to diversify the risk factor, he was among the first to join the endeavour. The project, called 'Sustainable Management of Tree in Cotton Production in Wetland Forest Ecosystem' was jointly launched in 2018 by Grama Nava Nirman Samithi (GNNS), Krishi Vigyan Kendra (KVK), a farm science centre of the Indian Council of Agricultural Research (ICAR), based in Jammikunta, and Centre for People's Forestry (CPF), a local NGO.

When KVK field facilitators started campaigns and awareness meetings on agroforestry in Bommanapally village, Gampa readily agreed to be part of the change. With support from KVK and the



Gampa Shekhar on his land

rural employment guarantee scheme, he completed mango block plantation in five acres for which he was given 405 mango saplings. He decided to take up cotton as intercrop in the upcoming season. 'KVK conducted meetings and gave us training. They also helped me to design the model for my plot. They facilitated government support for labour to dig pits for plantation,' he discloses. 'I learnt that through this agroforestry plantation instances of soil erosion would be reduced. The trainings also showed us how we could reduce fertilizer, pesticide and water use in cotton cultivation.'

The technical support and training to farmers is being given by the Central Research Institute for Dryland Agriculture (CRIDA) and Worldwide Fund for Nature-India (WWF-India).

Under the project, 13,600 mango plants, 1000 guava plants, 500 custard apple plants, and 5000 teak plants have been provided. In addition, eight tonnes of organic manure, two tonnes of neem cake, 100 litres of neem oil, and 250 pheromone traps and sticky traps with

loops were procured from various shops and establishments as part of providing input supply to selected agroforestry farmers.

Communication material was prepared by the project staff on Better Cotton Initiatives (BCI) and agroforestry activities and distributed to 3500 farmers. These included pamphlets, posters and brochures identifying pest in mango plants and suggesting remedies such as neem oil spraying. The project has benefitted through the convergence of various schemes being run by the government agencies, such as Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), District Rural Development Agency (DRDA), and the concerned Forest Range Officer (FRO) for sanction of mango and teak plantation. Farmers' trainings on water stewardship, BCI and agroforestry activities have been conducted by KVK scientists with technical support from WWF-India and CRIDA.

The farmers interested in agroforestry had explained to the project team that



Farmers doing inter-sowing as per project guidelines

due to low water level in their irrigation source (open well/bore well) they could irrigate only main crop and could not provide water for bund plantation. 'Also, due to non-availability of labour as well as high labour costs, the farmers wanted maintenance support under the MGNREGA scheme for undertaking agroforestry plantation,' says Sathish, Programme Officer, KVK. The local partners have coordinated with the Employment Guarantee Scheme (EGS) department to avail their pitting/digging services.

'In Bommanapally village, we are working with 40 farmers in an area of 79 acres,' informs Sathish. 'At the start of the project, we were working with 500 farmers from 16 villages. Today, nearly 1000 farmers from 26 villages are involved in agroforestry.' Bommanapally was chosen as the pilot village as it contains three major tanks with a large catchment area of 600 acres. In 2016, a severe attack of pink bollworms on cotton crops in this village adversely affected cotton farmers, which is why many of them evinced interest in choosing agroforestry as a means to diversify their crops and minimize risks, states Vamshi Krishna, Senior Manager

of WWF-India's Sustainable Agriculture Programme.

Tank-based irrigation systems are common in southern India through which water intensive crops such as paddy are grown in command areas. But these areas which are rainfed are in general used for cotton cultivation. 'The erosion of top soil due to intensive cultivation practices results in increased siltation load and pollution in the downstream tanks,' explains Vamshi.

Agroforestry in catchment areas checks soil erosion, reduces silt, and improves tree cover in these areas. 'CRIDA at Hyderabad has been roped in to provide technical support for promotion of different agroforestry models. Mango, teak, bamboo, and subabul (a fast-growing tree) have been shortlisted by experts as suitable in the project areas taking into consideration the soil type, rainfall, and market opportunities,' he adds. The provided species options for the plantation are mango, teak, subabul, and bamboo. The models are bund or intercropping. Presently, these models are being facilitated with farmers.

Changing weather patterns have been a source of concern for farmers in the district. Sandhya Rani, 40, also

of Bommanapally village, has been growing cotton and maize on her five-acre land for the past 20 years with high investment and low returns. 'These crops require more water but due to uncertain weather in the past few years, my yields have declined and I did not earn enough money to run my household,' she says forthrightly.

Sandhya was among the first farmers to join the project and was given 400 mango saplings free of cost which she planted in 22 rows as advised in the training meetings. 'In between the mango saplings, I planted rows of maize. Diversifying my crops is very useful in the short-term in case of drought,' she explains. 'My land is flat and sloping and surrounded by hillocks, so I face soil erosion. But I have noticed that the flow of rainwater has reduced after planting mango saplings and maize in rows.'

Similarly, her fellow farmer Gampa Anjaiah, 50, noticed perceptible reduction of erosion on his land after taking up mango plantation. 'I was told that this new activity would be more beneficial to me as I would have an additional crop to rely on and thus minimize my risks,' he recounts. 'I started in July this year and received 400 saplings which I planted in five acres. KVK has facilitated farmers like me to avail of labour under MGNREGA.'

Under the EGS, the farmers are also given a monthly maintenance allowance of ₹5 per sapling. 'We will get this amount for three years to ensure the survival of the mango plant,' informs Sandhya. 'Other costs which are met by the project include transportation of saplings, loading and unloading charges, digging and pitting and fertilizer application.' Gampa Shekhar is confident that his mango saplings will bear fruit in the next two years. 'Through agroforestry plantation, I am reducing soil erosion and also minimizing my cotton losses. I hope to increase my income by diversifying my crops.' ■

Nitin Jugran Bahuguna is a Delhi-based author journalist with over 30 years of work experience, specializing in human development issues.

Project's cotton farmer in the district who faces soil erosion because of the surrounding slopes



Regulation Risks Less Sustainable Alternatives to Plastic Scenario in Europe

Over the past couple of years plastics have become the public face of the waste pollution crisis, prompting an unprecedented consumer and regulatory backlash that shows no sign of stopping. The attached analysis from **Mark Victory** looks at how some narrowly focused regulation is shifting the problem to other sectors, doing little to improve end-of-life environmental impact or even intensifying the damage.

Over the past 2–3 years plastics have become the public face of the waste pollution crisis. Industry is responding by switching to other materials without considering their environmental impact relative to plastics, or whether sufficient local waste collection systems are in place, the *Plastic Promises* report launched by independent UK think tank the Green Alliance concludes.

Although its findings will come as little surprise to those involved in recycled plastics markets, and are mirrored across Europe, it once again highlights the gap in consumer understanding of the relative environmental impact of non-plastic alternatives and the unintended consequences this is having across the recycling industries. For example, non-plastic food-packaging alternatives – on average – increase energy use by 2.2 times, carbon dioxide (CO₂) emissions by 2.7 per cent, and weight by 3.6 times, according to a UK parliamentary select committee report released in September 2019.

Indeed, the shift in things like bottled drinks from glass to materials such as polyethylene terephthalate (PET) that took place across recent decades was in part driven by its lower carbon usage and weight. Coupled with this, food-contact paper and cardboard packaging typically needs to be treated with a plastic barrier,

making it more difficult to recycle and doing little to counterbalance the problem of microplastic ocean leakage. For consumers, plastic is a homogenized entity rather than a series of different materials with different degrees of sustainability, recyclability or local collection rates.

PET, for example, has post-consumer collection rates of plastic bottles across Europe at 63 per cent according to the ICIS 2018 study – the latest year for which data is available – but country by country collection varies from as low as 21 per cent in Bulgaria, to as high as 96.2 per cent in Germany.

These facts have done little to stem the tide of announcements of switches to non-plastic packaging from retailers and consumer brands, because the public perception is that these materials are always more sustainable, leading to rising pressure to abandon single-use plastics. The same consumer pressure is not being felt to the same extent on other packaging types, despite plastics accounting for less than a quarter of packaging waste generated in Europe. Plastics account for 19 per cent of packaging waste generated in Europe, compared with cardboard and paper at 41 per cent and glass at a similar 19



per cent, according to Eurostat figures collected in 2016 – the latest year for which data is available.

The knock-on effect of the public focus on single-use plastics is that this is concentrating regulatory efforts disproportionately on plastics because it is providing a mandate to act which is yet to exist for other packaging types, as conceded by the EU Commission at the ICIS PET Value Chain conference in March 2019.

This has led to a raft of upcoming regulation specifically targeted at the plastics industry, the latest of which is a plastic tax due to be introduced in Italy in the coming months. This will tax plastic at €0.45/kg with the exemption of recycled plastic and bio-based plastic. The law is clearly targeted at encouraging the use of recycling. In recent years, a two-tier market has opened up across European recycling markets between companies which are driven by sustainability targets – typically coming from the packaging sector due to the public pressure – willing to pay above virgin values to secure material, and those purchasing for cost-saving reasons. Southern Europe has typically seen a higher percentage of cost-based packaging purchasing of recycling than other regions. This is on top of EU legislation mandating

minimum average recycled content of 25 per cent in PET bottles by 2025 – on a country-by-country basis – and 30 per cent across all beverage bottles by 2030. Effectively allowing prices of recycled material to trade significantly above virgin values before cost-saving kicks in through taxation will no doubt increase buying interest in recycling from companies that had previously shown little interest, as will minimum average recycled content mandates.

Nevertheless, while these measures are targeted specifically at the plastics industry and not across environmentally harmful packaging as a whole, the regulatory framework runs the risk of giving other packaging materials an unfair competitive advantage. Rather than helping to solve the problem of packaging waste and encouraging recycling, this could drive firms to move to alternative materials that are equally, or even more, damaging to the environment – shifting the problem rather than tackling it.

The risk is doubled by the ongoing consumer pressure and lack of detailed knowledge on the impact of different materials. It is further compounded by the inability of waste collection rates to meet sustainability targets. Waste collection in Europe is predominantly



controlled by municipalities.

Underfunding in the wake of the global recession of 2008 has meant that collection systems have not kept pace with packaging growth or complexity.

Shortages of material for in-demand grades of recycled material – typically transparent material most attractive to the packaging industry – led natural recycled polyethylene (R-PE) pellet and natural recycled polypropylene (R-PP) pellets to trade above virgin grades for the first time in 2019, while the spread between virgin PET and recycled R-PET food-grade pellets reached a record high.

Faced with shortages of suitable recycled material, a growing consumer backlash and a hostile regulatory environment that is not mirrored in non-plastic packaging, it is no wonder that some companies are deciding to shift away from plastics. Further encouraging this shift towards material choices that do little to improve end-of-life environmental impact would be the worst possible outcome for the planet. Regulation that encourages recycling or responsible waste disposal can only be a good thing, but narrowly focused laws that shift the problem to other sectors could intensify the damage, or at a minimum leave it unchecked.

All the while, the major challenge of increasing collection rates and infrastructure remains unsolved. If lawmakers were determined to help the recycling industry, this is where their efforts would be concentrated. ■

Mr Mark Victory is Senior Editor, ICIS.



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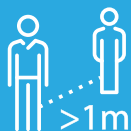
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