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1-15 JANUARY, 2017

Down To Earth

25 years

FORTNIGHTLY ON POLITICS OF DEVELOPMENT, ENVIRONMENT AND HEALTH

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TARIQUE AZIZ / CSE

REMEMBERANCE

SANITARY INSIGHTS

January 2, 2017, is the 15th death anniversary of Anil Agarwal, founder of the Centre for Science and Environment and *Down To Earth*. This year, as India steps up its sanitation campaign, we bring to our readers a selection of his writings on the subject

Karachi's Gandhi: the sanitary revolution

THE LATEST census has revealed a dramatic increase in India's urban population, especially in the population of its big cities. In 1981, there were 12 million-plus cities, there are 20 now. By the end of the century it is estimated that India will have the world's largest urban population. Managing the needs of this urban population in a cheap and effective manner will be an enormous challenge before India—perhaps the biggest ever. Sanitary conditions in urban India are appalling and fast becoming worse. Most state and city governments no longer even pretend to manage the problem. An official in the Union Ministry of Urban Development told us that except for the major metropolises, there were no funds to build new sewerage systems.

So what should be done? Without claiming to know many of the answers, we would suggest that

Pakistan's Akhtar Hameed Khan's approach be tried out. Give people the power to construct and manage urban services. To do this, participatory institutions will have to be developed at the *mohalla* level.

5 May, 1991

Investing science in mud, sewers and bikes

WE MUST find socially appropriate technologies for our urban settlements. Can we think in terms of mud buildings instead of brick and cement buildings? Can we think in terms of composting toilets instead of sewers and flush toilets? Can we think in terms of bicycles instead of cars? These technologies will be both equitable and sustainable for our society.

> **"Why don't we think in terms of composting toilets and, thus, stop polluting the Ganga and other rivers in India? It is indeed quite silly to keep polluting the rivers first with our sewers and then go around cleaning them, whereas human night soil can be recycled as manure"**

Let us take the question of housing. Both bricks and cement are extremely energy-intensive materials and demand mining the land. Even the bulk of our urban population cannot afford the cheapest, low-cost brick and cement building. Why don't we think in terms of mud buildings? Surely science and technology can improve mud buildings.

The question of sewers is similar. This is a technology that emerged during the colonial period in Europe. In India, however, its capital-intensity means that access to it is impossible. Nearly a third of our urban dwellers have no access to toilets, a third only to bucket-type latrines and a third to sewers. Even this last third is largely serviced by community toilets. In most Indian towns sewers are underutilised or choked.

Why don't we think in terms of composting toilets and, thus, stop polluting the Ganga and other rivers? It is indeed quite silly to keep polluting the rivers first with our sewers and then go around cleaning them, whereas human night soil can be recycled as manure. Cities can, in fact, become major human sources of manure and therefore, a source of nutrients and not just a drain on Indian croplands.

2 August, 1992

Planning for a mega-city

TO CITE just one example, a substantial part of Delhi's water ends up in flush toilets. The huge volume of wastewater thus generated demands massive public investments in sewage treatment facilities. Polluting technologies are usually cheaper because they externalise the health and resource management costs onto the society and the public. Flush toilets which use more water are, thus, more expensive than those which use less water. Is there not a need to reverse this price mechanism so that customers find it advantageous to purchase more environment-friendly and cost-effective technologies? Can Delhi impose a progressive and high sales tax on all flush toilets which use more water than those which use less? There is clearly a need to look at all natural resource-using and polluting technologies in this manner.

Can we also learn from the experience of Chennai and Chennai Refineries and create "sewage markets" in Delhi and the National Capital Region? Chennai's acute water scarcity has forced the refinery—which needs a regular supply of processed water—to actually buy sewage from the city's municipal corporation and then treat it, at its own expense, to obtain water. This experience shows that Delhi need not look to the central government or any foreign donor for reducing a large part of the current pollution load on the Yamuna. Industries can be made to invest not only in treating industrial wastewater, but also domestic wastewater. It all depends on the pricing and availability of water.

31 January, 1997

Thumbs up to conserving our rivers

THE GANGA Action Plan was mainly conceived to deal with the municipal sewage flowing into the Ganga. Industrial sewage treatment was supposed to be managed by the individual firms. But a number of economic problems were not adequately addressed. Treatment cost is high and many municipalities are not able to afford the costs. If the municipalities cannot pay for the operational costs of these treatment plants, river conservation programmes will only demand perpetual subsidies.

Only a very small section of the country's urban population benefits from sewerage systems and this section consists of the richest urban people. There is no reason that the government should subsidise this section. The high cost of sewerage systems means that only a small fraction of India's population will benefit from them. A large proportion of the urban population in India still uses the open environment for its ablutions.

It is an ecologically mindless technology too. Firstly, large reservoirs have to be built or large amounts of river water have to be diverted to supply cities with water that can be flushed down toilets and, then, this water accumulates in the form of concentrated sewage, flows into rivers and destroys the rivers.

It is, therefore, important to take a long-term view of India's strategy for human excreta disposal. Various alternatives are being tried out in different parts of the world, which do not use any water, or use very little water. Current research expenditures in this area are next to nothing.

15 August, 1997

Water: industry's new pet

THE SIMPLE assumption of private sector proponents is that if water is correctly priced, it would facilitate private investment and solve the water crisis in the developing world. This argument has many holes. Firstly, current water and sanitation technology, based on the flush toilet and sewage system, would make full cost pricing of water and sanitation services unaffordable by most in the urban South. It is important to recognise that private sector involvement cannot be only in the water supply business. This is just one small and profitable part of the water business. The real cost is in taking back the sewage and treating it to the quality needed for disposal in water bodies. This is the real "dirty" business. We know that sewage and drainage costs can be as high as 5-6 times more than the cost of water supply. And with increasing chemical pollution, water treatment costs are only going to increase.

The political economy of defecation is such that no democratic government will accept the hard fact that it cannot "afford" to invest in modern sewage systems for its citizens. Instead it will continue to subsidise the users of these systems, in the name of the poor, who would not be able to afford the systems otherwise. It is important to realize that almost all users of the flush toilet and its sewage system are the rich in our cities. Our political system today literally susbidises the rich to excrete in convenience. In fact we get a double subsidy.

> **"The political economy of defecation is such that no democratic government will accept the hard fact that it cannot 'afford' to invest in modern sewage systems for its citizens. Instead it will continue to subsidise the users of these systems"**

The logical policy would be to accept the cost and then impose differential pricing so that while the rich pay for the cost of the capital- and resource-intensive sewage and waste disposal technology, the poor pay for the cost of their disposal system, which is invariably connected to the seweage system and hence low cost. But this is easier said than done. ■

15 November, 2001

25 years

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Vol 25, No 16; Total No of Pages 80
Editorial, subscriptions and advertisements: Society for Environmental Communications, 41, Tughlakabad Institutional Area, New Delhi 110 062, Phone: 91-11- 29955124, 29956110, 29956394, 29956399 Fax: 91-11-29955879. Email: downtoearth@downtoearth.org.in
 Printed and published by Richard Mahapatra on behalf of Society for Environmental Communications. Printed at International Print-o-Pac Limited, B-204, 205, Okhla Industrial Area, Phase I, New Delhi-110020 india and published at 41, Tughlakabad Institutional Area, New Delhi 110 062.
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ON THE WEB

WHAT'S HOT

INTERVIEW

'A unique cropping system'

Down To Earth speaks to Vijay Jardhari, a Tehri Garhwal-based farmer and head of non-profit Beej Bachao Andolan, about Baranaja, a mixed crop farming practice in Uttarakhand. Baranaja is mainly used to grow kharif or summer crops, which mostly include millets and pulses. Baranaja ensures that the right amount of nitrogen is retained in the soil and, thus, maintains soil health. Other benefits include climate resilience. Baranaja, thus, provides food security to farmers.

VIDEO

Amma's far-sightedness

Down To Earth takes a look at the major welfare schemes implemented by late Tamil Nadu chief minister J Jayalalithaa. Among them are Amma Canteen, under which subsidised canteens were opened across the state; the Cradle Baby Scheme which fought against the skewed sex ratio; and rainwater harvesting, which helped alleviate Chennai's water scarcity. The schemes, though critiqued as populist, eventually resulted in Tamil Nadu having the best socio-economic indicators in India.

POPULAR

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Celebrating the diversity of mountain cultures

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Nitrogen pollution: the forgotten element of climate change

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Amma, we want some more

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ARCHIVE IN CONTEXT

As *Down To Earth* enters its 25th year of publication, we bring to you glimpses from our archives

Grace under fire

The giraffe, an icon of Africa's savannahs, is rapidly heading towards extinction, according to the International Union for the Conservation of Nature (IUCN). In the past 30 years, giraffe numbers have plummeted by 40 per cent, from around 157,000 in 1985 to 97,500 in 2015. The giraffe's IUCN Red List status has jumped two places, from "Least Concern" to "Vulnerable to extinction". *Down To Earth* had highlighted the decline in 2015: "Giraffe numbers have taken a dangerous plunge over the years without attracting as much attention as other equally threatened African mammals such as lions, rhinos and elephants." ("Neck deep in trouble", 16-30 November, 2015). With IUCN's findings, our worst fears have come true.

letters

Give the Donald a chance

This refers to the cover story "How Trump happened" (1-15 December, 2016). There is apprehension in certain quarters in America and in the rest of the world that the US may plunge into an uncertain future with President-elect Donald Trump at the helm. It is, however, too early to say so because Trump's gracious victory speech clearly reflects his optimism to govern the US by taking everyone along with him while vowing to ensure that none would be victimised on grounds of race, religion or nationality. Let us give him a chance.

K R SRINIVASAN
SECUNDERABAD

Down To Earth welcomes letters, responses and other contributions from readers. Send to Sunita Narain, Editor, *Down To Earth*, 41, Tughlakabad Institutional Area, New Delhi - 110062. Email: *editor@downtoearth.org.in*

Consumer's call

This refers to the editorial "Gopichand's healthy choice"(16-30 September, 2016). Why should we blame celebrities for endorsing harmful soft drinks? Instead, a mandatory warning, similar to the one on tobacco products—"Drinking this beverage causes obesity"—should be attached on soft drink bottles, whether big or small. The ball should be moved into the consumer's

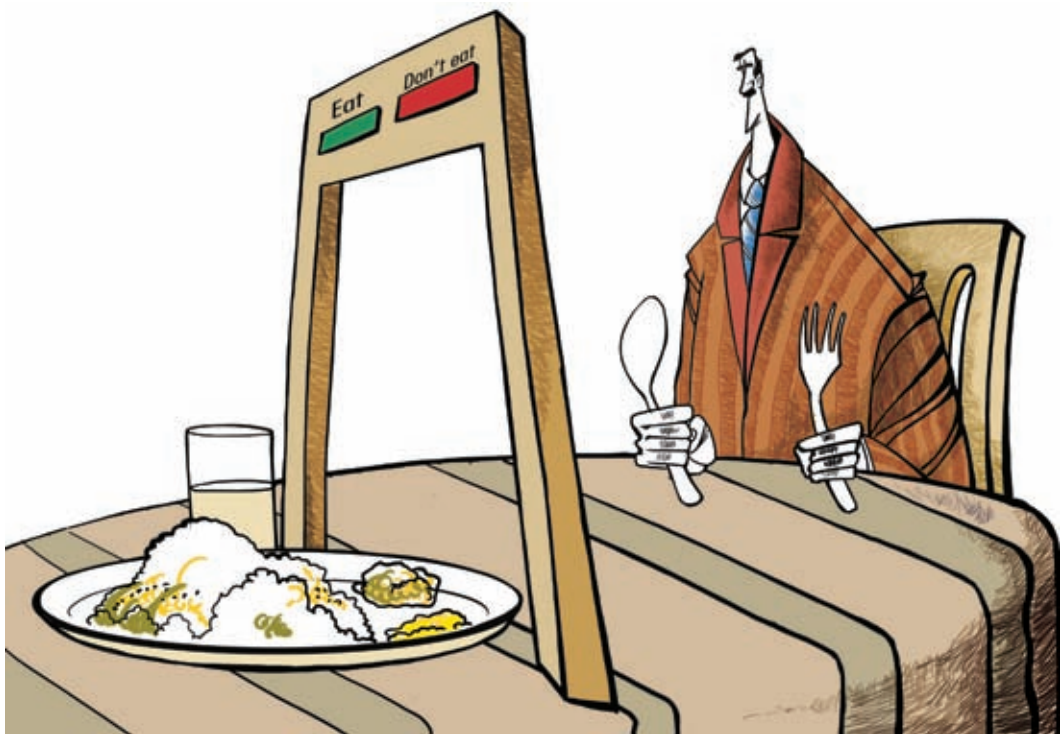
court. She/he should decide.

PRABHAKAR RAMAKRISHNA
VIA EMAIL

Conserve water

This refers to "A long walk" (16-31 March, 2016). With each passing day, we observe that water is becoming the biggest casualty of the modern development process. Rain, rivers and wells have been humanity's traditional sources of fresh water. Global warming upsets natural patterns of rainfall. Rivers are slowly killed at their sources by the steady destruction of

letters



SORIT / CSE

forests and construction of big dams. Wells lose water due to overuse of groundwater. Development cannot be reversed. But technology could be reoriented to serve the dual purpose of conserving water and regulating its use. Leaving aside global solutions, we should think of doing something about this issue at the national and regional levels.

VINOD DIXIT
AHMEDABAD

Meat gall

This refers to the opinion piece "Trouble with vegetarian fascists" (16-30 November, 2015). It is one of those typical elitist environmentalist articles, where one compares oneself to an ape while not living like one. We can't use all the luxuries of modern life and yet not look at less cruel methods to feed one self. And one always benefits by eating a plant-based diet as much as possible. I am aghast that when there's so much research being done on the benefits of vegetarian-based food, the author still has the gall to back a meat diet.

PADMAVATI
VIA EMAIL

Hanuz Dilli dur ast

The Delhi administration, instead of pointing its finger elsewhere, should work sincerely towards reducing pollution caused by its own sources ("Enough is enough",

http://www.facebook.com/down2earthindia

Have the authorities failed the victims of the Bhopal Gas Tragedy?

Yes, of course. So much time has passed. But the site of the disaster still has not been decontaminated. At least that should have been done.

RAY EVANS

The government—both Central and state, the Supreme Court, Parliament—all have failed the victims of the Bhopal Gas Tragedy, without a doubt.

PAWAN KUMAR

When after three decades, there is not even a shred of appearing to be sorry, you know that the victims have been left to their fate.

RITESH ANAND

Despite his actions having caused so much misery, no Indian government was able to catch, apprehend and extradite Warren Anderson back to India. Letting him escape itself shows the culpability of certain sections of the authorities. What more proof is needed to show that India has indeed failed the Bhopal Gas Tragedy victims?

MANZUR ALI

16-30 November, 2016). The introduction of the odd-even rule for vehicles, which was tried sometime back, did make some impact in reducing air pollution but this is not a permanent solution. The only solution is the public transport system of buses and metro rail that need to be expanded substantially. That would also reduce traffic congestion. We need experts to suggest practical ways of reducing air pollution and what could be done to minimise its impact on health of citizens for a long-term solution. People have a right to live in a pollution-free environment and it is the duty of the state to guarantee that.

D B N MURTHY
BENGALURU

✉ "Enough is enough" is a mortifying narrative of the world's largest democracy's capital city. The government can save Delhi by taking both, immediate urgent steps as well as long-term drastic measures. Controlling the movement of personal vehicles by the odd-even formula, banning diesel SUVs and cars, "one family-one vehicle" registration, boosting cycle use and subsidising electric cars are some of the immediate urgent steps.

However, Delhi can only be saved from doom if sagacious, long-term steps are taken. The steps must be taken with the consesus of all political parties to solve Delhi's pollution. Important steps can be shifting all thermal power plants in the city to distant locations, converting some of them into nuclear power plants, developing sustainable solar energy, enforcing segregation of household refuse, developing hydrogen-fuelled vehicles and banning fire crackers.

In addition, the boundaries of Delhi should be defined and no more colonies should be allowed to be added to the city. Instead, a well-protected green belt of 1-km width should be developed around Delhi wherever land is easily available.

L R SHARMA
SUNDERNAGAR

✉ The buck cannot just be passed on to the authorities. The masses living in Delhi are to blame too. Schemes in the past, which aimed at ameliorating the city's air quality got defeated since they did not enjoy support of the people (with the exception of the odd-even scheme). And why would the people of Delhi support any schemes? After all, they themselves are the contributors to air pollution, with their busy lives and growing number of vehicles on the road. The citizens' desire to live in a "modern city", which has the latest facilities like power supply and housing for instance, causes more trees to be cut. If there is such public apathy, then scenes like the "post-apocalyptic" one (as *Down To Earth* calls it) on October 31, 2016, will be the inevitable result.

JAYANTA TOPADAR
DHEMAJI

VIKAS CHOUDHARY / CSE

THE PEOPLE'S ENVIRONMENTALIST

Anupam Mishra nurtured India's environmental movement and environmentalists

SUNITA NARAIN

ANUPAM*JI* WAS the last of that generation that taught India its politics of environment. He was the man who went to Chipko, took Anil Agarwal, founder editor of this magazine, to Chipko, and brought back the story that the movement was not about trees but about the political determination of people to fight for the environment because it was a matter of their survival. He made us understand the true politics of environment, which is the politics of the poorest in this country, their knowledge, forgotten and neglected, and how that has to be part of development.

I remember vividly, as if it were today, my journey with Anupam*ji* and Anil into the desert of Rajasthan. We were travelling in Anil's red Maruti car, and the three of us stopped on seeing a flying saucer-type image in the desert. They got off from the car and talked to a person from the nearby village and found out that it was not a flying saucer, but a temple of modern India. It was a water-harvesting structure built in a way to collect every drop of water received in that water-scarce area. From there, I know, Anupam*ji* did not look back. He had brought us to show the work of a young activist in Bikaner, who, he said, had been doing remarkable work to protect the grasslands for cattle. This activist, who, we learnt, was Shibu Patwa, has continued his good work and is one of those gems that Anupam*ji* had found. Anupam*ji*'s entire journey was to locate the gems of India: people who were doing work without fame, without noise, without any fanfare, just real good work. Anupam*ji* found them, nurtured them and worked with them. Today, many activists, including myself, can look back at our journey and see what an important role he played in our lives. How he cautioned us and advised us, how he made us stay true to our mission. He was the guiding philosopher that we all need in our lives and I know of countless grassroots activists in this country who are what they are today because of Anupam*ji*.

But his most important achievement, I believe, will remain the work he did on tanks in India. If you look at the two books on the subject by him, they are not about the structure of the tank, but about the society that made the tanks. For him it was the story of the society that needed to be taught because that story teaches us about the need to rebuild a resilient, caring and humane society that would once again build its water bodies.

TARIQUE AZIZ / CSE

ANUPAM MISHRA (1948-2016)

I remember, he used to narrate stories about a sex worker who built tanks in Rajasthan, about a Maharaja and a trader who too built tanks. For him it was always about people.

Anupam*ji* has taught us that the environmental movement is not about technology, trees, tigers or bees. It is only about people and the humanness of society. If we want to remember him, let's remember that. ■

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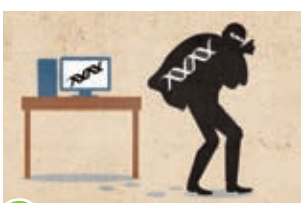

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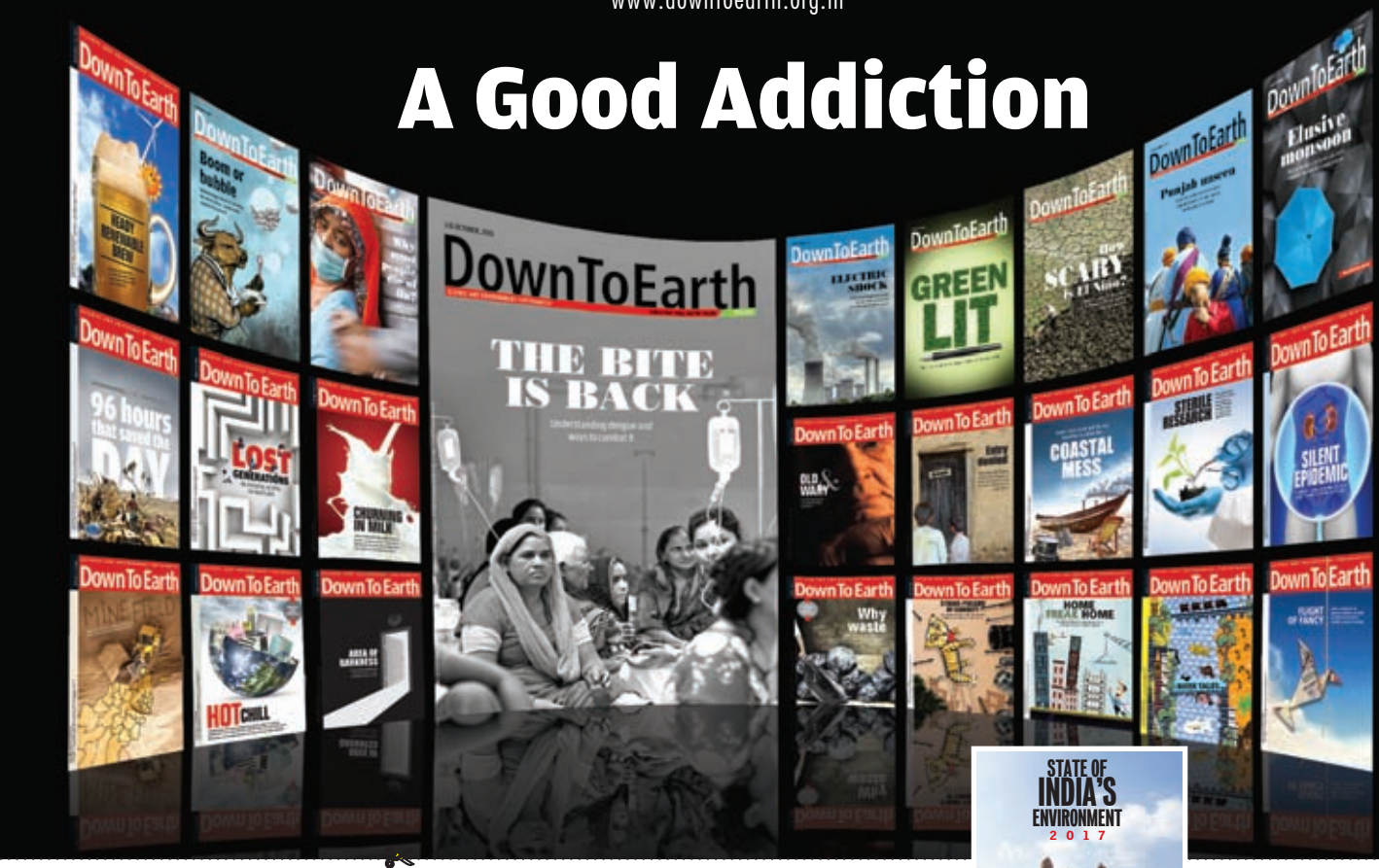

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CROSS HAIRS

Global methane emissions growing

AN INTERNATIONAL study has revealed that while carbon dioxide emissions have flattened out in recent years, global atmospheric levels of methane are increasing faster now than at any other time in the past two decades. According to the research, methane concentrations in the air began to surge around 2007 and grew precipitously in 2014 and 2015. Concentrations in 2014-15 shot up by 10 or more parts per billion annually. This is in stark contrast to the early 2000s when methane concentrations crept up by just 0.5 parts per billion on average each year. Agriculture, increasing livestock and fossil fuel exploration could be the reason, say scientists. ■

POINT

648MW

The capacity of the Kamuthi solar power plant in Tamil Nadu, the world's largest. It started operations on November 30, 2016

Source: Adani Group

1,000 WORDS BY VIKAS CHOUDHARY

FOR A CLEANER TOMORROW Women of Salvahan village in Himachal Pradesh's Mandi district check the water in a village tank. The women are members of a self-help group that works to keep the village clean. Their group has been formed as per an initiative by the district collector under the aegis of the Swachh Bharat Mission. They are required to do at least two sanitation activities in a week which could include anything from checking samples of drinking water, sweeping roads to segregating waste into recyclable and organic constituents and managing dustbins.

Squid may become favourite UK meal as seas warm up

THE TRADITIONAL British fish supper could be replaced by squid as waters around the island grow warmer, say government scientists. Fisheries data has revealed that squid and warm-water fish such as sardines and anchovies were flourishing around the North Sea. Squid are now being caught at 60 per cent of the North Sea's survey stations, compared to 20 per cent in the 1980s. Meanwhile, cold-water fish species like cod are heading north, towards Norway. Currently, squid catches off the UK are exported. But John Pinnegar of British government agency Cefas, which has been monitoring North Sea fish populations for more than 100 years, told the British Broadcasting Corporation that British consumers were likely to switch over to squid in the future. ■

Delhi's *mohalla* clinics popular among residents: *Lancet*

BRITISH MEDICAL journal, *The Lancet* has noted that the Delhi government's *mohalla* clinics scheme of walk-in clinics in the city's neighbourhoods —which aims to provide better primary care coverage in the national capital— is proving "popular" with residents. The journal's report said that Delhi has a fragmented healthcare system run by multiple state and Central government agencies, municipal corporations, as well as private players. Although *mohalla* clinics have added another layer to the existing system, they offer key advantages, the journal said. "They provide an assured package of services, facilitate access to basic

services, with potential for referral linkage, and make it all affordable by reducing indirect costs like travel and lost wages," said Chandrakant Lahariya, a public health specialist involved in designing the concept. There are 106 *mohalla* clinics in Delhi and 1.5 million patients visited them in the past year. ■

IN FOCUS

Goodbye Garden City

CREATIVE COMMONS

If the Karnataka government's latest bill gets the governor's nod, Bengaluru could lose its status as a "Garden City".

The Karnataka government has decided to reduce open spaces and parks to 10 per cent of the area in future layouts. The Karnataka Urban Development Authorities Bill also seeks to reduce the area to be earmarked for civic amenities to just five per cent.

Environmental activists have demanded a change in the rule to increase open spaces to 15 per cent in private layouts to be on par with layouts formed by government bodies.

The ruling Congress party has, however, defended the plan saying it is to help make owning land more affordable.

Activists and opposition parties are now exploring various options to try and stall amendments to the bill.

IN COURT

On December 2, the National Green Tribunal (NGT) banned the use of disposable plastic in Delhi with effect from January 1, 2017, and directed the city government to take steps to reduce dumped waste.

On December 14, the Gujarat High Court issued notice to the state government, seeking details of authorised leases and steps taken for stopping illegal mining of sand in riverbeds across the state.

On December 2, the Bombay High Court granted permission to the Mumbai Metropolitan Region Development Authority to cut mangroves as part of the Mumbai Trans Harbour Link that will connect Mumbai with Navi Mumbai.

On December 7, the Centre told the Delhi High Court that it had decided to allow the continued use of 51 of the 67 pesticides that have been banned globally, based on the recommendations of an expert panel. It also informed the court that of the 51, the status of 27 pesticides would be reviewed in 2018.

On December 2, the Odisha government filed a suit in the Supreme Court under Article 131 of the Constitution against what it called "Chhattisgarh's illegal action in unilaterally planning and constructing projects and barrages in the upper catchment of the Mahanadi River". It sought an injunction on the projects.

On December 14, NGT restrained the state government from proceeding the Palamuru Rangareddy Lift Irrigation Scheme till January 17. The court's order came after a petitioner convinced it that the government did not have forest clearance for the project.

SO FAR...

Total cases on environment and development tracked since January 1, 2016, till December 14, 2016

SUPREME COURT	HIGH COURTS	NATIONAL GREEN TRIBUNAL
100	145	671

Compiled by DTE-CSE Data Centre. For detailed verdicts, visit *bit.ly/1CIFrcf*

Reindeer 'shrinking' due to climate change

CREATIVE COMMONS

A BRITISH study has revealed that the average weight of reindeer is shrinking due to climate change. Between 1994 and 2010, the team behind the study tracked reindeer in Svalbard, in the Norwegian Arctic, catching, marking and measuring 10-month-old calves every winter and returning the following year to recapture and note the animals' size and weight. By the time they reached adulthood, reindeer born in 2010 weighed just over 48 kg, compared to 55 kg for those born in 1994—a drop of 12 per cent. The researchers blame climate change for the shrinking reindeer. With warmer winters in the Arctic, there is more rain, which falls on snow and freezes. The ice prevents reindeer from getting to the lichen, a fungus, which comprises the bulk of their winter diet and for which they usually forage in the snow. The reindeer starve, aborting their calves or giving birth to much lighter young ones. ■

VERBATIM

"This 'financial Pokhran' will bring a paradigm shift, but it requires a very different mindset to understand and articulate"

– S Gurumurthy, RSS ideologue, on demonetisation

People of no land

Jharkhand's decision to allow the use of tribal land for non-agricultural purposes could lead to mass displacement

JITENDRA | JHARKHAND

THE JHARKHAND government has achieved what even the British rule could not—complete alienation of the tribal population from their land. Amendments to the Chota Nagpur Tenancy Act (CNT Act) of 1908 and the Santhal Pargana Tenancy Act (SPT Act) of 1949, passed on November 23 by the Jharkhand Legislature, allow use of tribal land for non-agricultural purposes by the government. Earlier, the government could take over land only for public welfare activities.

In May this year, the government issued the Chota Nagpur Tenancy Act 1908 (Amendment) Ordinance and the Santhal Pargana Tenancy Act 1949 (Amendment) Ordinance, which led to widespread protests. There were three incidents of police firing in Ramgarh, Hazaribagh and Khunti districts in August and October, in which eight people were killed and over 20 injured. The Amendments regularise the Ordinances and are waiting President's assent to become a law.

"We don't know where we will go," says a visibly worried Gangia Devi, 65, sitting in the courtyard of her house in Baseria village of Hazaribagh. Flanked by mountains on three sides, the village does not have an accessible road. Her village is one of more than 20 villages that have to make way for a 1,980 MW North Karanpura Super Thermal Power Project being set up by the National Power Thermal Corporation (NTPC) at a cost of ₹15,000 crore.

Gangia Devi belongs to one of the 10 families of the Oraon tribe who live in the

MANOB CHOWDHURY

Mother of Pawan Kumar of Hazaribagh district's Sonbarsa village. Pawan was killed in police firing on October 1 during protests against changes in laws governing tribal land in Jharkhand

village. In the past 55 years, these families have been relocated twice for "developmental" reasons. Both the times the families were not rehabilitated by the state and had to find a new home on their own.

"In 1959, we were displaced from Ranchi after our land was given to the Heavy Engineering Corporation. We shifted to Patratu, 40 km west of Ranchi," says Dinesh Minj, a resident of Baseria. "The second time we had to move was in the 1970s for the construction of Patratu dam and we moved to this village. But only 10 families shifted to this village; the rest moved to different areas in surrounding districts and have been separated for good," he adds.

Minj says he now understands why the government has not been issuing residential and income certificates to them since 2008. "We have already been made homeless in official records," he says.

The preparation to evict them started after 2004 when the Union government allocated NTPC captive coal blocks for the power plant. But instead of resolving their problems, on November 2, Jharkhand Chief Minister Raghubar Das asked his party members to convince the people that the Amendments are for their own good. Now the President of India has to give accent to these Amendments before they get implemented because Jharkhand comes under the Fifth Schedule of the Constitution which provides for the administration and control of Scheduled Areas and Scheduled Tribes.

What has changed

Under the SPT Act, no transfer of urban or rural land is allowed. It can only be inherited. The CNT Act is a little more lenient and allows transfer of land within the same caste and geographical limits, but with the approval of the district collector. But the Amendments allow the use of agriculture land owned by schedule tribes, schedule castes and other backward castes for industrial and commercial purposes. The addition of Section 21 (B) in the CNT Act and Section 13(A) in the SPT Act by the Amendments allow the state government to frame rules from "time to time" for non-agriculture use of the land in the given geographical areas. Experts say the changes allow easy transfer of land through the backdoor. "The use of 'time to time' wording clearly shows malafide intention of the state government. For instance, two years from now the government might decide that a hotel is needed for the development of an area, and sell land to a private developer," says Stan Swamy, a Ranchi-based social activist who works for tribal rights.

Jharkhand is organising a global investor summit in February. The chief minister has boasted of having a land bank of 334, 207 ha in 10 districts of the state

In the name of investment

These changes, the state government says, will improve the investment climate in the state. Jharkhand is organising Global Investor Summit Jharkhand 2017 in February. The chief minister himself has been doing road shows in Mumbai, Bengaluru, Hyderabad, Kolkata and Delhi since September and has boasted of having a "land bank "of 334, 207 hectare (ha) in 10 districts of the state. This is almost 5 per cent of total area of the state and more than twice the area of Delhi. The land pieces include government land and forest land in cities including Adityapur, Bokaro and Ranchi, and the Santhal Pargana Industrial Area.

"These belong to the government and were listed on the website of the land revenue department in April this year for industrial use," says Rajeev Ranjan, Director, Department of Revenue and Land Reform, Jharkhand. Top officials of the state government have contacted 45 foreign embassies and even made trips to many western countries to invite investments. As per the government's estimates, the target is to attract investments of around ₹2 lakh crore by the summit.

Moreover, addressing industrial tycoons during road shows in Mumbai in September, the chief minister claimed that the state has acquired an additional 71,000 ha after the amendment of the CNT and SPT Acts, says Swamy.

Fudging the records

Swamy, who has studied land records of several districts of the state, says, "In Khunti district, for instance, records show that practically all the land, except the family-*patta* land, has been marked as *gairmajurwa* ("land without a labourer" or government

'Rethink the changes'

BABULAL MARANDI, the first chief minister of Jharkhand, says the changes in the Chota Nagpur Tenancy Act and the Santhal Pargana Tenancy Act are against the will of the people. Excerpts from the interview

How do you see the proposed changes?
All the proposed changes are against the will of the people. The government has been taking land even without amending the Acts. The tribal people are not against construction of railway lines and six-lane roads. People even made sacrifices by giving their land at low rates.

But you were the first chief minister to propose changes in these Acts. How are these changes different from yours?
I always preferred to take the people into confidence before passing a law. You should know their basic needs. Why are people of Jharkhand afraid of giving their land? They would rather give their life. A treatment without correct diagnosis can kill the patient. Acquisition of land by the government and private players at cheap rates for mining will cause mass displacement without adequate compensation. Time has come to think over the proposed changes. Methods used for acquisition and compensation earlier cannot be applied now. No one wants to give land. We have to think of a new approach. Many decisions of the Supreme Court and high courts also said that there should be participation of land owners in the profit. I do feel there should be 50 per cent of partnership of landowners in the mining. Then no one will protest.

For full interview, log on to *www.downtoearth.org.in*

Lost ground

From the colonial times, governments have encroached upon the land rights of tribal population living in eastern India

1855
Santhal tribes in western part of what now constitutes Jharkhand revolted against the exploitative British rule after decades of suffering

1855
After the uprising, a separate district created by Act XXXVII of 1855 to appease Santhals and to give them a sense of security. Their land will never be transferrable, says the order

1874
Two Scheduled Districts—Chota Nagpur and Santhal Pargana—created in Bengal presidency after another uprising

1908
Chota Nagpur Tenancy Act (CNT Act) passed to prevent alienation of backward castes and tribes. The Act was prepared by J B Hoffmann, a missionary who spent more than a decade studying the land governance system of the Munda tribe

1938
First Amendment of the CNT Act. It allows transfer of tribal land within police stations among tribal people as gift, sale or transfer

1949
Santhal Pargana Tenancy Act (SPT Act) passed

1969
The CNT Act amended second time to allow compensation of usurped tribal land. This encouraged encroachment of tribal land by non-tribal people, who were not removed but escaped by paying for the land they encroached on

1990
CNT and SPT Acts included in 9th Schedule of the Constitution to exempt them from judicial review

2016
CNT and SPT Acts amended to allow non-agricultural use of tribal land

MANOB CHOWDHURY

A protesters' camp destroyed by the police in Chiru Barwadih village of Hazaribagh

land). But there can never be a *gairmajurwa* land in villages of Khunti district because all the villages are designated as *Mundari Khuntkatti* in government records. These are the villages that have been inhabited by people of the Munda tribe for ages. They either belong to individual families or the village community."

"Last year the state government started a scheme to make developmental plans at the village level and panchayat levels and engaged with people. This allowed the government to survey the area at micro level," says Faisal Anurag, a Ranchi-based journalist, writer and activist. But people involved in the process now realise that all this was being done to find out the details of community land, rivers and forests.

"We were so excited about being part of the planning process and helped in filling up the survey documents," says Sameer Tapon, a tribal youth from Khunti, who is on the run after police booked him for protesting against dilution of the CNT and SPT Acts. Another tribal activist, Tarkan Munda of Kurapurti village in Khunti, says that they have given up their land for construction of hospitals and roads but still the government says they are hindering development. "How did the government make all the four-lane roads, hospitals and schools if we did not give our land?" he asks.

Swamy estimates that around 20 per cent of the area that now constitutes Jharkhand has been diverted for development of mines and dams since Independence. "Around 1.6 million ha of the state's total area of 8 million ha has been diverted since Independence. It has caused displacement of around 4 million people," he says. The first chief minister of Jharkhand, Babulal Marandi says that there is a need to rethink the acquisition method. "Methods used for acquisition and compensation earlier can't be applied now. No one wants to give land. We have to think of a different approach," Marandi says.

Eighty-eight-year-old Johan Nag of Bichaguttu village in Khunti district says that his grandfather, who fought along with Birsa Munda, a tribal leader belonging to the Munda tribe, against the repressive British agrarian policies, told him that Birsa foresaw this scenario. "Never be complacent about your rights. This battle would have to be fought again and again," Nag quotes Birsa Munda in the words of his grandfather.

The prophecy, it seems, has come true. ■

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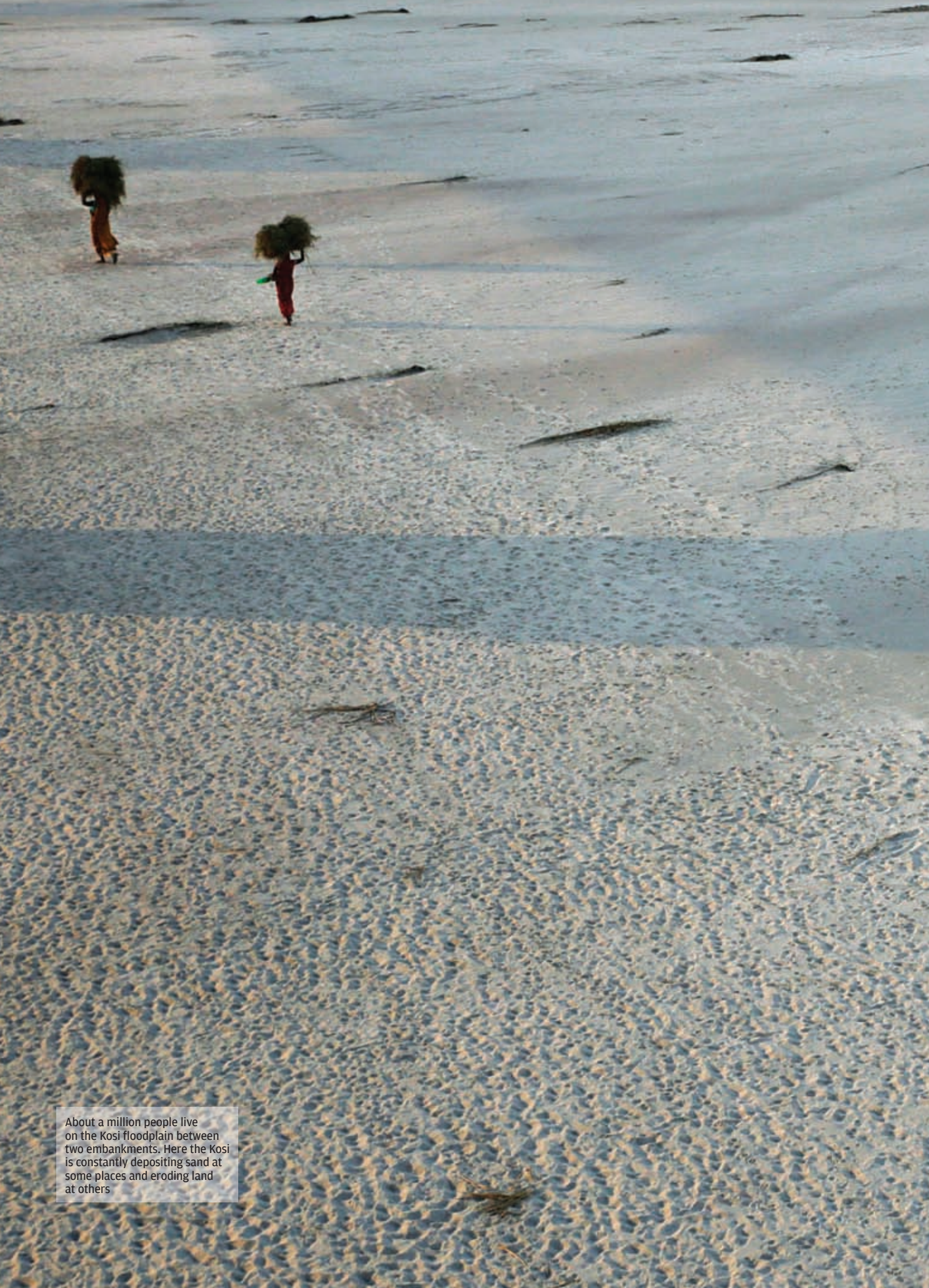
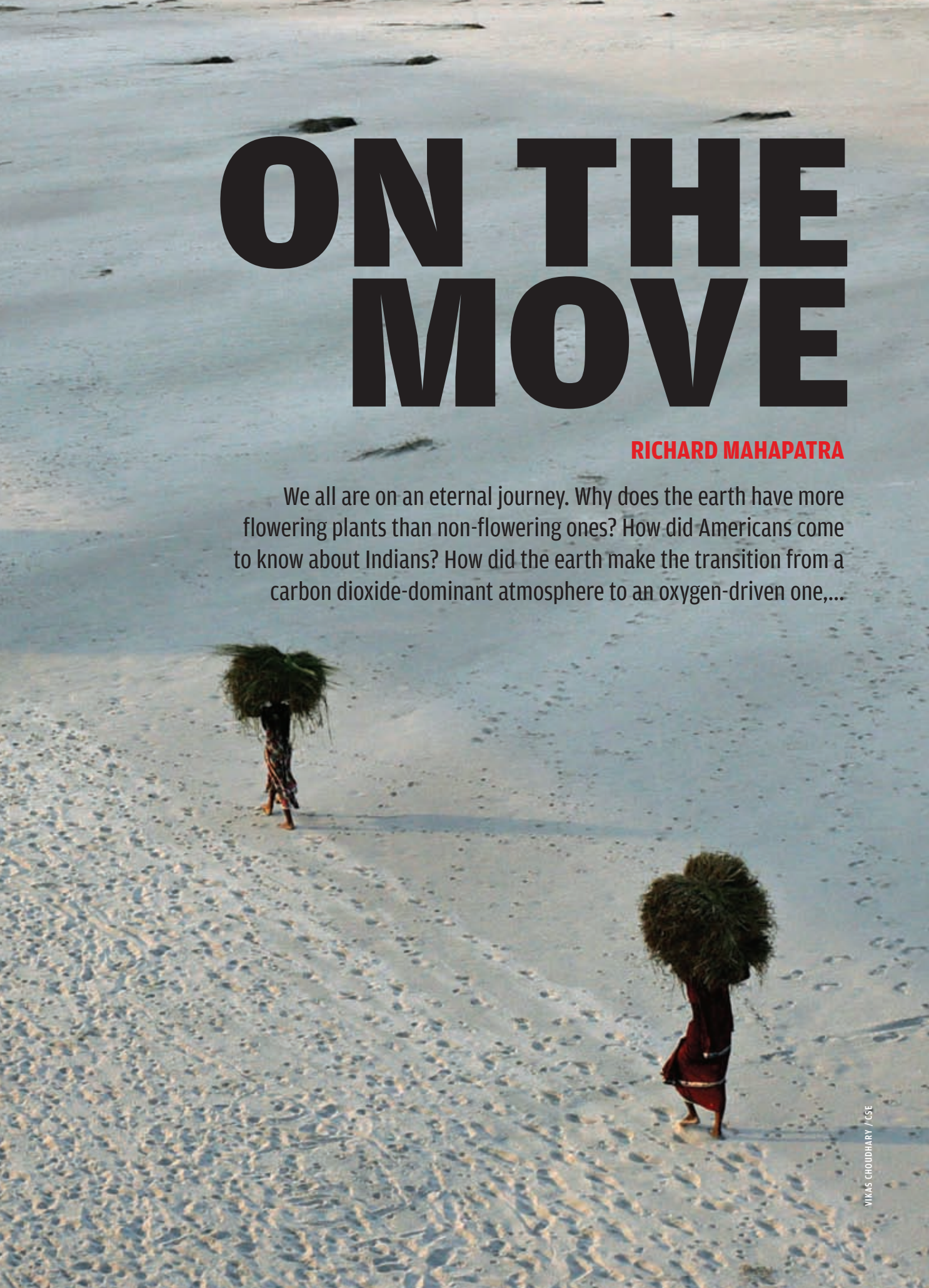


About a million people live on the Kosi floodplain between two embankments. Here the Kosi is constantly depositing sand at some places and eroding land at others

ON THE MOVE

RICHARD MAHAPATRA

We all are on an eternal journey. Why does the earth have more flowering plants than non-flowering ones? How did Americans come to know about Indians? How did the earth make the transition from a carbon dioxide-dominant atmosphere to an oxygen-driven one,...



VIKAS CHOUDHARY / CSE

...making life possible? Why do the actions of a few women in a remote Indian village become a statement on unique Indian environmental consciousness? There are millions of such questions that we raise every day. We have found answers to most of these questions. But who exactly found the answer for us? There are individuals and innumerable endeavours that constantly search for answers to millions of such questions. And what is common among them is a simple but profound activity: journey.

Everybody makes a journey. Knowingly or unknowingly. But it is not a sovereign individual activity. Every journey has an impact and it contributes a bit to unravel part of our mystical existence, an inherently ecological experience. If the bees and birds didn't make their journey, we wouldn't have had more flowering plants. We call it the process of pollination; the birds and bees wouldn't have done it deliberately except for their simple pursuance of food. But it led to a fascinating world of flowers and the great human desire to colonise the knowledge. Similarly, at the bigger landscape of the universe, if the solar systems didn't travel, thus, embarking on a journey to be deciphered billions of years later, life wouldn't have happened on earth.

Every journey has an impact and it contributes a bit to unravel our mystical existence, an inherently ecological experience

Thus, journey is not simply travel with a beginning and an end, and, of course, an objective. Our every step is somehow an unacknowledged tug in the process of evolution.

In this special edition of *Down To Earth*, our writers have tumbled into this world of journeys. Being a development and environment fortnightly, we need not undertake a journey as a tourist like many of us do during holidays. But what our writers have done is to trace back journeys of significance in various ecological regions. One way, they are the chroniclers of great journeys that fascinate, and have arguably redefined our perceptions of many things. For example, the Chipko movement in the Himalayas. It was a 20th century journey of women who just wanted to tell the world that they have certain rights they don't want to part with. How it came to be known as an environmental movement is the journey our writer has tracked.

For a country with 65 per cent of its population below the age of 35, this special edition is crucial to understand how the contemporary discourse on development evolved. For our readers, it is a journey to know of others' journeys, still ongoing, that have impacted our lives. So, it is not only that we all undertake a journey, but we are also companions in everybody else's journey. We call it the ecosystem.

ARCHANA YADAV
Rivers mirror our lives. As with rivers, we have to remove the constricting embankments of "learning" that shrink our horizons to allow a natural flow of life

VIBHA VARSHNEY
We believed that people in the harsh land of Rajasthan must be spending long hours in search of food. But their journeys are short and they preserve the food to last the whole year

JEMIMA ROHEKAR
Silent Valley National Park reinforces the fact that forests and their resident biodiversity are our greatest wealth

SNIGDHA DAS
A movement cannot have an impact until people realise the need for it. But once the immediate objective is achieved, people may forget why they had embarked on it. So a movement must never cease

SRESTHA BANERJEE
The people of Bastar seem to nurture life in death. One can paint tombs so beautifully only if there is hope

Through a narrow path

An engineering folly unfolds over a week-long journey along Bihar's Kosi river, a tempestuous tributary of the Ganga

BY ARCHANA YADAV

PHOTOGRAPHS: VIKAS CHOUDHARY

The Kosi carries a large amount of silt and sand. The sediment deposited on the riverbed impedes its flow, so it frequently erodes its banks and carves a new channel

I **STAND OVER** the Kosi barrage in Nepal that squeezes the river to a kilometre's width as if between two fingers, just before it enters Bihar. On one side, a few fishermen are catching fish in its slaty water. The fish, no bigger than the size of a palm, twist and flip as they are removed from the fine net and tossed into the boat. On the other side, boatmen are collecting wood that has drifted there from the forested hills of the Himalayas.

It gives me a kind of thrill to be aware that the water flowing under my feet carries snow-melt from peaks as high as Mount Everest and Khangchendzonga. The Kosi originates in Tibet. Even before the Himalayas rose 70 million years ago, the Kosi's tributaries flowed into the prehistoric Tethys Sea. The Himalayas gave it a catchment of amazing diversity. Ajaya Dixit, a water expert in Nepal, explains it thus: "As the crow flies, about 150 km from north to south the catchment covers six geological and climatic belts varying in altitude from 8,000 m to just 95 m: the Tibetan plateau, the high Himalaya, the midland hills, the Mahabharat range, the Siwalik range and the Terai ... Eight peaks over 8,000 m high, including Sagarmatha [Everest], are in the Kosi catchment as are 36 glaciers and 296 glacier lakes."

It is a large catchment and the hills are mostly loose soil. When it rains this soil is easily eroded and quickly carried down steep slopes. As the river debouches from the foothills, 50 km upstream of the barrage, it spreads the silt and sand in the shape of a huge fan. This megafan, about 180 km long and 150 km wide, is the floodplain I intend to traverse along the Kosi in north-east Bihar.

'Wrinkles on the forehead of pleasure'

Today, the river is confined within embankments built by 1959 to prevent floods. The earthen bunds extend like two long arms, 10 km apart, on both sides of the river. Every kilometre, spurs jut out from the bunds to protect them from the Kosi's current.

We enter Supaul district. It is late October. Bright green paddy fields, dotted with thick clumps of bamboo, extend for miles outside the embankments. In ponds formed by undrained water, women and children are scooping out clay to give a fresh coat of mud to their houses before Diwali. Some are drying *pater* (reed) or dragging soaked *patsan* (jute plant) out of the ponds. For a good stretch west of the main stream, one can see vast expanse of *kans* (wild sugarcane) in full bloom.

Ghonghepur village of Saharsa lies outside the western embankment of the Kosi, yet for most part of the year it remains surrounded by water. A large area between the Kosi and its tributary Kamla Balan is waterlogged, though it is "protected" by embankments

The idyllic picture is distorted as soon as one begins talking to the people. In Supaul town close to the river, I ask an old man, Ramesh Jha, about his memories of the river. He sings me a song.

Haral-bharal chhal chhai baag-bageecha
Sona katora khet
Dekh-dekh mori aafat e hai
Sabre baalu ke dher
(Orchards full of greenery
Fields, a bowl of gold
In no time, to my misfortune,
All turn into heaps of sand)

The song goes on recounting the miseries inflicted by the Kosi. It is a testimony to the destructive power of the river notorious for flooding and frequently changing its course. The Kosi probably carries the maximum amount of silt after the Brahmaputra in India, Dinesh Kumar Mishra, an engineer-turned-flood control campaigner who has studied the rivers of Bihar for decades, had told me. The sediment deposited on the riverbed impedes its flow, so it frequently erodes its banks and carves a new channel. In just 225 years between 1723 and 1948, it swung 160 km westwards.

Jha is 80 years old but his memory is as vivid as spring. He recalls that the Kosi began flowing through Supaul district in 1938. "Before the Kosi appeared, this region was prosperous. Rivers of milk, not water, flowed here. The Kosi brought in its wake epidemics. If a person would die there would be no one to throw away the body."

"After the embankments were built, it turned into a jail. Earlier, the water would come and go. The land remained fertile. Now even those who have 50 *bigha* land inside the embankments buy food from the market."

"Where is pleasure? Wrinkles have appeared on the forehead of pleasure."

Life between spurs

A little north, in Kalyanpur hamlet of Saraigarh Bhaptiyahi block, Poonam Devi is trying to rescue some rice from half-ripe paddy in her courtyard. The Kosi is eroding the land she has leased for farming between the embankments, devouring the crop along with it. So she brought the paddy home before it was ready for harvest. "Now it will go to the cattle," she says, gathering the rice on the ground and keeping the stalks aside. "The Kosi leaves gashes in the land as deep as one-and-a-half bamboo poles. As the water recedes, as much as a *katta* (126 sq m) of land falls into the water at one go."

Kalyanpur lies between two spurs on the eas-

tern embankment. "My parents' village is outside the embankment," she tells me. "I was 16 when I got married. Now I am used to living close to the river." She is now 30 and has five children. Her husband is away in Delhi, doing odd jobs as a labourer.

As it gets dark, CFL bulbs are switched on in her house. Walls are of unplastered bricks and the roof is of bamboo. The floor is a raised platform of compacted river sand. The house is neat and orderly. I ask her if I can see it from inside. Her face lights up with a smile for the first time during our conversation. The entrance hall has a mosquito net on a *takht* (wooden platform for sleeping or sitting). Two curved bamboo trays for winnowing called *soop* are tucked into the bamboo ceiling. This room opens to the inner courtyard on the other side. This courtyard is surrounded by a temple hut, a storeroom, a kitchen and a bamboo wall. The temple is clean but bare. It has no idol or photo, only one earthen storage vessel over which she lights an oil lamp. In one corner she has grown brinjal and bitter melon. In the outer courtyard, on one side is a large hall, where her family sleeps along with the cattle. All this goes under water during the rainy months of July, August and September. "Then, we climb on to the embankment. We cook, eat and sleep there."

A market in a hole

The region is criss-crossed by embankments. From Saraigarh Bhaptiyahi one can see two more embankments within the embankments. Called guide embankments, these were built to direct the river through a narrow channel under the Kosi Mahasetu, a 2 km-long bridge. The Kosi's tributaries have their own embankments. Hopping from one embankment to the other leaves me disoriented. But Upendra Singh Kushwaha, a social activist who is accompanying me, is keen on showing me a market surrounded by embankments. He has a small paunch, dark face and an enthusiasm that comes from mingling with the masses.

On reaching Nirmali, I understand why he wanted me to see the market. Said to be the biggest market in Supaul, it was protected by throwing a ring of embankment around it in 1956. Today, the market looks like it is holed up in a ditch. The sand brought by the Kosi and its tributary Bhutahi Balan has raised the ground level outside the bunds. Kushwaha makes us descend into the hole to see a relic of a railway station inside till our vehicle gets stuck in its narrow street. When it rains, the water has to be pumped out of this hole.

Islands in a lake

As I enter Saharsa, bamboo becomes sparser. Paddy is gradually replaced by weedy grass and water hyacinth. Waterlogging becomes worse. Along both the embankments extend 3-4 km-wide strips of marshy land. Cattle are kept in jumbo mosquito nets. People have perched their houses all along embankments and spurs.

This is where river engineering has gone horribly wrong. The silt deposited over half a century between the two embankments has raised the riverbed. From the embankments it is evident to the naked eye that the river is flowing at a higher level. As a result, the river water seeps outside through the embankments, while rainwater and streams outside cannot enter the river. Rather than draining the area, the Kosi is sending its water back into it.

Two men from Kosi Sewa Sadan, an NGO, take me to the fields around Mahishi village outside the eastern embankment that were once called *sonbarsa*, meaning rain of gold, because of the

In some folk songs the Kosi is portrayed as a beautiful maiden who asks her lover to join her army. He has a huge spade, suggestive of the deep gashes the river makes in the land

ALONG THE TRAIL

A curious fact: The Kosi is formed by the merging of three major rivers—Sun Kosi, Arun and Tamor—which are older than the Himalayas.

For the palate: The region is known for fish and *makhana* (fox nut). One can sample a variety of small and medium fish, *pothi, kauwa, singhi, maangur, kabai, tengra,* or *dal makhani* (not butter but fox nut). They can also watch how *makhana* is grown and processed.

Good time to visit: After Dussehra in winters when water begins retreating. Expect greenery and clean air since industry is absent.

bumper harvest. "You look at the fields. It is all grass, not paddy. Cattle that eat this grass fall sick. Fish in this water are diseased," they say. "Once there used to be so much maize here that you could not take care of it. Now maize just refuses to grow here." Earlier, people would also sow different varieties of rice for different levels of inundation.

It is worse outside the western embankment. Here a vast area is trapped between the Kosi and its tributary Kamla Balan. Although this area is protected by the embankments of both the rivers, drainage and seepage are worse here. Fields are in waist-high water through which people are moving in boats. It appears like a big lake with islands of villages. One such village is Ghonghepur. It is a small settlement of unkempt bamboo huts and some *pucca* houses, close to where the embankment ends. Mohammed Yunus, an old man, insists we sit in the boat and see the village. He shows us houses recovering from water that has just receded. Mud-coated bamboo walls have sagged at places. A man is feeding chopped water hyacinth to his cow. He knows it is bad for the cow but says, "What else can I feed it? This is what grows all around."

Earlier, people had different varieties of paddy for different levels of inundation. They say the Dasharia variety would grow 30 cm overnight, with rising flood water

A woman in a veil tells me all the houses in the village were in waist-high water for three months during monsoon. "Even the chairs in the school were in water." From October the water starts receding, but the fields remain under water till January-February. This leaves very little time to sow crops. "So what do you do for livelihood?" I ask. "Don't you see around? What can one do here? Most just go away to find work elsewhere." I look around. Most of the men around me are old, past the age when they could be useful as labourers.

Bihar has the highest rate of migration to other states in India. As per one estimate, 4.5 to 5 million Bihari migrant labourers work in other states. A good number of these come from the Kosi region. "Earlier, there was seasonal migration to tea gardens in Assam and Calcutta. It was not like today when the entire village or members of every family leave," Mishra tells me over the phone. "I have noticed migration of this kind since 1964."

Data collected by him shows 306,200 hectares (ha) of land is waterlogged along the Kosi. This is nearly the size of Patna! "To my mind people living in this area would be in hundreds of thousands," says Rajendra Jha, secretary of Kosi Sewa Sadan.

'Like the tongue between 32 teeth'

An equally big mass of humanity is trapped within the two embankments of the Kosi. Mishra estimates that more than one million people in about 380 villages are living in the belly of the Kosi. The river is constantly shaping the landscape there, eroding land here and depositing sand there. I request Rajendra Jha to take me inside. In his heyday, Jha had negotiated the surrender of several dacoits in the region, so he knows the area well.

From Baba Karu Dham near the eastern embankment in Mahishi, we board a teak boat double the size of a sedan. The boatman cranks the diesel engine and it starts with a loud sputter. With the warm sun on our back, we head towards a huge sand bar across the muddy river. In 10 minutes we are there. Two-three other boats have also arrived, each packed with about 20 people with their bundles of grass and bicycles. One even carries a motorcycle. Past the fields and *kans* shrubs, we reach a village called Baghaur. Most houses are thatched, made of bamboo and mud.

We meet 83-year-old Jagdeesh Singh. He is tall, well-built, hard of hearing but with good memory. He says he used to live close to Baba Karu Dham, 3 km away. The river began devouring the land in the late 1970s. "Each time the river eroded the village, we shifted a little away from the embankment. Between '77 and '87, we shifted five-six times."

More people join us. They say the sand bar is a huge island, 5 km wide and 25 km long, surrounded by the river's streams. More than 100 villages are perched on it. Baghaur has one primary school and an *anganwaadi*. But it does not have a health centre and electricity supply. Some have installed solar panels with government subsidy. Government offices, the police station, banks, all are outside.

"Our life is like the tongue between 32 teeth," says one of them, Chanchal Kumar Singh. "To go anywhere we have to cross the river. During the rainy season the river swells 2.5 km wide. It is very inconvenient to travel to anywhere."

"You can't even approach the police if you need protection. This emboldens the rogue elements."

"The water pumped from bore wells has so much iron that you cannot drink it." Singh quickly orders a boy to fetch a glass of water from a hand pump. "You see the yellow water. Even the glass is corroded. If you wash clothes with it, they too turn

yellow." He then shows us his homemade water purifier. It is a cylindrical metal container filled with sand and charcoal. Singh has fitted a tap near its bottom. It filters 40 litres of water in a day.

In the adjacent Birwar village we hear the same stories of displacement. We head for the nearest *ghat*. To reach there one has to cross three small streams, so we take off our shoes, fold our pants and sink our feet into the muddy be. At the *ghat* about two dozen people are waiting for the boat. After five minutes of sailing, the boat runs aground in a shallow area. The boatman and three passengers quickly jump out and start steering the boat from four sides. Soon as the boat is eased off, the boatman restarts it and takes us to the embankment.

The river has lost its character

A few kilometres downstream, on the other "safer" side of the embankment, a group of women is clamouring to get into an overloaded boat. They want to cross a stream, which cannot find its way to the walled Kosi, to reach Belwara rehabilitation village. As the name of the village suggests, people from within the embankments were resettled there. The sluice gate built to allow the stream to join the Kosi was blown away by the force of water during the 1984 floods. "People were badly cheated in the name of embankments. Many were resettled in a way it did not help. Others lost their land to water-logging. These embankments are ticking bombs. They can go off anywhere," warns Rajendra Jha.

The Kosi has breached its embankments eight times, causing big floods. In Supaul, Kushwaha had shown me a place near the international border from where the Kosi had started flowing in 2008 after breaching its embankment in Nepal. It looked like a huge roller had moved through the fertile countryside. All through its 3 km-wide path the river had uprooted the trees and left sand in its wake.

"The biggest loss is that the river has lost its basic character which is to drain its catchment," Mishra says. He has calculated that the total land trapped between the embankments and lost to waterlogging is 426,000 ha. "In other words the Kosi embankments that were meant to protect 214,000 ha of land against recurring floods in the river now threaten just double that area," he writes in his book on the Kosi, *Trapped Between the Devil and Deep Water*.

A bridge of boats

We are now in Beldaur block of Khagaria district. At Dumri Ghat, where the Bagmati meets the Kosi, two bridges stand like ghosts. Parts of them have collapsed in the middle, disrupting the only road link between Saharsa and Khagaria. The first bridge was made in 1991. Before that the Bagmati had been flowing a kilometre away from the Kosi and would join it a little downstream. To cut the cost of building the bridge, its length was kept short and the Bagmati was made to flow into the Kosi at Dumri. But the concrete bridge could not withstand the strong current of the two rivers and several of its pillars were washed away in 2010. The government then built another bridge, reinforced with steel, close to it. It too collapsed in 2012.

This bridge built to connect Saharsa and Khagaria collapsed in 2010. Another bridge built close to it was also washed away. The Bagmati was made to flow into the Kosi at this point, but the bridges could not withstand the current of the two rivers

When all the engineering failed, boatmen in Beldour struck upon the idea of joining their boats together to create a makeshift bridge. They, then, laid a platform of bamboo poles over big boats the size of a truck. The bridge is ready in January and dismantled by the end of May, so I cannot see it. But I meet Bajrang Saini and Kare Saini, who led the boatmen, at Dumri Ghat. Bajrang Saini is a man of about 50 in a *lungi* and a check *kurta*. He has plied boats all his life up to Farakka, so he knows many boatmen. He says he collected boatmen from as far as Bhagalpur who plied their boats on the Ganga. Building the bridge takes 20-25 people and as many days. "The first year we made a bridge of 42 boats at a gap of about 4 feet (1.2 m). We realised the gap was too wide, so next time we doubled the number of boats and tied them at a gap of one foot (0.3 m)," says Bajrang Saini.

We cross the river along with our Scorpio on a boat run by a diesel engine.

Now we head for our last destination Kursela in Katihar district. Here, after covering nearly 700 km, the Kosi, both mother and *dayan* (malevolent female spirit) to its people, quietly disappears into the Ganga under the bright sun.

After driving through the buffer zone, one arrives at the gate to the core area. Beyond this lies a forest with an evolutionary age of at least 50 million years

JEMIMA ROHEKAR / CSE

Sounds of silence

A trip to Silent Valley is a lesson in the history of environmental movements and biodiversity

BY JEMIMA ROHEKAR

SINCE THE day I was assigned to write about Kerala's Silent Valley National Park, a 90-sq km stretch of tropical evergreen forest tucked in the Western Ghats, I have been asked a question over and over again: why is it called Silent Valley? It is a peculiar name in a country like ours. There are more than 100 national parks in India, most of them named after either a physical feature like a river or a mountain; a historical or mythological place or character; an animal; or a former prime minister. Only two names inspire the imagination: the Valley of Flowers National Park in Uttarakhand and Silent Valley.

In a booklet titled "Storm Over Silent Valley", senior environmental journalist Darryl D'monte notes its widely accepted etymology. The valley was originally known as Sairandhri, another name for Draupadi, the wife of the Pandavas. And the river flowing through it is called Kunthipuzha, after their

mother. When an Englishman, who discovered this virgin forest in colonial times, found that that there was no white noise of the cicadas after dark, common in other forested areas, he renamed it the Silent Valley.

A special forest no one has heard of

Silent Valley is one of India's few rainforests. D'monte writes that it would be more correct to call it a *shola* forest, a type of vegetation found only at the base of valleys in the western hills of south India. Surrounded by high ridges, the forest is deep and virtually impenetrable. So secluded is Silent Valley that there is no written record of any human habitation in its core area. While there are some tribal settlements in the buffer zone, the mere fact that the forest is unspoilt by humans is enough to raise my suspense. I am also eager to visit the site of the first and most bitterly fought environment *v* development debate in India.

I arrive in Coimbatore, Tamil Nadu, and decide to hire a taxi to Mukkali, the base camp of the Silent Valley National Park, around 62 km away. Armed with a 20-word-strong Tamil vocabulary generously sprinkled with English, I start asking around for a way to the park. But the mention of Silent Valley invites raised eyebrows and casual shrugs from taxi drivers and shopkeepers alike. No one has heard of it before. I thought that the city's taxi drivers would be used to a steady stream of tourists and nature enthusiasts headed for the national park. They are not. I cannot blame them though. Eleven years ago, I spent three days reporting on tribals as a student in Attapadi, within a whispering distance of Silent Valley. Apart from a passing reference to the forest, I had then remained largely indifferent to its momentous environmental history. With so much written and spoken about this forest, why is Silent Valley still unknown to or underappreciated by people? Is the valley's silence a boon or a curse?

Silent Valley is a *shola* forest, a type of vegetation found only at the base of valleys in the western hills of south India. It is deep and virtually impenetrable

"I first heard about Silent Valley in 1972 when a newspaper article announced the Kerala government's plan to build a hydropower project over the Kunthipuzha," says M K Prasad, one of the pioneers of the Save Silent Valley movement. He was then a teacher of botany at a college in Kozhikode. When he visited the forest, he realised that building a dam would be nothing short of a blunder. "The forest was impenetrable and largely undisturbed. If the dam had been built, it would have started degrading the forest system slowly and we would have lost the entire forest over a period of time," he adds.

The idea for a dam had taken root in the 1920s. The natural drop of the Kunthipuzha river, as it flows into the plains, is the highest in Kerala at 857 metres, making it the ideal site for a hydropower project. After Independence, multi-purpose river valley projects became a top priority to fulfill the country's requirements for irrigation and electricity. So much so that by 1979, Government of India had invested nearly 14 per cent of the total planned expenditure on dams and canals. One of these projects was in Silent Valley; a 131-metre-high dam, which would generate 240 MW of electricity and irrigate 10,000 hectares of land in Kerala's Palghat and Malapuram districts. The project was, however, never to be.

One of a kind

Back in Coimbatore, I finally find a taxi driver who offers to take me to Mukkali by following the route on Google Maps. Soon enough, we are going up and down winding roads in the countryside from Tamil Nadu to Kerala. Banana, coconut and areca nut plantations line the road, protected by electric fencing to keep elephants from destroying the crop.

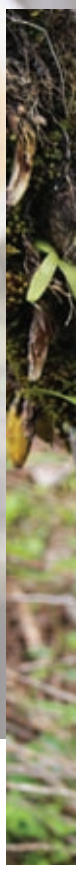
My visit to the national park is scheduled for the following day, and I am anxious to meet my guide, Mari, a 42-year-old tribal watcher popularly known as the "encyclopaedia of the Silent Valley National Park". He has been working with the Park since he was 15 years old, guiding forest officers, botanists, zoologists, photographers and tourists through the verdant labyrinth. He has only a little formal education and speaks almost no English, but is well-versed with the scientific names of innumerable species of plants, animals, birds and insects. A recipient of awards for his conservation work, Mari had also been invited by England's Prince Charles for a meeting on a visit to Kerala.

At the forest office in Mukkali, just as I am about to leave for my accommodation at

ALONG THE TRAIL

How to visit: Most visitors opt for a day trip to Sairandhri, which is a short distance into the core area of the national park, and a 1.2 kilometre-trek to the banks of the Kunthipuzha. For a closer look, check the Silent Valley official website or call the forest office for details about longer nature camps and walks.

Local festival: Standing out among the softly rolling hills is the sharp triangular Malleswaram Mudi, the highest peak in Attapadi near Silent Valley. Every Shivaratri, a group of Kurumba tribals make the hazardous trek up the mountain to worship Lord Shiva. Only the tribals are permitted on the mountain and they return with holy water for the rest of the tribe.



Silent Valley abounds in types of mushrooms, each looking stranger than the other. (Right) Of the more than 100 species of orchids in Silent Valley, the forest department has grown five species on a single stem near the watch tower for the benefit of visitors

Bommiyampadi about 13 km away, a mini bus pulls into the gate. Staff members, who have already heard that I am looking for Mari, start calling out to me, "Madam, Mari! Madam, Mari!" Out steps a tall, slender man with eager eyes and a polite smile. Mari has just returned with a group of tourists from the Park, their faces glowing from the treasures they have seen. I say *namaskar* to him and someone steps in to translate. "I learned about the forest's species from many Western botanists and zoologists who visited Silent Valley through the years. I find it very interesting," he says. "The irony is I do not know what many species are called in Malayalam as no Malayali ever taught me." Mari has inherited a precious legacy. His father, Letchiappan, was one of the three "unofficial guides" who had helped conservation experts study the uniqueness of the forest at the height of the Silent Valley dam controversy in the 1980s.

The next morning, our jeep represents a full house—the driver, Mari, Beat Forest Officer Ameen Ahsan S, a couple of friends from Coimbatore to help with translation, and myself. As we drive into the forest, we are surrounded by a riot of green. Mari points to camera traps fixed to tree trunks and Ameen informs us that these traps have recorded the presence of five tigers. There are also leopards and at least two black panthers in the forest, among other predators. Though the dense forest makes wildlife sightings rare, Silent Valley's most famous residents do not disappoint us. Perched on the branches on the way is a group of Lion Tailed Macaques (LTM), a primate classified as "endangered" by the International Union for Conservation of Nature (IUCN). The animal had become the mascot of the Save Silent Valley movement in the 1970s and 80s, with protestors arguing that a hydropower project would destroy the LTM's habitat and severely diminish its numbers. The Malabar Giant Squirrel and the Nilgiri langur also make an appearance. All three animals are endemic to the Western Ghats.

Charming as they are, the real magic of Silent Valley lies in its smaller or not usually noticeable habitants. At one point, we stop to admire a 200-year-old jackfruit tree. It still produces fruits for elephants, LTMs and birds alike. I crane my neck to see the tree top, but it is too tall and the canopy too thick to see through. Trees grow about 30-45 metres tall in a tropical rainforest and the canopy is so thick that it takes rainwater at least half an hour to percolate down the three to four layers to the ground, says Ameen. As we walk some of the way, I point at everything I have not seen before and pat come the common English and scientific names from Mari. Trees, ferns, leaves, flowers,

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mushrooms, spiders, butterflies, bees, dragonflies, lizards…Mari knows them all. He explains their features and also identifies birds by their calls.

A viper snake is curled along the road, its colour such that we would have walked right by if Mari and Ameen had not pointed it out. They guess that it has probably just eaten and is not likely to move much for a long period of time. We are no doubt relieved. A few hundred metres ahead, a large serpent eagle sits on a branch in the shade of the thick canopy, its watchful eyes taking in the surroundings. One slowly realises that the forest is a hub of thousands of interdependent and coexisting habitats.

The 1982 report of the joint committee chaired by M G K Menon, which assessed the potential ecological impacts of the hydropower project, states that Silent Valley has a high level of species diversity. With 118 vascular plants of 84 species in just 0.4 hectares of sampled area, the report quotes studies which show that the species diversity of Silent Valley is similar to that of the tropical rainforest of the Barro Colorado island in the Panama canal, considered worldwide as a prototype for measuring plant and animal diversity. The Zoological Survey of India findings indicated that Silent Valley could turn out to be a major potential reservoir for agents of biological control, given the presence of many predator and parasite species.

We pass by a few wild pepper trees. In the committee report, the Botanical Survey of India had noted that the Silent Valley plateau was home to wild relatives of domesticated plants, including cardamom, pepper, turmeric, ginger, cinnamon and beans, among others. As it has remained largely protected from human influence, Silent Valley is a thriving gene bank, which might one day come to our rescue if we were to lose our existing crop varieties to diseases and resistant pests. Since 1984, when the national park was formed, experts have discovered many new species of plants, amphibians and insects. Thus, the forest, with an evolutionary age of more than 50 million years, is possibly home to thousands of as yet undiscovered species.

As we stand atop the Park's 30-metre-high watch tower overlooking the valley, clouds flow over the hills, thickly carpeted by trees and grasslands as far as the eye can see. It is the last week of October and both Mari and Ameen are worried that it has not been raining as expected. "Deficient rainfall has reduced the forest density. The germination of seeds has been affected and undergrowth has also reduced. The flow of water in streams is lower than usual," they say. (By December 21, when the magazine went to press, the October to December rainfall in Kerala was 61 per cent below normal.) Mari points to the area where the dam was to come up four decades ago. What would have happened if it had come up, I ask. "…then these hillsides would have been covered with hotels and restaurants," he says. "Only a murderer can try to spoil this forest. It cannot be the work of a sane human being."

A movement is born

Botany teacher M K Prasad had also foreseen the impact a hydropower project in Silent Valley would have. Home to 1,000 species of flowering plants, 107 species of orchids, 100 ferns and fern allies, 500 species of butterflies and moths, 292 species of birds, among others, the Silent Valley forest was teeming with life. He wrote an article in the journal of the Kerala Sasthra Sahithya Parishad

The species diversity of Silent Valley is similar to that of the tropical rainforest of the Barro Colorado island in the Panama Canal

(KSSP), a people's science movement of which he was a member. The article was against the project in its entirety and received a huge response. Soon, the issue began to be discussed in the media and public meetings. Organisations such as the Bombay Natural History Society, Friends of the Trees Society, and WWF also started supporting the protest campaign.

The Kerala State Electricity Board (KSEB) did everything in its power to change the narrative in its favour. It argued that the project would provide electricity to power-deprived northern Kerala, that the dam's reservoir would submerge only a small area of the forest (830 ha) and tried to convince the public that there was nothing special about the Silent Valley forest. The Save Silent Valley movement, which by then counted professors and scientists among its supporters, refuted their claims. This only pushed KSEB to try harder. Prasad says that except the Hindu and the Indian Express, KSEB was able to buy out or influence all English and Malayalam media into supporting the dam. It accused Prasad of being an agent of the United States. "I once received an anonymous letter from someone claiming to be an employee of the KSEB, warning me not to accept an invitation from their employees' union to visit Silent Valley to seek my advice. It claimed that the plan was to get me killed," Prasad recalls calmly. He did receive an invitation soon after, which he declined.

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Seen from the 30-metre-tall watch tower in the core area is a plaque commemorating the formal inaugration of Silent Valley National Park by then Prime Minister Rajiv Gandhi on September 7, 1985

Meanwhile, the government formed committees to study the impact of the hydropower project on the forest's ecology. While one committee suggested safeguards, which the Kerala government readily accepted, another led by then agriculture secretary M S Swaminathan recommended that the project be scrapped. When Indira Gandhi was re-elected as the prime minister in 1980, she asked Kerala to stop work on the dam until the impacts of the project could be thoroughly reviewed. It culminated in the formation of the M G K Menon committee. Its report said that the 830-ha area that was to be submerged was an "important example of genuinely intact riparian system". It added that the dam would result in "reduction of habitat size and species diversity", enhance the extent of disturbance to the ecosystem and give humans access to Silent Valley.

The hydropower project was finally scrapped and declared a national park on November 15, 1984. It was a watershed moment in environmental history. "Nature conservation was largely limited to afforestation before the controversy. But the movement gave birth to the idea of carrying out an environment impact assessment of every development project before being given a go-ahead. Public hearings also became a must. I was fortunate to be associated with such a movement," Prasad says.

As I leave Prasad's home in Kochi in a cab, the driver and I talk about actor and demi-god Mohanlal's latest blockbuster. When I tell the driver I am visiting Kerala on an assignment to cover Silent Valley, he looks at me in the rearview mirror and asks, "What is Silent Valley?" ■

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Shaitan (left) and Moti play with wild *tinda* fruits at a farm in Godaro ki Dhani in Bikaner's Bhelu village

A fruitful journey

A food safari in the desert of Rajasthan reveals a variety difficult to imagine in cities

BY VIBHA VARSHNEY PHOTOGRAPHS: BHASKARJYOTI GOSWAMI

THE TERRAIN is just what we expected: harsh. Sandy soil covers the rocky earth as far as the eye can see. The road that takes us to the interiors of Kolayat *tehsil* in Bikaner district is flanked by *kikar* trees (*Prosopis julifera*) and *aak* bushes (*Calotropis procera*). This does not sit well with our story. We are in Rajasthan to find out about the traditional food or *desi khana* of the region. In the three-day trip, we hope to find out how people, who have occupied the area for centuries, have devised innovative ways to find food in this harsh environment. But *kikar* is an invasive tree that even goats do not consume and *aak* is known more as medicine than food.

We enter Godaro ki Dhani in Bhelu village, some 90 km from Bikaner, with some trepidation. Godaro ki Dhani, spread over 80 hectares (ha), is

The importance of traditional foods can be gauged from the fact that the trees and their fruits and seeds have different names

owned by four brothers. One of the brothers, Babu Ram, greets us from a chair where he is busy peeling a small, striated fruit. He is surrounded by *charpais* (cots) that are covered with the peeled fruit.

The sour fruit, which he calls *kaachar* (*Cucumis melo* variety *callosus*), belongs to the melon family. It is used in place of *amchoor* (dried mango) in the region. Babu Ram sells the dried fruit to traders who powder it and sell it in cities. The powder is called *kachri*. On our request, he takes us to the fields where the wild *kaachar* vines grow. We are accompanied by two young family members, Shaitan and Moti. Babu Ram tells us that the plant easily grows in the field as each fruit of *kaachar* has hundreds of seeds that grow profusely in the next season. This means that just a few fruits are enough for a crop for the next year.

Besides *kaachar*, the field has succulent *kakadiyas* (*Cucumis melo* variety *momordica*), which Babu Ram offers us while we walk under the sun. Shaitan and Moti hunt down some fruits of wild *tinda* or *tindsi* (*Praecitrullus fistulosus*) for us.

They tell us that the *tinda* fruit is preserved by cutting and drying. The dried vegetable is normally cooked when there is a shortage of food. The family then takes us to a neighbouring field to show us a *kumbat* tree (*Acacia senegal*). The tree, which fruits in summers, has only a few green beans hanging from its spiny branches. The beans are consumed green and its seeds, called *kumatiya*, are boiled and preserved. There is a bush of *bor* or *ber* (*Ziziphus mauritiana*) right next to this and the ripe red fruits are offered to us.

On our way back to Godaro ki Dhani, we rest under a *khejri* tree (*Prosopis cineraria*) and watch a woman collect *guar* (*Cyamopsis tetragonoloba*). Buddha Ram, the eldest of the four brothers,

brings water for us and narrates stories of how the bark of the *khejri* tree used to be milled and used as flour during famines. The bean of this tree, called *sangri*, is still consumed widely in Rajasthan.

Buddha Ram invites us for lunch and as we wait for the food, we eat more *kakadiya* and wild *matira* or watermelons (*Citrullus lanatus*). Matira, which is used by the family as a vegetable, is not as sweet as the watermelon we get in the cities. However, the succulent fruit is extremely refreshing under the afternoon sun. We also enjoy freshly roasted peanuts, which we had collected on our way to Buddha Ram's cottage, along with tea that is sweetened with jaggery.

For lunch, we eat a spicy *guar sabji*, a *kaachar sabji*, along with large *bajra* (millet) *rotis* and curd. Our meal is made up of ingredients that are integral to the rain-fed agriculture practised in the area.

But the family is slowly shifting to commercial farming of groundnut, which has become possible after the family installed a tubewell on their farm. Last year, the family had experimented with onion.

A woman carries *guar* plants at a farm in Godaro ki Dhani. *Guar* is a popular vegetable in Rajasthan

The family says they are shifting to commercial cultivation for higher profits. This year, they expect to earn as much as ₹5 lakh from groundnut alone, in addition to ₹50,000 from guar. The traditional *kaachar* is likely to contribute only ₹3,000 and its seeds, ₹5,000 to the family's income.

After the sumptuous meal, we travel to the nearby Nokhda village, which is known for the thorny *ker* tree (*Capparis decidua*). We meet 50-year-old Narayan, who has been trading in *ker* fruits for the past 30 years. The women and children in the region normally collect the fruit from the tree, which grows in the wild. Narayan, one of the four people in the village who buy *ker* from these collectors, says he pays ₹60 for a kg of the fruit. He adds that the fruit is treated with salt water for a few days to remove the bitter taste, after which it sells for over ₹100 a kg. The buyers sort them according to size (the smallest ones are most expensive as they do not have seeds). In fact, all of these traditional foods require processing before they can be stored. *Kumbat*, *sangri*, *ker*, *gunda* (*Cordia mixa*) are boiled before being dried and stored to reduce cooking time and, in some cases, to remove the bitter taste.

Nokhda residents introduce us to several other traditional foods. One of them is *bhurut* (*Cenchrus biflorus*), whose seeds used to be earlier milled and consumed as flour during famines. Then there is the *phog* tree (*Calligonum polygonoides*), which does not grow in the area. The fruit and flower of the tree are used to prepare *raita* and spicy *kadhi* during the summer season. We are told that *phog* trees grow around Jaisalmer.

Next day, we enter Jaisalmer and drive down to Chundi village, which is about 17 km away from the city. Interestingly, twenty-five-year-old Khevra, who owns around 200 ha of land, tells us that he has never heard of *phog*. His kitchen, however, is well stocked with other traditional foods. He has seeds of *tumba* (*Citrullus colocynthis*), a fruit that is normally used for feeding animals. His wife tells us that the seeds, which are boiled and made fit for human consumption, are added to *bajra* flour, which is used for making *rotis*. She says adding *tumba* makes the *roti* crunchy and increases its nutritive value. The family then shows us about 10 other local ingredients from their kitchen. The importance of the ingredients to the family can be gauged from the fact that 9-year-old Mahipal hurriedly takes the packets inside when some younger children from the family start playing with them. Khevra fondly talks about the sweet fruits of

ALONG THE TRAIL

Places to visit: Thar Desert is the 17th biggest desert in the world. The extinct river Saraswati is said to have passed through this desert. Efforts have been made to demarcate the path of the river and around 14 wells have been dug in the villages, including some in Jaisalmer and Bikaner. Carbon dating shows that the sweet water of these wells is 8,000-14,000 years old. The Desert National Park has sea shells and fossilised tree trunks that indicate the geological history of the area.

Best time to visit: If you are on a culinary journey and want to taste food found in the wild, visit in the summer months till the end of September. However, all traditional food is preserved and is available round the year.

Twenty-five-year-old Khevra from Chundi village in Jaisalmer district drives us to his land to show *khejri* trees

peelu (*Salvadora oleoides*) and wild mushrooms that grow in the sand dunes after the rains. The mushrooms are a delicacy in the area and are dried and milled to make flour. While we did not get a chance to see or taste the mushrooms, studies by researchers in Jodhpur reveal that as many as 48 types of mushrooms can be found in the Thar Desert.

We then accompany Khevra to his field in a tractor trolley to see his *khejri* tree. He practises rain-fed agriculture, but makes more money from selling sand from his land. It is evident that the knowledge of traditional food in the family is gradually decreasing. For instance, no one in the family knows that pods of *kheep* bush (*Leptadenia pyrotechnica*), which is growing all over his field, can be used as a vegetable. The family only uses the thin branches of this bush for thatching huts or during last rites.

Next, we visit Beldaro ki dhani, a colony of stone workers just five km away from Chundi village, and realise that Khevra and his family are among the very few in the region who still depend on traditional foods. Bhora Ram, a Chundi resident in his twenties, says it is easier to buy vegetables from the market as collecting local vegetables from the wild is time consuming. "It is easier to buy a kg of mushroom for ₹200 from the market than collect them from the wild," he says. We then meet Bhagwana Ram, who introduces us to some more traditional foods from the area. He tells us that seeds of a shrub called *lana* (*Haloxylon salicornicum*) can be used to make *rotis* and that *ker,* which is bitter in taste, can be used to make *laddus*. He speaks passionately about traditional foods and promises to cook them the next time we visit the region.

Kumbat, _ker_ and _sangri_ are more expensive than onion and potato. Some traditional foods are as expensive as dry fruits

The next day we travel to Jodhpur to meet S M Mohnot, director of the School of Desert Sciences, who is surprised that we managed to find so many varieties during our journey. "Traditional foods do not provide substantial support to the people now. They are just remnants of what used to be palatable some 100 years ago." They are now consumed mostly in *dhanis* (cluster of huts) as these are far from the market. He points out another reason for the waning popularity of these plants. *Kumbat*, *ker* and *sangri* are more expensive than onion and potato, some being as

Traditional foods helped tide over famines

Rise in commercial farming is eclipsing the importance of traditional foods

TRADITIONAL FOODS have helped the people of Rajasthan survive famines for centuries. They are, in fact, woven in the colourful tapestry of the people's pastoral life in the state. Their importance can be gauged from the fact that the trees and their fruits and seeds have different names, depending on their physical attributes.

The pod of *khejri* is called *sangri*, dried *tinda* is called *phophaliya*, flowers of *phog* tree are called *phogalo* and seeds of *kumbat* are known by a variety of poetic names such as *kumatiya*, *lehariya*, *papri* and *chapatiya*.

But this beautiful association between traditional foods and the Rajasthani people is fast fading. In April 2016, 19 districts of the state reeled from severe droughts, but the people did not fall back on traditional foods. In fact, several of the traditional foods are no more consumed in the state. Seeds of *bhurut* and bark of *kheri* are just two examples. The importance of traditional foods is going down because there has been a rise in commercial farming in the state, thanks to the Indira Gandhi Canal project. Just a few famine foods have survived because of their cultural significance. For example, *panchkuta*, a mix of *sangri*, *ker*, *gunda*, *kumatiya* and *kaachar*, is still prepared during weddings.

expensive as dry fruits. Production has gone down as on the one hand, these plants are being cut and on the other hand, new seeds are not finding suitable space for germination. A piece of land that yielded 100 kg of the product 50 years ago barely provides 10 kg of the traditional foods now, he says. The process of collection, processing and storing is also time-consuming. He adds that this is not the case with all traditional plant varieties. For example, while *sangri*, *ker* and *kumatiya* are still being collected, varieties such as *phog*, *tinda* and *kheep* are slowly disappearing.

Arvind Ojha, chief executive and secretary of the Urmul Trust in Bikaner, says certain local food varieties are making a return because of tourism. "Guests want to taste traditional foods and we see a big commercial scope here. We are trying to popularise these foods among our self-help groups. For example, we have created awareness about how *guar phalli* can be dried and sold as a spicy snack from the desert. It is already being sold in fairs." Ojha adds that the traditional varieties have the additional benefit of being organic. "We are planning to set up solar dryers to ensure the quality of these products. We are encouraging farmers to ensure that native trees and plants remain part of the farm." He adds that a single *khejri* tree can increase a farmer's earnings by as much as ₹10,000 a year. Besides, crops grow better under the tree and its leaves can be used as fodder.

After the three-day journey through traditional foods, we are back to the restaurants of Jodhpur serving *alu poori* and chowmein, a representation of the standard restaurant food in places like Delhi. It reminds me of what Kheraj Ram of Nokhda village said that as far as food is concerned, Delhi is a city of *fakirs* (paupers). City dwellers cannot even imagine the wide variety of traditional foods that grow wild in Rajasthan. Our only fear is that the rural people of Rajasthan too might soon lose their traditional recipes. ■

@vibhavarshney

Cheta Devi from the Mandal valley in Chamoli district. Earlier, she would leave home at four in the morning to collect fodder from the steep mountainsides and return by noon. These days she collects fodder from the forest people have grown next to the village and harvests nutrient-rich napier grass planted along her farm

Embrace of Chipko

Impacts of the Chipko movement are visible in Chamoli even after four decades, but Tehri Garhwal has taken a different turn

BY SNIGDHA DAS PHOTOGRAPHS: SRIKANT CHAUDHARY

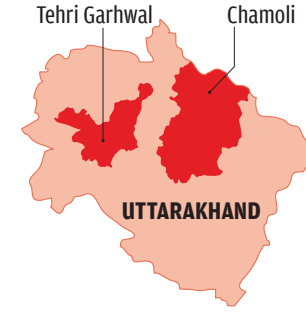
WOMEN IN the Himalayan villages hugged trees, braving the axes of loggers with government permits, and stopped the clear-felling of mountain slopes. This simple but effective way of protest that marked the Chipko movement and its protagonists has always intrigued me. Now that I am heading for the birthplace of the movement, a small town called Gopeshwar, anticipation and excitement sweep over me.

The taxi I boarded from Rishikesh soon leaves the crowded plains behind and starts climbing the steep incline. The road bends and curves at every possible angle, offering glimpses of the mighty Himalayan range. I start getting goose bumps when I realise that guardrails are missing on portions of the road that clings to the edge of a cliff. About 10-20 metres below, the Ganga flows in the opposite direction with all its force. I try not to let any negative thought cross my mind and shift focus on the assignment at hand.

More than four decades have passed since the Chipko movement was born in March 1973. It was primarily a peasant's movement and at its heart was a Gandhian philosophy: self-sustenance of villages. But most villages in Uttarakhand continue to depend on the money-order economy. In fact, a staggering 3,600 of the state's 16,793 villages have turned into ghost habitations as people are abandoning agriculture and migrating to towns. The other aspect of the movement, which brought it glamour, is that it was largely led by simple, uneducated women who spent most part of the day fetching water from distant streams and foraging for firewood and fodder from steep mountainsides. In Reni village near Joshimath, women under the leadership of 50-year-old Gaura Devi, drove out the lumbermen. This is no mean feat in a society where egalitarianism is almost absent. The movement has inspired eco-feminism in India and worldwide, but has it brought liberation to the women of Uttarakhand? How does the present generation relate to its forests? And has the government changed its attitude towards forests?

All these thoughts keep popping up in my mind as the taxi crosses the Ganga at Devprayag and starts following the meanders of one of its headstreams—the Alaknanda. We pass a few hamlets nestled in the valleys created by its tributaries. Houses here are located halfway between the fields below and forests above.

The landscape begins to change as we enter Chamoli district, bounded by Tibet in the north. Mountains become taller, forests denser and roads steeper. The sun is about to set when I spot Gopeshwar. There I meet Chandi Prasad Bhatt, the founder of the movement that swept Uttarakhand, then part of Uttar Pradesh, in the 1970s. The movement for the first time catapulted the environment into political discourse and has shaped the understanding of environmentalism in India. But Bhatt prefers to introduce himself as a worker of the Sarvodaya Movement that worked for universal progress. He asks us to take a tour around Gopeshwar and villages in the Mandal valley—part of the Alaknanda valley—the next day before he could explain the impact of the movement.



Women turn over an oak leaf

Located at an elevation of 1,550 metres, Gopeshwar town, with a population of 100,600, spreads across the mountainside. Rows of houses and trees are neatly arranged along a steep, winding, litter-free tar road. In fact, in a sharp contrast to most Indian villages, almost all habitations in the valley appear clean. "People here do not litter as they feel responsible towards nature," says Bhupal Singh

Negi from Gopeshwar, who participated in Chipko as a student and has since accompanied Bhatt in his mission.

Just below the town is a village of 300-odd households, also named Gopeshwar. It is surrounded by a thick forest of *banj oak* (*Quercus leucotrichophora*), an evergreen tree native to the Central Himalayas. "The village women have raised this forest," says Negi. Inspired by the Chipko movement, the women planted the saplings on the barren village common land in the early 1980s and formed a committee to nurture them. Today, none of them is alive. But the saplings have grown into 12-18-metre-tall trees and allowed several other trees, shrubs and grass to grow underneath. Negi says young women from the village now take care of the forest. They pool funds to repair the stone wall around the forest meant to prevent cattle from straying into it. Two of them take turns to guard the forest every day. "This forest now fulfills all our needs. No woman in the village has travelled to other forests in the past 25 years," says Chandrakala Bist, a committee member.

Residents of Papdiyana village have a similar oak forest to show off, which they have raised under the guidance of Murari Lal, another lieutenant of the Chipko movement. At 83, Lal uses a walking stick but can quickly climb the hill to show the oak trees he planted in 1973. "The forest belies the forest department's claim that oak can be grown only in the high altitudes of the Central Himalayas."

The passion for growing oak forests among the hill communities reminds me of what Anil Agarwal, the founder editor of *Down To Earth*, had mentioned in one of his articles: Oak leaves give rise to a nutrient-rich, water-absorbing humous. An oak forest, therefore, holds on to water for a long time and releases it very slowly, giving rise to perennial streams and rivulets. This is the reason hill village communities have come to be established around oak forests over the ages. Lal cites one more utility of oak forests: once oak took roots on the barren land, plants like *malchhada*, *khinda* and *kunja* regenerated on their own. Leaves of these plants mixed with dung act as a pesticide.

On the way, we stop by Kunkuli village. Located along the Balkhila river, a tributary of the Alaknanda, this village looks straight out of a storybook. It has a natural oak forest right next to it and farmlands along the river. At a tea stall, I meet a farmer and ask how he treats the forest. "We have not touched it since 1983," says Sarvendra Singh Bartwal, who retired as a postmaster three years ago and has since been working on his fields, growing three crops a year. "Our day-to-day needs are met by a forest that we have grown on the

Ash tress stand tall in the forest next to Mandal village. Residents of the village staged the first Chipko movement in 1973 to save trees that Allahabad-based Symonds Co wanted to fell to make sports goods

village common land. Today, the two-hectare patch has medicinal and aromatic trees, such as large cardamom, soap nut and mentha, and plants like *bhimal* (*Grewia optiva*) and *kachnar* (*Bauhinia variegata*) that provide palatable fodder."

Bartwal leads me to a group of women, who are leaving for home after spreading manure on their fields. Among them is Kanta Devi, who headed the village van panchayat (forest council) twice since 2002. She tells me how the lives of women have changed for better since the village grew its own forest. "Earlier, women in the village would leave home around 4 in the morning and return by 11 am. These days they collect leaves, dropped twigs and grass from the new forest and spend more time with their children," says Devi, who also plays an active role in anti-liquor campaigns.

The road leads to the forest of Mandal village, where people under the leadership of Bhatt had staged the first Chipko movement. Ash trees stand tall in this mixed forest at an elevation of 2,280 metres. Only a few beams of sunlight penetrate the thick canopy. These are the trees Allahabad-based Symonds Co wanted to fell to make sports goods. When Bhatt's cooperative organisation Dasholi Gram Swaraj Sangh (later renamed Dasholi Gram Swaraj Mandal, DGSM), set up to generate employment, learned about Symonds' intention, it organised the residents of Mandal, under their headman Alam Singh Bist. They resolved to hug the trees to prevent felling. Bhatt later tells me that the word he used originally was the Garhwali "*angalwaltha*", or embrace, which was later popularised as "*chipko*". "No one had to hug the trees. The mere threat was enough and Symonds had to return empty-handed."

The word originally used was '*angalwaltha*', meaning embrace. It was later popularised as '*chipko*'

On the way back we meet Kalavati Devi—the fierce leader of Bacher village who in the 1980s forced the government to provide electricity to her remote village, campaigned against alcoholism and fought against timber mafia. "Forest is like our child. We protect it with our lives, be it from timber mafia or fire," says Kalavati Devi, now 63. For the past four decades women have been heading the van panchayat. "We do not trust men with forests," she says. This year, for the first time, Bacher has elected a man to head the van panchayat.

I meet Bhatt at DGSM the next day. "This is the transformation we had strived for. We wanted people to realise the importance of trees and environment in their lives so that they can protect it long after we are gone. Four decades ago, when I was young and Gopeshwar a small village, women in the region would not speak out. Today, they take all decisions related to forest and village governance," says the 83-year-old Gandhian, his eyes lighting up. "Even the forest department has changed its attitude. Earlier, chir pine constituted 90-95 per cent saplings in the department's nursery. Chir pine is commercially important but does not benefit soil. In the past 10-15 years they have not had chir pine in their nursery."

The impact of Chipko is palpable across the valley. A study by the Space Applications Centre of the Indian Space Research Organisation, Ahmedabad, in August 1994 shows that between 1972 and 1991, at least 5,113 ha of forest has been raised outside the reserve forest boundary and in the vicinity of villages, in the watersheds of Nagolgad, Amritganga (Balkhila), Menagad and Kalpaganga and other watershed of the Alaknanda. This is 9.6 per cent of the total watershed area. Of the forest raised 1,854 ha has been exclusively on the barren land of the villages.

No forest, no gain

The impact of Chipko fades as we leave Chamoli. Slopes look increasingly bare as we pass through Pauri Garhwal and head towards Tehri Garhwal district. Vast stretches of chir pine dominate the landscape. At places deep gashes run up the sides of the mountains. Bhatt's words ring in my head: "Only forest cover can prevent landslides." At several places, farmlands are lying fallow.

"People here are losing interest in agriculture and forests," Aaranya Ranjan of Uttarakhand Jan Jagriti Sansthan (UJJS) in Jajal, Tehri Garhwal, tells me over the phone. UJJS was founded in 1983 by a group of veteran Chipko activists who wanted to make agriculture profitable. "Agriculture is no longer profitable due to attacks from wildlife and changing climate, while forests are out of bounds for people," he adds. This not only fuels large-scale migration but makes forests vulnerable to fires. Earlier, people would regularly take their cattle for grazing into the forest and collect litter from the forest to use it as bedding material and green

ALONG THE TRAIL

Local food: Eat at local *dhabas*. They serve freshly plucked wild vegetables and other local favourites, such as *ragi* (finger millet) or barley *chapatti*, *kulath* (horse gram) *ki dal* and *jhangora* (barnyard millet) *ki kheer*.

Local festivals: People worship goddess Nanda Devi in a three-week festival, Nanda Devi Raj Jat, celebrated once in 12 years. The festival is prominent around Mount Nanda Devi and its sanctuary. Another festival, the Uttarayani fair, held on the occasion of Makar Sankranti in January, is used as a platform by social activists who set up camps in the fair ground to publicise their agenda.

manure. Now it remains accumulated in the forest and helps spread the fire."

To understand the matter better, we visit Vijay Jardhari in Jardhargaon. He had joined the Chipko movement under Sunderlal Bahuguna when it spread to Tehri Garhwal in the late 1970s. Today, he is busy promoting traditional crops that are resistant to climate change impacts under the movement Beej Bachao Andolan (BBA). His courtyard resembles an exotic nursery, where a tomato tree from the Northeast and a variety of basil plant greet us. "People protect forest only when they have ownership over it," says Jardhari, citing the example of the forest next to his village. "It was completely degraded before the 1980s. Inspired by the Chipko movement, we constituted a van suraksha samiti, which planted trees and nurtured the forest. The committee employs two guards for ₹300. Eventually, all varieties of trees came up. A few streams now flow from the forest. Today, people depend on the forest for herbs, fodder and tuber. So when the forest fire of 2013 started spreading, people from the village rushed to the forest and cleared the fire line. People in several villages like Patuli, Lashial and Kot who have grown their own forests acted the same way."

Sarvodaya worker Dhum Singh Negi, who quit his government job to join the Chipko movement and went on a fast to save Advani forest, close to the Hemal river, feels sad that people in the region are abandoning agriculture and migrating to towns. "We are trying to make agriculture profitable for farmers by spreading the message of BBA. But people are leaving villages because of lack of educational and healthcare facilities," he says.

A major impact of the Chipko movement was that it prompted the Union government to amend the Indian Forest Act, 1927, and introduced the Forest Conservation Act 1980, which says forest land cannot be used for non-forest purpose. The same year, in another historical order, commercial green felling was banned in forests above the 1,000 metre altitude. "All these laws ensured conservation of forests but also disassociated people from forests," says Anil Prakash Joshi of Gaon Vachao Andolan in Uttarakhand.

Self-sufficiency of villages is one area where the movement has failed, admits Shekhar Pathak, a historian with in-depth knowledge of Uttarakhand and founder of People's Association for Himalaya Area Research. People in the hills depend on forestry, animal rearing and agriculture. "We wanted to reconstruct the economic activities of people by providing them training in toy-making and temple crafts. This was the objective with which Van Nigam (forest corporation) was set up in the 1975. But its activities are now limited to felling and distributing timber," says Pathak.

However, he thinks, the movement is far from over. In Chamoli, DGSM continues to organise plantation programmes on barren land through eco-development camps. To reduce pressure on forests, it grows commercially important plants in a nursery at Bacher and supplies the saplings to villages. "The rate of survival of saplings planted by DGSM is up to 90 per cent, whereas the survival rate achieved in government plantations is 10-15 per cent," says Pathak. DGSM has also introduced nutrient-rich fodder napier grass (*Pennisetum purpureum*) in the seven years in 23 villages across Mandal valley and is promoting iron ploughs.

Tehri now witnesses a second wave of the movement under BBA and UJJS. In Dehradun, Chipko activists have set up Himalaya Action Research Centre that trains farmers in organic farming and micro-enterprises.

As I leave for Delhi, I remember Bhatt's words. Every village should have a *gram van*, the village forest. Research shows that a forest of 50 hectares can generate enough fodder in six months and help the village earn ₹10 lakh a year. This is both economic and environmental gain. ■

@down2earthindia

Chandi Prasad Bhatt, the founder of Chipko movement. He believes that every village should have a forest of its own

Sita, a resident of Parapur village in Dantewada district, says that the village has not received any developmental benefits despite being just a few kilometres from a mining township

SRESTHA BANERJEE / CSE

Bastar beyond Maoists

Such is the obsession with Maoists that no one is paying attention to health and education in this ancient and beautiful land

BY SRESTHA BANERJEE

FOR ALL of us in the 21st century, Bastar is a landscape of forests, tribals and a bloody battleground for security forces and the armed insurgents known as Maoists. One way, it is a landscape of perceptions. Unless one ventures into this area in Chhattisgarh.

From Jagdalpur to Dantewada, the road meanders through dense sal forests. Often wild fruit-bearing trees and medicinal plants appear. Posts of the Central Reserve Police Force are visible within short distances of each other. People generally refuse to go to these places after daylight. We were also warned.

"*Aap ko dar nahi laga yahan aane mein*" (Didn't you feel scared coming here)?" asks a clerk at Dantewada District Collectorate as I approach him for a meeting with the District Commissioner.

ALONG THE TRAIL

Local food: The people of Dantewada are mainly non-vegetarian. However, leafy vegetables such as *lal bhaji* and *khatti bhaji* are eaten as accompaniments to rice. Liquors such as *paje* (a non-toxic, home-made liquor made from water and cooked rice), *sulphi* (collected from a tall palm-like tree) are popular in the region.

Local festivals: Celebrations are typically oriented around nature and harvest, such as *pane pandum* (before sowing paddy seeds in May and giving thanks for the new crops in November) and *gadi pandum* (before picking the *mahua* flower).

On seeing two women—my colleague and I—in south Bastar, this was the first question that came to his mind. Insurgency raging in the Bastar forests for the past decade has created an atmosphere of fear. Uneasy conversations of conflicts, guns and arrests are common. The lush green Dandakaranya forests and the serene streams somehow fail to relieve the nervousness.

The word "*dandakaranya*" roughly translates to "the jungle of punishment". Folklore has it that the forests were home to many deadly creatures and exiled people. The reputation endures. Its people today seem to be living in exile. Even though rich in beauty, resources and tribal culture, the forests are infamous as "maoist-infested".

Of the many fallouts of insurgency a critical one is the way it has affected the lives of some of India's poorest people—the adivasis predominant in this area. Stories of their everyday life, their needs and aspirations have been subsumed into the dominant narrative of insurgency. Pressing issues of malnutrition, healthcare, clean water and education have largely remained on the sidelines. Our journey through Dantewada, is to walk through the sidelines.

First sprouts of life

But first, a short ecological history. Bastar's geography is its history. Apparently, some three billion years ago life took shape here. The plant and tree species we see now are ancestors to the first sprouts of life in what we call India. It was still a separate geological plate and India at that point of time did not look like what it is today. The tribals were not there but the plants and trees were busy preparing the ground for them to appear much later.

Bastar has that fabled Abujmarh, or the unknown hills, covered with 3,900 square kilometres of forests. It was only in 2009 that the government opened access to these hills. They were out of bounds since the 1980s. It is arguably the place where one can experience pre-agriculture life. The forests host tribes like the Gonds, who do not have a word for "future" and "breakdown". Many of the tribes have numbers only till seven. It is a life that existed more than 10,000 years ago.

The red irony

Early morning we set out to go to Bacheli, one of the two most important iron ore-mining sites of the National Mineral Development Corporation (NMDC) in Dantewada. Bacheli lies in the foothills of the Bailadila Range, an ecological hot spot and famous for its high-quality iron ore deposits. The corporation has been mining iron ore in Bailadila since the early 1960s. At present, it has five operational leases spreading over 2,553 hectares of forested area. In 2015-16, it earned a royalty of ₹577 crore. Last year, the earning was ₹953 crore, says District Commissioner Saurabh Kumar. The district has enjoyed such handsome earnings for years now.

It is arguably the place where one can experience pre-agriculture life. The forests host tribes like the Gonds, who do not have a word for 'future' and 'breakdown'

But the richness of the red ore has escaped a large section of the population here. On the main road through Bacheli, a signboard boasting "Indian Coffee House" points in the direction of NMDC township, a pocket of affluence. Just on the other side, a few kilometers inside, people walk a considerable distance for a pot of water.

A common sight in Parapur, a sparsely populated tribal village in Bacheli, is women with *handi*s (pots) on their heads going to fetch water. Nande is one of them. Unable to speak Hindi, she communicates with us through gestures and with the help of a local person accompanying us. Every day she and many others walk a long distance to get water.

Only about two per cent of the rural households have access to treated tap water in Dantewada. As per official data, 84 per cent households in the region "rely" on hand pumps. But the hand pumps we come across in the village are mostly non-functional. Wherever the hand pumps are functional, people are apprehensive of the quality of the water. They fear the reddish water contaminated with iron ore. Instead, Nande and others *rely* on spring water brought by pipelines.

10 km walk to see a doctor who may not be there

We are sitting in the office of Gramoday, a non-profit that has been working on health issues in Dantewada for the past 13 years. Gouri Shankar,

SRESTHA BANERJEE / CSE

People in the region do not trust the quality of water in the hand pumps. Instead, they rely on the stream water brought by pipelines

along with 10 others, works here. "The interior villages are particularly cut off from the health centres," says Gauri Shankar. In villages such as Kamalur and Jherka in Bacheli, people have to walk more than 10 km to reach the primary health centre (PHC). The villages close to the town centre are comparatively better off—NMDC hospital is nearby and the walk to the health centre is 4-5 km.

Asish Bose, a health consultant at the district hospital, acknowledges the critical shortage in health infrastructure. "From basic services such as having trained personnel to give anaesthesia at the district hospital to the very limited resource on the ground such as the primary health centres, the challenge is multifaceted," he says. A survey of the Ministry of Health and Family Welfare done until 2015 underscores this. Dantewada has only 11 PHCs for a population of 533,638, of which 82 per cent is rural. This means there is roughly one PHC per 48,500 people. Even these few centres rarely have full time doctors.

Equally challenging is the health and nutrition support to children and women in the villages. "While there are *anganwadi* centres, nutrition education among the workers and the monitoring of nutrition and growth are not up to the mark," says Seema Kunjum, who works on health issues and with *anganwadi* workers in Dhurli village.

To compare my experience with statistics, I look up the Rapid Survey on Children by the Ministry of Women and Child Development. In Chhattisgarh, about 38 per cent of tribal children below five years are underweight, while 44 per cent suffer stunted growth, it reads.

Home is where the school is not

We stop by a small school in Ronje village, just outside the town, around 10 in the morning. Boys and girls in white and blue uniform have gathered for classes. A student of Class VIII, Taravati lives with her distant relatives in Ronje so that she can attend school. Her village does not have a school. "Most students live in hostels to study," she says.

Staying in school hostels set up by the government in and around the bigger villages and town centres is an accepted way of life for many children in Bastar today.

Schools in interior villages are sparse. "Even where there are buildings, a major problem is the availability of teachers," says Trivendra Kumar Nirmalkar, a teacher at the *prathamikshala* (primary school) in Netapur, a village of about 150 families. Literacy rate in this village is abysmally low—just 12 per cent. Small wonder, the school has two

SRESTHA BANERJEE / CSE

Students from faraway areas attend this middle school in Ronje village of Dantewada. Schools are sparse in interior villages, so children have to leave home for education

teachers and just 22 students.

Middle schools are a bigger challenge. "Typically, children have to walk about 5 km to reach middle schools. In the hilly terrain that is difficult," Nirmalkar says. "Another problem is that children drop out of school by the time they graduate to middle school," adds Praneet, a member of Bachpan Banao, a non-profit working on child education in Dantewada. The teachers in these schools are mostly non-tribals from other places. They teach in Hindi. They do not know the Gondi and Halvi languages that the children speak. This hinders learning and also creates a sense of uneasiness. Nirmalkar thinks education is a distant investment for the people in tribal villages whose immediate concern remains livelihood. "As the children reach the age of 10 or 11 years, they are typically directed to work that can support the family income," he adds.

One phrase that comes up often in our conversation with government officials and members of education non-profits is "*pota* cabins" (portable cabins). These are places that provide food and education. "*Pota*" also means "stomach" in the Gondi language. The cabins began appearing in Dantewada since 2011 to provide "secured dwellings". Made of mostly bamboo and wood, these residential schools have facilities for students of first to eighth grade. "There are now 17 such schools with about 500 seats each," says Praneet.

The safe havens for children are being created at a distance, so children have to leave home.

Hope in the graveyard

The gloomy statistics notwithstanding, the people here must be cherishing hope. A striking thing about the tribals is how beautifully they paint their life after death. In the graveyards in the villages and along the roads, some of the tombs, particularly of tribal leaders or significant people, I presume, have rich and detailed engravings—their portrait, politics, favourite habits.

They seem to nurture life in death. One can paint death so beautifully only if the life is rich, if there is hope.

An opportunity?

The conflict in the Bastar region is also a conflict of resource rights. For years people in this region knew that the resource beneath their land is of someone else: sometimes the state, sometimes the mining corporation. They felt alienated, suffered unequal development and fought for their rights.

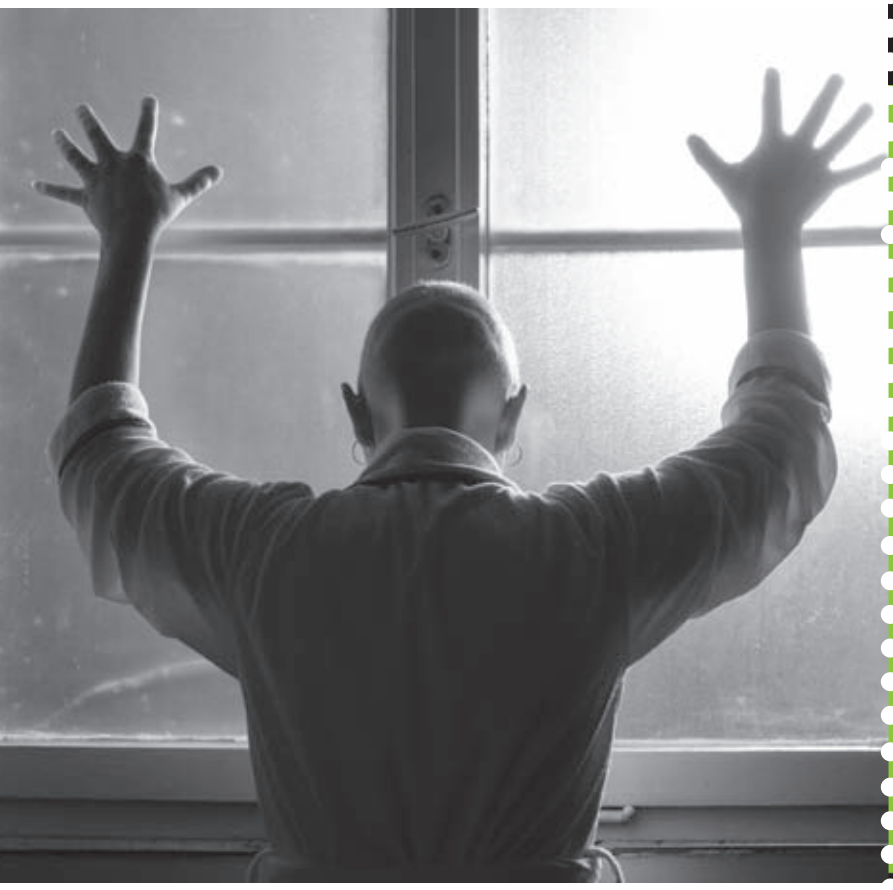
Finally, the government has recognised the right of the people over resources. To this effect, in March 2015, Parliament passed an Amendment to the Central mining law, the Mines and Minerals (Development and Regulation) Act of 1957. One of the key provisions of the amendments is the institution of District Mineral Foundation (DMF), a non-profit Trust, to be developed in all mining districts of India. DMFs are meant as a vehicle for ensuring that the benefits of mining are shared with the people of the region. They must address crucial human development factors such as nutrition, healthcare, clean water, sanitation, education. Mining companies will have to give DMF a share of the royalty they pay to the state government.

For the government this is a momentous opportunity to reach out to the remote parts of Bastar. It is an opportunity to seek a renewed contract with the people of the region, an opportunity to write a history of renewed hope. I leave with the hope that someday I would come back to Dantewada when the first question to me would no more be about the fear it evokes. ■

@sresthab

Cancer calculus

About 17.5 million cancer cases and 8.7 million deaths globally in 2015



ISTOCKPHOTOS

GLOBALLY, CANCER is the second leading cause of death worldwide, says a new report that used vital registration system data, cancer registry incidence data and verbal autopsy data. Between 2005 and 2015, cancer cases increased by 33 per cent; the odds of developing cancer during a lifetime are 1 in 3 for men and 1 in 4 for women; and, the most common childhood cancers are leukemia, other neoplasms, non-Hodgkin lymphoma, and brain and nervous system cancers. While prostate cancer was the most common in men (1.6 million cases); tracheal, bronchus and lung (TBL) cancer was the leading cause of cancer deaths for men. Breast cancer was most common for women (2.4 million cases) and also the leading cause of cancer deaths in women. **JAMA Oncology, December 3**

GEOLOGY

Without oxygen

SCIENTISTS HAVE found bacteria that existed two billion years before plants and trees, which evolved about 450 million years ago. They discovered these microfossils preserved in a layer of hard silica-rich rock in two separate locations in the Northern Cape Province of South Africa. This discovery could help reveal a diversity of life and ecosystems that existed just prior to the Great Oxidation Event, a time of major atmospheric evolution. **Geology, December**

HEALTH

No safe level

EVEN CASUAL smokers are at an increased risk of early death. Researchers have found that people who consistently smoked an average of less than one cigarette per day over their lifetime had a 64 per cent higher risk of earlier death than non-smokers. Those who smoked between one and 10 cigarettes a day had an 87 per cent higher risk of earlier death than non-smokers. The risks were lower among former low-intensity smokers compared to those who were still smokers, and the risk fell when they quit at an early age. **JAMA Internal Medicine, December 7**

CLIMATE CHANGE

Precipitating gloom

INCREASED PRECIPITATION induced by climate change could make waterbodies murkier. Researchers, who analysed 5,000 lakes in Wisconsin, USA, found that nearly a quarter of them had turned darker in the past two decades. They did not just identify the trends in water clarity (an indicator of lake health) but also how the landscape and the climate interacted to determine year-to-year fluctuations. Limiting farming to 10 per cent of the riparian buffer zone around a lake and the streams flowing into it can improve water clarity. **Ecological Applications, November 17**

HEDGEHOG TALES **RAKESH KALSHIAN**

Scientific stutter

Do animals have a language, and hence a mind, of their own?

WHY IS that we humans have the gift of the gab while monkeys and apes, our closest cousins, can only manage gibberish? A widely held view is that their voice box is not sophisticated enough to articulate sounds the way we can. Darwin, however, suspected it had to do with their primitive cranium. A new study, published in *Science Advances*, that explored the phonic repertoire of a long-tailed macaque supports Darwin's hunch. Evolutionary biologist William Tecumseh Sherman Fitch III from the University of Vienna and neuroscientist Asif Ghazanfar from Princeton University trained the monkey to do a wide variety of oral gymnastics—yawning, eating, wincing, screaming, et cetera, and made a video of it.

On careful analysis, they found to their surprise that there was nothing, at least in theory, in the anatomy of the macaque's vocal apparatus that would come in the way of it talking like humans. So the only reason it cannot, they concluded, was that its brain is not hard-wired to make discrete sounds like vowels and consonants.

TARIQUE AZIZ / CSE

In other words, primates, and for that matter most animals, do not have language because they don't have the mental corkscrew, so to speak, to open the bottle of language. Fitch says their findings also suggest that anthropologists should stop looking at fossil record for evidence of when our ancestors learned to speak, as all of them had the speech hardware. Instead, he argues, we should be trying to figure out when we acquired the genetic software necessary for activating the vocal machinery. Some linguists believe the study could even account for the slight differences among various languages with respect to qualities like timbre and cadence, as different voice boxes could potentially give rise to different tongues.

However, not everyone's convinced about the study's chief claim that primates cannot talk because they cannot think. For instance, in July this year, Durham University researchers trained, for the first time ever, an orangutan to mimic human speech.

This view is supported by primatologists such as Frans de Waal, a professor of psychology of Emory University. In his recent book *Are We Smart Enough to Know How Smart Animals Are?*, he argues: "Even though language assists human thinking by providing categories and concepts, it is not the stuff of thought. We don't actually need language in order to think. With animals, the situation is similar." American philosopher Jerry Fodor echoes Waal's view: "The obvious (and I should have thought sufficient) refutation of the claim that natural languages are the medium of thought is that there are non-verbal organisms that think."

While conceding that we are the only species endowed with language, he goes on to describe many examples of non-verbal communication from the animal world, such as signaling of bees or the hand gestures of apes, and argues that the rudiments of what defines human—politics, culture, morality, and, in our case, language—are also present in other species.

This of course raises the even more intractable question of whether animals have consciousness. Just as Waal dismisses the link between language and cognition as a "red herring", many biologists now believe it is time we took out the spanner of consciousness from the works of thinking, for we don't even agree on what consciousness is. As the Oxford zoologist Antone Martinho, who successfully trained his ducklings to appreciate concepts of "same" and "different", says, "If my ducklings do "think", whatever that might mean, the best evidence for it is the fact that vertebrate brains are broadly more alike than they are different... It is only a muddling of the distinction between consciousness and cognition...that forces us to play down the intellectual prowess of our companion species. We would do well to break this habit."

But while this would be sweet music for the ears of animal rights activists, the real challenge is to instill this new thinking in the popular imagination. ■

Green Masterpiece by Airports Authority of India

The New Integrated Terminal Building at Vadodara Airport was dedicated to the Nation by Shri Narendra Modi, Prime Minister of India in the august presence of OP Kohli, Governor of Gujarat; Vijay Rupani, Chief Minister of Gujarat; P Ashok Gajapathi Raju, Union Minister of Civil Aviation;Jayant Sinha, Union Minister of State for Civil Aviation; NitinbhaiPatel, Deputy Chief Minister of Gujarat; Rajendra Suryaprasad Trivedi, Minister of State for Sports, Youth Cultural Activities(I/C),Pilgrimage Development, Government of Gujarat; RN Choubey,Secretary Civil Aviation; Dr Guruprasad Mohapatra, Chairman, Airports Authority of India (AAI), among other dignitaries.

The New Integrated Terminal Building has the GRIHA features to reduce resource consumption and greenhouse gas emissions. It has LED Lighting with sensors, Low VOC Paints (Volatile Organic Compound), Low heat gain Glazing, Rainwater Harvesting, Energy Efficient Chillers, Cavity Walls, Usage of Fly Ash Bricks, Re-use of treated water (600 KLD STP), Double Insulated Roofing System VFDs (Variable Frequency Drive) for High Capacity Motors. Moulded or pressed articles of sugarcane bagasse pulp or other fibrous cellulosic material have been used as decorative material.

The building creates a bold and continuous aerodynamic form. It is a sleek contemporary structure which has a huge archway that wraps the entire terminal and Sky lights follow the geometry of the trusses, further opening the structural framework to allow natural light to permeate the terminal. The terminal building is equipped with state-of-the art passenger-friendly facilities, such as Common Use Terminal Equipment (CUTE); Check-in counters; Reserved Lounge; CIP Lounge; Glass Cleaning System in Air & City side façade; Escalators; Elevators; Baggage Handling System; Inclined Arrival Baggage Claim Carousels; Central Air-conditioning; Public Address System; Intelligence Addressable Fire Alarm System; Flight Information Display System (FIDS); CCTV for surveillance; Sewerage Treatment Plant with Zero Waste; Rainwater Harvesting; Energy Efficient Glass; a unique Food Court outsideTerminal Building & Car Parking, etc. The new terminal, to a great extent, caters to all passenger facilities, be it comfort, convenience, aesthetics, eco-friendliness, and so on.

Celebrated minds

In 2016, many Indian-origin scientists made it big and got international acclaim for their work. From inventing binoculars which rapidly calculate the prescription for eyeglasses to microscopes made of paper, these scientists have kept the spirit of discovery alive. Snapshots of six scientists

VAISHNAVI RATHORE

RAMESH RASKAR

Cutting-edge technology

BORN IN Nashik, Ramesh Raskar is an associate professor at the Massachusetts Institute of Technology and the head of MIT Media Lab. Raskar invented the EyeNetra, which allows eye testing in remote locations. EyeNetra is a small binocular device that snaps onto a mobile phone. While looking into the binocular, the user can quickly calculate a prescription for eyeglasses. This eliminates the need for expensive diagnostic tools and is already being used in the US, Brazil, and India. He has also used femto-photography to capture images around corners.

Raskar has helped teams in Kumbh Mela by providing a technology that displays the heat maps of crowd movements. This can be used for crowd control. He has also developed a system to detect impending epidemic outbreaks in real time and a camera that allows users to read pages of a book without opening the cover.

The future applications of his work include avoiding car collisions at blind spots, detecting survivors in fire and rescue situations, and performing endoscopy and medical imaging to eliminate the need for an X-ray. Raskar was awarded the 2016 Lemelson-MIT Prize, which celebrates outstanding inventors.

SUMEET WALIA

Nano-electronics

SUMEET WALIA is renowned for his work in nano-electronics. He specialises in the use of metal oxides for developing high-performance electronic devices.

This year the MIT Technology Review listed him among the "10 Innovators Under 35". Walia teaches at the Royal Melbourne Institute of Technology. Recently, he was part of a team of researchers who found that the performance of mobile phone cameras and solar cells could be boosted by the use of sound waves to controllably change the electronic properties of materials.

"My work focuses on fabricating

ultra-thin layers (thousands of times thinner than a human hair) of metal oxide materials and tailoring them for a range of functionalities in three key areas—to develop wearable sensors for healthcare monitoring and harmful gas detection; an electronic chip to store and recall events from the past, mimicking the functionality of the human brain; and, high speed nanoscale transistors that can operate at speeds faster than the current silicon-based electronic technologies and result in energy efficient, ultra-fast electronic devices," Walia told *Down To Earth*.

MANU PRAKASH

Low-cost scientific tools

MANU PRAKASH invents tools to do field science that are both low cost and powerful. His Foldscope is a microscope made out of paper and a glass bead for a lens and costs less than a dollar. It has been distributed to more than 50,000 people in 135 countries.

Foldscope has been used for projects to explore diseases in bees, documenting pollen grains in urban landscapes, mapping biodiversity of microscopic organisms, detecting cervical cancer and teaching hygiene and sanitation.

Born in Meerut, Prakash is an associate professor of bioengineering at Stanford University. He has been listed as one of the 23 candidates for MacArthur Fellowship 2016, popularly known as "genius grant". He has also been designing tools to track and detect mosquito species. This would enable communities to combat mosquitoes on a largescale and track the vectors for some of the most deadly diseases.

Prakash has also developed a computer that works by moving water droplets. The goal is to make computers control and manipulate physical matter. The immediate application of this innovation may involve turning the computer into a chemistry and biology laboratory.

SHIRAZ MINWALLA

Theoretical physics

HE WAS awarded The World Academy of Sciences Prize 2016 for his contribution to theoretical physics. Shiraz Minwalla studied at the Indian Institute of Technology, Kanpur, and got his doctorate from Princeton University, New Jersey, USA. He now teaches at the Tata Institute of Fundamental Research, Mumbai. "My research focuses on obtaining a better understanding of the dynamics of gravity (related to black holes) and quantum field theories and their interrelation. My research pushes the boundaries of knowledge and has no immediate practical applications," Minwalla told *Down To Earth*. "My goal is to obtain a complete understanding of the physical laws that underlie the universe, which are probably unattainable in entirety," he adds.

PRADEEP CHALUVALLY-RAGHAVAN

Ovarian cancer research

A DOCTORATE from the University of Calicut, Pradeep Chaluvally-Raghavan was given the 2016 Liz Tilberis Early Career Award for his commitment to ovarian cancer research. He teaches at the Medical College of Wisconsin, Milwaukee.

Chaluvally-Raghavan's current research focus is on the role of non-coding genetic aberrations in ovarian cancer. "Since the cancer cells grow faster than the body's own healthy cells, it is important to understand the precise mechanism that tumour cells employ to proliferate and metastasise to distant sites. My research will help develop agents that would target the tumour cells without affecting the normal cells in the body," he told *Down To Earth*. We hope our studies will help improve the quality of life of patients suffering from breast, ovarian and other gynaecological malignancies, he adds.

SHUBHA TOLE

Genetics

SHUBHA TOLE is part of the Asian Scientist 100 list for 2016. This list is compiled by combing through scientific awards and breakthroughs across the region.

Her lab is interested in the genetic mechanisms that control the formation of perception, language, learning and memory.

Her current research focuses on genetic 'knockout' mice, RNAi, embryonic stem cells, tissue culture, and molecular biology approaches to address questions of the development and evolution of the brain. In her work on mammalian nervous system, Tole discovered a master regulator gene that controls how the brain's cortex hippocampus and amygdala develop.

Her work throws light on what exactly happens when things go wrong during the intricate process of building the brain. These disturbances can cause neuropsychiatric disorders such as autism and epilepsy.

At present, she teaches at the Tata Institute of Fundamental Research, Mumbai. Tole is committed to education, public outreach and mentorship and wishes to groom young scientists. ■

PATENTLY ABSURD **LATHA JISHNU**

A Nelson's eye on digital biopiracy

Biodiversity meet puts off decision on benefit-sharing from digital gene sequences

THERE WAS a lot of good news pouring out of Cancun after the 13th meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD) ended on December 18 with a yard-long declaration that covered just about every issue dear to conservationists. The declaration, named after the Mexican city where COP13 was held, outlines a plan to restore the ecology and improve conservation—which might sound suspiciously vague—but has more than 70 detailed decisions on a host of problematic issues. These range from management of pollinators and tackling invasive species to the sustainable use of bush meat and bringing biodiversity values into national accounting systems.

So there was gush. CBD chief Braulio Ferreira de Souza Dias believes the Cancun Declaration and the "powerful commitments" made at the High Level Segment meeting are a strong signal that countries are ready to achieve the Aichi targets. This ignores his secretariat's warning issued earlier that two-thirds of the 20 globally agreed goals to address biodiversity loss, that is, the Aichi biodiversity targets, are way off the mark and unlikely to meet their 2020 deadline. But then, CBD needs to look on the bright side even if habitat and species loss continues unabated.

TARIQUE AZIZ / CSE

Even more sanguine was Erik Solheim, executive director of the UN Environment Programme, who thinks that "for the first time we are really speaking meaningfully to one another about the real value of biodiversity to tourism, to agriculture, to forestry, to fisheries—to the very lifeblood of our economies." In the midst of all this hope and cheer, a new rift opened up at Cancun between the usual parties: developing countries, which are the repositories of mega biological diversity and rich nations, which want to use these resources without sharing benefits with the countries that have nurtured the resources.

COP13 was notable for dissension on a new front: digital biopiracy. This is a CBD loophole which allows companies to access gene sequences of plants and seeds on the Internet and then use them in various ways, including by re-creating physical DNA via synthetic biology techniques, without the consent of biodiverse countries or communities from where the genes originated and without any benefit-sharing. Information that originates in a country's plants, microbes, animals or fungi are being commercially exploited through the Internet without any benefits flowing back to host nations.

The developed world put up a formidable front, ranging from the European Union and Canada to Australia, arguing that digital sequences should remain open and free. In other words, companies should be free to bypass CBD and specifically its supplementary agreement on access and benefit-sharing that's enshrined in the Nagoya Protocol.

While developing countries wanted digital gene sequences and other genetic information that is increasingly available digitally to come under the ambit of Article 10 of the Nagoya Protocol to stop biopiracy, rich nations, which house the large biotech firms, wanted the discussions to be taken off the table. Fortunately, a compromise was hammered out around a proposal made by Namibia which was strongly backed by South Africa, Kenya, Brazil and Malaysia to take the gene sequences issue out of the synthetic biology agenda item and establish it as a decision under a new COP13 agenda item. A clear timeline has also been laid out for a process to arrive at a draft resolution to be placed before CBD members at Sharm el Sheikh where the next COP13 will be held two years hence.

Too late for developing countries? Possibly, since the loophole will allow biotech firms to continue their use of gene sequences without let or hindrance. And who knows if there will be agreement in Egypt in late 2018 while the world turns a Nelson's eye on digital biopiracy. ■

Programme Manager/ Deputy Programme Manager

(Environmental Governance Group of CSE)

About the Environmental Governance Group

Environmental Governance Group at CSE is engaged in capacity building, research and advocacy for environment protection. The major work of the team includes - developing policies/ plan and building capacity at the level of policy makers, industry representatives and urban local bodies for better compliance, monitoring and enforcement.

Work Profile

The selected candidates are expected to contribute to capacity building programs apart from research and advocacy work.

Specific tasks include:

- Research on policy matters and contribute to capacity building programs;
- Analysis and interpretation of the data/ information as required for specific research work;
- Preparation of reports, communication materials, and other publications as necessary;
- Communicating and networking with a wide range of stakeholders for effective advocacy;
- Travel as required for the work.

Required Skills

- Research and analytical skills and a good hold on report writing;
- Good oral communication and networking ability;
- Ability to work in a team to meet deadlines;
- Creative thinker and ability to innovate.

Qualifications and Experience

Bachelors in Environmental Engineering or Masters in Environmental Sciences or equivalent, with a work experience of 5 to 10 years in the field of environment and social work.
The designation and salary would be commensurate with qualifications and experience of the selected candidates. The position is based in New Delhi.

Please send in your applications to jgupta@cseindia.org latest by 20 Jan, 2017.

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ENGINEER
THE END

By 2025, the number of End of Life Vehicles in India is estimated to reach over 21 million. Here's how we can manage them efficiently and effectively

NITISH ARORA

ISTOCK PHOTO

OVER THE last decade, India recorded one of the highest motorisation growth rates in the world. There were over 200 million motorised vehicles registered by 2015. It is estimated that more than 8.7 million vehicles reached the End of Life Vehicles (ELV) status in 2015, out of which about 83 per cent would be two-wheelers. And by 2025, the number of ELVs is estimated to reach over 21 million. Moreover, the recent ban on diesel vehicles by the National Green Tribunal implies that more vehicles will soon end up as ELVs.

At present, such vehicles usually end up in the unorganised sector. Here, after dismantling, the auto components are either refurbished or sent for recycling. But the efficiency of material recovery is quite low as workers are not trained and lack the requisite equipment to dismantle and recycle the auto components.

While some aspects of ELV recycling are addressed by the vehicular and environmental policies as well as in the waste management rules, there are other aspects that are yet to be covered by existing laws. The Central Pollution Control Board (CPCB) recently issued guidelines to regulate the sector in an environmentally friendly manner, recommending a system of "shared responsibility" involving all stakeholders—the government, manufacturers, recyclers, dealers, insurers and consumers. The guidelines also state that if large quantities of metal and other materials present in ELVs are salvaged or recycled, it can once again be used by various sectors, thus reducing the demand for virgin raw materials.

A mechanism needs to be put in place that offers incentives to garner the support of both consumers and manufactures for the effective management of End of Life Vehicles

Building a business model

A viable business model calls for putting in place the right incentives and disincentives that govern the consumption and lifestyle behaviour of citizens, fostering international cooperation, and setting up of a regulatory framework to implement the model.

But there are many problems. The Automotive Industry Standard (AIS), 129, defines ELV as a vehicle which, at the discretion of its last owner, is ready to be scrapped. But since the scrapping allowance is minimal, many vehicle owners do not discard their vehicles when the government timeline expires. They, instead, sell their vehicles in rural areas or to the second-hand dealers.

For recycling to become a reality, incentives need to be provided in the form of paying the last ELV owner a salvaging price according to the value of the ELV. Here, the extended producer responsibility framework should be embedded within the ambit of shared responsibility, as propagated by the CPCB guidelines. So far, the AIS 129 does not provide guidelines for a "take back system".

Possible routes

It is important to make the customer aware of the danger—environmental, legal or related to misuse—of using the services of the unorganised sector, and provide them world-class services at their doorsteps. Also, the very definition of ELVs in India leaves a fundamental impediment—defining the average life of a vehicle. For instance, in countries such as Taiwan, China and Singapore the average life of a vehicle is 10 years or in terms of the kilometres driven, whichever comes first. This needs to be incorporated in the regulatory framework for accurate assessment of a vehicle.

On the supply side, there are many challenges—high investment costs for establishing reverse logistics networks; the cost of the quality assurance test equipment; or, the fact that some products may not have been designed to be dismantled easily for reuse. These factors can fail the business case for reuse, remanufacture and recycling. There is also an urgent need to formulate rules which mandate automobile manufacturers to frame the Standard Operating Procedures (SOPs) to dismantle every model and type of vehicle, which would encourage them to reconsider the material while making new automobiles.

The SOPs could then be shared with the semi-formal sector, which would enhance the efficiency in the recycling process. Streamlining the unorganised sector is extremely important. AIS 129 standards need to be incorporated in the regulatory framework to ensure compliance by the unorganised sector, where most of the recycling is done. But the material recovery rate in this sector is low, and compliance with AIS 129 will help enhace material use efficiency.

Further, the non-availability of facilities such as the National Automotive Testing and R&D Infrastructure Project in each hub does not serve the requirements of small and medium-sized auto component manufacturers. Such centres are critical to train personnel who could then dismantle scientifically, thereby leading to better resource recovery. Before the government implements the National Electric Mobility Mission 2020, it needs to set up high-grade recycling units to recover lithium, cobalt and other metals used in traction batteries, which is important from an ecological point of view.

Step-by-step

Vital ingredients need to be developed to make this business model a viable one. First, the setting up of collection centres, which would collect vehicles from owners and carry out the deregistration process. Second, the setting up of de-pollution centres to remove hazardous materials from the vehicles. It will also be their responsibility to safely dispose the harmful materials.

Third, shredding centres should be set up, which would segregate materials for recycling. Automotive shredder residue should be sent to incineration plants for energy recovery. Lastly, vehicles about to be scrapped often have reusable parts. These parts can be separated at the de-pollution units and could be sold to retailers or to used-part dealers. Importantly, a mechanism needs to be put in place that offers the right economic incentives to garner the support of both consumers and manufacturers for the effective management of ELVs in India. ■

The author works with The Energy and Resources Institute, New Delhi

RIGHT TO DISSENT **LATHA JISHNU**

Modi's surgical strike on jobs

Demonetisation has deepened the gloom on India's employment prospects which have been shrinking

KAUTILYA, WHOM the Bharatiya Janata Party (BJP) sets so much store by, would not have approved of the way Prime Minister Narendra Modi has gone about with demonetisation. The fountainhead of statecraft in ancient times would have been appalled by the frequent changes in policy. Kautilya, better known as Chanakya, decrees in the *Arthashastra*, his celebrated guidebook for rulers, that the one quality a ruler should always follow is to be well-prepared, whether the task is big or small. "Planning is the light that shows the path in darkness," says one of his aphorisms.

And there are other injunctions that the BJP strongman has overlooked in his headlong rush to junk over 86 per cent of the currency in circulation. Kautilya says: "A work which is obstacle-ridden should not be started. One who knows (opportune) time accomplishes the task. One should commence a work after understanding the country and the consequences." That is pretty close to the bone although written some 22 centuries ago. As we come to the end of the 50-day period sought by the prime minister to get the cash situation back to normal, what is most worrying is the impact of the chaotic demonetisation on employment and the economy. Already under severe strain, the job market has gone into a tailspin in the past seven weeks, bearing out the dire prediction of worthies such as Amartya Sen and Manmohan Singh of the impact on the economy.

TARIQUE AZIZ / CSE

Reports have been pouring in daily of the different sectors where workers have been laid off in the wake of Modi's war on cash. Textile units in Tamil Nadu, construction in northern states, jute workers in Bengal were all being laid off apart from tens of thousands in small and medium enterprises (SME). The SME sector employs 40 per cent of the workforce.

Three weeks before Modi made his so-called "surgical strike" on black money on November 8, India had been given what can only be called scary news. A study by a Delhi-based think tank had warned that employment was shrinking continuously with as much as 550 jobs disappearing every day in the past four years. The Prahar study capped the gloom that set in when data released by the Labour Bureau in early 2016 showed only 135, 000 new jobs had been created in 2015, compared with 419,000 in 2013 and 900,000 in 2011.

The only hope is that the current layoffs are temporary. Once enough cash is back in the system—and here again we have different estimates of when this will transpire—the economy should start looking up. But such optimism is hard to sustain since the Reserve Bank of India (RBI), followed shortly by the Asian Development Bank, has pared India's growth forecast by half a percentage because of the disruption of economic activity in recent weeks.

And can we any longer trust RBI? The figures of cash infusions that it has been putting out simply do not tally. Either the banking system is suffering a shortfall of ₹5,000 crore or a whopping ₹56,000 crore, according to the different numbers of new currency notes the central bank has been claiming to have put back in circulation. Sharp eyes have also noticed that the august RBI has been editing and excising official figures on its website. Not at all a reassuring situation.

Adding to the uncertainty is the protest announced by bank employees who have been bearing the brunt of the strain caused by the chaotic demonetisation. The demand of the bank staff—adequate supply of cash to all branches along with transparency in numbers—makes it clear that the new RBI governor is out of his depth in managing the cash flows.

This makes one recall another of Chanakya's *sutras* on governance. "Everyone should be yoked to task for which he is fitted." So apt now. ■

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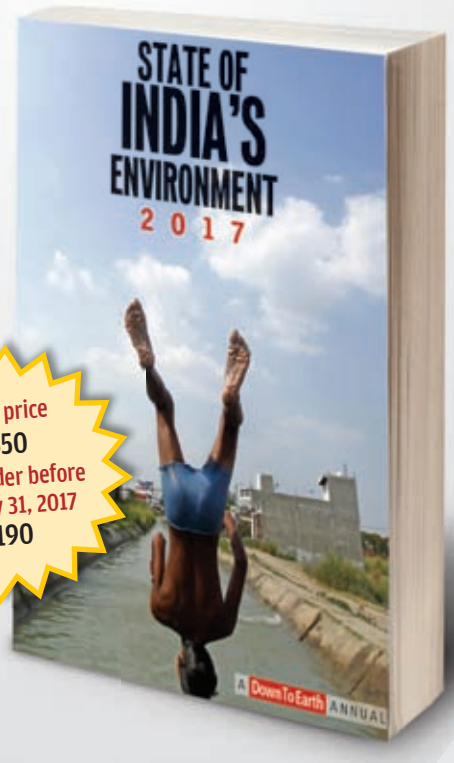

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ISSN 0971-8079. Licensed to Post without Pre-payment U(SE)-44/2015-2017 at Lodhi Road HO,
New Delhi-110003. Published on 1st of every month. POSTED ON: 2-3 of the same fortnight.