

## Speaking of science — Plastic waste: What man has wrought the bugs try to solve

Toxic: Ruminants like cow and buffalo unknowingly devour plastic material and end up dying a slow and painful death. | Photo Credit: [M. Karunakaran](#)

The tiny landlocked African country Rwanda has banned plastic bags since a few years. The ban has made this war-torn nation much cleaner. Kenya has just announced a ban on plastic bags, and a fine of 4 years in prison and/or \$40,000. The Kenyan seacoast has mountains of plastic waste, making life on land, and in the sea, difficult. Another African nation, Morocco, with a coastline of 1,800 km, has had such a ban for almost a decade. It is time that India, with its 7,500-km coastline, learns from these Africans and bans plastic bags and related stuff before we too choke our seacoasts—and land, too—into a man-made disaster.

The Task Force on plastic pollution, set up by the Planning Commission in 2014, estimated that 60 cities across the country generate over 15,000 tons of plastic waste every day—almost 6 million tons per year. This is what we see daily as we walk around the streets. And cattle and other animals, which freely move around the streets, unknowingly devour some of this plastic material, which is not digested but stays put in their stomachs. Ruminants like the cow and buffalo end up dying a slow and painful death. The holy cow meeting an unholy end!

This dump we see daily is just part of the problem. A much greater, and not so visible disaster looms underwater, a lot of this plastic waste from across the world eventually ends up in the oceans, which cover over 70% of the earth's surface and hold 97% of the earth's water. The amount of plastic rubbish reaching the oceans is 8 million tons per day—that is, one truckload every minute. This would mean that by 2050, there will be more plastic in the world's oceans than fish!

What can science do about it? An interesting theoretical analysis was recently made by Professor Richard Sole of the Pompeu Fabra University in Barcelona, Spain. He estimated that of the huge amounts of plastic thrown in the oceans, the amount floating around is hardly 1%. The rest is sunk way down and/or slowly being degraded or broken down. Which plant, animal or microbe in the ocean might be doing this? And if we identify them, we may have a biological solution to at least part of the problem. The site <http://www.dailymail.co.uk/sciencetech/article-4555014/Plastic-eating-microbes-evolved-ocean.html#ixzz4r7uHOSH2> is well worth visiting to learn more.

There is some interesting research being done towards identifying, isolating and studying the biological species that seem to degrade plastics into small molecules that are usable for safer purposes. The species identified so far are some fungi and bacteria. An elementary review on such 'biodegradation of plastics' by A. Muthukumar and S. Veerappanpillai of VIT Vellore lists as many as 32 species of microbes which degrade a variety of plastics which go to make water bottles, carry bags, industrial material and such (see their paper in *Intl. J. Pharm. Sci. Rev. Res.* 2015; 31 (2): 204-209; free access). And of immediate relevance to the Indian coastline is a report by Sangeetha Devi and others from Bharathidasan University, Tiruchi, also in 2015 (*Marine Pollution Bulletin*, 2015; 96: 32-40, no free access). They found that two strains of the fungus *aspergillus* spp, found in the waters of the Gulf of Mannar degrade the plastic HDPE (which is used to make milk and fruit juice bottles, grocery bags and such).

These fungi seem to release some enzymes which degrade HDPE, essentially breaking up the polymeric molecule into smaller pieces; these enzymes are being studied in some detail by the Tiruchi group. It is clear that further research work from marine organisms will reveal more microbes that are capable of degrading polymeric and plastic wastes. It would also be possible to find their cousins on earth which can degrade these wastes. And, once we study the basic biology

and genetics of these plastic-eating bugs, we can genetically modify them in order to make them more efficient and versatile in handling a variety of wastes.

And more data is becoming available on the types of wastes that are being handled by these microbes. In March 2016, a group from Kyoto University found an two enzymes from the microbe they named as *Ideonella sakainesis* (after the town Sakai in Japan), capable of breaking down the polymer PET (polyethylene terephthalate, used in making packaging trays, polyester clothing and others) into its basic monomeric molecules terephthalic acid and ethylene glycol (S. Yoshida et al., *Science* 2016; 351: 1196), which are used as building blocks for a variety of chemicals. The microbe is found in soil, sediment, waste water and similar material.

Most recently, a group of Pakistani, Sri Lankan and Chinese scientists together showed that the fungus *Aspergillus tubigensis* can degrade yet another major plastic material called polyurethane or PU (Sehroon Khan et al, *Environmental Pollution*, 2017; 225: 469-480). PU is used in the manufacture of car tyres, gaskets, bumpers, fibres, plastic foam, synthetic leathers and so on. The group found this bug in a general city waste disposal site in Islamabad, which suggests that it would very likely be found at several places in India too.

A cynical wag once said: what science made, let it unmake. It appears that whether it be in water or land (maybe even in the sky), if we work with focus, we would be able to find such plastic waste degrading organisms, and thus try to 'unmake' the problem. We can even genetically modify them to suit the purpose. This type of research will bring a great deal of benefit to not only terrestrial life forms but those living under water as well. Ironically enough, work of this kind could even fetch a Nobel Prize for safely breaking down plastics, just as Nobels were given for making plastics in the first place.

dbala@lvpei.org

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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## Habitat connectivity crucial for tigers

Responsibility India's place in tiger conservation is crucial as it is home to 60% of the tiger population.

It is not just tiger numbers that are important. Habitat connectivity could be crucial in maintaining genetic diversity and, thereby, the survival of India's three tiger populations, suggests a recent study published in *Scientific Reports*. The isolated tiger population in Ranthambore in Rajasthan demands urgent conservation attention, being at risk of inbreeding and lack of connectivity with other populations.

India's place in tiger conservation is crucial: 60% of the world's wild tigers are found here. Apart from poaching and habitat loss, fragmentation is one of the threats India's tigers face. Tiger populations are now cut off from each other and their genetic profiles reflect this — smaller, isolated populations are less genetically diverse (due to lesser intermixing of different populations) than larger, connected ones. Genetic variation is crucial for evolution and low genetic diversity can threaten the survival of populations.

Scientists from five institutes including the National Centre for Biological Sciences (NCBS) at Bengaluru and Wildlife Institute of India at Dehradun studied genetic variation in India's tigers. While earlier studies had examined only around 12 regions of the tiger genome, this team analysed 10,184 single nucleotide polymorphisms (SNPs), which are several minute changes in the genome, in tissues of 38 wild tigers obtained during post-mortems from across 17 protected areas in India.

### Three lineages

They find that genetically, India's tigers comprise three distinct populations: the northwest cluster (consisting only of tigers from Ranthambore), southern (south India) and central (comprising tigers from the Terai, northeast and central India). While the isolated Ranthambore population had the least genetic diversity, the central cluster — which is also the most connected — harboured the highest. "We find that large seemingly more connected populations have more diversity than smaller isolated ones," says lead author Meghana Natesh at NCBS.

The study identifies new patterns that need to be studied in depth: tigers from the northeast and Simlipal (Orissa) appear to derive their ancestry from many regions. At the same time, the Ranthambore population, being cut off from other tiger populations, could be at risk in future due to inbreeding, which could decrease genetic variation in the population already at risk. This cluster needs urgent conservation action, say the scientists. "The future of tigers may depend on connected populations," they add. Tiger corridors could therefore be crucial in maintaining genetic diversity within and between these clusters and, in turn, aiding the survival of India's national animal.

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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## The climate connection to dengue

Ideal conditions: "There was a strong correlation between rainfall and dengue numbers."

Rainwater collects in a plastic tarp creating an ideal habitat for mosquitoes to lay their eggs. |

Photo Credit: [AwakenedEye](#)

Given its close link with both temperature and rainfall, it is possible to forecast the outbreak of dengue. But for such forecasting to be effective, it should be based on models specific to different climatic zones in the country, a new study has shown.

Scientists have reached this conclusion after evaluating the relationship of climatic factors to the spread of dengue in different climatic zones in India — Punjab, Haryana, Rajasthan, Gujarat, and Kerala. They focussed on changes in a factor called extrinsic incubation period (EIP) of the dengue virus, by taking into account daily and monthly mean temperatures in these areas.

The EIP is the time taken for incubation of the virus in the mosquito. During this period, after the mosquito draws blood that is rich in viruses, it escapes the gut and passes through the mosquito's body and reaches its salivary glands. Once this happens, the mosquito is infectious and capable of transmitting the virus to a human host.

However, climatic conditions play an important role in EIP, the scientists say. Lower temperatures (17-18°C) result in longer EIPs thereby leading to decreased virus transmission. With increasing temperatures, feeding increases because of the enhanced metabolism of the mosquito, leading to shorter EIPs. Even a five-day decrease in the incubation period can hike the transmission rate by three times, and with an increase in temperature from 17 to 30°C, dengue transmission increases fourfold. A further increase in temperature beyond 35°C is detrimental to the mosquito's survival.

The study has been jointly done by the Hyderabad-based Indian Institute of Chemical Technology (IICT), the National Institute of Pharmaceutical Education and Research (NIPER), Guwahati, in collaboration with scientists at the University of Liverpool.

The researchers observed that except for Gujarat, which comprises arid regions, there was a strong correlation between rainfall and dengue numbers. They propose an increase in breeding grounds for mosquitoes as a major reason for this finding.

The study found that Kerala, which is warm (temperature ranges from 23.5 to 30°C) and wet and with short EIPs (9-14 days), experiences the highest number of dengue cases. It has been found that EIP is the shortest during the monsoon season in most States and therefore there is an enhanced risk of dengue during this time.

Researchers say it is important to take into account the dynamic EIP estimates in different regions in assessing disease burden. "This climate-based dengue forecasting model could help health authorities assess the disease intensity in a geographic region. Based on that they can plan disease-control operations well in advance and optimise the use of resources meticulously," explained Dr. Srinivasa Rao Mutheneni of IICT, who led the study.

With changes in temperature affecting the extrinsic incubation period of the virus, future changes in the climate might have a substantial effect on dengue and other vector-borne disease burden in India. "Though such methods are in vogue for disease control operations, we are still in the initial stages of implementation of such strategic control methods," Dr. Rao said. Factors such as population density and migration also need to be included for future risk assessment studies.

Dr. Shikha T. Malik is with India Science Wire

Lifestyle-related risk factors are being cited, compounded by an inadequate number of treatment centres in the region

Without policies to stop the worrying spread of antimicrobial resistance, the mortality rate could be disturbing

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## Investing in the ecosystem

In April 2016, while inaugurating the third Asia ministerial conference on tiger conservation, Prime Minister Narendra Modi paid tribute to nature. Invoking the Buddha, he said, “The forest is a peculiar organism of unlimited kindness. It affords protection to all beings, offering shade even to the axe-man who destroys it.” He went on to emphasise the importance of reimagining the country’s natural ecosystems as its ‘natural capital’ and factoring in the economic, social, cultural and spiritual value of ecosystem services into the calculation of true economic growth and development.

Natural resources are a critical yet often ignored part of our country’s national infrastructure. Boasting 11% of the world’s floral and faunal species, India is one of the 17 most ecologically diverse countries. Blessed with every major ecosystem, these biomes directly contribute billions of dollars to the Indian economy, annually. The financial value of India’s forests, for example, which encompass economic services such as timber and fuel wood, and ecological services such as carbon sequestration, is estimated to be \$1.7 trillion.

With increasing economic activity, natural capital assets are on the decline, directly affecting the quality of life and potentially giving rise to future inefficiencies in the economy. ‘Earth Overshoot Day’, a figurative calendar date when humanity’s total annual resource consumption for the year overshoots the earth’s capacity to regenerate it, has advanced every year at an alarming rate. This year it was observed on August 2.

As we approach the limits of natural capital stocks, we need to rethink the cascading effects that this would have on the economy, the environment and society. Scientists have identified nine earth system processes to have boundaries which mark the safe zones, beyond which there is a risk of ‘irreversible and abrupt environmental change’.

Four of these boundaries have now been crossed — climate change, loss of biosphere integrity, land system change and altered biogeochemical cycles, such as phosphorus and nitrogen cycles. This means that human activity has already altered the balance of a few delicate equilibriums, the effects of which are reflected by changing weather patterns, accelerated extinction events for both flora and fauna, and global warming. This stresses the need for a comprehensive evaluation system that takes these undesirable side-effects of economic activities into account.

As the biggest contributor to the economy, business needs to consider evaluating its impacts and dependencies as it would have a direct impact on capital assets and wealth. This translates to broadening valuation and risk management to include natural capital, as it is currently not reflected in market prices. In addition to shareholder wealth, holistic development calls for maximising returns from other key areas such as physical capital, human capital, natural capital and social capital.

If valued properly, natural capital has the potential to optimise resources and thus maximise the net benefits of economic growth and development. There is often a chance of ignoring or undervaluing natural capital, effectively leading to projects with far higher negative externalities compared to the benefits. It is necessary that we are cognisant of the limitations of natural capital and its role as a primary support system for the economy.

Valuing natural capital would require internalising externalities and taking into account the myriad economic and ecological products and services that natural ecosystems make possible. Undertaking natural capital valuation can offer businesses a number of opportunities.

Natural capital risk is one of many risks that an organisation faces, and a thorough natural capital assessment can help integrate this risk into risk management committee deliberations, legal and reputational risk framework. Projects can be reassessed on the basis of their vulnerability to impacts and dependencies associated with the value chain. Companies can consider environmental stress tests for issues such as natural disasters, air pollution, resource scarcity and climate.

Natural capital thinking can also create opportunities to innovate and adopt newer, more efficient technologies. One Californian fashion company demonstrated this by developing a unique waterless ozone technology to address water shortage challenges during a four-year-long drought. The company was able to reduce its water use and water bills by 50%, saving at least \$1,300 per month.

While findings from externality assessments are restricted to internal business decision-making, going forward, externality valuation can also contribute towards enhancing organisational transparency by informing stakeholders about the potential future risk to business and preparing proactive responses to these risks.

Unlike the economic value of goods and services, the intangible nature of natural assets is mostly invisible and hence remains unaccounted for. While it may be difficult to put a price tag on nature, unchecked exploitation of scarce natural resources and an inadequate response to India's unique climate challenges can be a very costly mistake. Making natural capital thinking the norm requires a strong policy push and the adoption of valuation frameworks such as the Natural Capital Coalition's Natural Capital Protocol. Integrating natural capital assessment and valuation into our economic system is critical to usher in a truly sustainable future for India.

*Rana Kapoor is MD and CEO, YES Bank and Chairman, YES Global Institute*

The new U.S. Fed Chairman is unlikely to opt for policies that might upset the President's plan

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## Air pollution throws shade on India's solar success

A man walks on solar panels in Coimbatore .

Air pollution is diminishing India's capacity to harness power from the sun, experts say, undermining billions being invested in renewables as the energy-hungry giant emerges as a solar superpower.

New research has found the smog and dust that sickens millions across India every year is also sapping solar power generation by more than 25 percent, far beyond levels previously thought. In the first study of its kind, U.S. and Indian scientists measured how man-made particles floating in the air and deposited as grime on solar panels combined to seriously impair sunlight from converting to energy.

This interference causes steep drops in power generation, they found. At present levels in India, it could amount to roughly 3,900 MW of lost energy — six times the capacity of its largest solar farm, a gigantic field of 2.5 million panels. “A simple calculation shows that this is a big amount of energy we are going to lose,” Professor Chinmay Ghoroi, who co-authored the paper, told AFP at the IIT-Gandhinagar. These huge losses will only compound as India realises its grand solar ambitions, experts say.

Jaggi Vasudev's Rally for Rivers claims they will, but this is not based on the most nuanced science

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## Delhi's air pollution puzzle

There were 4.24 million deaths globally in 2015 attributable to PM<sub>2.5</sub>—fine particulate matter with a diameter less than 2.5 micrometer—of which the share of India's 1.09 million deaths is 26%, according to the latest report of the World Health Organization (WHO). PM<sub>2.5</sub> are more harmful to human health than PM<sub>10</sub> (particles with a diameter between 2.5 and 10 micrometer) because unlike PM<sub>10</sub>—which only goes down to the lungs—PM<sub>2.5</sub> can enter the blood supply from the lungs and turn into invisible killers.

Among megacities—cities with the population of at least 14 million—Delhi has the worst air quality, according to the WHO report. Delhi witnessed widespread public protests in November 2016 after the city was engulfed in a toxic smog when the PM<sub>2.5</sub> level rose to 999 micrograms (mg)/metre cube (m<sup>3</sup>)—16 times higher than the Indian ambient air quality standard of 60mg/m<sup>3</sup>, and 40 times higher than the WHO standard of 25mg/m<sup>3</sup>—on a 24-hour average basis.

Terming Delhi's air "a public health emergency", the Supreme Court in 2016 had asked the Union government to prepare a graded response action plan specifically for the city—similar to what Beijing, Paris, and Singapore had done to improve their air quality. The plan, enforced on 12 January, describes a series of measures to be implemented by the court-mandated, environment pollution control authority (EPCA) in coordination with relevant state agencies. The measures range from shutting down schools to stopping construction activities to putting in place traffic rationing schemes—depending on the degradation in air quality.

The graded response programme is described as a big step forward because for the first time there is a legal framework for coordination among Delhi's various pollution controlling agencies and its neighbouring states. This is important because the sources of PM<sub>2.5</sub> air pollution in Delhi are both internal and external, according to a study by the Indian Institute of Technology, Kanpur (IIT-K).

The contribution of the neighbouring states of Rajasthan, Haryana, Uttar Pradesh and Punjab to Delhi's air pollution—mainly due to the burning of crop residue—is variable and depends on the time of the year: it is about 26% during winters and 12% during the summer.

However, several months after the plan, hailed as a panacea for all of Delhi's air quality woes, came into effect, official data from the country's top pollution watchdog, the Central Pollution Control Board (CPCB), indicates that the air continues to be unhealthy in Delhi. In the 182 days since the plan's launch, air quality has been healthy only for 20 days if we compare it with the national PM<sub>2.5</sub> health standards. Furthermore, it did not meet the WHO air quality guidelines of PM<sub>2.5</sub> even for a day.

If we look at the existing framework used to tackle air pollution in Delhi, the reasons for its continued failure become obvious.

The CPCB, which is responsible for developing air pollution guidelines at the national level, and the state pollution control boards (SPCBs) which enforce these guidelines in the states, face institutional, technical, and manpower constraints. All SPCBs have a combined manpower shortage of 35% to 40%. This hampers the ability of the EPCA to enforce the plan.

For example, if the air quality hits the "severe" mark (PM<sub>2.5</sub>>250 mg/m<sup>3</sup>), the plan requires the EPCA to direct the Delhi Pollution Control Committee (DPCC) to halt all construction activities, stop the use of diesel generators, and close brick kilns and power plants. But in the absence of adequate manpower, these actions become difficult to execute.

Delhi has 15 air pollution monitoring stations manned by the CPCB, of which only 10 are functional. In comparison, Beijing has 35 and London 100. Many of these stations are not properly calibrated, and there are quality concerns regarding the data they generate, former CPCB member secretary B. Sengupta said recently.

An air pollution forecasting platform is a prerequisite for efficient functioning of the graded plan. Think about this: The plan mandates to increase parking fee when the air quality becomes poor but doing so requires meetings among multiple levels of municipal administration, which can take up to at least a week's time for decision-making and coordination among relevant agencies. Air quality models, real-time data on emission sources, local meteorology, and characterization of size and chemical speciation of the PM are needed for such a platform. At present these capabilities are limited and only a work in progress, says S.N. Tripathi, professor of civil engineering, IIT-K.

The graded plan requires coordination among at least 16 agencies of Delhi and its neighbouring states. These inter-state agencies often represent competing political interests but their coming together is critical for the execution of the plan. There is not much leverage with the Centre in such cases.

On the contrary, think of what the US—a successful example—does. Under the US Clean Air Act, the environmental protection agency has been given the ability to withhold federal dollars (e.g., for highways) if local authorities do not come up with plans to solve air pollution non-compliance situations. The cutoff of funds was never actually implemented, but the threat was enough. “That would get them moving on the problem fast”, says George Thurston, director of the programme in exposure assessment and human health effects at the department of environmental medicine, New York University.

*Shekhar Chandra is the 2017 Lawrence E Susskind fellow and a PhD candidate in environmental policy at the Massachusetts Institute of Technology.*

*Comments are welcome at [views@livemint.com](mailto:views@livemint.com)*

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## Mountains of garbage: India's neglected waste management crisis

The [collapse of a great wall of garbage](#) in east Delhi's Ghazipur area, sweeping people and vehicles into a nearby canal, is a stark reminder that India's neglected waste management crisis can have deadly consequences. More than a year after the notification of the much-delayed Solid Waste Management Rules, cities and towns are in no position to comply with its stipulations, beginning with the segregation of different kinds of waste at source and their scientific processing. Neither are urban local governments treating the 62 million tonnes of waste generated annually in the country as a potential resource. They have left the task of value extraction mostly to the informal system of garbage collectors and recyclers. Improving on the national record of collecting only 80% of waste generated and being able to process just 28% of that quantum, requires behaviour modification among citizens and institutions. But what is more important is that the municipal bodies put in place an integrated system to transport and process what has been segregated at source. The Swachh Bharat programme of the Centre has focused too narrowly on individual action to keep streets clean, without concurrent pressure on State and municipal authorities to move closer to scientific management by the deadline of April 2018 set for most places, and arrest the spread of pollution from trash.

In the absence of stakeholders at the local body level, recoverable resources embedded in discarded materials are lost due to dumping. Organic refuse, which forms about 50% of all garbage, readily lends itself to the generation of compost or production of methane for household use or power generation. But it is a major opportunity lost. Organic waste that could help green cities and feed small and affordable household biogas plants is simply being thrown away. It is also ironic that while some countries such as Rwanda and Kenya have introduced stiff penalties for the use of flimsy plastic bags, India is doing little to prevent them from drifting into suburban garbage mountains, rivers, lakes and the sea, and being ingested by cattle feeding on dumped refuse. A new paradigm is needed, in which bulk waste generators take the lead and city managers show demonstrable change in the way it is processed. There has to be a shift away from large budgets for collection and transport by private contractors, to the processing of segregated garbage. As the nodal body for the implementation of the new rules, the Central Pollution Control Board should put out periodic assessments of the preparedness of urban local bodies in the run-up to the deadline. Without a rigorous approach, the national problem of merely shifting city trash to the suburbs, out of sight of those who generate it, will fester and choke the landscape. Considering that waste volumes are officially estimated to grow to 165 million tonnes a year by 2030, many more suburbs are bound to be threatened by collapsing or burning trash mountains.

Rajasthan's ordinance shields the corrupt, threatens the media and whistle-blowers

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## Development must be climate-smart

Hardship in August: A waterlogged road in Mumbai this monsoon. | Photo Credit: [Rajanish Kakade](#)

Heavy rains this year from the southwest monsoon and accompanying floods have devastated people's lives in parts of Mumbai, Chandigarh and Mount Abu (Rajasthan), all in the same period as Hurricane Harvey's rampage through Houston. [Mumbai is reported to have received 400 mm of rain](#) within a matter of 12 hours while [Houston received about 1,300 mm](#) over several days with Harvey.

Climate models have indicated with high confidence that climate change will lead to an increase in extreme rainfall events. According to the Intergovernmental Panel on Climate Change (IPCC) Special Report on Extreme Events, global warming leads to "changes in the frequency, intensity, spatial extent, duration, and timing of extreme weather and climate events, and can result in unprecedented extreme weather and climate events".

Après le déluge: on the Mumbai floods

For India, the average monsoon rainfall is expected to increase initially and then reduce after a few decades. Examining daily rainfall data between 1951 and 2000, B.N. Goswami, former Director of the Indian Institute of Tropical Meteorology, Pune, showed that there has been a significant increase in the magnitude and frequency of extreme rainfall events along with a decrease in the number of moderate events over central India. These changes interacting with land-use patterns are contributing to floods and droughts simultaneously in several parts of the country.

The main reason for understanding extreme events is to help policymakers, emergency responders and local communities to plan and prepare for them. Cities could be laid out to reduce flooding by following natural contours, drainage and tank systems. Emergency responders should be well prepared to transport and care for people who may become stranded during disasters. Insurance companies might also be concerned about underwriting places that are at perpetual risk in the future. Once an extreme event such as a heat wave or heavy rain occurs, people want to know to what extent a single event has been caused by climate change, that is, by greenhouse gases released through human activities.

All you need to know about Assam floods

Research that tries to understand this relationship between anthropogenic climate change and extreme events in particular locations is called "attribution". Is an extreme event, such as torrential rainfall or record storm surges, part of a natural cycle of variability or due to human-induced climate change? To what extent do poor preparedness and ecologically insensitive land-use worsen the impacts? According to much of the literature, it is easier to determine attribution for severe heat or cold waves. NASA scientist James Hansen earlier found, for instance, that the Texas heat wave of 2011 and the Russian heat wave of 2010 were due to climate change.

Conversely, for rainfall simulation, climate models cannot mimic or simulate extreme rainfall such as the kind Chennai experienced in 2015. According to a paper by Geert Jan Van Oldenborgh and colleagues, the 494 mm rain in Chennai was a rare event, with less than a 0.2% chance of occurring in any given year. The Chennai flood of 2015 did not have a clear climate signature to show that it was due to warming of the earth. On the other hand, with regard to Hurricane Harvey, Michael Mann, a well-known climate scientist, wrote in *The Guardian* that climate change made

the impact much worse, because of higher sea surface temperatures and a blocking region of high pressure that kept the rain clouds over Houston for a long period.

## Urbanisation and hydrology

The actual patterns of flooding in Chennai, Mumbai and Houston, however, were due to several human-induced activities: rampant increase in built-up area across natural drainage channels, the diversion or damming of rivers upstream leading to sediment transport and siltation, coastal subsidence and other effects of development.

Any rain that falls on soil or vegetation is mostly absorbed into the earth's surface. Some of it slowly trickles into shallow or deep protected aquifers that make up what we call groundwater. The rest usually flows downhill along surface or subsurface stream channels. The spread of infrastructure such as roads, highways, buildings, residential complexes, tiled or asphalt-covered land obstructs rainwater from percolating into the soil. Often there are further barriers that block movement of water and increase flooding.

In many parts of the world, construction in cities or in urbanising areas does not take into consideration the existing topography, surface water bodies, stream flows or other parts of terrestrial ecosystems. In much of India, urban growth over the past few decades has blithely ignored the hydrology of the land. In Chennai, for example, systematic intrusion into the Pallikaranai marsh and other wetlands by housing complexes and commercial buildings, slums along Cooum and Adyar rivers, and large-scale construction along the coast are just examples of the flagrant encroachment of the built environment that obstructs rivulets and absorption of rainwater into the earth.

When it rains heavily, exceeding the capacity of the soil to absorb it and regular stream flows are blocked from proceeding into the sea, these heavily built-up areas get inundated. Satellite images from 15 or more years back show the existence of hundreds of lakes and tanks, and several waterways within the city's boundaries.

For decades, urbanisation has ignored ecological principles associated with water bodies, vegetation, biodiversity and topography. These are not 'environmental' issues to be disregarded or attended to only after we have attained 'growth'. Rather, they are part and parcel of and integral to how we live and whether we prosper.

Development needs to be climate-smart, but also avoid social and institutional challenges such as moral hazard. If investments are made in places where severe impacts are likely, the government will end up bailing out those engaging in such risky activities. If the built environment and structures of financing and housing are 'locked-in' or get firmed up with regard to institutional arrangements, these can lead to further complications.

Still, construction on existing lake beds and other waterbodies needs to be removed or redesigned to allow flood drainage along natural water channels. As the frequency of extreme weather events increases around the world, losses in rich countries are higher in terms of GDP, but in terms of the number of people at risk, it is the poor countries that suffer the most. Those who are the most vulnerable and the poorest end up bearing the brunt of the burdens of climate change and mal-development, which together operate to worsen impacts.

Sujatha Byravan is a scientist who researches science and technology policy

The new U.S. Fed Chairman is unlikely to opt for policies that might upset the President's plan

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## Caution warranted for river-linking project

Is the proposed interlinking of rivers a bold and ambitious engineering project that will resolve the country's water woes or is it an ill-conceived plan built on obsolete ideas that will devastate the country's riverine ecosystems? Even as the government claims to have made significant progress with the initial clearances and negotiations so as to kick-start the project, which has been in the pipeline for several decades, expert opinion on the matter remains as sharply divided as ever.

To be fair, this is to be expected, given the sheer scale and scope of the project: 30 river linkages and more than 3,000 storage structures spread across a 15,000km canal network that will transfer 174 trillion litres of water every year, and will cost a total of Rs5.6 trillion. This puts the river-linking project on a par with some of the most daring feats of engineering attempted in the history of mankind. It is a reimagining of the entire aquatic ecosystem of a country as large and diverse as India. That said, the basic idea driving the project is actually fairly simple: Connect the Himalayan and peninsular rivers via a network of canals so that excess water from one channel can be diverted to another which has inadequate flow.

Proponents of the project, which include successive governments at the Centre, argue that river linking offers three key benefits: It will irrigate about 87 million acres of farmland, control floods, and generate 34 GW of hydroelectric power. These are tantalizing prospects: India's rain-fed farms are forever hostage to the vagaries of nature, so much so that even one bad monsoon has a direct and debilitating economic impact. At the same time, simultaneous floods and droughts in different parts of the country continue to wreak havoc, destroying the lives and livelihoods of millions. India also desperately needs clean energy to fuel its development processes, and if river water can be leveraged and redirected to serve these purposes, that's an option worth exploring.

However, river-linking critics insist that the project is built on bad science and an outdated understanding of water systems and water management. Specifically, the concept of surplus and deficit river basins—which is at the core of the river-linking project—is contested. A new study by researchers at the Indian Institutes of Technology in Mumbai and Chennai, analysing weather data over 103 years (from 1901 to 2004), has found that rainfall has decreased over the years by more than 10% even in river basins that once had a surplus, such as those of the Mahanadi and the Godavari.

Also, the project seems to view the river as a unidimensional water pipeline when it is, in fact, an entire ecosystem—and any changes to its natural course will have an impact on all the flora and fauna, the wetlands and the floodplains that are intricately linked to the river system. In fact, the long-term environmental impact of such a project is a major concern. For example, one of the reasons why the Ken-Betwa link, which is now receiving priority attention, has been stuck for several years is because it requires environmental clearance for diverting 5,500 hectares from the Panna National Park, a tiger reserve. Critics also point to the less than positive experience that other countries have had with such projects—be it the Soviet regime's decision to divert the Amu Darya and the Syr Darya, which fed the Aral Sea, to irrigate the desert, or the Australian government's experiments in its Murray Darling basin.

There are political challenges as well. Water transfer and water sharing are sensitive subjects that have already spawned century-long disputes, and few political parties today can expect to win the next election if they are seen as having signed away a scarce natural resource. Moreover, water is a state subject in India, and even though the Centre is empowered to bring an inter-state river under its control to serve the national interest, it has effectively never done so owing to enormous resistance from the states.

The resultant turf wars are already under way—with the Ken-Betwa link, for example, the governments of Uttar Pradesh and Madhya Pradesh have been unable to agree on how much water should be transferred from the Ken river. Union water resources minister Nitin Gadkari intervened a few days ago and has called for a meeting of the chief ministers concerned, but this will not be an easy political bargain—no matter that the same party leads both the state governments and at the Centre.

Given all these concerns, not to mention the massive price tag, perhaps the government would do well to consider other interventions, both on the supply side and the demand side, such as conservation of water resources and more efficient irrigation and agricultural practices, etc., to deal with India's looming water crisis.

*What effect do you think the interlinking of rivers will have on the country's economy and ecology? Tell us at [views@livemint.com](mailto:views@livemint.com)*

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## India could embrace CO2 capture technology

India will explore the possibility of introducing technologies for capturing carbon dioxide emitted while burning coal and other fossil fuels, the country's Coal Secretary Susheel Kumar has said. Mr. Kumar is leading an Indian delegation at an international conference on Carbon Capture Utilisation and Storage (CCUS) in Alabama.

"Attending the conference has been very informative for my colleagues and me, we now have some food for thought to carefully contemplate the feasibility of CCUS with relevance to India," he said.

### Commercial uses

A lot of advanced research in the area, of late, has been focussing on capturing carbon dioxide emissions from sources like coal-fired power plants, to either reuse or store it so it will not enter the atmosphere. CO2 has commercial and industrial uses, particularly for Enhanced Oil Recovery (EOR) in depleting oil fields. Carbon dioxide has the ability to change the properties of oil and make it easier to extract.

The International Energy Agency's Green House Gas Research and Development initiative organises the annual Post Combustion Carbon Conference, which is currently in session in Birmingham, in the State of Alabama.

Dr. Prabhat Ranjan, Executive Director of Technology Information Forecast and Assessment Council (TIFAC) of Department of Science and Technology; S.K. Acharya, Chairman and Managing Director of Neyveli Lignite Corporation; and other officials are part of the Indian delegation at the conference.

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## Tigers use corridors to traverse India-Nepal border

17DFR Tiger who crossed the line | Photo Credit: [17DFR Tiger who crossed the line](#)

Borders don't faze these tigers: over a decade, at least 11 tigers moved from India into Nepal's protected areas through the Terai, a landscape comprising agricultural areas and protected forest-grasslands in the Himalayan foothills. This reaffirms that tiger conservation requires not just protected areas but corridors too — especially across large landscapes — to ensure habitat connectivity and in turn, population growth.

### Habitat loss

With protected areas becoming isolated due to habitat loss and conversion, large mammals including tigers have to now traverse human-dominated areas to disperse to new territories. North India's Terai Arc Landscape, which shares a 700-km border with Nepal, spreads across more than 50,000 sq. km and has one of the world's highest human population densities. Apart from agricultural fields and rural settlements, it also comprises 16 protected areas (five in Nepal and 11 in India) and six major trans-boundary corridors which connect Indian wild habitats with Nepal's.

To test how effectively these corridors aid tiger movement, scientists from WWF-India and WWF-Nepal camera-trapped tigers for 38,319 days in the protected areas, covering an area of more than 9,000 sq. km in multiple surveys between 2005 and 2016. Identifying individual tigers, they found that at least 11 tigers used these corridors to re-colonise Nepal, thus aiding the recovery of tiger populations which had declined drastically in the mid 2000s due to severe poaching pressures.

Growth rates of the tiger population in Nepal's Suklaphanta and Bardia national parks show that tiger numbers were far higher than would have been possible from just reproduction by the existing population. Connecting the locations that individual tigers were photographed from, the team found that one tiger had moved across an area of 248 sq. km, as opposed to the usual 20-sq. km-area in the Terai.

"This speaks volumes about the need to protect large landscapes, even agricultural ones which serve as crucial corridors," says Pranav Chanchani, National Coordinator for Tiger Conservation, WWF-India. "Till the 1930s and 1940s, the now-fragmented protected areas were contiguous. But with increasing human settlement large parts of the Terai were cleared and patches that would have been corridors destroyed."

Planned development near the protected areas — including two roads — could endanger the already-fragmented habitat, say the authors. They suggest that the tiger populations need to be conserved as a 'metapopulation', that is, populations that are physically separate, but interact with one another as animals migrate between them, helping populations persist over the years.

Jaggi Vasudev's Rally for Rivers claims they will, but this is not based on the most nuanced science

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## U.S. environmental agency eyes limits to herbicide linked to crop damage

Collateral damage: At his farm in Arkansas, John Weiss with his crop of soybeans, which has shown signs of damage due to the drifting of Monsanto's pesticide Dicamba. | Photo Credit: [Reuters](#)

The U.S. environmental agency is considering banning spraying of the agricultural herbicide dicamba after a set deadline next year, according to state officials advising the agency on its response to crop damage linked to the weed killer.

Setting a cut-off date, possibly sometime in the first half of 2018, would aim to protect plants vulnerable to dicamba, after growers across the U.S. farm belt reported the chemical drifted from where it was sprayed this summer, damaging millions of acres of soybeans and other crops.

A ban could hurt sales by Monsanto Co. and DuPont which sell dicamba weed killers and soybean seeds with Monsanto's dicamba-tolerant Xtend trait. BASF also sells a dicamba herbicide. It is not yet known how damage attributed to the herbicides, used on Xtend soybeans and cotton, will affect yields of soybeans unable to withstand dicamba because the crops have not been harvested.

The Environmental Protection Agency discussed a deadline for next year's sprayings on a call with state officials that addressed steps the agency could take to prevent a repeat of the damage, four participants on the call told Reuters.

A cut-off date for usage in spring or early summer could protect vulnerable plants by only allowing farmers to spray fields before soybeans emerge from the ground, according to weed and pesticide specialists.

Monsanto spokeswoman Christi Dixon told Reuters that the agency had not indicated it planned to prohibit sprayings of dicamba herbicides on soybeans that had emerged. That action "would not be warranted," she said. The EPA had no immediate comment.

EPA officials made clear that it would be unacceptable to see the same extent of crop damage again next year, according to Andrew Thostenson, a pesticide specialist for North Dakota State University, who participated in the call.

State regulators and university specialists are pressuring the EPA to decide soon on rules guiding usage because farmers will make planting decisions for next spring over the next several months.

Tighter usage limits could discourage cash-strapped growers from buying Monsanto's more expensive dicamba-resistant Xtend soybean seeds. Dicamba-tolerant soybeans cost about \$64 a bag, compared with about \$28 a bag for Monsanto's Roundup Ready soybeans and about \$50 a bag for soybeans resistant to Bayer's Liberty herbicide. Already, a task force in Arkansas has advised the state to bar dicamba sprayings after April 15 next year.

"If the EPA imposed an April 15 cut-off date for dicamba spraying, that would be catastrophic for Xtend — it invalidates the entire point of planting it," said Jonas Oxgaard, analyst for investment management firm Bernstein.

Monsanto has projected its Xtend crop system would return a \$5 to \$10 premium per acre over soybeans with glyphosate resistance alone, creating a \$400-\$800 million opportunity for the company once the seeds are planted on an expected 80 million acres in the U.S., according to Mr.

Oxgaard.

By 2019, Monsanto predicts U.S. farmers will plant Xtend soybeans on 55 million acres, or more than 60% of the total planted this year. About 3.1 million acres of soybeans vulnerable to dicamba were hurt by sprayings this summer, accounting for 3.5% of U.S. plantings, according to the University of Missouri.

Chemical companies have blamed the crop damage on farmers misusing the herbicides. Specialists, though, say the weed killers are also risky because they have a tendency to vaporise and drift across fields, referred to as volatility.

It teaches the lesson of cooperation and living within the ecological means of a place By S. Vishwanath

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## China looks to ban petrol, diesel cars

A BMW in Shenyang in China's northeastern Liaoning Province.AFPSTR

China is joining France and Britain in announcing plans to end sales of gasoline and diesel cars.

China's Industry Ministry is developing a timetable to end production and sale of traditional fuel cars and will promote development of electric technology, state media on Sunday cited a Cabinet official as saying.

The reports gave no possible target date, but Beijing is stepping up pressure on automakers to accelerate development of electrics.

China is the biggest auto market by number of vehicles sold, giving any policy changes outside importance for the global industry. A Deputy Industry Minister, Xin Guobin, said at an auto industry forum on Saturday that his Ministry has begun "research on formulating a timetable to stop production and sales of traditional energy vehicles", according to the Xinhua News Agency and the Communist Party newspaper *People's Daily*.

France and Britain announced in July that they will stop sales of gasoline and diesel automobiles by 2040 as part of efforts to reduce pollution and carbon emissions that contribute to global warming.

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## A forest policy on today's terms

The Union Ministry of Environment, Forest and Climate Change as well as all State Forest Departments are guided by the National Forest Policy, 1988, which states: "The basic objectives that should govern the National Forest Policy are the following: Maintenance of environmental stability through preservation and, where necessary, restoration of the ecological balance that has been adversely disturbed by serious depletion of the forests of the country."

This laudable aim is obscured by the unfortunate fact that there is no such thing as an 'ecological balance'. The term originated as 'the balance of nature' in ancient Greece and was quoted off and on through the Middle Ages. However, with a better understanding of the functioning of natural systems, the concept was completely rejected by the beginning of the last century and does not find mention in textbooks of ecology. Similarly, the concept of 'environmental stability' is questionable because it is evident that natural processes are never stable or stagnant but are always in the process of change and succession. Therefore, environmental stability is a myth.

It is interesting that there is no official definition for the term 'forest' yet, despite ministries and government departments being named after it. In order to couch the laudable goals of the 1988 National Forest Policy, in valid terms, we would first need to define the term 'forest'. This is not a difficult task, since a forest is a self-sown and self-regenerating community of plants that supports a community of creatures dependent on those plants, and on each other, for food and shelter.

The 'self-sown' bit is important in the Indian context, since vast amounts of public money have been spent on 'planting forests', which is an oxymoron. Naturally there are no results to show for these 'planted forests', and Haryana has recently shown the way by practically stopping 'forest plantation' in favour of protecting and permitting existing vegetation to grow.

Having defined a forest, we can now state the primary aim of the 1988 National Forest Policy in the following valid terms: "Maintenance of a healthy natural environment through preservation and, where necessary, restoration of the original natural ecosystems that have been adversely affected by over-exploitation of the forests and other natural resources of the country."

It may be noted that the term 'original natural ecosystems' refers to the state of affairs prior to their exploitation by humans.

The second point of the policy states: "Conserving the natural heritage of the country by preserving the remaining natural forests with the vast variety of flora and fauna, which represent the remarkable biological diversity and genetic resources of the country."

Perhaps this should include grasslands, wetlands, and other ecosystems, and could therefore be stated as follows: "Conserving the natural heritage of the country by preserving natural forest and other ecosystems with their vast variety of flora and fauna, and encouraging such ecosystems to expand into areas they had formerly colonised, but from where they have been extirpated." This would suggest that degraded lands be protected so that original ecosystems can re-establish themselves on those lands. When land has been thoroughly degraded, the usual succession is grasses, shrubs, bushes and, finally, trees. By planting trees directly in such areas, we try to jump the gun, but the build-up of top soil and soil microorganisms that proceeds from a succession is missing, hence the large-scale failure of such plantations.

The third point needs some modification, too. It states: "Checking soil erosion and denudation in the catchment areas of rivers, lakes, reservoirs in the interest of soil and water conservation, for mitigating floods and droughts and for the retardation of siltation of reservoirs."

It does not suggest how this is to be done and why this point fits in, in the policy. Perhaps if it were stated in this way: "Protecting the catchment areas of rivers, lakes, reservoirs to enable natural vegetation to grow back unhindered to conserve soil, help groundwater recharge, for mitigating floods and droughts and for retardation of siltation of reservoirs." The justification for this wording is that the natural vegetation of an area has evolved over millennia to adjust to the rainfall regime, soil conditions, and the subsurface water systems of an area. In places where catchment areas have untouched natural vegetation, rainfall percolates into the soil and is released over a period of months, resulting in perennial streams and rivers. Where this has been damaged, the streams, rivulets and rivers have become seasonal, as in peninsular India.

The final point that needs modification is 2.2 of 'basic objectives': "The principal aim of Forest Policy must be to ensure environmental stability and maintenance of ecological balance including atmospheric equilibrium which are vital for sustenance of all lifeforms, human, animal and plant. The derivation of direct economic benefit must be subordinated to this principal aim."

This is a laudable point, but the terms of reference are not valid. Therefore, it might be better to state this in the following terms, so that the spirit of what is being stated is not lost: "The principal aim of Forest Policy must be to ensure a healthy natural environment and the maintenance and healthy functioning of life-support systems, including the water cycle and nutrient cycle, by protecting natural forest and other ecosystems native to the area. The derivation of direct economic benefit must be subordinated to this principal aim since the indirect economic benefit of healthy life-support systems is incalculable."

The remainder of the Forest Policy document is stated in valid language and needs no modification.

Couched in these terms, the Forest Policy document develops an overarching responsibility for the Ministry of Environment, Forest and Climate Change towards restoring and maintaining the health of India's surface and sub-surface water systems, since both are largely governed by forests and other natural ecosystems. The protection of healthy natural ecosystems in catchment areas should be a vital national goal, given the challenges of failing freshwater systems facing the nation at present. The State Forest Departments are the entities that can do the most in this context, by stopping invalid practices like planting forests and instead use that money in sensible ways to directly and indirectly protect natural ecosystems in sensitive areas like watersheds, catchment areas, and coasts, as has already been envisaged in the National Forest Policy, 1988.

What is worrisome, however, is that in the 30 years since it was formulated, no officer of the Indian Forest Service has pointed out these shortcomings. There is clearly an urgent need to review the curriculum of the Indian Forest Service since it seems to rely on concepts that have been discarded more than a century ago.

*Peter Smetacek runs the Butterfly Research Centre in Bhimtal, Uttarakhand*

The new U.S. Fed Chairman is unlikely to opt for policies that might upset the President's plan

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## Another way climate change might worsen megastorms

In a recent talk about his new book, *Scale*, physicist Geoffrey West described climate change as a form of entropy—disorder that's created as the price of all the order and creative energy pent up in cities. In this view, climate change is not, as some argue, just a euphemism for global warming. It's a broader term that reflects the unpredictable, disorderly way global warming will affect the planet's oceans and atmosphere.

In other words, we won't be so lucky as to see a regular, incremental increase in the earth's average temperature. Instead, we're seeing rapid, erratic changes in weather patterns that people have counted on for centuries.

Consider one of the more interesting hypotheses about global warming: that it will cause the wind patterns that normally keep storms moving from place to place to slow down, causing prolonged downpours as well as droughts. It's an idea that's been cited in the peer-reviewed literature and featured in *Scientific American*, but like many exciting ideas in science, it's still not universally accepted. Some are waiting for more evidence.

For people who've looked into the slowing of wind circulation, however, Hurricane Harvey was a case in point. Part of the reason it was so destructive was because it got slowed down over Houston. The storm was caught between two high-pressure blocking systems shortly after it made landfall in Texas, so instead of rolling over the region, it got stuck for several days, dumping 50 inches of rain over an enormous area—a total of 19 trillion gallons. The longer it lingered, the more rain fell; ultimately, some parts of the state saw a year's worth of rainfall in less than a week.

Charles Greene, an atmospheric scientist at Cornell University, believes that warming in the Arctic led to a slowing down of a high-altitude, circulating wind known as the jet stream, which he argues contributed to Harvey's lingering destruction. If that turns out to be the case, it portends more such events to come. He suspects recent droughts in the western United States may have been exacerbated by the same phenomenon, as a more sluggish jet stream allowed masses of dry air to get locked into place.

Why would global warming affect winds and storms? As Greene explains, warming isn't happening in a uniform way. The Arctic is warming faster than the earth's temperate zones, and so there's less of a difference than there used to be between Arctic and mid-latitude temperatures. "These temperature differences are what drive atmospheric winds," he said, which include the jet stream and a more northerly circulation pattern called the polar vortex. The polar vortex normally confines frigid air to the Arctic, and when it weakens, Arctic air can swing south and create unusually cold weather at lower latitudes.

The Arctic is warming faster than the rest of the planet because there's a positive feedback loop at work. As reflective sea ice melts, it exposes dark ocean underneath, he said. That means more of the sun's energy gets absorbed into the oceans, driving yet more warming in a positive feedback system. In the fall, some of the ocean's heat is released back into the atmosphere. That change in Arctic temperature alters the polar vortex, slowing and weakening it. That has coincided with an increase in the number of tropical cyclones and nor'easters.

In his view, the warming Arctic is also causing the jet stream to slow, and thereby allowing the formation of more "blocks" of high pressure to lock storms such as Harvey in place. He acknowledges, however that there isn't enough evidence yet to link cause and effect, or rule out natural variability.

Kevin Trenberth, climate scientist at the National Center for Atmospheric Research in Boulder, Colorado, says Greene and his colleagues have more work to do to demonstrate the links between Arctic melting, wind patterns and extreme weather. But there are already well-established links between global warming and storms.

Trenberth's work focuses on the oceans, which are heating up along with the atmosphere. While the surface of the ocean has been slowly warming since the mid-20th century, the 1990s brought something new: Water started to warm up 700 to 2,000 metres below the surface. The increase is small, he said, but the total energy pent up under the surface is enormous. Normally, big storms churn up cold water from the depths, and this allows their energy to peter out. Now that there's warmer water below the surface, there's extra heat available, he said, and that can cause a storm to intensify and last longer.

And that's not the only way global warming can lead to more destructive storms. It's well understood that warmer air holds more moisture, which allows Harvey and other storms to pack more precipitation. Warmer oceans also likely added fuel to this storm, and will continue to do so over the course of the century. The water in the Gulf of Mexico is 2 to 4 degrees warmer than it has been historically this time of year, said Greene. Warmer water allows storms to intensify fast, as Harvey did by going from Category 2 to Category 4 within hours. Now, Hurricane Irma seems to be doing the same thing as it heads toward Florida.

The arguments among scientists are for the most part not about whether global warming is contributing to extreme weather, but which consequences of global warming will wreak the most havoc. In his talk, physicist Geoffrey West explained that the kind of disorder associated with global warming is the price we pay for our ordered civilization. There's no reason to be ashamed that it's happened—or to deny it. Better to look forward and realize it's still possible to mitigate the damage, and to adapt. **Bloomberg View**

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## Footing the bill

Hurricane Irma has left a trail of devastation across the Caribbean Islands. Coming hard on the heels of Hurricane Harvey which hit Texas, talk of climate change is inevitable. Climate scientists and meteorologists have said that a link, if any exists, can be proved only in the months to come, when research models called attribution studies are used.

But the political fallout will not wait for studies. Politicians from the island nations that are most vulnerable say they are going to press for top fossil fuel consumers to help them repair damage attributable to climate change, marking a sharp divide between rich and poor nations.

Meanwhile, natural disaster insurance is gaining in prominence; it has the backing of the UN and World Bank. After last year's Hurricane Matthew, for instance, prompt insurance payouts helped the Caribbean islands. Given the difficulty of striking international political consensus, perhaps it's time to pay more attention to such unconventional solutions for building resilience in the developing world.

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## Say goodbye to gasoline: China's going electric

**Sydney:** Say goodbye to gasoline. The world's slow drift toward electric cars is about to enter full flood.

China, one-third of the world's car market, is working on a timetable to end sales of fossil-fuel-based vehicles, the country's vice-minister of industry and information technology, Xin Guobin, told an industry forum in Tianjin on Saturday. That would probably see the country join Norway, France and the UK in switching to a wholly electric fleet within the lifetime of most current drivers. The announcement is important because the most influential players in the global auto market have always been not companies, but governments.

Diesel cars make up about half of the market in the European Union (EU) and less than a percentage point in the US, largely because of different fuel-taxation and emissions regimes. Carburetors have been regulated out of most developed markets as fuel injection—originally a more costly technology—results in less tailpipe pollution.

Moves toward electrification of the world's cars have been tentative. Just 695,000 electric vehicles were sold in 2016, according to Bloomberg New Energy Finance (BNEF), equivalent to about three days of sales in an 84 million-strong market. Including those already on the roads, the global car fleet is roughly a billion-strong.

At the same time, the direction of travel is unambiguous. China's auto industry plan released in April envisages new energy vehicles—including electric and hybrids—making up all the future sales growth in the country.

With conventional cars plateauing at current levels, new-energy vehicle sales will reach 7 million annually in 2025.

As many as 800,000 charging stations will be built this year alone, according to the official China Daily.

Government mandates will require manufacturers to sell 8% of their vehicles with electric or hybrid power trains from next year, or purchase credits to make up the difference, rising to 20% by 2025.

India, due to overtake Germany and then Japan as the world's third-biggest auto market by 2020, is on a similar path. Prime Minister Narendra Modi's think-tank Niti Aayog aims to get electric vehicles to 44% of the fleet by 2030, and is aggressively favouring them with tax rates 31 percentage points below those on hybrids and internal-combustion-engine cars under its new harmonized GST.

France and the UK, the world's sixth- and seventh-biggest markets, are planning to phase out sales of non-electric cars by 2040, while Norway aims to reach that line 10 years earlier.

Neither of those targets looks especially ambitious, given the rapid drop in battery costs—in the US and EU, electric cars will reach price parity with conventional vehicles in terms of purchase and running costs around the mid-2020s, according to BNEF.

The International Energy Agency believes the use of oil in passenger cars has already more or less peaked, with just 7% of demand growth by 2040 set to come from the sector.

The pattern will accelerate as major automakers dedicate more of their research and development

budgets—and, subsequently, lobbying funds—to the EV transition.

Until the first Tesla Inc. Roadster went on sale just nine years ago, Mitsubishi Motors Corp. was the only major car company to take the prospect of fully electric vehicles seriously. Now, every large automaker is working on battery-powered cars, with even longstanding skeptics like Fiat Chrysler Automobiles NV's Sergio Marchionne and Maruti Suzuki India Ltd.'s R.C. Bhargava announcing plans in recent weeks.

For all the eye-catching symbolism of a ban, it's unlikely that fossil fuel will soon be illegal on the roads.

Gasoline and diesel cars will still be sold in 2040, and probably 2050 and 2100 as well.

But with an increasing cost disadvantage and growing infrastructure issues, as gas stations close or go electric, internal-combustion engines will be sold only to enthusiasts—like high-performance sports cars, kit cars and vintage cars are, today.

The conventional car isn't quite dead yet—but its years are numbered. **Bloomberg Gadfly**

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## Cabinet approves MoU between India and Armenia on Cooperation in the field of Disaster Management

### **Cabinet approves MoU between India and Armenia on Cooperation in the field of Disaster Management**

The Union Cabinet chaired by the Prime Minister Shri Narendra Modi has given its approval for signing of a Memorandum of Understanding (MoU) between India and Armenia on Cooperation in the field of Disaster Management

The MoU would enhance cooperation in the field of Disaster Management and contribute to the well-being and safety of the people of both the countries in the event of disaster. It will also result in exchange of information in the relevant fields of disaster management which is of mutual interest.

Further, the MoU seeks to put in place a system, whereby both India and Armenia will be benefited from the disaster management mechanisms of the other country and will help in strengthening the areas of preparedness, response and capacity building.

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## A fragile ark that shelters 2,626 creatures

In a first, the Zoological Survey of India (ZSI) has published a compendium of animal species in the Indian Sundarbans, estimating that there are 2,626 of them in the fragile island ecosystem. The listing includes a diverse 25 phyla, as they are biologically classified.

The Indian segment of the Sundarbans, part of a UNESCO World Heritage site, forms part of the Ganga-Brahmaputra delta across 9,630 sq. km, distributed among 104 islands.

The region hosts 2,487 species that come under the zoological kingdom of Animalia, and 140 under the more primitive Protista.

“The publication titled *Fauna of Sundarban Biosphere Reserve* is the first consolidated and updated information of the faunal diversity of the Sundarbans. It lists over 2,600 species, including the new species described from the mangrove ecosystem as well as threats faced by them due to climate change,” ZSI Director Kailash Chandra told *The Hindu*.

Biswajit Roy Chowdhury, secretary of Nature Environment and Wildlife Society, a non-governmental organisation and one of the authors of the publication, says it is encyclopedic in its scope.

“When we talk about Sundarbans we refer to only a few major species in the reserve forest area in about 4,260 sq. km. The publication catalogues the entire faunal diversity of Sundarban Biosphere Reserve covering 9,630 sq. km spread over 19 blocks in South 24 Parganas and North 24 Parganas of West Bengal,” Mr. Roy Chowdhury said.

### Gone missing

The researchers document the famous tigers of these islands, which have adapted to aquatic conditions around, the human-tiger conflict, and behaviour of the big cat. The fortunes of 50 mammalian species including the Asian small-clawed Otter, Gangetic Dolphin, Grey and Marsh Mongoose and the wild Rhesus Monkey, the only primate here, are also documented.

“Due to pressure on habitat from people and natural threats that have shrunk the mangrove swamp habitat, mammal numbers are declining,” the authors say. Two Rhinos, Swamp deer, Barking deer and Hog deer and Asiatic Wild Water Buffalo are not found in Sundarbans anymore, they say.

There are 356 species of birds, the most spectacular being raptors, or birds of prey, that occupy the highest canopies of the forest. Osprey, Brahminy Kite and White-Bellied Sea Eagle are dominant, while Rose-ringed parakeets, flycatchers and warblers are also found in the middle tier, while in the lower tier, kingfishers abound — and the Sundarbans has nine of them.

There are 11 turtles, including the famous Olive Ridley and Hawksbill sea turtles and the most threatened freshwater species, the River Terrapin.

A crocodile, 13 lizards including three species of Monitor Lizards and five Geckos are found here. The rivers, creeks channels and the islands together harbour about 30 snake species, led by the King Cobra, considered vulnerable by IUCN.

Others documented are the Monocellate or monocled cobra, Russell's viper, common and banded kraits. Besides, ten species of frogs and toads are found.

## Cartilaginous fish

The mangrove ecosystem covers about 350 species of fish. Cartilaginous fish, which have skeletons of cartilage rather than bone, make up 10.3%. The IUCN conservation status shows 6.3% fish are near-threatened and 4.85% are threatened. Also, there are 173 molluscs.

In another indication of its richness, 753 insect species are encountered in the Sundarban Biosphere Reserve. Of these, 210 are butterflies and moths. Moreover, Crustaceans — crabs, shrimp and prawns — constitute 334 species.

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## Creating corridors of certainty: on India's tiger population

Ranthambore in Rajasthan is arguably India's most well-known tiger reserve, aglow with bold tigers posing for the camera. It has a fierce conservation ethic, a success story with few parallels. It is estimated that there are over 60 tigers in this relatively small tiger reserve. But what about the future? A genetic study suggests that Ranthambore's tigers suffer from low genetic diversity and isolation.

While the reserve itself is doing well in terms of tiger numbers, it is cut off from other forests. This is a microcosm for many other tiger reserves in India. Several are admirably run with healthy tiger numbers, but simultaneously they are also witness to fast-paced disturbance in the landscape around them. While numbers of tigers are stable inside reserves, connectivity between them is getting cut off.

### Ranthambore now home to 62 tigers

Based on a study of samples from tiger post-mortems and collection from live tigers, a new study, which had inputs from laboratories at the Wildlife Institute of India, the Centre for Cellular and Molecular Biology, Kerala Veterinary and Animal Sciences University, and Aaranyak has found that India has three distinct and genetically connected tiger populations. These are in: south India; central India, the Terai and north-east India; and in Ranthambore. The Ranthambore population has the least genetic diversity and may suffer from isolation. There are two issues here: populations require genetic flow to remain robust; securing healthy tiger numbers are not enough for tiger health. Second, we are in an age of active management. When tigers go extinct in an area, they are flown in or carried in from other areas — as was done in the case of Panna (Madhya Pradesh) and Sariska (Rajasthan). It appears, *prima facie*, that the problem is solved. But are these management devices a suitable proxy for genetic flow through actual habitat corridors?

India has more than 60% of the global wild tiger population. Thus, the question is not just of today but also of tomorrow.

Several studies suggest that tigers do well in remote and dense forest. But tigers also need new forest to colonise, dispersing from their natal areas as they reach adulthood. Natural history has viewed the tiger to be the epitome of the 'wild' animal — doing well in areas with less human disturbance, taking down large prey, keeping a distance from people, and being fiercely territorial of space. Modern surveillance proves this theory demonstrating that tigers will traverse long, difficult distances to establish territories. As examples, we have had tigers moving from Ranthambore to Bharatpur (Rajasthan), from Pilibhit to Lucknow (both Uttar Pradesh), and from Pench (Madhya Pradesh) to Umred (Maharashtra).

### The Ranthambore story

Genetically isolated or stranded populations can suffer from genetic depression, and subsequently, mutations and ailments. This has already happened to species which have had stranded populations such as the Florida panther and possibly the Great Indian Bustard. While the tiger is undoubtedly the epitome of wildness, its wildness is not restricted to being a fierce obligate carnivore which hunts to survive, dying when weakened. Wildness and wildlife conservation also include preserving ecological processes which hold their own evolutionary potential. A robust forest or habitat corridor between tiger reserves is an important means of maintaining these ecological processes and may hold the key to the survival and adaptation of the species.

Yet today there is a hard disregard for conservation outside protected areas. Even the cores of reserves are on the chopping block. Is this because there is contentment that tiger numbers are stable overall? In Madhya Pradesh, the Ken-Betwa river interlinking project will submerge a large part of the Panna tiger reserve and landscape. A new proposed irrigation project will submerge more than three lakh trees in the Palamau tiger reserve (Jharkhand). New highway proposals which will make wider cuts through Sariska, Kaziranga (Assam) and between the Kanha and Pench reserves are being considered or implemented. Clearly, a wildlife corridor or habitat is a bad word in the lexicon of planning and development.

The tiger story is built around a narrative of numbers. Undoubtedly, numbers are important. They indicate a continuous protection effort and that the habitat is doing well. But numbers are the beginning of the tiger story, and not the end.

K. Ullas Karanth: 'We are slow to adopt science for conservation'

The fact that the forest department carries out conservation but does not own land outside of the forest is an important factor. Thus an effort to link reserves would need many more stakeholders and political will. This is not easily done, but needs to be attempted as a conservation priority. Rajasthan recently created the Mukundra tiger reserve for Ranthambore's 'spillover' tigers. Apart from moving tigers with human intervention, the corridor between the two reserves should be strengthened too. Other States need to start restoring corridors or stepping stones between forests.

With mounting human pressure, to ask for more acres of protected forests may be utopian. But conserving workable corridors is doable — and as science shows us, also necessary.

*Neha Sinha is a wildlife conservationist*

The new U.S. Fed Chairman is unlikely to opt for policies that might upset the President's plan

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## The Ghazipur landfill collapses, another catches fire, and no one wants a dumpsite in the backyard. Where must our solid waste go?

On September 2, an avalanche of garbage at Ghazipur keeled over killing two people | Photo Credit: [Shanker Chakravarty](#)

A defiant mound — lush with grass as on a golf course — rises amidst 150-foot-high mountains of rotting garbage that constitute Delhi's most infamous landfill, in Ghazipur. At the foot of the mound is a stout, rectangular transformer — a 'demonstration project' — meant to show that landfill gas (a mix of methane and carbon dioxide) can be squeezed out of the garbage and be used to produce electricity.

For decades now, commuters on the highway connecting Delhi to Meerut would have been forgiven for mistaking the giant brown heaps for a mountain range. But locals know that it is a hulk of trash that grew at an average of about 3,000 tonnes a day every year — until this month, that is.

On September 2, an avalanche of garbage keeled over onto a road and with its momentum broke through a boundary wall pushing cars and motorcycles into an adjoining drain. Two people died and at least seven were injured in this accident.

"It was a massive sound, like an explosion," said Ram Manohar, who works at one of the effluent treatment plants built to convert some of the waste into biogas, "I ran to see what happened and the next thing I saw was a car floating in the drain."

To Shanta Kumari, who lives in the nearby slum, the disaster was imminent. She and her three sons have lived in one of the slums surrounding the landfill for several years. They have now got used to the stench, says Shanta, although it can get particularly overwhelming during the rains. "The stench apart there have been several fires that billow out during the summer. We've lodged several complaints but nothing has happened and we now accept it as a part of our life."

The bulk of the waste in the landfill being organic means that it's a potent source of methane and is inflammable, a fact that's well known to everyone — from government authorities to activists.

Delhi has other landfill sites at Bhaswal, northwest of the city, and it's so prone to fires that the Delhi Fire Services has engines on standby and positioned close enough to quickly douse it. Delhi isn't the only city that hosts deadly landfills.

Deonar, Mumbai's largest and oldest dumpyard, caught fire multiple times last year and required firemen for weeks; it spiked pollution levels to nearly twice that of Delhi. The Central Pollution Control Board has reported that waste from India's cities has crossed 1,42,870 (1.43 lakh) tonnes per day, of which a substantial 12,858 tonnes is not even collected. Of the 91% (1.3 lakh tonnes) collected, around 65,000 tonnes is dumped or disposed off in the most unscientific and unhygienic manner. Only 23% is being treated while 27% is dumped in landfills.

### Energy from waste

A waste-to-energy plant commissioned in Ghazipur works sub-optimally because it requires that there be no solid waste in the refuse before treatment.

In an earlier interview, Ravi Agarwal, Director, Toxics Link, an organisation that works on waste management problems, had said that unless basic steps such as segregating waste at source were undertaken, it would be impossible to deal with Delhi's garbage woes. Professor Manoj Datta

of the Department of Civil Engineering, IIT-Delhi, in the aftermath of the recent disaster said that the 'stability of the landfill' could be increased by flattening the slopes, strengthening the top and removing leachate and gas.

Thirty-five years ago, this 80-acre shrine to garbage was an empty, featureless outback of Delhi. A fish and poultry market, a slaughterhouse, a vegetable and flower market predate the dumpsite and in the eyes of the municipal corporations, was a logical dumping ground for a rapidly-consumerising Delhi. In the late 1980s, as the trucks started to stream in — with piles of refuse from the markets as well as residential colonies of east Delhi — Mohammed Nazir and his schoolmates discovered that it became increasingly hard to host a decent game of cricket here.

"The ball would always get stuck in the trash and after a while it became impossible to ignore the stench," said Nazir, who's now a 45-year-old fish retailer at Murga Mandi, the generic name for the assortment of sprawling retailers that dominate the area.

As Nazir grew, so did the line up of trucks and eventually the landfill, which was stipulated to grow no more than 70 feet, but breached the limit in 2004. There's also an informal economy that subsists around the landfill: waste collectors, operators of trash-skimming equipments, truck drivers who ferry the trash.

For Kumari, living near a dumpsite that receives nearly a third of the city's garbage is a small price to pay because it pays her bills. Her sons climb the mounds of trash everyday for the slightest object of value — iron parts, electronic scrap, plastic — that are then sold for recycling. "Were this to go away, how will we eat?" she asks.

### **Foiled plan**

After the accident, Anil Baijal, Delhi's Lieutenant Governor decreed that no more fresh garbage was to be dumped at the Ghazipur landfill; the convoy of trucks has slowed down to a trickle. Mirza, who works as a watchman at the Ghazipur dump, says that a handful of trucks continue to come in because the government's plans to have garbage dumped in an alternate location has run into stiff opposition from locals.

### **When disaster strikes**

A waste-to-energy plant by the Jindal group in south-east Delhi's Okhla belt was stalled for years because residents in the vicinity complained that it wasn't using proper incineration technology and that the fumes were triggering illnesses.

Even as Delhi's waste management problems balloon, Delhi denizens' protests against any waste-to-energy plant or landfill coming within sniffing distance of their homes, has meant that authorities only firefight when a disaster strikes rather than implement long-term garbage-management plans.

The government amended solid waste management rules last year, mandating that all establishments take charge of ensuring that waste is segregated and waste collectors be absorbed into formal networks. "This requires a concerted government effort but given that different political parties control different wings of government, and Delhi's unique statehood means that it's extremely hard to work on long-term solutions," said a top official at the CPCB, who didn't want to be named.

The green mound was also once part of the dump that has now been flattened out and has its waste dredged to make landfill gas and run a micro power plant. In November, the government will begin an attempt to use the solid waste from the landfill as filler in the construction of a highway

connecting Delhi and Meerut, a plan that was made public in the aftermath of the accident. But “it’s too expensive and I doubt that this mountain heap will go away,” said Anoop Kumar, an engineer who works at the treatment plants.

Jaggi Vasudev’s Rally for Rivers claims they will, but this is not based on the most nuanced science

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## Land use conversion and climate change can make a deadly combination for Mumbai

The coastal landscape of Mumbai has changed drastically in the last few years | Photo Credit:

[AP](#)

For the second time in a little more than a decade, rain and floods brought Mumbai, India's commercial capital, to a grinding halt. The city recorded nearly 300 mm of rain on August 29, one of the heaviest spells in the city's history. It was much lower than the all time single-day record of 944 mm of July 2005, but it was enough to bring the city to its knees.

The media reported on the impact on citizens, the failure of the local administration to first anticipate and then deal with the situation. While this remained focused primarily on the causes of flooding, there was another series of reports on larger phenomenon at play: Global warming and changing land use in the city. This makes a deadly combination indeed.

The coastal landscape of Mumbai has changed drastically in the last few years — satellite imagery following the August deluge shows, for instance, how mangrove forests in areas like Thane, Malad, and the Manori creek, have been lost or encroached upon. The new airport that was approved in Navi Mumbai a few years ago will destroy nearly 160 hectares of mangroves. The initial proposals by the Mumbai Metropolitan Region Development Authority had suggested the reclamation of more than 20 sq.km. of the city's salt pans for housing and other projects. The desire for more land is clearly jettisoning the security of the city and this is only expected to grow more pronounced as weather patterns become more extreme and also more uncertain with climate change.

### Capacity to cope

There are two threads of discussion that are relevant here. On the positive side is the realisation, at least to an extent, of the importance of ecosystems like the mangrove. This is reflected in the creation in Maharashtra of a mangrove cell to protect and regenerate mangroves. Mumbai has some very good patches of mangroves, two of which (in Vikhroli and Airoli in Navi Mumbai) were included in a list of 12 important mangrove systems in India recently released by the Mangrove Society of India. While protection of the mangroves is unlikely to completely prevent the kind of events Mumbai has seen recently, the move will certainly help ensure a better capacity to cope. A 2009 study by scientists at the University of Delhi and Duke University in the United States showed, for instance, that villages with wider mangrove belts suffered relatively lesser damage during the 1999 'super cyclone' that ravaged the Odisha coast and killed an estimated 10,000 people.

A study published in May 2017 in the journal *Hydrobiologia*, pointed out that in the U.S., wetland coastal protection services provide an estimated \$23.2 billion per year against economic losses as well as deaths associated with major storm events.

### Huge challenges

The bigger challenge in India comes however from the overarching thrust given to industrial expansion and infrastructure development.

This is starkly visible in the NITI Aayog's recently-released 'Three year action agenda 2017-18 to 2019-20'. While the action agenda for coastal regions does list issues surrounding coastal zone management and regions vulnerable to cyclones, flooding, earthquakes and tsunamis, these are included only as broad generalities. The major thrust, clearly, is on exploiting the land and the

resources along the coasts for aggressive economic growth, suggesting as it does port development as part of the Sagarmala programme, easing of sea-river movement, a massive thrust to tourism development, creation of a 2500 km long East Coast Economic corridor running from Visakhapatnam to Chennai, and the creation of 14 Coastal Employment zones based on the Chinese model of Special Economic Zones.

Conservation and protection are clearly not a priority — and this is a matter of serious concern, not just for Mumbai but for regions all along India's coastline. The NITI Aayog report itself notes that nearly 250 million people in the country live within 50 km of the coastline. And no amount of infrastructure development or economic growth will ensure their protection as the case of Mumbai has shown not once, but twice in little more than a decade.

*The writer researches issues at the intersection of environment, science, society, and technology.*

Jaggi Vasudev's Rally for Rivers claims they will, but this is not based on the most nuanced science

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**30th Anniversary of Montreal protocol and 23rd World Ozone Day Celebrated****30th Anniversary of Montreal protocol and 23rd World Ozone Day Celebrated****PAN-India Awareness Campaign reaches out to nearly 28 lakh students in the country**

Highlighting the strength of the active collaboration between the government, industries and all stakeholders in the implementation of Ozone Depleting Substances (ODS) phase-out programme in the country, Union Minister of Environment, Forest and Climate Change, Dr. Harsh Vardhan highlighted the importance of individual awareness and the strength of collective action. The Minister also laid special emphasis on the role played by children in ensuring the success of such campaigns.

Addressing a gathering at the celebrations of the 30<sup>th</sup> anniversary of the Montreal Protocol and 23<sup>rd</sup> World Ozone Day here today, with the theme - "Caring for all life under the Sun", the Minister made a special mention of the pan-India awareness campaign launched by the Environment Ministry on the occasion. This campaign was among the most widespread engagements of the Ministry for awareness generation, carried out with the active partnership of States through schools and academic/research institutions spread across the country. The awareness campaign saw a participation of about 28 lakh students in more than 13, 000 schools and reached out to 214 districts across 16 states of the country. The Minister also spoke of the strong policy leadership given by India during the negotiations for the Kigali Amendment to the Montreal Protocol. Dr. Harsh Vardhan said that it is recognized that India played a crucial role in the adoption of the Kigali Amendment to the Montreal Protocol.

A series of publications launched by the Minister on the occasion include – a handbook on HCFC Phase-out and Energy Efficiency in Buildings; the first edition of 'newsTRAC'; and a newsletter for service technicians in Refrigeration and Air-conditioning (RAC) sector. These two publications were launched as part of the enabling component of India's HCFC Phase out Management Plan, for which United Nations Environment is the cooperating agency and Energy Efficiency Services Ltd. and The Energy and Resources Institute (TERI) are the national implementing partners. Two videos on India's achievements in implementation of Montreal Protocol and HCFCs phase-out and Energy Efficiency in buildings were also launched.

## **MONTREAL PROTOCOL: A BRIEF BACKGROUND**

The year 2017 marks the 30<sup>th</sup> Anniversary of the Montreal Protocol on Substances that Deplete the Ozone Layer. The Montreal Protocol is one of the most successful global environmental treaties, the implementation of which has not only led to the phase-out of around 98% of ozone depleting chemicals, but also averted more than 135 billion tonnes of carbon dioxide equivalent emissions. Nearly 2 million cases of skin cancer per year have been averted globally. The Montreal Protocol is the only environmental treaty which enjoys universal ratification of 197 UN member countries.

During the Kigali negotiations, India piloted the concept of two base lines and a differentiated phased down time schedule to factor in the needs of developing countries. This was the first time in the Montreal Protocol that the concept of two baseline has been adopted both for developed and developing countries. On India's initiative, energy efficiency was included for the first time in the Montreal Protocol as an agreed finance solution while phasing down HFCs.

India has consciously chosen a path for most environment-friendly and energy efficient technologies, while phasing out Ozone Depleting substances, unlike many of the developed countries. India is among the few countries globally and a pioneer, in some cases, in the use of non-ODS low Global Warming Potential (GWP) technologies.

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## U.S. denies softening stand on Paris climate accord

Environment Ministers from 30 countries attend a meeting called by Canada, China and the European Union in Montreal September 16, 2017. | Photo Credit: [AFP](#)

The White House pushed back on September 16 at a European suggestion it was softening its stance on the [Paris climate accord](#), insisting Washington will withdraw from the agreement unless it can re-enter on more favourable terms.

The remark came as Environment Ministers from some 30 countries gathered in Montreal seeking headway on the [Paris climate accord](#), which [President Donald Trump had pulled out](#) of in June 2017.

At the summit, which was attended by a U.S. observer, the U.S. “stated that they will not renegotiate the Paris Accord, but they (will) try to review the terms on which they could be engaged under this agreement,” the European Union’s top climate official Miguel Arias Canete said.

Mr. Canete said there would be a meeting on the sidelines of next week’s U.N. General Assembly with American representatives “to assess what is the real U.S. position,” noting “it’s a message which is quite different to the one we heard from President Trump in the past”.

### Climate agreement proposes a binding 2°C target

The U.S. observer was not immediately available for comment and the White House insisted the United States would withdraw from the Paris climate accord without more favourable terms. “There has been no change in the United States’ position on the Paris agreement,” White House spokeswoman Sarah Huckabee Sanders said in an email. “As the President has made abundantly clear, the United States is withdrawing unless we can re-enter on terms that are more favourable to our country,” she said.

Called by Canada, China and the European Union, the summit took place 30 years to the day after the signing of the Montreal Protocol on protecting the ozone layer — which Canada’s Environment Minister hailed as a multilateral “success story” by governments, NGOs and ordinary citizens jointly tackling a major global threat.

We “committed to full implementation of the Paris Accord. Everyone agreed that the environment and the economy go together, they are linked. You cannot grow the economy without taking care of the environment”, Catherine McKenna said at the end of the summit, attended by more than half the G20 members as well as some of the nations most vulnerable to climate change — from the low-lying Marshall Islands and Maldives to impoverished Mali and Ethiopia. “Changes are real, extreme weather events are more frequent, more powerful and more distressful,” she told the gathering, pointing at the devastation wrought by mega-storms such as Harvey and Irma which many climate scientists believe are boosted by global warming.

Nearly 200 countries agreed in Paris in December 2015 to curb carbon dioxide emissions with the aim of limiting the rise in average global temperatures to 1.5°C by 2050, compared to pre-industrial levels.

### 1.5°C target is a tall order

When Mr. Trump decided in June 2017 to withdraw, Canada, China and the European Union

immediately reaffirmed their respective commitments to the pact, which the Group of 20 declared “irreversible” the following month.

Time is ticking, Mr. Canete told AFP, as Ministers work to narrow their differences and better understand how to implement the ambitious accord — with less than two months to go until the next U.N. Conference on Climate Change (COP23), in Bonn in November 2017.

“We need a rulebook to be able to monitor and verify and compare emissions of all the parties and see how far we are towards the targets,” Mr. Canete said, with a goal of having those rules in place in time for the COP24 meeting in Katowice, Poland in late 2018. Key player China — the world’s largest car market — brings to the table a potentially major advance in transportation after announcing its intention to ban gasoline and diesel-fuelled cars, following decisions by France and Britain to outlaw their sale from 2040.

The European Union — which is targeting a 40% cut to its emissions by 2030 — will also shortly put forward a proposal to member states on slashing carbon emissions in the transportation sector, European Commission President Jean-Claude Juncker said this week.

And Canada — as the world’s sixth-largest oil producer — insists it is “committed to its international climate obligations”, which it hopes to reach by massively investing in “clean energy” technologies.

China’s special representative to the talks, Xie Zhenhua, said Beijing considers the Montreal Protocol to be a “very effective and efficient” example of multilateral action on the environment — largely because it rested on a broad consensus. “We should take actions now,” Mr. Xie said, “to ensure that we can realise the goals that we have set.”

“The key issue is how we should combine climate actions with economic growth, the protection of people and job creation,” he added. “If we can combine all these matters we could make Paris agreement a great success.”

Jaggi Vasudev’s Rally for Rivers claims they will, but this is not based on the most nuanced science

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## Odisha govt rapped for delay in notifying elephant corridors

Rise in numbers: As per the latest census figure, Odisha had 1,976 elephants in 2017, 22 more than that in 2015. File photo: Lingaraj Panda

The National Green Tribunal has expressed extreme disappointment over the lethargic pace of notifying elephant corridors — fixed paths which connect traditional elephant habitats — in Odisha.

Adjudicating the case filed by the Wildlife Society of Orissa, Justice S. P. Wangdi, judicial member, and P. C. Mishra, expert member, of the NGT, Eastern Zone Bench, directed the Odisha government to give a specific timeframe for completion of processes before publication of the notification in respect of the elephant corridors.

### Legal sanctity

In 2010, the State government had identified 14 corridors, which would not only have helped the elephants move without any disturbances, but also increased chances of exchange of genetic diversity interchange. Later, another nine corridors were identified. However, the government has been dilly-dallying in notifying the corridors that would have given legal sanctity for their preservation.

“The State government on January 13, 2017, had categorically stated that the work of assessing habitat viability and ground-truthing of the already identified elephant corridors had been handed over to the Asian Nature Conservation Foundation (ANCF). The report in respect of which was expected to be received by early 2017. This has been repeated by the government in the subsequent affidavit filed on February 20,” the order says.

“Today being September 12, which falls in the later part of 2017, it was expected that the work would be completed by this time. On being questioned as to whether the report has been filed or not, the government submits that it has not yet been submitted but, as per instructions, it is expected within the first week of October,” says NGT’s last Tuesday’s order.

### Further complications

“Every day’s delay in doing so, would give rise to further complications and a situation may so arise when traditional elephant corridors would be non-existent leading to their gradual extinction. We may remind ourselves that this earth is not for the survival of human race alone,” said the NGT.

“We expect the Odisha government, one of the States where the elephants survive as their traditional abode, shall take immediate steps for protection of this gentle giant,” emphasises the tribunal in its order.

Shankar Pani, counsel for Wildlife Society of Orissa, said the NGT also came down heavily on the State government for its inaction over illegal commercial operations in two identified elephant corridors.

As per the latest census figure, Odisha had 1976 elephants in 2017, 22 more elephants compared to 2015. During the past five years (since 2013-14), elephants have come out of forests regularly in 26 of the 30 districts.

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## A case for continued support for green energy

Going by recent reports, it appears that the Union government is contemplating withdrawing all kind of incentives that are being provided to renewables-based electricity by 2022. It is said that there will not be any targeting of renewable energy after 2020 (presumably no renewable purchase obligations, or RPOs, after 2022). Moreover, the draft National Energy Policy 2017 proposes gradual withdrawal of the provision of “must run” status and other support such as non-levy of interstate transmission charges. The sharp reduction in bids for solar and wind power forms the basis of the argument that now these technologies are ready to face markets.

If this is really the direction being pursued, there is an urgent need to view things in the right perspective. While the record low prices of solar power in the recent past have been on account of very low global prices of solar photovoltaic modules and accessories, there have been other underlying reasons as well. For instance, in the case of the Rewa solar park, the fact is that a payment security mechanism was put in place along with provisions for guaranteed uptake of electricity from the solar park. These critical aspects in turn helped bring down the cost of capital that constitutes about 70% of renewable electricity prices. Or the fact that the Solar Energy Corp. of India wind power auction contained three very crucial elements: (i) power purchase agreement with PTC (India) Ltd (and not the distribution utility, thereby providing security of payment against the sale of electricity as well as assured offtake of electricity); (ii) waiver of inter-state transmission charges; and (iii) compensation for system losses till the interconnection point by allowing for construction of 5% additional capacity. The point, therefore, is that these low prices are the result of several facilitating measures. Of course, one has still to see how sustainable these tariffs are insofar as businesses are concerned.

Even with the provision of “must run” under the regulation and with RPO in place, there have been several cases of curtailment in off-take of renewable energy in states like Tamil Nadu and Rajasthan. So under the circumstances, the proposition of doing away with such provisions appears to be totally counter-productive to India’s ambitions in this field. Or it may be the case that the outcomes of recent solar and wind auctions have lulled officials to complacency, a classic malady of taking success for granted—of assuming that things will continue to move in a certain way but ignoring the key parameters that helped chart out that direction in the first place. Undoubtedly, a good policy framework has to have sunset clauses for incentives but withdrawals must also be nuanced and gradual, arrived at after taking into account their long-term implications on the sector.

If these were not enough to send mixed signals to the clean energy community, we have the Economic Survey 2016-17, volume II, that was released by the ministry of finance recently. The survey talks about the “social cost” of renewable energy in comparison to that of coal-based power generation. Besides other cost parameters, including health and environmental costs, the survey includes “the opportunity cost of stranded conventional power assets” as one of the components of the social cost. Thus, the losses incurred by investors and lenders due to the underutilization of coal power plants becomes the most significant contributor to renewable energy’s social cost, making it three time more expensive than conventional power. At best, this is strange logic. According to Central Electricity Authority figures, the share of renewable electricity in India’s total electricity generation was around 7.6% between April 2016 and March 2017. Surely this cannot be the reason for below-par plant load factors of coal power plants.

Second, by the same logic, no disruptive transition to better and more efficient technologies would ever be possible because during the transition stage, the older assets are bound to be underutilized or in a sense, financially stranded. Let us take, for instance, the UJALA, or Unnat Jyoti by Affordable Lighting for All, scheme that aims to promote efficient use of energy. This

whole UJALA campaign must also be rendering manufacturers of incandescent lamps in a state of financial stress, so is that being factored in while estimating the social cost of LED lamps? And what about the present thrust on electrical vehicles that surely would result in the supply chain of conventional automobile components becoming stranded assets? And how transparently does this “social cost” dispensation take into account the cost of longer term impacts of different alternatives? How accurate are the cost-components and how close are the assumptions to Indian realities? Public health in any case is always heavily discounted in all such calculations.

A good policy regime tries to balance these seemingly divergent viewpoints and provides direction for long-term and sustainable solutions for larger public good. This is particularly critical when the decisions made today could have far-reaching implications for generations to come. Besides, basing such decisions on anecdotal premise rather than on sound analytical evidence could very well jeopardize the momentum that renewable energy sector in the country has gained. What message are we trying to give investors and developers with such pronouncements? It appears as if there is a lack of cohesion within different arms of the government, leading to conflicting signals. This, however, needs to be managed quickly to avoid the serious implications such mixed signals could have on our commitment to achieve about 40% of installed power capacity from non-fossil fuels by 2030.

*Amit Kumar is senior director, The Energy and Resources Institute (Teri).*

*Comments are welcome at [views@livemint.com](mailto:views@livemint.com)*

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## Giant sea snail plan to rescue Barrier Reef

A giant starfish-eating snail could be unleashed to help save the Great Barrier Reef, officials said on Monday, with a trial under way to breed thousands of the rare species.

Predatory crown-of-thorns starfish, which munch coral, are naturally-occurring but have proliferated due to pollution and run-off at the struggling World Heritage-listed ecosystem. Their impact has been profound with a major study of the 2,300-km long reef's health in 2012 showing coral cover halved over the past 27 years, with 42% of the damage attributed to the pest.

### Hunting by scent

Now, Australian Institute of Marine Science (AIMS) research has shown they avoid areas where the Pacific triton sea snail — also known as the giant triton — is present.

The snails, which can grow to half a metre, have a well developed sense of smell and can hunt their prey by scent alone.

Research showed they were particularly fond of crown-of-thorns, but only eat a few each week, and with the snail almost hunted to extinction for their shells, there are not many left.

This led the government to announce on Monday funding to research breeding them. "The possibilities the triton breeding project opens up are exciting," said Queensland federal MP Warren Entsch. "If successful, this research will allow scientists to closely look at the impact of giant tritons on crown-of-thorns behaviour and test their potential as a management tool to help reduce coral lost to outbreaks." Giant tritons held at AIMS have laid numerous egg capsules. But they are so rare, almost nothing is known about their life cycle.

Jaggi Vasudev's Rally for Rivers claims they will, but this is not based on the most nuanced science

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**Environment Ministry to conduct five rounds of Quiz - 'Prakriti Khoj' across the Country****Environment Ministry to conduct five rounds of Quiz - 'Prakriti Khoj' across the Country**

The Ministry of Environment, Forest and Climate Change will hold a quiz on environment - 'Prakriti Khoj' throughout the country. The quiz is planned in five rounds and the qualifying round will begin on September 25, 2017 by paying tribute to Pandit Deen Dayal Upadhyaya on his birth anniversary. The qualifying round will continue till September 29, 2017. The second, third, fourth and fifth rounds will be held subsequently, as per the schedule given below:-

- Second Round: 30th October to 3rd November 2017
- Third round: 20-24, November 2017
- Fourth round: 4-6, December 2017
- Fifth round: 18-20, December 2017

The quiz will be conducted online through multiple-choice questions. Thematic areas like climate change, biodiversity, forest and wildlife, pollution, waste management, rivers and lakes, natural history, international conventions such as Convention on Biological Diversity, United Nations Framework - convention on climate change, United Nations Convention to Combat Desertification, Convention on International Trade in Endangered Species of Wild Fauna and Flora etc. have been chosen for the quiz. A separate web portal - [www.ngc.nic.in](http://www.ngc.nic.in) and [www.pkeq.nic.in](http://www.pkeq.nic.in), containing information on the quiz has been developed by the Ministry. The link for first qualifying round will be open for five days from September 25 2017 to September 29, 2017 between 8.00 Am to 6.00 PM. Dates of the quiz will be updated on the Prakriti Khoj portal, as well as Ministry's website.

In this phase, the quiz is open to only students of Eco-clubs (NGC programme of MoEF&CC). The students who are members of Eco-clubs in particular schools are required to send their names for registration through State Nodal Agency. The User Id and password will be provided to the registered students through email on their personal email IDs, as well as on their school IDs.

During the first phase, the Ministry in cooperation with State Nodal Agencies - National Green Corps, State Pollution Control Boards, state government bodies within the Environment departments and State Science Council will implement the quiz programme through online mode. The quiz will be organized in the school premises under the supervision of Principals/Eco-club Coordinators. There will be cash prizes for the winners. All participants will receive an E-certificate of participation duly signed by the Union Minister of Environment, Forest and Climate Change.

This environment awareness initiative - "Prakriti Khoj" had been launched on September 5, 2017. It has been launched with an aim to reach out to young, aspiring minds of school students through a fun-filled interactive learning mode for triggering a sense of awareness towards environment protection and conservation. This quiz, in a way, will provide a unique platform for students to measure their awareness levels regarding environmental issues and motivate them to participate in major programmes of the Ministry related to conservation and protection.

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## **India to conduct the First 'BIMSTEC Disaster Management Exercise- 2017' from October 10-13**

### **India to conduct the First 'BIMSTEC Disaster Management Exercise- 2017' from October 10-13**

The First 'BIMSTEC Disaster Management Exercise- 2017' (BIMSTEC DMEx-2017) will be conducted by the National Disaster Response Force (NDRF) as the lead agency from October 10-13, 2017 in Delhi and the National Capital Region (NCR). This Exercise will be a platform for sharing Best Practices on all aspects of Disaster Risk Reduction (DRR), strengthening regional response and coordination for Disaster Management among the BIMSTEC member countries.

Delegates from all seven nations of the 'Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation' (BIMSTEC) grouping, - namely Bangladesh, Bhutan, India, Myanmar, Nepal, Sri Lanka and Thailand, representatives from Embassies/High Commissions of BIMSTEC nations in Delhi, National Disaster Management Authority (NDMA), and Senior Officers from the Nodal Ministries are participating in the event.

At the 17th BIMSTEC Senior Officials Meeting held in Kathmandu, Nepal on February 7, 2017, it was decided that India would organize the first annual Disaster Management Exercise for the region.

The main focus of the BIMSTEC DMEx-2017 will be on testing the region's preparedness and resilience towards effective activation of inter-Governmental interaction/dialogue/agreements for immediate deployment of regional resources for disaster response. It will help create synergy and synchronize efforts to institutionalize regional cooperation among the member countries. The exercise will help strengthen the effective utilization of the Search & Rescue Teams for Disaster Relief & Emergency Response, including Emergency Rapid Assessment Teams and Management of mass casualties especially in situations involving breakdown of infrastructure and communication.

At the end of the four-day Exercise, a publication will be brought out on the outcomes and recommendations of the Joint/Common Exercise and include Agreement among BIMSTEC Nations on regional cooperation for Disaster Management and Emergency Response. This would be presented to the BIMSTEC Leaders at the Summit to be hosted by Nepal in October/November, 2017.

The BIMSTEC DMEx-2017 is being conducted in two phases in Delhi and NCR. The main exercise will comprise of Table Top Exercise (TTX), Field Training Exercise (FTX) and After Action Review (AAR) which is scheduled for October 10-13, 2017. Earlier, the first phase comprising a Preparatory Meeting and field visit of site selected for FTX during the main exercise, was held in Delhi NCR on August 8-9, 2017.

India has been at the forefront of DRR efforts by hosting the South Asian Annual Disaster Management Exercise (SAADMEx) and the Asian Ministerial Conference for Disaster Risk Reduction (AMCDRR). India has also offered its expertise and capabilities in DRR such as the South Asia satellite, GSAT-9, and the Tsunami Early Warning Centre to other countries. Disaster Management was one of the important Agenda items the BIMSTEC leaders deliberated upon during the Goa BRICS Summit in October last year where BIMSTEC leaders were the Special Invitees.

The BIMSTEC region is home to around 1.5 billion people, constituting around 22% of the global population with a combined GDP of US \$2.7 trillion economy. Majority of the BIMSTEC countries are situated in the South Asian Region (SAR), prone to natural disasters such as floods, cyclones, earthquakes, avalanches and drought.

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## Bound by Paris deal, says India

Committed to a cause: External Affairs Minister Sushma Swaraj addresses a UN General Assembly meeting on Tuesday. AP

India on Tuesday reaffirmed its commitment to the landmark Paris climate change agreement, saying it was willing to “work above and beyond” the pact to reduce greenhouse gas emissions.

External Affairs Minister Sushma Swaraj, during a UN ‘Leadership Summit on Environment Pact’, said India had been at the forefront of the debate on environment and development.

Her remarks came amid uncertainty over the U.S. role in the deal after President Donald Trump in June announced that America was withdrawing from the Paris deal, arguing that it gave undue advantage to countries like India and China.

India, which is the world’s third largest carbon polluter, reached a pact, along with more than 190 nations, in December 2015 with an aim to prevent an increase in the global average temperature and keep it well below 2 degrees Celsius.

The deal, which replaced the 1997 Kyoto Protocol, was ratified last October.

Participating in the UN meet hosted by Secretary-General Antonio Guterres, Ms. Swaraj said India was willing to work “above and beyond” the Paris agreement. “Understanding our responsibility towards Planet Earth,” External Affairs Ministry spokesperson Raveesh Kumar tweeted.

### Solar alliance

The summit was presided by French President Emmanuel Macron. India takes the climate change issue very seriously, Mr. Kumar said.

“We also mentioned that India and France are working together on the international Solar Alliance,” he said.

During the day, Ms. Swaraj had a series of bilateral meetings with leaders from Mexico, Norway and Belgium. She also called on Mauritius Prime Minister Pravind Jugnauth.

“There were some discussions on the possibility of a high-level visit from Belgium to India later this year,” Mr. Kumar said.

Later in the evening, Ms. Swaraj attended a reception hosted by British Prime Minister Theresa May for the Commonwealth Heads of Government delegations. Ms. Swaraj is scheduled to hold meetings with her counterparts from San Marino, Brazil, Morocco and Moldova and call on Afghan President Ashraf Ghani. She is also scheduled to participate in several multilateral meetings including that of the G-4 (Brazil, Germany, India, and Japan) and the Shanghai Cooperation Organisation Foreign Ministers.

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## Beyond social media

On September 4, the Cell for IPR Promotion and Management (CIPAM) under the aegis of the Department of Industrial Policy and Promotion (DIPP), Ministry of Commerce and Industry, launched a social media campaign to promote Geographical Indications (GIs) with the hashtag #LetsTalkIP.

The press release says that GIs are of utmost importance to the country as they are an integral part of India's rich culture and collective intellectual heritage and that their promotion is in line with the Government's 'Make in India' campaign. It adds that it is an area of strength and optimism for India as the "GI tag" has accorded protection to several handmade and manufactured products, especially in the informal sector. CIPAM proposes to talk about interesting facts and stories on GIs using social media.

With legislation enacted in 2003 — the Geographical Indications of Goods (Registration & Protection) Act, 1999 (the GI Act) — for their protection and 295 names registered with the Geographical Indications Registry, GIs today need no introduction.

The proposed campaign is certainly heartening because goods branded as GIs can be made indigenously by local communities independently and in a self-sustaining manner. And India, with its rich cultural heritage and diversity, has GIs. It is an added advantage that if protected the correct way, GIs can promote rural development in a significant manner and could be fitted in as the most ideal intellectual property right to bolster a programme such as 'Make in India'.

But there is a catch. A GI is supposed to convey to a consumer the assurance of a certain quality, reputation or other characteristics of the goods on which it is applied, which are essentially attributable to its geographical origin. For example, when you see the name Scotch for whisky, a registered GI under the GI Act, on a bottle of whisky, you expect it to originate from Scotland and possess certain qualities that you would not associate with other whiskies. Does the GI Act ensure that all the GIs registered thereunder meet such expectations?

The keywords here are "quality control". This is the sine qua non of any GI protection. In fact, the European Community Regulation 1151/2012 for the protection of GIs is titled as a regulation "on quality schemes for agricultural products and foodstuffs". The emphasis laid on quality must be underscored here. Recital 46 of this regulation states that the added value of GIs is based on consumer trust and that it is only credible if accompanied by effective verification and controls. Further, the quality schemes should be subject to a monitoring system of official controls to ensure verification of compliance with the law and rules relating thereto, and should include a system of checks at all stages of production, processing and distribution.

In the Indian scenario, the question arises whether the GI Act provides for quality control measures and verification of compliance. The word 'quality' itself appears in the GI Act only in two instances, first in Section 2(1)(e) which defines a GI, and second, in connection with Section 11(2) that stipulates that the application should state as to how the GI serves to designate the goods in respect of, *inter alia*, quality. Unlike the European Regulation, the GI Act does not provide for monitoring mechanisms at multiple levels. In fact, there is no single reference to an inspection or monitoring structure in the Act. Though there is a mention of it in Rule 32(1)(6)(g) which lists what should be the content of the statement of case, it is quite perfunctory in that it states, "particulars of the inspection structure, if any, to regulate the use of the geographical indication". In contrast, the European Regulation stipulates multiple monitoring measures, both within the GI-controlling body and outside it.

Currently, there is a proliferation of GI registrations in India without any legal provisions stipulating post-registration quality control measures that are to be employed in the production of goods branded as GIs. This is detrimental not only to the protection process of GIs in India but also to the very existence of these GIs, because prolonged failure to meet consumer expectations would dilute the premium and credibility of GI-branded goods. Why would a customer pay a premium to a GI branded product if there is no difference in quality as compared to similarly placed goods?

While the campaign is a wonderful idea to promote awareness, there is more work that is required at the legislative level to ensure credibility of the GI protection process in India. To make such efforts more meaningful and worth the passion put in by bodies such as CIPAM, we need to first fill the legislative gap in ensuring quality control through monitoring mechanisms.

*Latha R. Nair is a partner with the IP law firm K&S Partners. E-mail: latha@knspartners.com*

The new U.S. Fed Chairman is unlikely to opt for policies that might upset the President's plan

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## From ocean to ozone, the limits of our planet

The population of vertebrate species on Earth in the wild saw a dramatic fall of about 30% between 1970 and 2006, with the worst effects being in the tropics and in freshwater ecosystems. Destruction of species' habitats by pollutants and land-use change are obliterating flora and fauna at unprecedented rates. In fact, the ecological footprint of humanity — the natural habitats, such as water and land, transformed or destroyed as a result of human activity — far exceeds the biological capacity of the earth.

In an attempt to understand the natural world, its relationships with human societies and limits, in 2009, Johan Rockström and others from the Stockholm Environment Institute described elements of the biophysical world that link us together. Often regarded as a “safe operating space for humanity”, these planetary boundaries include loss of biodiversity, land-use change, changes to nitrogen and phosphorus cycles, ocean acidification, atmospheric aerosols loading, ozone depletion, chemical production, freshwater use and, of course, climate change.

In the course of 12,000 or so years after the last ice age, the Holocene epoch has offered a stable climate, a period of grace for humanity to grow and to flourish, with settlements, agriculture and, more recently, economic and population expansion. This epoch has since given way to the Anthropocene, the exact beginnings of which are debated, but which has led to over-reliance on fossil fuels, industrial agriculture, pollution in water, soils and air, loss of species and so on, which are devastating for many life forms and connected ecosystems throughout the planet.

Many of these conditions respond in a non-linear manner to changes. This means, for instance, that ecosystems that are stressed by their exposure to pollutants may not recover once the pollutants are removed. Or, some systems may collapse precipitously under conditions referred to as thresholds. We understand many of these thresholds and how they interact with each other, but not all.

When ecological thresholds or tipping points are crossed, significant large-scale changes may occur, such as breakdown of glaciers in Greenland and the Antarctica, the dieback of rainforests in the Amazon, or failure of the Indian monsoons. Since these boundaries interact with one another and cause changes across scales, crossing a threshold in one domain can speed up or undermine processes in another subsystem. For instance, greenhouse gas (GHG) emissions increase ocean acidification, land-use change often increases GHG emissions, and increasing nitrogen and phosphorus deplete species biodiversity and freshwater resources and increase warming from climate change.

According to Mr. Rockström and others, we are already at critical levels of concern for climate change, fresh water, species biodiversity and changes to nitrogen and phosphorus cycles, which are reaching tipping points. For example, GHG emissions have led to average atmospheric carbon dioxide concentrations being about 410 ppm. This is well above the 350 ppm level considered a 'safe' limit, and the earth is already about a degree Celsius warmer than average pre-industrial temperatures.

Since publication of these studies by Mr. Rockstrom and others, there has been plenty of discussion, even strong disagreement, regarding the boundaries. Some scientists, such as Kate Raworth, have expanded them to reflect and include several social dimensions such as equity and gender justice that were subsequently placed in the centre of a schematic representation of the boundaries as a circle with a hole or as a doughnut.

One may regard planetary boundaries as support systems for life on Earth or view them as

expressing “carrying capacity” and defining “limits to growth”. The latter is a thesis that was originally published nearly half a century ago by the Club of Rome as a book in 1972. It described the situation we would find ourselves in with exponential population and economic growth. While the “limits to growth” argument was challenged for good analytical reasons, it still provided a lens through which to view the changing world of the 21st century. It also offered the idea of thinking about a system as a whole — systems thinking — not just as separate parts and feedback mechanisms as valuable processes in considering long-term change.

The idea of sustainability has been embedded in the human imagination for a very long time and is expressed through our ideas of nature, society, economy, environment and future generations. But it became formally a part of international agreements and discourse when it was recognised at the Earth Summit of 1992 in Rio de Janeiro.

This systems view and the recognition of interlinkages among the social, environmental, and economic pillars of sustainability, and between biophysical planetary boundaries and social conditions, are essential to have a chance of keeping the world safe for future generations. It is telling that scholars who work on planetary boundaries regard climate change as one of the easiest to manage and contain.

In thinking about these planetary limits then, researchers and policymakers should reflect on multiple systems and the linkages among them, and whether step-by-step or transformative changes must be considered to keep the planet safe for the future.

*Sujatha Byravan is a scientist who studies science, technology and policy*

The new U.S. Fed Chairman is unlikely to opt for policies that might upset the President’s plan

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## Battling e-waste in China's industrial hub

Getty images

The proliferation of cellphones, computers, television sets and other gizmos has a downside. The growing consumption of digital products is generating mountains of e-waste, whose disposal is posing serious health and environmental risks. But recycling of e-garbage is also providing jobs to hundreds of thousands in many parts of the developing world. China is at the heart of reconciling this contradiction between guaranteeing much needed incomes and preserving clean air, water and soil, necessary for public health.

Guiyu, a coastal township in southeast China, is the world's e-waste capital. Since the turn of the century, the area has seen millions of tonnes of electronic leftovers, generated at home and abroad, being routinely dumped. The e-garbage pile began to inflate after some local businessmen taught residents the process of extracting valuable by-products — gold, silver and copper — from motherboards, wires and picture tubes. Poor workers provided the feedstock for this booming industry. But problems began to arise when people fell sick, and the drop in air, water and soil quality caught global attention. "The whole town was blanketed by foul air that smelled of acid. I always felt like coughing," the *South China Morning Post* quoted Yang Linxuan, a resident, as saying.

Air contamination followed when mountains of plastic wiring were burnt in open fields to retrieve the embedded copper in them. Acid baths, which combined nitric acid and cyanide, sprang up to extract gold from motherboards. Serious water contamination resulted when untreated effluents, including acid to wash out residual toner ink from cartridges, were channelled into a tributary of the Beigang river, which soon began get choked.

Mercury, fluorine, barium, chromium, and cobalt, which either leach from the waste or are used in processing, are blamed for skin rashes and respiratory problems. The foul air and water can also damage kidneys and the nervous system, and weaken the immune system, heightening the risk of cancer. A study conducted by the Shantou University Medical College in 2014 found that heavy metal contamination had turned the air and water toxic and that children in the town had high levels of lead in their blood.

### National embarrassment

The unregulated Guiyu e-waste industry soon became a national embarrassment for China. The local government of the Guangdong province, of which Guiyu is a part, decided to launch a comprehensive plan in 2013. It was decided that instead of the several recycling workshops, known for their blacksmith-type furnaces, with long flues meant to take toxic smoke away into the atmosphere, all recycling activity would be carried out in an industrial park on the outskirts of the town.

Consequently, a \$233 million facility became fully operational in December 2015. More than 1,200 workshops were consolidated into 29 big units, which carried out the bulk of the recycling. Guangdong University, specialising in minimising pollution, has been a core partner in this exercise. Simultaneously, the supply chain of bringing e-waste from abroad has been disrupted. In July, Beijing notified the World Trade Organization that it would cease 24 kinds of waste imports by the end of the year.

Despite its efforts, not everyone is convinced. Liu Hua, a campaigner with environmental group Greenpeace's Beijing office, told the *South China Morning Post* that there was no fundamental

break in the extraction process in the industrial park. He pointed out that “the process of extracting precious metals from e-waste is still polluting”.

***In 2013, Guangdong decided to launch an industrial park for e-waste recycling on the outskirts of Guiyu that would consolidate more than 1,200 workshops into 29 big units***

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## Multi-Agency Exercise 'Pralay Sahayam' Held

### Multi-Agency Exercise 'Pralay Sahayam' Held

A multi-agency exercise was conducted on the banks of Hussain Sagar Lake as the final event of 'Pralay Sahayam' in Hyderabad today. The event demonstrated efforts of all central and state agencies, National Disaster Relief Force (NDRF) and the Armed Forces towards jointly tackling an urban flooding scenario in Hyderabad.

The Minister of State for Defence Dr. Subhash Bhamre who was the Chief Guest on the occasion, congratulated the organising committee for the successful conduct of the exercise. The Deputy Chief Minister of Telangana Shri Mohammad Mehmood Ali was the Guest of Honour. General Officer Commanding-in-Chief (GOC-in-C) Southern Command Lt Gen PM Hariz was the conducting authority of the exercise. For the purpose of the exercise, Hussain Sagar Lake was transformed into urban colonies partly submerged under water, post heavy showers in the city. A large number of dummy structures depicting multi-storied buildings and houses with stranded people, power stations, educational institutes etc., were erected in the lake in an inundated condition. The hapless stranded occupants of these dwellings were rescued in joint operations carried out by the State Government agencies, Police, State Fire & Emergency Services, NDRF, CISF and the Armed Forces. The Indian Air Force and the Army Aviation employed the Mi-17 helicopters, Advanced Light Helicopter (ALH) and Chetak Helicopter for aerial evacuation, demonstrating special skills in hovering and winching. The massive Mi-17 lowered a Gemini class inflatable boat of the Indian Navy for rescuing the trapped citizens. The agile ALH and Chetak Helicopters virtually hovered over the roof tops and winched in people trapped in stranded, inaccessible buildings. Special Forces such as the Army Commandos and Marine Commandos from the Indian Navy carried out a highly synchronized Search and Rescue operation in the flooded colonies. Dog Squad of NDRF and Telangana State police were pressed into action to search for trapped personnel. Relief activities such as evacuation of rescued people, provisioning of medical care and distribution of essential supplies was carried out by multiple agencies in a coordinated and efficient manner.

The exercise brought out the role and function of the State Emergency Operations in coordinating conduct of the joint operations. Further the significance of early warning systems of agencies like Indian Meteorological Department (IMD), National Remote Sensing Centre (NRSC) and Indian National Centre for Ocean Information Services (INCOIS) was emphasized.

The exercise culminated with a static display which demonstrated the efficient and functional layout of a relief and rehabilitation camp for the displaced persons. The camp catered for emergency medical assistance and other essential services for the needy. Indian vendors showcased state-of-the-art disaster management equipment and related wares. NGOs such as Plan India, Care India, Sphere India, etc., also participated, bringing out their capabilities, organization and operational strategies.

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## Removing toxic metals from tannery waste

Removing hexavalent chromium from industrial effluents, particularly untreated tannery waste, will become easier and more efficient thanks to the work by a team of researchers from the Indian Institute of Chemical Biology (CSIR-IICB), Kolkata. Importantly, the heat-dried fungal biomass converts Cr(VI) — which is neurotoxic, genotoxic and a carcinogen — to a non-toxic trivalent form of chromium, thus eliminating the problems of disposing Cr(VI)-containing waste. Cr(VI) is found in very high concentration in tannery waste. The results were published in the journal, *Scientific Reports*.

A team led by Sucheta Tripathy from the Structural Biology and Bio-Informatics Division at IICB isolated a fungus, *Arthrinium malaysianum*, and used the fungus biomass to remove Cr(VI). In experiments carried out in the lab using potassium dichromate solution, the adsorption capacity of the biomass was found to be as high as over 100 mg per gram of dry weight. In the case of untreated tannery waste, the fungal biomass was able to remove over 70% of Cr(VI). It can also remove other toxic metals such as lead and arsenic, which are normally found in tannery waste.

The positively charged functional groups found on the surface of the fungus binds to Cr(VI) ions. These groups were found intact even after heat drying. The functional groups have more ability to adsorb the negatively charged Cr(VI) through strong electrostatic attraction in acidic conditions. “Though the tannery waste is slightly alkaline, the fungus was still able to adsorb heavy metals,” says Rajib Majumder from the Structural Biology and Bio-Informatics Division at IICB and the first author of the paper. Once Cr(VI) gets adsorbed, the reducing functional groups found on the fungus converts it to Cr(III), which is not toxic. “The efficiency of conversion of Cr(VI) to Cr(III) was unaffected even when the concentration of Cr(VI) was increased 10 times,” he adds.

Besides adsorbing and converting the toxic form of chromium to a non-toxic form, the fungus biomass can also be reused by removing the adsorbed material. “We were able to reuse the biomass three times efficiently, beyond which it became unusable,” says Mr. Majumder.

Having tested the ability of the heat-dried fungus biomass in removing chromium and other heavy metals, the team is working to immobilise the biomass on a glass or ceramic substrate. “We are trying to produce a biomaterial to increase the surface area for real-time applications,” Dr. Tripathy explains.

The new U.S. Fed Chairman is unlikely to opt for policies that might upset the President’s plan

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## Worrying downgrade — On snow leopard conservation

The elusive and charismatic snow leopard has lost its endangered status in the Red List of the International Union for Conservation of Nature, causing genuine worry among wildlife biologists, who believe this sends out the wrong signal to those working to protect it. If the argument for a downgrade to vulnerable status from endangered is that conservation actions have reduced the threat to the cat, there is an equally persuasive response on how little scientists know about its population health, given its remote habitat in the alpine zones of the Himalayas and trans-Himalayas. As a major range country, India has worked to protect these animals, and even launched a programme on the lines of Project Tiger for its conservation, covering 128,757 sq. km of habitat in Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh. There is also an upcoming international collaborative effort, the Global Snow Leopard and Ecosystem Protection Program, involving the countries that make up the range of this graceful animal. It is vital that this momentum should not be lost merely on account of the technicality that the estimated numbers have crossed the threshold for an 'endangered' classification, which is 2,500. If anything, studies on its vulnerability have to be intensified, and the task of monitoring its entire habitat of high mountains speeded up.

It would be a disservice to conservation if governments shift their focus away from the big challenges to the snow leopard's future: trafficking in live animals in Central Asia, and hostility from communities because of its attacks on livestock. India handled the problem of the cat preying on goats, sheep, donkeys and other animals by roping in communities in conservation, and compensating them for any losses. An insurance programme in which residents of a part of Spiti Valley in Himachal Pradesh participated also worked well. New research indicates that even when wild prey is available, the attacks on livestock by snow leopards have cumulatively been on the rise. The response to this finding must be to insulate the owners from losses and encourage them to move away from traditional pastoral grazing. A more fundamental worry is over the likely loss of habitat owing to changing climate patterns. Fortunately, research models indicate that there are considerable stretches of steppes in High Asia that could withstand climate-related changes in the greater Himalayan region, creating refuge lands for snow leopards. Today, the factors that pose a threat to the species remain unchanged, and the IUCN down-listing, which changes the classification since 1986, should not be misread by policymakers. If conservation has protected the cat, it must be strengthened by enlarging protected areas in all the range countries, and keeping out incompatible activities such as mining and human interference.

Rajasthan's ordinance shields the corrupt, threatens the media and whistle-blowers

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## Indian renewable sector at crossroads

It has been nearly three years since the announcement of the 100 gigawatt (GW) solar capacity target for March 2022. The sector has made huge strides in this time and it is a good time to take stock of the progress made so far and analyse key trends.

Annual capacity addition has grown in the last three years at a compounded annual growth rate of 80% to an estimated 16 GW as of September. Top international and Indian investors, including private equity funds, sovereign wealth funds, conglomerates and utilities have entered the market, drawn by its high growth prospects and supportive policy framework. Growing capacity addition and private sector interest provide a ringing endorsement of government vision. In fact, it is remarkable that financing, which used to be touted as the main barrier to sector growth, has turned into a key enabler. As the sector matures, however, it faces new challenges and the policy environment needs to adapt accordingly.

The sector's growth has been very patchy—Karnataka, Andhra Pradesh, Telangana and Tamil Nadu account for 56% of total operational plus pipeline capacity. In contrast, their combined power consumption is only about 25% of national consumption. By 2018, renewable power penetration in these states is expected to cross 20%, generally regarded as a critical threshold for grid stability. Most other states, including Maharashtra and Gujarat, are already power-surplus, the result of breakneck thermal power capacity addition in the last five years (91 GW), and hence moving cautiously on renewable power. The problem is so acute that the ministry of power envisages no new thermal power capacity from 2022-27 and the recent economic survey has called for rationalization of renewable capacity addition.

The result ironically is that demand for solar power is slowing down when tariffs have fallen to a low of Rs2.42 per kWh, making solar power the cheapest new source of power in India. We expect utility-scale solar capacity addition to slow down to about 5 GW per annum, down from about 8 GW in 2017, over the next three-four years before the excess supply situation eases.

Aggressive bidding and the sharp fall in prices have raised concerns whether the solar sector will suffer the same fate as thermal power or roads, where irrational pricing led to many projects being abandoned or financially distressed. Our assessment is that because of their short gestation period, credible sponsor groups and small individual project sizes, most solar projects will come online as planned. Delays are possible and some investors will bear pain but the banks should be largely protected.

The steep fall in tariffs has led to “buyer's remorse” for many distribution companies (discoms), which have procured solar power at higher prices and are now trying to wriggle out of their commitments. States are not only scrapping ongoing tenders but also, in some cases, seeking to renegotiate or cancel previously allocated projects. We are hopeful that the regulators and judiciary bodies will clamp down on such unilateral attempts as happened in Gujarat in 2014, when the state's discoms tried to renegotiate their high-priced power purchase agreements. Wayward discoms, poor planning and policy uncertainty pose the biggest challenges to the sector. Private investors, particularly international players, need reassurance that contracts will be honoured.

As the sector matures, incentives provided by the government—capital subsidies, accelerated depreciation, free transmission, zero value-added tax, etc.—are being gradually wound down. Instead, the sector faces a growing challenge of how variable, intermittent power can be absorbed into the grid. More stringent forecasting and scheduling restrictions are on their way and the “must run” status of the sector is also under threat.

Solar panel manufacturing also remains a dilemma. Domestically manufactured modules account for less than 10% of consumption notwithstanding the Make In India campaign and policies such as domestic content requirement. Total import bill for the sector is estimated at Rs30,000 crore this year, about 1% of total imports. This may not be a daunting amount but the conundrum for policymakers is whether we need cheap power or economic growth and jobs. Are we just replacing oil imports from West Asia with equipment imports from China? Domestic manufacturers have petitioned for protectionist duties. A cogent long-term vision for manufacturing sector is missing and there are fears that India has missed the bus on manufacturing.

Inevitably, these challenges need to be addressed to achieve solar power potential in India. The 100 GW target for 2022 may be too ambitious but there should be no doubt that solar is the right technology for addressing many of India's energy sector woes—cost, access, air quality and security. It has the potential to transform our economy, environment and the lives of hundreds of millions of our citizens.

If prices keep falling even at a reduced rate of 5-7% per annum, as is widely believed, solar power will become vastly more attractive than other competing power sources. We could be looking at solar power at Rs1.50 per unit in a few years. Improvements in storage technology will solve the main challenge of intermittency. That will mean 24x7 solar power at attractive prices and no environmental burden. We are confident that long-term growth of solar power in India will be faster than most industry forecasts.

*Vinay Rustagi is managing director at Bridge To India. Comments are welcome at [theirview@livemint.com](mailto:theirview@livemint.com)*

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## From waste to health

Keeping cities clean is essential for keeping their residents healthy. Our health depends not just on personal hygiene and nutrition, but critically also on how clean we keep our cities and their surroundings. The proliferation of dengue and chikungunya are intimately linked to the deteriorating state of public health conditions in our cities.

The good news is that waste management to keep cities clean is now getting attention through Swachh Bharat Mission. However, much of the attention begins and stops with the brooms and the dustbins, extending at most to the collection and transportation of the mixed waste to some distant or not so distant place, preferably out of sight.

The challenge of processing and treating the different streams of solid waste, and safe disposal of the residuals in scientific landfills, has received much less attention in municipal solid waste management than is warranted from a health perspective. If we do not rise to the occasion to manage the waste that we generate and fail to create clean and healthy cities, we will face many more man-made disasters such as we have seen in recent months in Deonar, Bellandur, and Ghazipur.

One of the problems is that instead of focusing on waste management for health, we have got sidetracked into "waste for energy". In the process, we are opting for financially and environmentally expensive solutions such as incineration plants which are highly capital-intensive. While the National Green Tribunal (NGT) does not allow incineration of mixed waste, nor of any compostables or recyclables, enforcement is a challenge, and the danger to health from toxic emissions looms large.

If only we were to begin by not mixing the biodegradable component of solid waste (close to 60 per cent of the total) in our cities with the dry waste, and use this stream of waste for composting and biomethanation, the management of dry waste would also be made much easier through recycling and processing including by incineration of non-recyclables with appropriate filters to check emissions; scientific landfills will be needed for the little that remains.

City compost from biodegradable waste provides an alternative to farmyard manure (like cowdung) which has been valued from time immemorial for its rich microbial content that helps plants to take up soil nutrients. It provides an opportunity to simultaneously clean up our cities and help improve agricultural productivity and quality of the soil.

India's Green Revolution rescued us from huge dependence on food imports during droughts by using high-yielding varieties of seeds and chemical fertilisers to boost the productivity of food grains. But over time, excessive and imbalanced use of chemical fertilisers has led to severe deterioration in the quality of soil. Organic manure or compost plays a very important role as a supplement to chemical fertilisers in replenishing the nutrient-depleted soils. City compost can be the new player in the field.

Benefits of compost on the farm are well-known. The water holding capacity of the soil which uses compost helps with drought-proofing, and the requirement of less water per crop is a welcome feature for a water-stressed future. Because of good water retention, farmers do not need second or third sowing if rains fail. By making soil porous, use of compost also makes roots stronger and resistant to pests and decay. Farmers using compost therefore need less quantity of pesticides. There is also evidence to suggest that horticulture crops grown with compost have better flavour, size, colour and shelf-life.

City compost has the additional advantage of being weed-free unlike farmyard manure which brings with it the seeds of undigested grasses and requires a substantial additional labour cost for weeding as the crops grow. City compost is also rich in organic carbon, and our soils are short in this. Fortification of soil with organic carbon is an essential element of integrated plant nutrient management as it increases the productivity of other fertilisers. City compost can also be blended with rock phosphate to produce phosphate-rich organic manure.

Chemical fertilisers when used by themselves pollute surface water with nitrogen runoff because only 20 per cent to 50 per cent of the nitrogen in urea is absorbed by plants. The rest runs off into streams and lakes. The addition of compost or organic manure reduces nitrogen wastage, as its humus absorbs the nitrogen and acts like a slow release sponge. The superiority of a system of integrated plant nutrient supply (IPNS), which combines the use of chemical fertilisers with organic manure, was established as far back as 1989 by the Fertiliser Association of India.

Farmers clearly recognise the value of city compost. In most cities, waste transport drivers are bribed by farmers to dump reasonably biodegradable raw garbage onto their fields for making compost onsite for their own farm use. But uncovered and uncomposted raw waste heaps breed rats and insects which carry disease, and attract stray dogs which not only carry rabies but form hunting packs that kill nearby livestock at night. They are also notorious for dog bites and causing traffic accidents by day.

If city waste was composted before making it available to the farmers for applying to the soil, cities would be cleaned up and the fields around them would be much more productive. It would, however, require that delivery mechanisms be set up for the delivery of city compost to farmers.

Recognising the importance of organic manure for the balanced nutrition of crops and restoring soil health, the Supreme Court had directed fertiliser companies in 2006 to co-market compost with chemical fertilisers. However, this direction went largely unheeded. The Solid Waste Management Rules 2016 make the co-marketing of compost mandatory. To provide incentive for co-marketing to the fertiliser companies, in February 2016, the Government of India's Department of Fertilisers notified a policy to promote the use of city compost by offering Market Development Assistance (MDA) of Rs 1,500 per tonne on the purchase and distribution of city compost through the rural outlets of these companies. In 2017, the MDA scheme was extended to compost manufacturers on bagged compost.

The MDA scheme has not worked well because of its administrative complexity and it needs to be simplified. The high volume but low value nature of compost also makes it not so attractive for fertiliser marketing companies to promote its use. While compost manufacturers must meet the quality specifications laid down by the Fertiliser Control Order (FCO), it is equally important for fertiliser companies to make vigorous efforts to market city compost using their well-connected dealer channels and help develop this nascent sector.

It could well be that the companies would rather sell chemical fertiliser which is heavily subsidised. A possible solution in such a situation would be to find a way to make the payment of fertiliser subsidy to the fertiliser companies conditional on the co-marketing of compost. The state agricultural departments can also help facilitate the use of city compost through their widespread extension networks.

Assuming that urban India generates 70 million tonnes of municipal solid waste in a year, and assuming 15 per cent yield of compost, this would provide 10 million tonnes of city compost annually. Quite apart from cleaning up the cities of biodegradable waste, this would be a major and sustainable contribution to improving the health of our soil without further damage by excessive chemical inputs. What a marvelous transition from waste to health.

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**Minimum Support Price for Minor Forest Produce is launched Nationwide****Minimum Support Price for Minor Forest Produce is launched Nationwide****TRIFED Signs MoU with Amazon****Minister of Tribal Affairs Inaugurates National Workshop on Minimum Support Price for Minor Forest Produce**

Minister of Tribal Affairs Shri Jual Oram inaugurated the National Workshop organized by TRIFED on “**Minimum Support Price (MSP) for Minor Forest Produces (MFP) scheme – Taking it to the next level for a Fair and Equitable Deal to the Tribals**” Ministers of State for Tribal Affairs Shri Jaswantsinh Sumanbhai Bhabhor and Shri Sudarshan Bhagat were specially present to grace the occasion. Ms Leena Nair, Secretary, Ministry of Tribal Affairs, Shri Pravir Krishna, Managing Director, TRIFED and senior officials were also be present on the occasion. Senior level functionaries of Government of India from the Ministries of Tribal Affairs, Rural Development, Textiles, Forests and Environment and over 100 senior officers from all the States also participated in the day-long Workshop.



Shri Jual Oram, Minister of Tribal Affairs said that this workshop is a step to expand the horizon of the scheme of providing Minimum Support Price for Minor Forest Produce. This scheme is already implemented in 9 States and today it is expanded nationwide. This workshop will help to expand the scheme Nationwide. He also said that MFP collection centres should also be depots of daily requirements to sell items of daily need to the tribals. He said that after minerals, MFP could be the largest generation of revenue. He emphasised on the use of social media and new technology to help the tribes to sell their produces at best prices.

Shri Sudarshan Bhagat, Minister of State for Tribal Affairs said that Minimum Support

Price provided to Kisans have helped them overcome the vagaries of the market price fluctuations for their produce. Similarly providing Minimum Support Price for Minor Forest Produce will help Tribals for their progress and development. At present Minimum Support Price will be given for 24 Minor Forest Produce but gradually efforts will be made to increase the number of Minor Forest Produce.

Shri Jaswantsinh Sumanbhai Bhabhor, Minister of State for Tribal Affairs said that he is very happy about these type of workshops and this step will help tribals to develop in all their fields. Similar efforts were made by this Government for developing vulnerable people like women, villagers and poor.

Ms. Leena Nair, IAS, Secretary, Ministry of Tribal Affairs, Government of India said that This workshop is a clarion call for understanding the gaps in the scheme of providing Minimum Support Price to Minor Forest Produce and making course correction. She also said that this Scheme should be implemented through women's self help group because women play important role in this business. She emphasized that Haat Bazars must be strengthened.

Shri Pravir Krishna, Managing Director, TRIFED said that This workshop aims at expanding the horizon and taking it to all the States. MoU with Amazon is a step towards expanding the reach of the 'Tribe India' brand to next level to National & International markets through e-commerce.

### **TRIFED Signs MoU with Amazon: Marketing of Tribal Handicrafts Scaled-up for Empowerment of Tribals**

In order to have institutional support to marketing initiatives, TRIFED has formally signed an MOU with M/s Amazon Seller Services Pvt. Ltd for sale of tribal products through leading e-commerce giant [www.amazon.in](http://www.amazon.in) at a mutually agreed terms & conditions.

As a part of the MOU, exquisite authentic tribal art and craft items crafted and sculpted by tribal artisans from all over the country will be showcased on the online portal [www.amazon.in](http://www.amazon.in) for sale. The aim is to promote tribal handicrafts like handloom products, cane and bamboo products, tribal jewellery, Dhokra craft, tribal weaves and embroidery, tribal paintings etc by cashing in on the online retail space reach to boost sales.

All customers on [www.amazon.in](http://www.amazon.in) and the Amazon mobile shopping app have easy and convenient access to over 65 million products across hundreds of categories. They benefit from a safe and secure ordering experience, convenient electronic payments, Cash on Delivery, Amazon's 24x7 customer service support, and a globally recognized and comprehensive 100% purchase protection provided by Amazon's A-to-Z Guarantee. They can also enjoy Amazon.in's guaranteed one-day, two-day delivery, Sunday and Morning delivery on products fulfilled by Amazon

"TRIBES INDIA" showrooms managed by TRIFED, offer a wide range of Tribal Products from different parts of the country, which include Metal Craft, Tribal Textiles, Jewellery, Tribal Paintings, Cane & Bamboo, Pottery, Gifts and Novelties, Organic and Natural products sourced

from tribals at their places of habitats from higher Himalayas (Bhutia tribes in the Uttarakhand, Bodh & Kinnaura tribes in Himachal Pradesh) in the North and (Toda & Irula Tribes in Nilgiri Hills) in the South and from North Eastern States (Tangkhul Naga, Bodo, Konyak & Dimasa Tribes) to the desert of Rajasthan and Rann of Kutch (Bhil, Garasia, Rathwa, Gamit Tribes) in the West. There is fabulous collection of tribal paintings mainly Saura from Orissa, Gond from Madhya Pradesh, Warli from Maharashtra and Pithora from Gujarat.

From a single store in 1999 at Delhi, now TRIFED has established a chain of 42 retail outlets and tie-ups with 13 State level Emporiums. The idea is to provide opportunities to the tribal artisans of the country to market their products on a sustained basis. TRIFED plans to expand this network to other cities as well so as to provide a larger market for tribal products.

### **Background:**

A National Workshop on Minimum Support Price for Minor Forest Produce Scheme was organised by Tribal Cooperative Marketing Development Federation of India Limited (TRIFED). Tribals constitute 8.6% of our population. Minor Forest Produce is very important to tribals economy. There is lack of proper storage facility and logistics. It is, therefore, important for the Government to intervene for supporting them. The MSP for MFP Scheme provides a safety net for these tribals. Although the Scheme was launched in 2014 it had mixed result for various reasons. Some states did well but in several other States the Scheme is yet to take off. The State has to play the role of as active player and not remain a mere spectator. The Scheme needs to be taken to the next level through value addition and synergy with the programmes of other departments.

Minor Forest Produce (MFP) is a major source of livelihood for tribals who belong to the poorest of the poor section of society. The importance of MFPs for this section of the society can be gauged from the fact that majority of 100 million tribals depend on MFPs for food, fodder, shelter, medicines and cash income. It provides them critical subsistence during the lean seasons, particularly for primitive tribal groups such as hunter gatherers, and the landless. Tribals derive 20-40% of their annual income from MFP on which they spend major portion of their time. This activity has strong linkage to women's financial empowerment as most of the MFPs are collected and used / sold by women. MFP sector has the potential to create about 10 million workdays jobs annually in the country.

Government of India has taken a number of initiatives for socio economic development of tribals like introduction of Forest Rights Act, PESA Act and has been implementing schemes for development of MFP by providing financial support to State TDCCs and TRIFED for market development of MFPs. Recognizing the critical importance which MFP hold for tribals and its potential to create large scale employment opportunity thereby, helping in reducing poverty and increasing empowerment of tribals particularly women and poor people of the poorest and backward districts of the country, Govt. of India has now decided to introduce an ambitious scheme of providing fair price for the MFP collected by tribals through Minimum Support price (MSP).

The scheme has been started with the objective of providing fair price to MFP gatherers, enhance their income level and ensure sustainable harvesting of MFPs. The MSP scheme seeks to establish a framework to ensure fair prices for the produce collected by them, assurance of buying at a particular price, primary processing, storage, transportation etc while ensuring sustainability of the resource base. It is a holistic scheme for development of MFP trade and covers 24 non-nationalized / non-monopolized MFPs namely,

Karanj Seed, Mahua Seed, Sal Leaf, Sal Seed, Lac (Rangini & Kusumi), Chironjee, Wild Honey, Myrobalan, Tamarind, Gums (Gum Karaya), Kusum Seed, Neem Seed, Puwad Seed, Baheda, Hill Broom Grass, Shikakai, Guggul (exudate), Bael (dried & without crust), Nagarmotha, Palash Kesuda (Flower), Shatavari (dried), Madhunashini, Kalmegh, Tamarind (de-seeded).

The scheme is applicable for implementation in all the States across India. Any de-nationalized MFP / items removed from the purview of monopoly procurement in future will also qualify for coverage under the Scheme. Similarly, any nationalized / monopolized procurement MFP will disqualify for coverage under the Scheme. However, if any State willingly wants any nationalized items to be included in MSP, then it shall have to change its nationalized status accordingly.

Government of India has extended financial support for part of working capital requirement of State Implementing Agencies and also share losses, if any, with the State Governments in the ratio of 75:25. It is expected that State level agencies which were not participating in procurement process due to fear of incurring losses will now aggressively pursue procurement and marketing of identified items under MSP as they are assured of financial support as well as substantial sharing of losses. It is expected to increase quantum of MFP procurement substantially thereby benefitting tribal people. The Scheme also envisages training of tribal MFP gatherers on sustainable harvesting and value addition activities including facilitation for marketing of the produces so that natural resources can be optimally utilized in a sustainable manner.

The scheme seeks to institutionalize various medium & long term aspects of sustainable collection, value addition, market infrastructure development, knowledge base expansion of MFPs, market intelligence development etc. Strengthening the bargaining power of Gram Sabhas / Panchayats and their involvement shall also be addressed and taken care of during implementation of the scheme.

Ministry of Tribal Affairs, Government of India is the Nodal Ministry for implementation of the scheme which will announce Minimum Support Price (MSP) for the selected MFPs with the technical support from TRIFED. TRIFED will act as the Central Nodal Agency for implementation and monitoring of the scheme through State level implementing agencies. State designated agencies will undertake procurement of notified MFPs directly from MFP gatherers (individual or collectives) at haats notified procurement centers at grass root level at prefixed Minimum Support Price and ensure full & timely on the spot payment to MFP gatherers.

Value Addition assumes critical importance in ensuring remunerative prices to the tribals in the renewed approach. Two stage value addition would be the cornerstone for enhancing livelihood income of the tribals under the scheme. The grassroots level procurement is proposed to be undertaken through SHGs associated with Implementing Agencies. Convergence and Networking with other Govt departments / scheme shall be undertaken to utilise the services of existing SHGs, Aajivika etc. These SHGs shall be appropriately empowered to undertake the procurement operations on a scientific and systematic lines. The SHG members shall undertake preliminary value addition like cleaning, grading, drying & home level primary processing under the direction and supervision of State Implementing Agency. The stock after preliminary processing shall be supplied by these SHGs to the storage of State Implementing Agencies. For higher value addition of MFPs, Big Corporates shall be involved under PPP model. This PPP model will be based on utilising Private entrepreneur skills in undertaking processing as well as marketing of the produce and Central / State Government support in terms of creating infrastructure and providing enabling environment for undertaking value addition of systematic scientific lines. These will be sophisticated large value addition hubs managed by Private entrepreneur.

The entire operation shall be monitored through State level committee headed by Chief Secretary and district level committees headed by District Collector for effective implementation of the provisions of the scheme. The scheme will touch the lives of tribal people involved in collection of MFPs across all the States and help optimum utilization of natural resources in a sustainable manner. This scheme will be an important milestone in economic development of tribals.

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## Climate change is going to hit the Indian economy hard

The farm sector in India is in distress and several state governments have responded with loan waivers, which could affect their fiscal math and the ability to push capital expenditure at a time when the Indian economy has slowed significantly. This comes after India faced deficient rainfall for two consecutive years in 2014 and 2015. According to estimates, production of kharif crops in the current year is expected to decline by 2.8% because of an uneven monsoon. The possibility of such weather events is likely to increase in the future. And that means a serious challenge for a country like India where about 50% of the population directly or indirectly depends on agriculture for a livelihood.

An analytical chapter from the World Economic Outlook of the International Monetary Fund (IMF), released on Wednesday, highlights some of the damaging macroeconomic impact of weather shocks, particularly for low-income countries. The IMF notes that for the median emerging market economy, growth goes down by 0.9 percentage point in the same year because of a 1-degree Celsius increase from a temperature of 22 degrees Celsius. The impact on the median low-income developing country is even higher. What is worse is that the output doesn't recover quickly after a weather shock. Even after seven years, the per capita output is lower by 1% and 1.5%, respectively, for the median emerging market and the median low-income country.

Weather does not affect the agriculture sector alone, it affects productivity in general. Research shows that productivity starts declining strongly after peaking at an average annual temperature of about 13 degrees Celsius. Therefore, countries located in areas with higher temperature will face a disproportionate impact of global warming. Loss of output and lower productivity also affects capital formation, which has a bearing on medium- to long-term growth prospects.

The necessary steps to minimize the impact of climate change will have to be taken at both the individual country level and the global level. In order to reduce the impact of changing weather patterns, emerging market and low-income economies will have to build significant macroeconomic resilience.

The IMF, for example, notes: "The results suggest that having the right policies and institutions in place may help attenuate the effects of temperature shocks, to some extent. The instantaneous effect of a temperature shock is slightly smaller in countries with lower public debt, higher inflows of foreign aid, and greater exchange rate flexibility." India is relatively better off in this context, but it needs to preserve and further strengthen macroeconomic stability to be able to deal with such shocks.

Over the years, India has done well to reduce its dependence on the monsoon, which is evident from the fact that two successive years of drought did not result in runaway inflation. However, more needs to be done to enhance productivity in the agriculture sector. Financial losses can be reduced by higher penetration of insurance products.

Further, India can work on programmes that will help improve the quality of land and reduce the risk of climate change. In Ethiopia, for example, food and cash is provided to the poor who participate in local environmental programmes. This has resulted in reduction in soil loss and has increased the availability of water. India can perhaps use employment under the Mahatma Gandhi National Rural Employment Guarantee Act in a better way to enhance soil and water conservation. India also needs to strengthen its overall capability by investing in and adopting technology as the impact of climate change is not limited to agriculture. For instance, better use of technology can reduce energy consumption for air conditioning. A district cooling system is being constructed in Gujarat International Finance Tec-City. It will be interesting to see if this can be adopted in other

cities as well.

At the global level, a consensus was attained under the Paris Agreement to contain the rise in global temperature to below 2 degrees Celsius from the pre industrial levels. Advanced countries have also committed to provide financial assistance to developing countries to help cope with the impact of climate change. However, things are not moving as desired. The Donald Trump administration in the US is not keen on continuing with the Paris Agreement. This will damage the project substantially and a renegotiation will only increase uncertainty. It is also being reported that advanced economies may not meet their commitment of reducing emissions. The lack of will among industrialized economies to contain emissions is disappointing, and it could lead to consequences that go beyond the realm of macroeconomics. India would do well to prepare for the challenge.

*How can India reduce the impact of global warming? Tell us at [views@livemint.com](mailto:views@livemint.com)*

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**'India Playing a Leadership Role in Wildlife Management by Involving Local Communities': Dr. Harsh Vardhan**

**'India Playing a Leadership Role in Wildlife Management by Involving Local Communities': Dr. Harsh Vardhan**

### **India Hosts Global Wildlife Programme to Address Illegal Wildlife Trade**

In an attempt to address illegal wildlife trade across 19 countries of Asia and Africa, India is hosting the Global Wildlife Programme (GWP) jointly with World Bank and United Nations Development Programme. Union Minister of Environment, Forest and Climate Change, Dr. Harsh Vardhan will inaugurate the Global Wildlife Programme on October 2. Briefing mediapersons on the Global Wildlife Programme here today, Dr. Harsh Vardhan said that India is playing a leadership role in management of wildlife through involvement of local communities. Pointing out that no programme can succeed solely because of Government policies, the Minister said that peoples' participation at societal level can ensure its success. "Five crore people living around national parks and sanctuaries are working as partners in environment conservation", Dr. Harsh Vardhan said. The Minister pointed out that a 15-year National Wildlife Action Plan (2017-31), with a special focus on peoples' participation will also be launched on October 2. He emphasised that the Conference will act as a platform for knowledge exchange and coordination on the action taken on the ground to combat illegal poaching of wildlife and improve governance on wildlife conservation. Dr. Harsh Vardhan underlined the fact that the number of rhinos, tigers and elephants is in fact, increasing.

The Minister said that till now programmes and plans related to wildlife were focused on and around national parks and sanctuaries. However, the strategy and programmes will now be based on the landscape of the region. He added that the impact of such issues as global warming, climate change and disaster management on the people living around wildlife areas and on the wildlife will also be discussed.

Coinciding with the 'Wildlife Week', the theme of the Conference is - "Peoples' participation in wildlife conservation". The meeting will bring about strengthened cooperation between India and the 18 GWP countries in better management of wildlife habitats and minimizing human-wildlife conflict situations. It will also enable India to strengthen its enforcement mechanism to control illicit trade.

The GWP will hold discussions on management of wildlife habitat, securing sustainable community livelihood, enhancing enforcement, monitoring, cooperation to reduce wildlife crimes such as poaching and related threats. The Conference will provide an opportunity for India to showcase its conservation efforts through joint forest management, vana sanrakshan samitis, eco-development committees in and around Protected Areas.

The proposed outcomes of New Delhi Conference include: Reiterating Mahatma Gandhi principles to the world, as the Conference coincides with Gandhi Jayanti and UN International Day of Non- Violence on October 2, 2017; Take leadership in Wildlife Conservation by showcasing India's conservation models for Asiatic lion, single horn

rhino, tiger and Asiatic elephants; Consolidating “people’s participation for wildlife conservation”; Need to strongly address unaccounted black money generated through illegal wildlife trade at global market; Sensitise stakeholders like Governments, corporate, banks, public sectors, media, youth etc for investments in wildlife conservation and develop sustainable models for wildlife conservation thorough peoples’ participation in 19 GWP countries.

The meeting will host wildlife experts, leading practitioners across 19 GWP countries, government representatives from India’s forestry and conservation sectors, leading corporate associated with environmental and biodiversity conservation, civil society organisations and school children. The participating nations include – Afghanistan, Botswana, Cameroon, Ethiopia, Gabon, India, Indonesia, Kenya, Malawi, Mali, Mozambique, Philippines, Republic of Congo, South Africa, Tanzania, Thailand, Vietnam, Zambia and Zimbabwe. In addition, representatives of World Bank, United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP) and International Union for Conservation of Nature (IUCN) will also be present. Earlier, four similar Programmes had been convened at Gland (Switzerland), Hanoi (Vietnam), Nairobi (Kenya) and Liberville (Gabon). Led by the World Bank, the Global Wildlife Programme was initiated in 2015.

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