

1-15 SEPTEMBER, 2017

Down To Earth

AFRICA

FORTNIGHTLY ON POLITICS OF DEVELOPMENT, ENVIRONMENT AND HEALTH

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OLD ANSWERS FOR 'NEW' MONSOON

FLOODS IN the time of drought are India's new normal. Let us get this clear. Each year without fail, a vicious cycle of crippling drought and then devastating floods plays out before us. Sometimes this cycle gets so bad that it even makes it to the headlines. But the fact is that this cycle is getting a new normal. First, floods and droughts come together. Today, even as 40 per cent of the districts in India face prospects of drought, close to 25 per cent districts have had heavy rainfall of more than 100 mm in just a matter of hours. Secondly, the rainfall is not only variable but also extreme.

Chandigarh, a city of open parks, was recently submerged in water. It had deficient rainfall till August 21, and then it got 115 mm of rain in just 12 hours. It drowned. In other words, it got roughly 15 per cent of its annual monsoon rain in just a few hours. Bengaluru hardly had any rain and then it poured. It got 150 mm of rain in just about a day, which is close to 30 per cent of its annual monsoon rain. It is no wonder that the city drowned. Mount Abu got over half its annual monsoon rain in two days.

This is the double whammy I have discussed countless times in my articles. The fact is that on the one hand, we are getting our water management wrong—we are building in floodplains, destroying our waterbodies and filling up our water channels. On the other hand, climate change is beginning to show its impact on the monsoon. It is leading to more rain in a fewer number of rainy days, as scientists have predicted. We now see more rain and more extreme rain events.

This year, up to mid-August, data shows that India has had 16 extremely heavy rain events, defined as rainfall over 244 mm in a day, and 100 heavy rain events, defined as rainfall between 124 to 244 mm in a day. This means that rain will become a flood. Worse, in met records, the rain will be shown as normal, not recognising that it did not rain when it was most needed for sowing or that the rain came in just one downpour. It came and went. It brought no benefits. Only grief.

It is time we understood this reality. This means learning to cope with twin scenarios, all at once. This means being obsessive about how to mitigate floods and how to live with scarcity of water. But the good news is that doing one, can help the other. But we need to stop debating, dithering or dawdling. We know what to do. And we have no time to lose—climate change will only increase with time as

weather and rainfall will only get more variable, more extreme and more catastrophic.

Take floods. The media has reported that the government is considering—which can only be called a hare-brained scheme—desilting the massive Brahmaputra to control floods in Assam. This is not just unfeasible but an unnecessary distraction as it means we will lose more time. In Bihar, the government wants to do more of the same by building embankments along its rivers. This is when its own Kosi is perhaps the only river in the country, which is called both mother and witch. It comes down from the Himalayas; is known to bring vast quantities of silt; and, changes course with regular precision. We know that all efforts to tie up the river by building embank-

ments have not worked; the silt fills the river and the bed rises, and the water spills and seeps out across the region. This year's floods in Bihar have already taken over 250 lives (conservative figures) and devastated more than 10 million people. Not small. And remember with every flood and every drought the poor get poorer. All the development dividend is lost; homes, toilets and schools built are washed away and livelihoods, destroyed.

The answer to floods is what has been discussed for long. In fact, it was practised in these flood-prone regions many decades ago. It requires planning systems that can divert and channelise water so that it does not flood land and destroy life. It means linking rivers to ponds, lakes and ditches so that water is free

to flow. This will distribute the water across the region and bring other benefits. It will recharge groundwater so that in the subsequent months of low rainfall, there is water for drinking and irrigation. It will also ensure that there is food during the flood period, as wetlands are highly productive in terms of fish and plant food.

Mitigating floods and droughts has only one answer: obsessive attention to building millions and millions of connected and living water structures that will capture rain, be a sponge for flood and storehouse for drought. The only question is: when will we read the writing on the wall? Get with it. Get it right. ■



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Nature as teacher

Listen to Clea Chandmal talk about permaculture—the science of designing agricultural spaces using natural principles. She believes permaculture can insure farmers against climate change and market fluctuations.

Healthy sauce

Learn how to make chutney out of *chulu* or apricot grown in the Himalayas. The chutney is usually made from half ripe fruits. It is rich in vitamin A and C, iron, calcium and phosphorus.



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For a greener Africa



From providing clean energy, ensuring safe sanitation to reducing carbon emissions, these 15 African start-ups do it all to make Africa a greener continent.

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Uneasy non-evolution



The government recently diluted rules related to coastal and fishing communities. A timeline of how India amended its coastal norms 25 times in the past two decades.



WEB SPECIAL

A novel idea

Tamil Nadu is deploying concrete reefs near vulnerable islands in the Gulf of Mannar to prevent their further erosion.

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Well, Mr Trump?

A new report says Americans are already feeling climate change's effects as the US' average temperature has increased rapidly since 1980.

f FACEBOOK

A whole new world

US scientists successfully edit human embryos to correct a mutation that causes an inheritable heart condition.

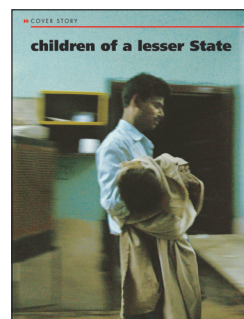
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GLIMPSES FROM OUR ARCHIVE

Things never improve in India

The Gorakhpur tragedy has shaken India. Many of the children who died were seeking treatment for Japanese Encephalitis. In "Children of a lesser State" (1-15 October, 2005), *Down To Earth* had reported from eastern Uttar Pradesh about

the area's annual tryst with the disease. We had warned, "This year's epidemic will soon be on the wane... And lessons that could have been learnt this year, too, would be lost." Gorakhpur has proved us right, sadly, once again.



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VIKASH CHOUDHARY / CSE

Against coercive tactics

This is regarding the cover story "Mission Madness" (16-31 July, 2017). We are glad for the appreciation of the Swachh Bharat Mission (SBM) and its focus on behavioural change for rural sanitation. As you know, SBM entails community involvement and participation as a key to make villages open-defecation-free (ODF) and clean. Building social pressure against open defecation through persuasion and consensus is important for behavioural change. Needless to say, I agree that coercive tactics are inappropriate and unlikely to lead to sustained change in behaviour. SBM Grameen is about positive behaviour change communication and generating community consensus in an equitable and constructive manner.

I would like to share that the Ministry of Drinking Water and Sanitation has sent an advisory to all states on July 25 underlining that such actions are against the spirit of SBM. This is also shared in the public domain through a press release. We are also constantly reemphasising this message with the district officials and state governments in all interactions.

PARAMESWARAN IYER

**SECRETARY, MINISTRY OF DRINKING WATER AND SANITATION
VIA EMAIL**

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

✉ Violence perpetrated by outsiders on the poor and innocent in the garb of liberating the nation from open defecation is a matter of serious concern. The collective behavioural change approach of Community Led Total Sanitation (CLTS) never provides outsiders the right to embarrass, harass, coerce, punish or penalise insiders to stop open defecation. Although CLTS is being used extensively across the country, many of these training courses have systematically incorporated pressure tactics by outsiders.

In reality, CLTS is an exercise where the community through its own analysis realises the harsh fact of ingesting each other's faeces as long as open defecation continues. Internalising this prompts a community to collectively think of methods to stop open defecation, such as immediately using unused toilets and supporting the poorest members in building makeshift toilets. Such actions begin immediately after a powerful triggering exercise is facilitated by

outsiders by involving as many people from the community as possible, including children. After the village is declared ODF, many communities impose monitoring activities and in some cases, penal actions.

The difference between a reward or penalty decided by a community and that by an outsider or the government is that the former is non-violent and non-confrontational. A community is rewarded only after adequate time is given to abandon open defecation. In Bangladesh, for instance, community members impose a small fine and the offender is requested in their panchayat not to practise open defecation and is also assured support. Apart from acting against such violence, the government should also spread the message that it is the community itself which takes the decision to become ODF in a sustainable manner.

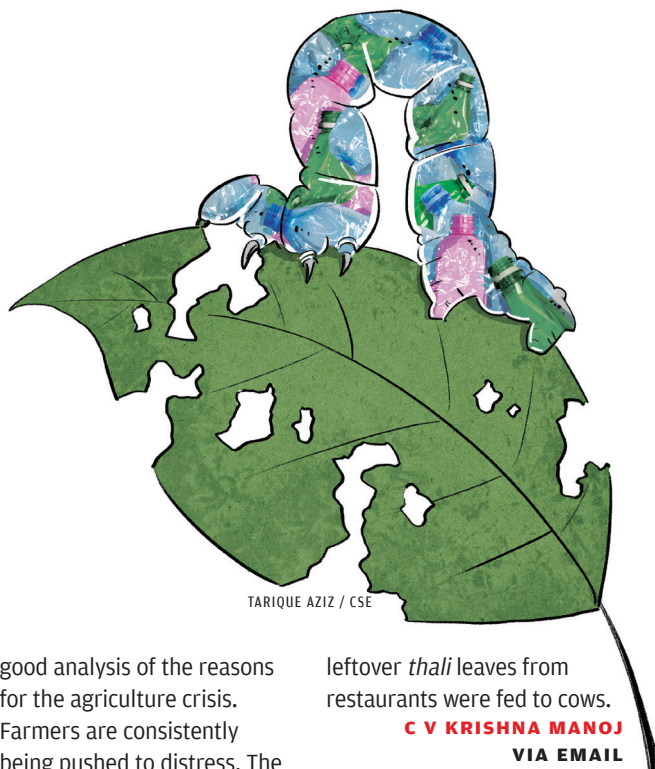
KAMAL KAR
CHAIRMAN,
CLTS FOUNDATION
VIA EMAIL

Say no to neoliberal policies

The cover story "Why farmers now dread a normal monsoon" (1-15 July, 2017) offers a



VIKAS CHOUDHARY / CSE



TARIQUE AZIZ / CSE

good analysis of the reasons for the agriculture crisis. Farmers are consistently being pushed to distress. The policy by successive governments allowing imports in the years of bumper crops is due to the commitments made to the World Trade Organization regarding imports of food grains. Ultimately, neoliberal policies are the main reason for this crisis.

SHANKAR AMMANAGI
VIA EMAIL

Packed and disposed

This is regarding the column "Plastic, the hungry caterpillar" (1-15 August, 2017) by Rakesh Kalshian. The need of the hour is to devise a plan for the manufacturers of fast moving consumer goods to take back the non-biodegradable packaging of their products. Besides waste segregation at source, we need to incentivise the use of leaves like *palasha* (*Butea monosperma*) and *siali* (*Bauhinia vahlii*). Disposable tableware can be made from arecanut leaves and bagasse can be used for packing food. Earlier, asafoetida and curd were sold in stitched *Butea monosperma* leaves, and

leftover *thali* leaves from restaurants were fed to cows.

C V KRISHNA MANOJ
VIA EMAIL

✉ It was shocking to know that at least 80 per cent of Americans have ingested plastics that are measurably present within their bodies, according to the Centre for Disease Control and Prevention, US. Indian consumers and manufacturers should note and reduce the consumption of plastic.

BHARATH KUMAR
VIA EMAIL

Riches from small inputs

This is regarding the article, "Small farms can be profitable" (15-30 April, 2004). I was astonished to know the success story of Ramesh Chander Dagar. I am interested in cultivation by traditional methods and his methods are motivating. I had no idea that instead of burning the leftover of paddy crop, locally known as *pawal*, one can use it as raw material for vermicompost and also to supplement one's income.

RABINDRA NATH THAKUR
VIA EMAIL

☒ Sustainable agriculture as practised by Dagar is inspiring. In the age of climate change and global warming, India's farmers should implement his methods. Unemployed youth can also learn from him in how to be self-sufficient.

ASHOKE KUMAR DAS
VIA EMAIL

☒ I appreciate your efforts in organic farming. This is a great way to increase the income of poor farmers. The method of harvesting rainwater to increase groundwater levels through a pond has been successfully implemented by a man named Nammazwar in Tamil Nadu. He also uses *pancha kavya*, *jeevaa mirtham* and *ganabeejamiratham* as alternatives to chemical fertilisers.

S SANKARNARAYAN
VIA EMAIL



NIDHI JAMWAL / CSE

☒ I am 77-year-old retired employee from the Karnataka State Financial Corporation. After taking up organic cultivation at Kulgod village, Gokak taluk in Belgaum district, I have faced a lot of restrictions from my family and friends. Your zeal encourages farmers like us to continue.

SHANKAR AMMANAGI
VIA EMAIL

Planning under duress

This is regarding the article, "Aral apocalypse" (1-15 August, 2017). The current state of Aral Sea isn't any different from that of large water bodies across India. Take Naini Lake in Nainital district, Uttarakhand. Soon, it may turn



NEHA MUNGEKAR

into a pond. First we put immense pressure on these resources and then when they cease to exist, we lament. Can we not prevent and prepare, instead of repenting when it is too late?

SUVIDHA BISHT
HARYANA

Unhealthy care

This is regarding the article, "Government hospitals on sale" (1-15 August, 2017). Privatisation in education and health has made crucial services unaffordable to the common man. In a poor country such as Cuba, healthcare is protected under its Constitution as a fundamental human right. It reminds us that efficient healthcare can be made affordable and ensure primary care and prevention, which is unfortunately absent in India.

The current model of healthcare is unsustainable and the plan to open more public hospitals and primary healthcare clinics merits consideration.

H N RAMAKRISHNA
BENGALURU

Offshoots of organic farming

This is regarding the article "Organic Trial" (1-15 April, 2017). Irrespective of the analysis, the state government's initiative to go for organic farming is a noble idea which has saved several plants from going extinct. It has also protected the region's biodiversity. I believe that many species of plants and animals we see here are because of the organic movement in the state.

C K CHHETRI
VIA EMAIL

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Government introduces new guidelines for diversion of forest land, which will make any project involving such diversions more costly

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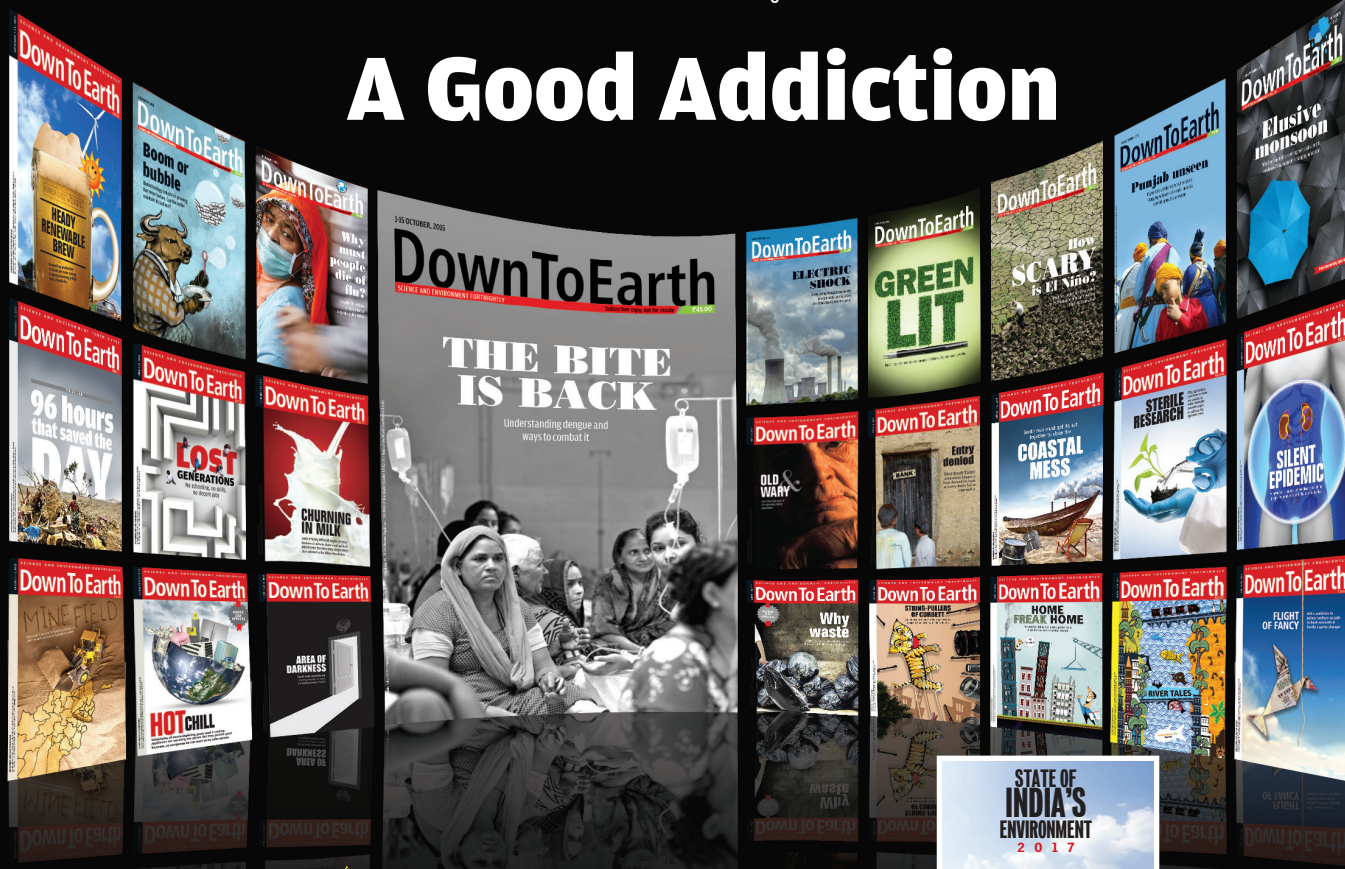
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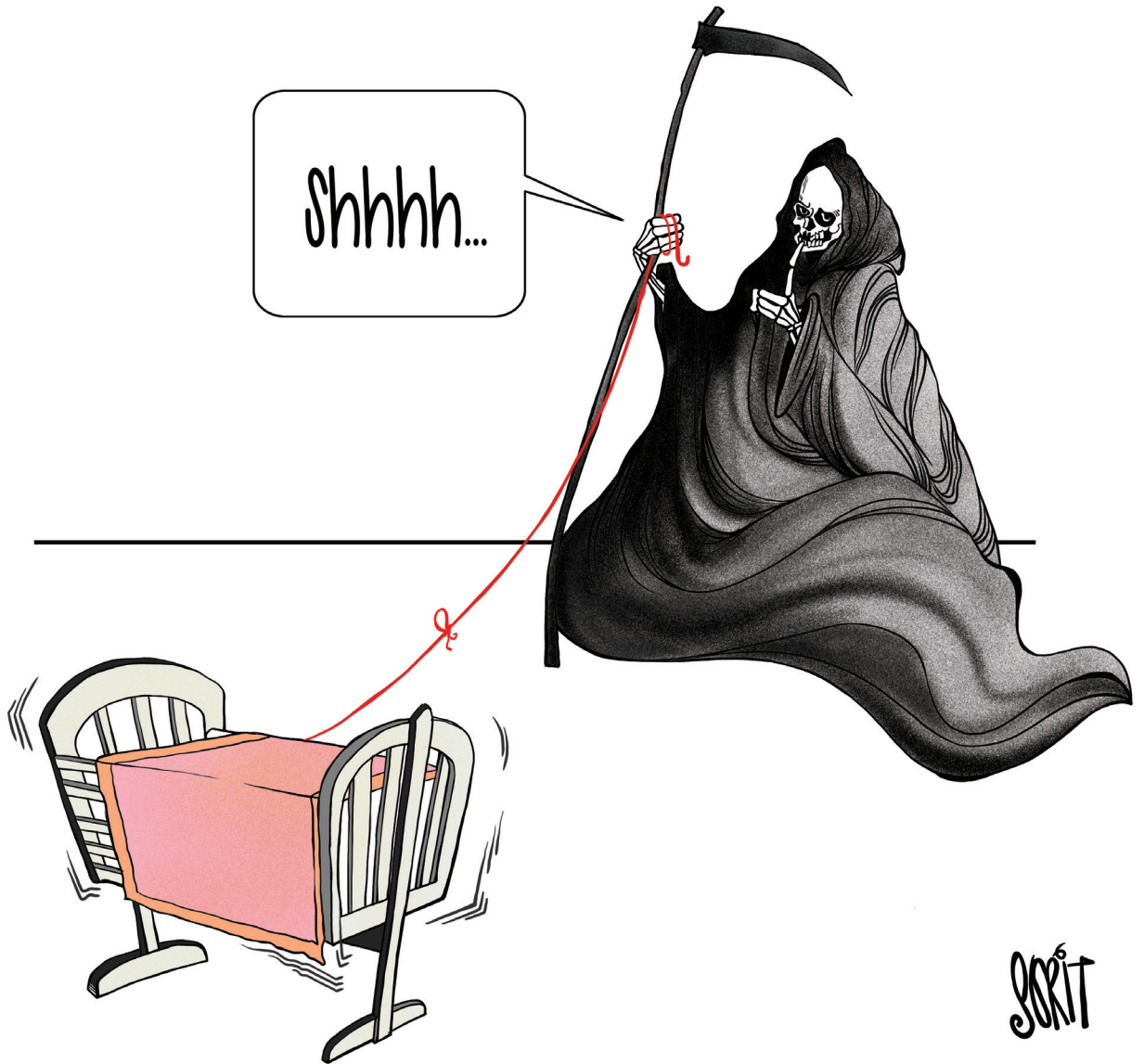
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CROSS HAIRS

BY SORIT GUPTO

The children's ICU of a Gorakhpur hospital



Diversion of forest land to cost more

THE GOVERNMENT has introduced new guidelines concerning the diversion of forest land, which will likely make any project involving such diversion more costly. The guidelines add 30 per cent of the net present value (NPV) of forests to the diversion cost as the “cost for possession of forest land”. NPV is the amount paid by

the project proponent for diverting land for non-forest use to compensate the loss in ecosystem services. An additional 50 per cent of NPV will be added as “habitat fragmentation cost” while another 10 per cent of NPV will be added as compensation for the loss of animal husbandry and productivity of the soil. ■

POINT

5%

The fall in the number of snakebite deaths in India between 2014 and 2016. The highest number of annual snakebite fatalities happen in India

Source: Minister of State for Health Anupriya Patel in a written reply to the Lok Sabha

1,000 WORDS BY VIKAS CHOUDHARY



BANKS OF FOAM: The Yamuna river at the Okhla Barrage on the Delhi-Noida border after a shower of heavy rain. Rain is supposed to clean the Yamuna's otherwise filthy waters. But as can be seen here, they have caused industrial foam to be pushed downstream. Delhi causes maximum pollution in the Yamuna. The 22-km stretch of the Yamuna in Delhi from the Wazirabad to the Okhla Barrage receives a discharge of 850 MGD (million gallons per day) of sewage from 21 drains. The 33 Sewage Treatment Plants operational at present treat only 390 MGD of this, although even their total combined capacity of 640 MGD is inadequate to treat all of the sewage emptied into the river.

Government serious about straw burning

THE UNION government has set aside funds to purchase over 34,000 machines to better manage paddy straw and avoid burning it in three northern states. Happy seeders, hay rakes and straw choppers will be bought for Punjab (13,700), Haryana (15,000) and Uttar Pradesh (6,045). Farmers in the three states burn crop residue during September-November and March-May, as wheat and paddy are grown in rotation in the region. It contributes significantly to air pollution in cities like Delhi. As a result, on December 10, 2015, the National Green Tribunal banned the burning of crop residue in Rajasthan, Uttar Pradesh, Haryana and Punjab. ■

632 die of swine flu in India, 303 in Maharashtra alone

A TOTAL of 632 people have died from swine flu or H1N1 between January 1 and July 16 this year in India, according to latest government figures. There have been a total of 13,188 confirmed cases. Last year, 265 people had died of swine flu. Maharashtra is at the top of the list of affected states and Union territories. There have been 2,738 confirmed cases of H1N1 in the state, while 303 people have died. Karnataka has the second-highest number of confirmed cases — 2,480.

Other states with high number of confirmed cases include Telangana (1,450) and Kerala (1,169). Other than Maharashtra, Gujarat (81), Kerala (66) and Rajasthan (59) have reported high number of deaths. The Union Ministry of Health and Family Welfare has issued an advisory that vulnerable groups such as diabetics, cardiac patients, people who are HIV positive or have full-blown AIDS, pregnant women, children and the elderly should get vaccinated. ■

IN FOCUS

Climate change's gastronomical effects



AJAY PANACHICKLE

The Brokpa tribals of Ladakh, who claim to have been **vegans for some 2,200 years of their existence**, are slowly opting an alternative diet that includes dairy products, eggs and meat—thanks to climate change.

The Brokpa live in the villages of Dha, Hanu, Beema, Garkon and Dhardik on the Line of Control with Pakistan. The total population of **the villages is about 1,700 residents**.

Climate change has made summer and winter warmer. Records show a **rise of 1 °C** in the minimum temperature during winter and **0.5 °C** in peak summer at Brokpa villages **between 1973 and 2008**.

As a result, **pests have increased**, leading to a significant drop in the Brokpa's traditional crops, forcing them to change their lifestyle.

The tribe traditionally grew barley, potatoes, apples and apricots, while wheat was introduced later. Due to the rise in temperature, the Brokpa now also cultivate **cherries, plums, grapes, tomato, cabbage, cauliflower, gourd, capsicum, beans and peas** despite the high altitude where they live.

The milder winter has caused pests—including fruit flies, codling moth, yellow rust, green and black-headed worms—to survive and even thrive.

Thus, while **variety in Brokpa agriculture has increased, production has dropped**, due to pests. This is one of the reasons, alongside migration, that meat and dairy consumption is becoming common.

IN COURT

On July 21, in the case regarding damage to the Yamuna river's flood plains during the three-day Art of Living event in Delhi, the National Green Tribunal (NGT) directed the Delhi Development Authority to nominate a senior officer as a member of the committee which shall submit an action plan to NGT on the flood plains.

On July 31, the Supreme Court directed that no manufactured fire-crackers shall contain antimony, lithium, mercury, arsenic and lead in any form whatsoever and it is the responsibility of the Petroleum and Explosive Safety Organisation to ensure compliance, particularly in Sivakasi.

On July 21, in a case regarding illegal mining and sinking of the area in and around Umaria, Madhya Pradesh, NGT ordered that the matter be taken up urgently so as to take necessary steps to prevent the loss of any life and property.

On July 25, NGT directed the Uttarakhand Pollution Control Board to submit an affidavit stating the time period from which industries in Dehradun's Pharma City have been operating without the consent of the Board. The factories are accused of discharging toxic waste into the Yamuna river.

On August 9, the Patna High Court ordered the Bihar government to submit within four weeks, its plan and time frame to repair the 4,095 non-functional tubewells in the state.



On July 21, NGT requested its Western Zonal Bench in Pune to hear the matter regarding the proposed international airport at Mopa village in Goa expeditiously and preferably on day-to-day basis.

SO FAR...



Total cases on environment and development tracked from January 1, 2017, till August 8, 2017

SUPREME COURT

56

HIGH COURTS

68

NATIONAL GREEN TRIBUNAL

283

NGT slams Delhi over the use of plastic

THE NATIONAL Green Tribunal (NGT) has slammed the Delhi government over the indiscriminate and rampant use of plastic in the national capital despite its prohibition. A bench headed by NGT Chairperson Justice Swatanter Kumar directed the government to enforce the ban. "There is ban order on plastic. Why have you not enforced it strictly? There are plastic bags spread all across Delhi. Why don't you check it up?" the bench asked. When the government counsel said plastic was already banned, the bench said, "Everyday, we see plastic lying on roads in different parts of the city. Why don't you do something?" In 2016, NGT had banned the use of disposable plastic in Delhi and the National Capital Region with effect from January 1, 2017.

Compiled by DTE-CSE Data Centre. For detailed verdicts, visit bit.ly/1C1FrCf

Centre creating online database on tribes

THE UNION Ministry of Tribal Affairs is creating a unique repertoire on India's tribes—an online database to document their evolution, contribution to India's freedom struggle, changes in lifestyle, cuisine, architecture, education level, mortality rate, traditional art, folk dances and other anthropological details. The database would include rare photographs and videos—running

in thousands—collected from different Tribal Research Institutes across states. After its launch, the database would be updated regularly with inputs from anthropologists. Officials say the main reason for creating the database is the minimal attempts to document tribal lifestyles, despite them constituting 8.6 per cent of India's population as per the 2011 Census. ■

EXTREME

260,000

The number of extra deaths projected to be caused by air pollution till 2100 if climate change is left unaddressed, according to a recent study published in *Nature Climate Change*

15,000 The number of deaths out of 260,000 that would be caused by a boost in fine particulate matter

43,600 The number of deaths out of 260,000 that would be caused by a climate change-related boost in ozone

60,000 The number of extra deaths projected to be caused by air pollution by 2030 if climate change is left unaddressed

55,600 The number of deaths out of 60,000 that would be caused due to a climate change-related boost in fine particulate matter

Q & A



“Other opioids are more important”

WHO: Nagesh Simha, Medical Director, Karunashraya, Bengaluru

WHAT: On July 30, Union Minister for Women and Child Development Maneka Gandhi suggested legalising marijuana, a psychoactive drug, in India for medical purposes on the lines of the practice adopted by countries like the US to curb drug abuse

WHY: “Medical marijuana is useful in specific situations in palliative care. These include nausea and vomiting in certain end-of-life situations. It is especially used in certain cases of HIV-AIDS. Medical marijuana is legal in some western nations and some states of the United States of America. But as far as India is concerned, if it is palliative care that we are after, then marijuana should not be such a priority. Because its range of use is very limited. According to the rules of natural justice, it is incumbent on us to rather make opioids like morphine more available and accessible since that is useful to more patients. Use of medical marijuana will take a very long time to get regularised in India.”

Stop propagating superstition as science: Indian scientists



FACEBOOK

NEARLY TWO months after scientists globally marched to support research, facts and a scientific temper in the face of rising ignorance to climate change and fund cuts, Indian scientists did the same. August 9 saw scientists across 30 Indian cities hit the streets for the first time in the country, demanding the government not only increase funding for crucial basic research, but also stop supporting the “unscientific beliefs and

superstitions” being propagated as science. The march, through a memorandum to Prime Minister Narendra Modi, demanded that India increases its spending on scientific research to 3 per cent of the GDP, from the current 0.85 per cent, and that “the Government uphold Article 51A of the Constitution, and restrain attempts that run counter to the development of scientific temper, human values and spirit of inquiry enshrined in the Constitution”. ■

Indian fishers under threat

FISHING COMMUNITIES have expressed their disapproval on the new draft Marine and Coastal Regulation Zone (MCRZ) notification. The MCRZ is based on the report of an expert committee set up by the government to review the CRZ notification of 2011. In Kerala, the National Fishworkers Forum has submitted a memorandum to the Central government demanding withdrawal of the draft notification, terming the proposed changes as an infringement of the livelihood rights of coastal communities. MCRZ allows tourism activities in ecologically sensitive areas and land reclamation for commercial purposes along the coast. The regulation also reduces the limit for housing infrastructure along the coast. The CRZ notification of 2011 permitted houses for coastal communities after 100 metres, however the draft notification reduces the limit to 50 metres. The draft rules also limit Coastal Regulation Zone for offshore islands to 20 metres from the high tide line instead of the earlier 500 metres. ■



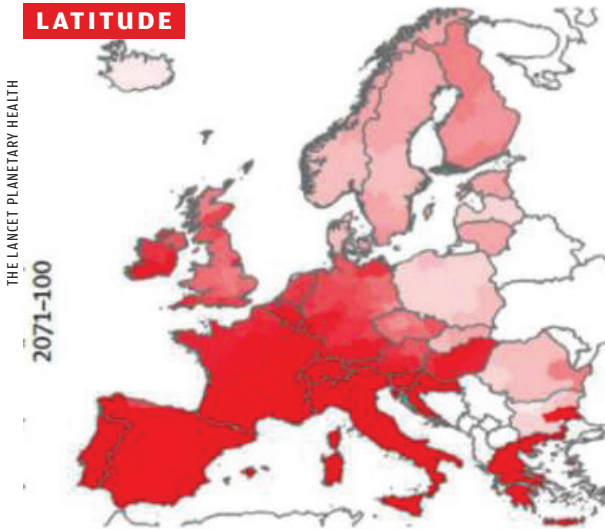
VIKAS CHOUDHARY / CSE

Rural India's sanitation status

IN A recent survey, the results of which were recently released by the Union Ministry of Drinking Water and Sanitation, only 62.45 per cent rural households across India were found to have access to toilets. The report also said that 91.29 per cent of people who have access to toilets, use them. The Quality Council of India conducted the survey for the ministry. It surveyed 140,000 rural households between May and June this year.

Uttar Pradesh and Bihar were found to have the worst rural sanitation facilities. Only 30 per cent of the rural households in Bihar had access to toilets, while Uttar Pradesh was slightly better at 37 per cent. Jharkhand scored the same as Uttar Pradesh. The original survey report will be published later by the ministry. Only a few sections have been published till now on social media by the ministry and the Quality Control of India. ■

LATITUDE



Red in the above map signifies heat. The redder the map, the more people will die of extreme heat in that region

In a study published in the journal *The Lancet Planetary Health*, researchers have plotted predictions about how an increasing number of Europeans could die from extreme heat if climate change policies are not adhered to. They analysed the effects of the seven most harmful types of weather-related disasters, including heat waves in 31 European nations. Their findings suggest heat waves could cause 99 per cent of all future weather-related deaths in Europe—rising from 2,700 deaths a year from 1981-2010 to 151,500 deaths a year in 2071-2100.

VERBATIM



"Your lordships cannot run the government. We cannot be asked to do miracles. It is an enormous task"

— Attorney General K K Venugopal to the Supreme Court while opposing fresh pleas being made by the non-profit Swaraj Abhiyan for relief measures in drought-hit states



TARIQUE AZIZ / CSE

MICROBES

BREAKING THE MOULD

RAKESH KALSHIAN

Microbes will always triumph over antibiotics. We can only choose the battles that will make a difference

AS species, we have evolved into killing machines extraordinaire. For us, killing is not just a matter of self-preservation, an instinct shared by all creatures that defend themselves with whatever weapons nature has blessed them with—poison, horns, incisors or claws. Armed with a supernatural arsenal, we now don't merely disable or kill; we aim to annihilate, be it termites, weeds, mosquitoes, cancer cells, or, going by Trump's "fire and fury" bluster, even fellow human beings.

Antibiotics are part of that arsenal and were designed to annihilate bad bacteria. Whenever we fall sick, doctors order them as a matter of routine. We are duly advised to complete the course, which usually lasts in multiples of five to seven days, lest some bacteria survive the attack, and mutate, thereby becoming immune to the drug. Not sticking to this dogma, according to the medical establishment, is one of the reasons behind the crisis of antibiotic resistance.

Intriguingly, it now turns out that this widely-held dogma has no scientific basis. In a recent edition of the *British Medical Journal*, medical researchers at Brighton and Sussex medical school claim that "the idea that stopping antibiotic treatment early encourages antibiotic resistance is not supported by evidence, while taking antibiotics for longer than necessary increases the risk of resistance." The heretics believe we are better off opting out the moment we feel better.

This heresy does have some backers, but not yet large enough to inspire a paradigm shift and make doctors change tack. Meanwhile, the crisis of antimicrobial resistance (AMR) continues to spiral from grave to critical. According to The Review on Antimicrobial Resistance commissioned by the UK government, by 2050, every year, AMR is likely to claim 317,000 lives in North America, 390,000 in Europe and over 4 million in Asia and Africa.

Apparently, the situation is so grim that researchers have painted apocalyptic visions of an "antibiotic winter" in which it will be almost impossible to do chemotherapy, organ transplants or C-sections, not to speak of treat deadly infections such as gonorrhea, meningitis, and typhoid. Last December, when news of bacteria resistant to the antibiotic colistin, apparently the last resort against multi-drug resistant bacteria, broke out, it filled researchers with dismay and dread.

Portents for India are particularly ominous as it is the world's largest consumer of antibiotics. According to a study published in *The Lancet*, in 2010, India consumed about 13 billion units, followed by China's 10 billion, and the US's almost 7 billion units. Worryingly, in the absence of rigorous studies and data, we don't even know how strong or large the enemy is.

As if this isn't scary enough, we have very little idea about how much antibiotics is consumed by the global dairy and meat industry. According to one estimate

the US pumps 80-90 per cent of all its antibiotics into farm animals for the single purpose of fattening them! Apparently, China is an even greater offender—researchers believe that the bacteria strain resistant to colistin came from a Chinese pig farm, while the EU, which outlawed this practice in 2006, is finding it difficult to enforce the ban.

So if we add to this toxic pool antibiotics that leak into drinking water as industrial and domestic effluents (treatment plants can't screen them), or those that leak into our meat and milk through farm animals, it would be fair to say that we are all dunked in a thick soup of antibiotics. Little surprise then Darwinian logic should kick in and select for resistance.

This sounds like a horror sci-fi movie in which antibiotics are made to appear almost like Trojan horses. And yet, about 75 years ago, when penicillin, the first antibiotic, was made, these wonder drugs were hailed as a panacea that would deliver humankind of all sorts of pestilences.

Earlier, in the late 19th and early 20th century, germ theory—the outlandish idea that diseases were exploits of some wretched critters so small we couldn't even see them—inspired pioneers like Louis Pasteur, Joseph Lister and Robert Koch to take on bacterial scourges that had wiped out millions around the world. Between 1918 and 1919, the Great Spanish Flu engulfed 500 million people, and liquidated between 20 million and 40 million.

However, while this campaign did bring about a sanitation revolution, thereby erecting a first line of defense against an invisible enemy, scientists still had no idea about how to slay it once it had laid siege. They tried everything they could—poisons, dyes, and toxic metals—to spot and kill the bacteria, but in vain, until Alexander Fleming stumbled upon the bacteria-killing ability of common bread mould, out of which he extracted penicillin. Before long, scientists were farming antibiotics from fungi and bacteria, which triggered the antibiotic revolution. Such was the euphoria about these wonder drugs that doctors believed they could cure almost any ailment without the collateral damage that went with many other potent medicines. So even as they saved millions of lives, indiscriminate and overzealous use eventually gave rise to phalanxes of mutant germs that defied ever-potent formulations.

Look at it this way. For millions of years, germs—bacteria, fungi, and algae—have been trying to outwit one another in a Darwinian struggle for existence. In this never-ending arms race, not only have they acquired chemical missiles called antibiotics, but they have also evolved self-defense strategies. In 2011, scientists stumbled upon 30,000-year-old bacteria lurking

under permafrost in Canada's Yukon province that defied modern antibiotics, suggesting genes bestowing resistance to antibiotics have existed since ancient times.

So does this mean we are not guilty of inciting antibiotic resistance? Not entirely. As the American microbiologist Martin Blaser writes in his dystopian yet sobering *Missing Microbes*, “although resistance is ancient, we have made it a lot worse. We don't even know how many orders of magnitude...[but] even ocean life shows evidence of the spread of resistance from our activities.” That antibiotic resistance is of ancient vintage also suggests that resistance is inevitable, and that any dream of a panacea against microbes is bound to shatter.

As worrisome as antibiotic resistance crisis is, some scientists believe that the abuse of antibiotics might even be behind the rise of modern plagues such as autoimmune disorders, juvenile diabetes, autism, obesity, food allergies, and a bunch of mysterious intestinal disorders, all of which defy scientific explanation. According to this hypothesis, such derangements happen when large colonies of innocuous bacteria are bumped off as collaterals in the scorched-earth as-

sault of antibiotics. For, these bacterial swarms, which cover every millimetre of our bodies (picture this: against 30 trillion cells in the human body, there are about 100 trillion bacteria, collectively called the microbiome), inside as well outside, act as useful and efficient butlers performing key roles in the body's immune, metabolic, and

cognitive faculties.

Clearly, the genie is out of the bottle, and it won't be easy putting it back in. Pharmaceutical companies do not want to invest in new antibiotics, as returns are only modest. Governments are doing their bit, like our own draft National Action Plan on AMR, to prevent the abuse of antibiotics through awareness campaigns, devising tests that can tell if a patient needs them, and hunt for new ones. However, given the scale and complexity of the AMR crisis, this may not be enough to inspire hope. For a start, governments can follow Denmark's example by eliminating antibiotics in the meat and dairy industry.

In any event, in the light of the legendary resilience of microbes, the least we can do is to keep them at bay by waging a limited war. As the evolutionary biologist Stephen Jay Gould put it: “We live in the Age of Bacteria (as it was in the beginning, is now, and ever shall be, until the world ends)...”. ■

This monthly section will explore the tangled web of modern ideas about science and environment across space and time

Raising superbugs

Poultry farms are reservoirs of multi-drug resistant bacteria and play a major role in their spread, shows the latest CSE study

LAB STUDY: PRIYANKA TRIPATHI, RAINA HASAN, SHREYA VERMA

RESEARCH: AMIT KHURANA, MOUNA NAGARAJU, RAJESHWARI SINHA

POULTRY FARMS in India use antibiotics—not only to cure their chicken from diseases but also to help them gain weight and prevent diseases. The practice is common in the sector which has been growing at a steady pace of 10 per cent per year the past decade. Chand Singh, owner of a broiler poultry farm in Haryana's Kawi village, says he regularly gives birds a combination of two antibiotics—enrocin and colistin. Ramchander, owner of ano-

ther broiler farm in Sanpka village, some 150 km from Kawi, says he uses ciprofloxacin and enrofloxacin antibiotics.

This reckless practice could be responsible for the emergence of antibiotic resistant bacteria, which can survive an antibiotic that would normally kill them or stop their growth. A recent study by Delhi-based non-profit Centre for Science and Environment (CSE) highlights the high prevalence of antibiotic resistance (ABR) in the poultry environment. Worse, the study findings

VIKAS CHOUDHARY / CSE



suggest that ABR is also spreading beyond the poultry farms because untreated litter is commonly used as manure in nearby agricultural farms.

“On the one hand, antibiotic misuse is common in the poultry sector and on the other, the sector is plagued with poor waste management. The two are responsible for the emergence of ABR in poultry farms and its spread into the surrounding environment. We decided to conduct the study to understand the level of and spread of ABR in and around broiler poultry farms,” says Chandra Bhushan, deputy director-general, CSE. Worryingly, the study found some of the bacteria to be resistant to antibiotics that are normally used in hospitals as the last resort to fight infections.

The findings should serve as a wake-up call for the government as India at present does not have adequate laws to contain ABR.

Even the guidelines of the Central Pollution Control Board (CPCB) on poultry waste management do not adequately address ABR. This is despite the fact that several studies over the past years have pointed towards misuse of antibiotics in humans as well as animals, and the emergence of ABR. In 2014, a study by CSE had also found residues of multiple antibiotics, such as fluoroquinolones (enrofloxacin and ciprofloxacin) and tetracyclines (oxytetracycline, chlorte-tracycline, doxycycline) in chicken meat samples because of rampant use of antibiotics in poultry.

The latest study covers broiler farms in four key poultry meat-producing states—Uttar Pradesh, Rajasthan, Haryana and Punjab—which collectively contribute about 40 per cent of total poultry meat production in India. CSE researchers collected a total of 47 samples: 35 from 12 poultry farms and 12 control soil samples from areas where poultry litter was not used as manure. The poultry farms were randomly selected from different clusters (a village with at least three broiler farms) and had an operational size of 3,000 to 21,000 birds. Antibiotics were used in all the selected farms. CSE’s pollution monitoring lab collected three samples from each farm—poultry litter from inside the shed, soil from outside the shed and soil from an agricultural land outside the farm where poultry litter was used as manure. Agricultural soil sample could not be collected from Jaipur cluster.

The team isolated and identified three bacteria—*Escherichia coli* (*E. coli*), *Klebsiella pneumoniae* (*K. pneumoniae*) and *Staphylococcus lentus* (*S. lentus*). *E. coli* and *K. pneumoniae* strains cause meningitis, urinary tract infections and respiratory illnesses, such as pneumonia. Patients in hospitals are also at high risk of contracting *K. pneumoniae* infections because of their low immunity.

After isolating the bacteria, they were tested individually against 16 antibiotics belonging to 13 antibiotic classes, which were selected on the basis of their extent of use in poultry and importance to humans. Ten of the antibiotics belong to the World Health Organization’s (WHO) critically important classes (CI) for human medicine. The study did not test *E. coli* and

ALERT 1: *E. coli*

100%

isolates collected from poultry litter were multi-drug resistant

100%

isolates collected from agricultural soil were multi-drug resistant

K. pneumoniae isolates for resistance against three of the 16 antibiotics.

High on resistance

The CSE study found alarmingly high levels of drug resistance not just in the bacteria isolated from the chicken litter, but also from the soil samples collected from the poultry farm as well as the neighbouring agricultural land (see ‘Advantage bacteria’, p21). In fact, all the 62 *E. coli* isolates tested were found to be multi-drug resistant, which means resistant to at least three antibiotic classes. One in every six *E. coli* isolates were resistant to 12 of the 13 tested antibiotics. Two *E. coli* isolates were resistant to all the 13 tested antibiotics. If these *E. coli* isolates infect a human, then hardly any medicine will work and cure them.

Similarly, 92 per cent *K. pneumoniae* isolates were multi-drug resistant, 30 per cent were resistant to at least 10 antibiotics and 10 per cent were resistant to all of the 13 antibiotics. In the case of *S. lentus*, 78 per cent isolates were multi-drug resistant and about one-fourth isolates were resistant to at least eight antibiotics. Overall, highest resistance was found in *E. coli* and relatively lesser resistance in *K. pneumoniae* and *S. lentus*.

The study not only establishes that poultry farms are reservoirs of ABR, it also shows that ABR is moving out of the farms to neighbouring areas (see ‘Spread out’, p21). It found a similar resistance pattern in the *E. coli* isolates collected from poultry litter and agricultural soil where the untreated litter was used as manure. For instance, 100 per cent *E. coli* isolates from both sources



India has close to 800 million poultry population

Poor practice

The common practice of using untreated poultry litter as manure in agricultural land is transferring bacteria that are resistant to multiple antibiotics

HOW RESISTANT BACTERIA MOVES OUT OF THE FARM

Litter used as manure

Dead birds

Liquid waste discharge from farms

Flies carry the bacteria

Consumption of meat and eggs

Farmworkers or visitors

FARM WASTE, which includes faecal matter, litter and dead birds, contains bacteria that are resistant to antibiotics

INTENSIVE BROILER POULTRY FARMS

extensively misuse antibiotics by routinely using them for fattening the chicken in less time using less feed and as a substitute for better hygiene conditions

Scope of the study

It was conducted across nine districts in key poultry states in north India

	Uttar Pradesh	Rajasthan	Haryana	Punjab	Total
Total samples collected	17	8	15	7	47
Samples from poultry farms	12	5	12	6	35
Control samples	5	3	3	1	12
Poultry farms visited for samples	4	2	4	2	12
Clusters	4	2	4	2	12



It reaches humans through **agriculture produce and waterbodies**

HUMANS

Community

Antibiotics used | DO = Doxycycline Hydrochloride; AMC = Amoxycylav; NIT = Nitrofurantoin; LE = Levofloxacin; CIP = Ciprofloxacin; C = Chloramphenicol; CXM = Cefuroxime; CTX = Cefotaxime; CTR = Ceftriaxone; AK = Amikacin; GEN = Gentamicin; COT = Co-trimoxazole; MRP = Meropenem; CD = Clindamycin; LZ = Linezolid; AZM = Azithromycin

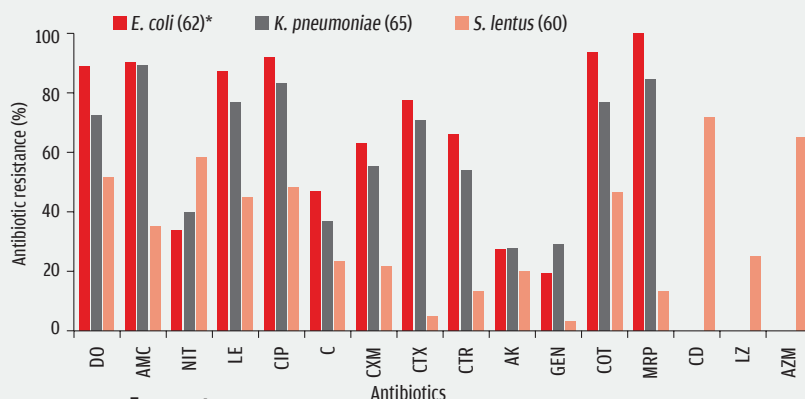
Note | All the samples were subjected to microbial analysis for bacteria isolation and characterised morphologically and biochemically. Select isolates were identified by 16 S rDNA gene sequence analysis by an external laboratory. Antibiotic susceptibility of all bacteria was determined by disk diffusion method, according to the Bauer-Kirby technique. Zones of inhibition obtained for each bacterium was compared with Clinical and Laboratory Standards Institute (CLSI) standards. European Committee on Antimicrobial Susceptibility Testing (EUCAST) standards were used where CLSI standards were not available

ILLUSTRATION AND INFOGRAPHICS: RAJ KUMAR SINGH / CSE

1-15 SEPTEMBER 2017

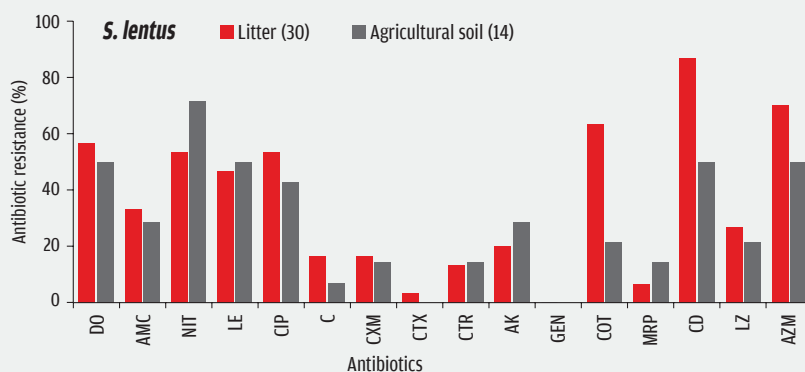
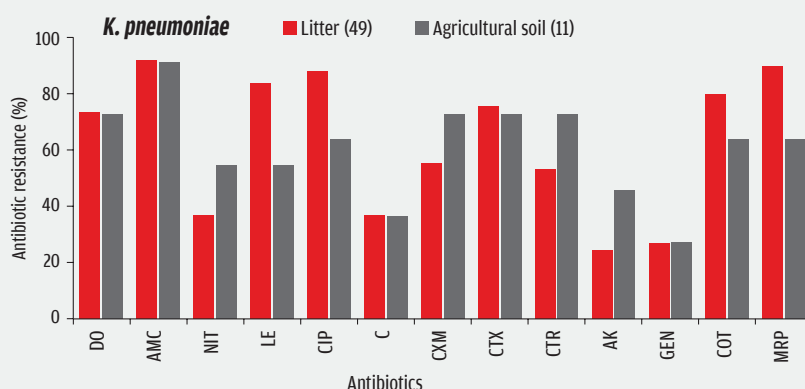
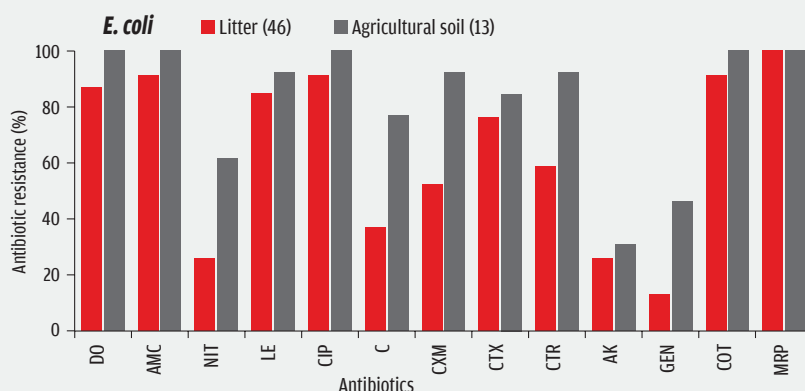
Advantage bacteria

High multi-drug resistance was found in all 187 isolates from poultry environment



Spread out

Strong similarity in resistance pattern was observed in *E. coli* isolates from litter and agricultural soil



* () signify number of isolates. A total of 217 bacteria isolates were obtained, of which 125 were from poultry litter, 24 from poultry farm soil, 38 from agricultural soil and 30 from control soil samples

were resistant to meropenem, a CI antibiotic that hospitals use as the last resort to contain bacterial infections. *E. coli* isolates from litter and agricultural soil also had similar high (>70 per cent) resistance against antibiotics of three more CI classes—penicillins, fluoroquinolones and 3rd and 4th generation cephalosporins.

The study found a strong statistical correlation (p value of 0.08; Pearson's correlation coefficient $r=0.88$) between the resistance pattern in the isolates in poultry litter and agricultural soil. It also found just three *E. coli* isolates from poultry farm soil samples. The two findings suggest that the farms were directly using untreated poultry litter as manure.

In *K. pneumoniae*, isolates from poultry litter samples had high ABR to CI antibiotic classes, such as penicillins, fluoroquinolones, carbapenems and 3rd and 4th generation cephalosporins. ABR in these isolates from agricultural soil showed slightly lower resistance against these antibiotic classes. About 90 per cent of *K. pneumoniae* isolates from both litter and agricultural soil was resistant to amoxycylav antibiotic. However, a strong statistical correlation between the resistance patterns from these two sources was not observed.

Similarly, in the case of *S. lentus*, all isolates showed high resistance to two antibiotics. Overall, the resistance pattern of the litter isolates and agricultural soil isolates of *S. lentus* were not statistically comparable.

In the control soil samples, no isolates of *E. coli* was found. Only a few isolates of *K. pneumoniae* could be obtained and



A worker at a poultry farm in Haryana's Sonapat district adds antibiotics to chicken feed

S. lentus was most common. In both, the overall resistance levels observed were high, but of statistically different pattern to what was found in agricultural soil.

The results of the study establish that multi-drug resistance is moving from poultry farms to agricultural land in the case of *E. coli*. However, more studies are required to understand the behaviour of *K. pneumoniae* and *S. lentus* in view of different sources of bacteria, such as other animals and use of synthetic fertiliser and pesticides in agricultural fields.

Visible impacts

The CSE study findings are already visible on the ground. A government veterinary doctor from Jind, a district in Haryana that was covered under the study, said they have stopped administering enrofloxacin, a fluoroquinolone antibiotic, because it is no longer effective in the area. "We instead prescribe antibiotics, such as neomycin, doxycycline and levofloxacin," says the doctor. Requesting anonymity, he says the high antibiotic misuse in poultry farms is responsible for ABR in the area.

Abdul Ghafur, a consultant on infectious diseases at the Apollo Hospital, Chennai, says that resistant bacteria from poultry farms can directly infect farmers and meat handlers or indirectly put humans at risk through agricultural produce and waterbodies. Moreover, the antibiotics against which a high degree of

resistance was observed in the three bacteria CSE tested, are losing effectiveness at a speed greater than anticipated. "About 5-10 per cent of Indians have carbapenem-resistant bacteria in their body. This increases to 30-40 per cent in hospitals. Due to this growing resistance, colistin use is becoming a regular practice. After this, there are no antibiotics," he says. High resistance observed in humans in *E. coli* and *K. pneumoniae* has prompted WHO to identify them as "priority pathogens" to develop new antibiotics for them.

Several papers clearly establish the growing incidence of ABR and the role of antibiotic misuse in rearing food animals. A policy paper, *Antibiotics in manure and soil—A grave threat to human and animal health*, published by the National Academy of Agricultural Sciences in 2010 recognises the passage of antibiotics into soil and food chain because of its use in food animal production.

In July 2017, *Environmental Health Perspectives* published a study which looked at 18 poultry farms in Punjab and found a link between antibiotic use in poultry farms and ABR. The study highlighted high prevalence of multi-drug resistant *E. coli* strains from cloacal swab samples of birds in broiler farms. Even a WHO Advisory Group on Integrated Surveillance of Antimicrobial Resistance project in North India (2014-2017) found ABR in isolates of food-borne bacteria from humans and animals.

ALERT 2: *K. pneumoniae*

98%

isolates collected from poultry litter were multi-drug resistant

73%

isolates collected from agricultural soil were multi-drug resistant



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“Overall, very high level of resistance was observed towards fluoroquinolones, tetracyclines, aminoglycosides, which are commonly used in animal farms,” says Neelam Taneja, professor, Department of Medical Microbiology, Postgraduate Institute of Medical Education and Research, who was part of the project.

There is also growing evidence that increased antibiotic use in poultry creates reservoirs of resistance genes that can be transferred to other pathogens through a phenomenon called horizontal gene transfer. This means resistance in one bacterium can be passed on to other kinds of bacteria, even for multiple antibiotics. An August 2017 study, published in the *Applied and Environmental Microbiology*, found ABR genes from bacteria in soil that was exposed to antibiotics used in human medicine or food animal production for about 16 years.

Despite the worrying trends, the sector continues to use antibiotics. A research on the global trends in antimicrobial use in food animals published in 2015 in the *Proceedings of the National Academy of Sciences* states that the use of antimicrobials, which includes antibacterials, in livestock in India, Brazil, Russia, China and South Africa is expected to increase by 99 per cent between 2010 and 2030. India's contribution in the 2030 projections could be significant due to growing farm intensification and limited regulatory control.

Slow to act

India has so far focused on combating ABR due to antibiotic misuse in humans. The

ALERT 3: *S. lentus*

87%

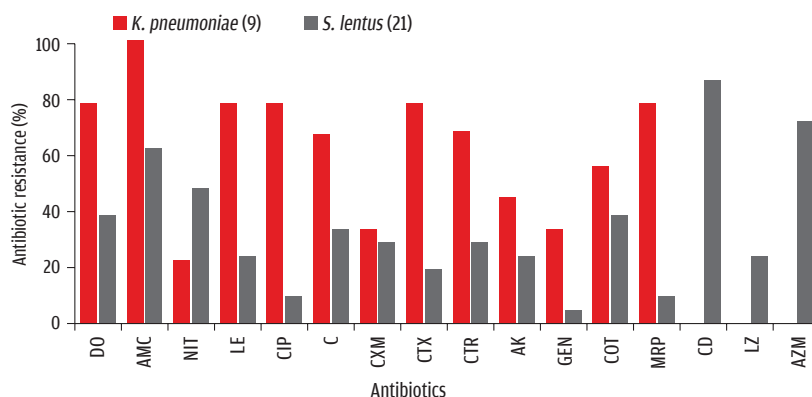
isolates collected from poultry litter were multi-drug resistant

64%

isolates collected from agricultural soil were multi-drug resistant

Resistance trends in control samples

S. lentus was the key isolate derived from the samples where poultry litter was not used



Union Ministry of Environment, Forest and Climate Change (MOEF&CC) places poultry and hatchery in the green or low pollution potential category in its polluting industries list. Also, CPCB guidelines on waste from poultry farms do not focus on ABR. This is despite the fact that India is among the top producers of fish, poultry and dairy, and the environment contribution of ABR through waste could be significant. The quantum of litter produced by about 800 million poultry population indicates towards the huge scale of the problem. Another challenge for the country is the tropical climate and poor sanitary conditions that result in high incidence of infections, which in turn, increases the chances of antibiotic use and ABR.

In April 2017, India released its first strategic National Action Plan on Antimicrobial Resistance for 2017-2021. The plan was part of the country's commitment to the Global Action Plan on Antimicrobial Resistance, which was endorsed by WHO, the Food and Agriculture Organization and the World Organisation for Animal Health in 2015.

What next

While the action plan is a step in the right direction, India needs concrete measures to be able to contain ABR due to antibiotic misuse in rearing food animals. The first critical step should be that the Department of Animal Husbandry, Dairying and Fisheries regulate to limit the non-therapeutic use of antibiotics in poultry. The de-

partment should also adopt alternatives to antibiotics and implement bio-security measures. It should also ban the use of poultry litter as feed for aquaculture.

The sector requires ABR-centric environmental regulations, which can happen through a greater role by MOEF&CC and CPCB. The Union ministry should ensure that poultry sector waste is considered as an important ABR contributor. Meanwhile, CPCB, along with state pollution control boards, should prohibit the use of untreated poultry litter as manure and ensure the adoption of waste to energy measures such as biogas generation because they are a less risky manure management option than composting. The CSE study recommends biogas generation for big and integrated players and that it should be made mandatory for acquiring poultry farm licences. The study also suggests a nationwide programme to promote community biogas generation plants for small poultry farmers in clusters. It also says that farms where composting is the only option, it should be done under supervision through adequate laws on process validation and site-approval. The study says that CPCB has to strengthen its existing guidelines and notify them.

Lastly, the government should invest in research to better understand the impact of manure treatment on ABR and resistance transfer mechanisms. ■

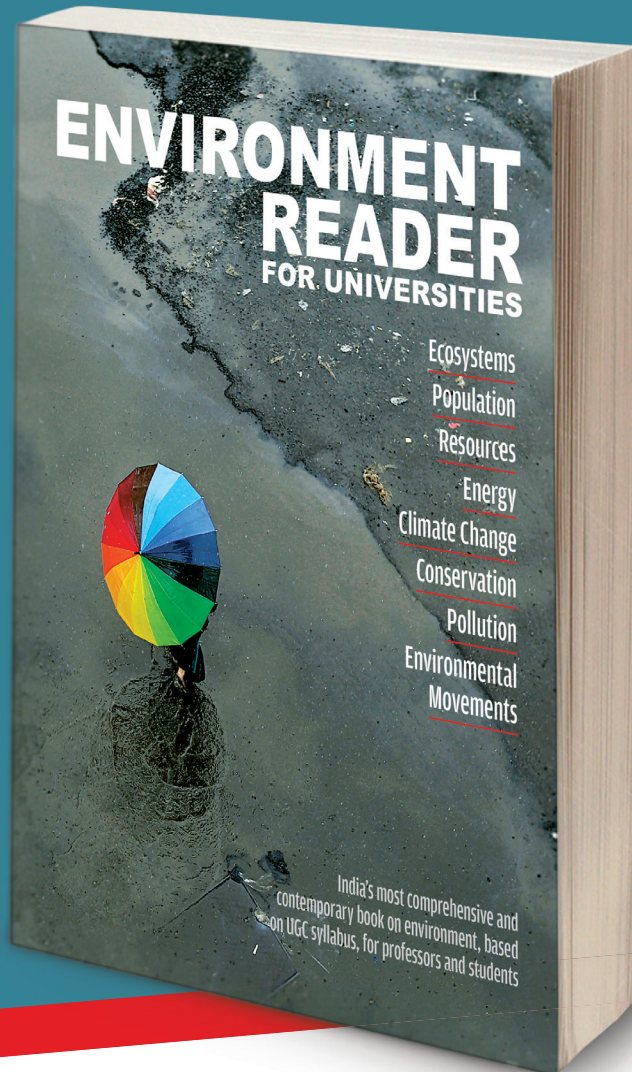
(Advisory inputs on study by
Rajarshi Banerjee)

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Suffocating tragedy



There is no scientific consensus on the cause of encephalitis that has been claiming lives every year in the Gorakhpur region since 1978. But an unprepared government along with medical mismanagement made matters worse this year. **VIBHA VARSHNEY** and **KUNDAN PANDEY** report

MORE THAN 9,950 children have died of encephalitis in a single hospital in Gorakhpur in the past 40 years. But the health system continues to be unprepared to deal with the disease. On August 10 this year, a news portal ran a story about shortage of liquid oxygen in the Baba Raghav Das Medical College (BRD), and warned of an impending crisis. Since January, the disease had already claimed 160 lives. But oxygen was not made available and that night 23 children died. Children continued to die, and by August 21, the death toll rose to 260 for the year. Though it was clear that the children died due to lack of oxygen in BRD on August 10-11, the state government denied underpreparedness, even as it suspended the principal of the college and vowed to take action against the supplier.

PHOTOGRAPHS: MANOJ KUMAR SINGH

In cold blood

Children continue to die across India due to medical negligence

Ajmer, Rajasthan | May, 2016

Seven children died at a government hospital. The families allege negligence by doctors

Gurugram | May, 2017

A three-year-old child died because he did not get an ambulance on time which could have shifted him from Gurugram's civil hospital to Safdarjung hospital in Delhi

Indore | June, 2017

17 people, including two children, died at the Maharaja Yeshwantrao Hospital due to lack of oxygen

Bilaspur, Chhattisgarh | December, 2014

At least 13 infants, most of them premature, died at the state government-run Chhattisgarh Institute of Medical Sciences

Kolkata | June, 2011

The death of 19 children, most of them infants, within a period of 48 hours in the state-run Dr B C Roy Postgraduate Institute of Paediatric Sciences, triggered protests amid allegations of medical negligence

Raipur, Chhattisgarh | August, 2017

Three children died at B R Ambedkar Hospital after a decline in oxygen pressure. All of them were on ventilators in the Intensive Care Unit

Cuttack, Odisha | September, 2015

61 infants died at a children's hospital in two weeks. A preliminary inquiry found that staff negligence contributed to the deaths

Malkangiri, Odisha | October, 2016

41 children died in Malkangiri District Hospital. Infected with Japanese encephalitis, the children were referred from community health centers, but the hospital had no machines for CT scans or MRI scans, or even a ventilator, which are crucial to manage the disease

Source: Media reports

So was the hospital management aware about the shortage? The journalist who wrote the story, Manoj Kumar Singh, says everyone was aware about the looming crisis and the government is now just passing the buck. It seems Rajiv Mishra, the principal of BRD, reminded the authorities in several letters about sanctioning the pending payment to the supplier. According to media reports, Mishra wrote the first letter on March 22 to senior officials in the state's health ministry. On August 1, Mishra copied this letter to the Medical Education Minister Ashutosh Tandon. Reports also suggest that the supplier too had informed the college and higher authorities that unless his dues of ₹68.65 lakh were cleared, the company would stop delivery.

This is not the only case of mismanagement in government hospitals across the country as far as shortage of oxygen supply is concerned. According to Amulya Nidhi, an Indore-based activist, in July, 17 people, including two children, died at the Maharaja Yeshwantrao Hospital in Indore due to lack of oxygen supply. The Madhya Pradesh government has constituted a "committee" to investigate the matter (see 'In cold blood').

K P Kushwaha, who was the former head of the paediatrics department at the

BRD Medical College, says corruption is the biggest reason for these deaths. From sanctioning to transferring money, a share of the money has to be given to government authorities, he says. Amit Sengupta, a Delhi-based public health expert, says it is evident that the Uttar Pradesh government did not sanction the payment despite repeated reminders. It is likely that this was a result of corrupt practices, and thus, needs to be investigated.

Need for guidelines

The Gorakhpur tragedy is an example of the deplorable state of India's public health system. BRD caters to patients from 15 districts of eastern Uttar Pradesh and also from a few districts in Bihar. Patients from Nepal too come here for treatment. At any given point in time, the paediatric department is treating 300 children, but there are only 210 beds.

So the hospital is not only overcrowded, but it also faces a resource and financial crunch. A Comptroller and Auditor General report in June this year had warned that there was a 27.21 per cent shortage of clinical equipment and 56.33 per cent shortage of non-clinical equipment in this hospital. The supply of oxygen is part of

non-clinical equipments.

Srinath Reddy, president, Public Health Foundation of India, a policy think tank, says that to ensure accountability, India needs to enforce standard management guidelines for doctors, nurses and hospital staff for effective treatment methods as well as to procure equipments. Yet most states have not even adopted the Clinical Establishment Act, 2010, which prescribes a minimum standard of services and facilities for clinical establishments, he says.

Experts say there is a need to decentralise the public health management system to ensure accountability. At present, the inefficiency is partly due to the lengthy bureaucratic processes.

Reddy says to ensure accountability, the Right to Health is essential. India's National Health Policy, 2017, however, says that the country cannot yet include this in the Constitution. Sengupta says that in many countries such as Brazil and South Africa, the Right to Health is part of their Constitutions, which means that the government can be held responsible in cases of laxity and negligence. Worse, loopholes in India's healthcare system allow the accused to easily evade the law, adds Sengupta.

Grappling with the mystery

Acute Encephalitis Syndrome (AES) has been hounding children in Uttar Pradesh's Gorakhpur region for many decades. Most cases and deaths are reported in August and September each year. The lack of oxygen in BRD hospital may have made the headlines this August, but the fact remains that the scientific establishment in India is yet to decipher the cause of these deaths.

A review of research to identify the cause of the disease says that most studies between 1975 and 1999 identified Japanese Encephalitis Virus (JEV) as the main cause of encephalitis across the country. However, studies published after 2000 point to a shift to Chandipura virus and enteroviruses, says the study published in the *National Medical Journal of India* in 2012. So the mystery of encephalitis remains unresolved. In fact, researchers say the cause of the disease in as many as 59 per cent of patients between 2013 and 2014 in Gorakhpur remains unknown.

Apart from JEV, Chandipura virus and enteroviruses, AES patients have also been tested for herpes simplex, measles, mumps, dengue, varicella, Parvovirus, West Nile virus, malaria, typhoid, Bagaza virus, Cocksac-

kie virus, leptospirosis, heat stroke, Reye's syndrome and plant toxins like those in litchi fruits and pods of *Cassia occidentalis*.

This year, the mystery deepened when researchers came up with another causal agent. It was linked to *Orientia tsutsugamushi*, a bacterium which causes a disease known as scrub typhus. The disease was on the decline in Asia for many decades, but now it seems to have re-emerged. "Gorakhpur and Assam have reported the maximum number of scrub typhus cases leading to AES in the country," says Siraj A Khan of the Regional Medical Research Centre, Northeast Region, Indian Council of Medical Research (ICMR), Dibrugarh, Assam. The most common symptoms of scrub typhus include fever, headache, body ache, and sometimes rashes. Recent studies

The mystery deepened this year when researchers came up with a new causal agent. Most of the deaths in Gorakhpur were due to Scrub typhus, a disease which led to encephalitis

suggest that it can cause AES too.

When 46 children admitted to BRD between August 17 and October 16, 2016 were tested for scrub typhus, immunoglobulin M—the first antibody to appear in response to an antigen—was detected in 63 per cent of cases. Similarly, immunoglobulin G—which is the most common type of antibody in blood—was found in 82.6 per cent of cases. This indicates that these children were suffering from this disease. This study was published in *Emerging Infectious Diseases* in August this year. Apart from India, scrub typhus cases have been also re-emerged in South Korea, China, Micronesia and Maldives. The disease has now spread to new countries such as Cameroon, United Arab Emirates and Chile.

Scrub typhus is present in areas with scrub vegetation which grows where mature forests have been cut down. Rodents and humans are incidental hosts to the mite, which is both a reservoir and the vector for the bacteria. Its re-emergence and spread to newer areas suggest that rodents bearing infected mites may be expanding their range due to climate change, argues David M Walker in



The Baba Raghav Das Medical College Hospital caters to patients from 15 districts of eastern Uttar Pradesh and also from a few districts in Bihar

an article published in the *New England Journal of Medicine* in September 2016. Walker is the director of the Center for Biodefense and Emerging Infectious Diseases, the University of Texas Medical Branch.

A September 2012 study published in *Ecological Applications* shows that the pressures of global trade too increases the risk of disease incidence due to changing land use. For example, after Taiwan joined the World Trade Organization in 2001, rice cultivation fell from 80 to 55 per cent. This led to an exponential increase in the number of ticks and chiggers in abandoned rice fields. Flooded paddies are poor habitats for the mites. The authors say that this study shows that apart from climate change, global travel and habitat destruction; economic policies can also affect human health by influencing and changing the landscape.

However, some experts are not convinced that all the cases in Gorakhpur were due to the scrub typhus. "It seems to be a mix of illnesses and the major cause of the outbreak still remains elusive," says George M Varghese, professor, Department of Infectious Diseases, Christian Medical College, Vellore, Tamil Nadu. The symptoms reported from Gorakhpur are atypical to scrub typhus. Most of the patients were infants, but they are unlikely to have any exposure to vegetation, which is the mode of acquisition of scrub typhus, he adds.

Confusion kills

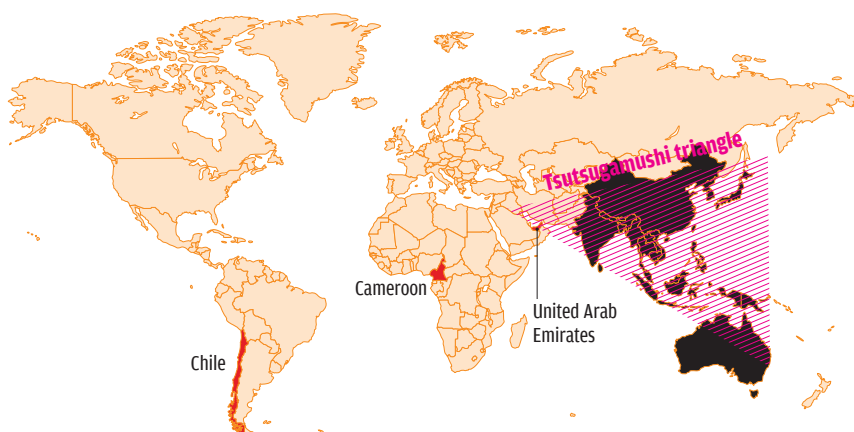
The uncertainty in the causal organism is one of the reasons for the high number of deaths. In Assam, which is recognised as an endemic zone for AES caused by the JE virus, scrub typhus is usually not suspected. Though scrub typhus is treatable, death rates are as high as 49 per cent, says a study published in *Emerging Infectious Diseases* in January 2017.

The re-emergence may also be due to changes in the antibiotics used to treat fevers. Earlier, fever patients would be routinely prescribed antibiotics such as tetracycline and chloramphenicol, which effectively treat scrub typhus. But now the commonly-used antibiotics are cephalosporins, which are ineffective against this disease, says Varghese. Nevertheless, it is

Climate change and scrub typhus

The re-emergence of scrub typhus, a probable cause for Acute Encephalitis Syndrome, suggests infected rodents may expand their range with climate change

■ Traditional areas of disease ■ New areas



Source: Various research papers

clear that scrub typhus is back. Earlier, community samples in India showed around 5 per cent serological prevalence of past infections, but now the prevalence rates are as high as 30 per cent, says Varghese.

Way ahead

The world is facing a re-emergence of scrub typhus and it is crucial that doctors are made aware to ensure early diagnosis and proper treatment, says Varghese. In 2015, ICMR developed guidelines for diagnosis and management of such diseases. Early diagnosis and prescribing the drug, doxycycline, which costs less than ₹200, can easily save a patient. India is also part of an ongoing trial in high burden countries to evaluate the best treatment for severe scrub typhus," reveals Varghese.

While researchers like Varghese are

working to improve and develop treatment and diagnostics, the need of the hour is to quickly solve the mystery around the disease to help patients.

Walker points out that researchers seldom work on rickettsial diseases, which includes scrub typhus due to difficulties in carrying out research, even though it is often as prevalent as malaria and dengue. "This neglect has led to spotty and incomplete data that preclude the calculation of disability-adjusted life-years lost to the disease—information that is essential for soliciting philanthropic support for research," he writes.

What we need is "focused research to identify the cause of these diseases," says Kushwaha. When asked about what could be causing AES, D T Mourya, director, National Institute of Virology, Pune, says that the institute is working on several aspects of this problem ranging from epidemiology to laboratory investigations and that "it is premature to make any comments at this stage". Till the time a solution is found, doctors must also keep scrub typhus in mind while treating patients. Prevention too can reduce cases. "There is no vaccine to prevent this disease. Hence, the preventable measures are personnel protection and vector control," suggests Khan. ■ @down2earthindia

Scrub typhus is present in areas with scrub vegetation which grows in areas where mature forests have been cut down. Rodents and humans are incidental hosts to the mite, which is both a reservoir and the vector for the bacteria

Capital loss

The Land Pool Scheme of the Andhra Pradesh government to acquire land for the new state capital is turning out to be a nightmare for farmers

JITENDRA | AMARAVATI

ANDHRA PRADESH'S Land Pooling Scheme (LPS) was touted to be a model land acquisition initiative. But three years after it was launched, it has left farmers with no land or job. And the rise in living costs has rendered the compensation barely enough to survive.

When Andhra Pradesh was divided in 2014 and it emerged that Hyderabad would cease to be the state capital in a decade, Chief Minister N Chandrababu Naidu decided to use LPS over the more stringent Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 to acquire land for building a new capital at Amaravati. Between June 2014 and February 2015, over 13,000 hectares (ha) of agricultural land was "pooled" from over 25,000 landholders in 28 villages.

The government opted for LPS because it is much easier to implement. The land acquisition Act requires the government to take consent of 70 per cent of the total affected families for undertaking a public work on agricultural land, but under LPS the government can negotiate the terms of

transfer with individual landowners. For instance, Y Lakshmi Narayan, a farmer of Lingayapalem village in Vijayawada district, gave 1.5 ha of his farmland to the government and was promised ₹2 lakh a year for 10 years (with a 10 per cent annual rise) and return of 30 per cent of his land (which was to be developed to have road connectivity; power, water and sewage connections; and, medical and educational institutions in close vicinity) in eight months.

"Initially the compensation money seemed fine, but the government did not take into account the phenomenal rise in cost of living. Electricity rates have more than doubled, from ₹2.5 a unit to ₹6, while the cost of rice has risen from ₹25 a kg to ₹45. Same is the case with the cost of commute. Earlier, auto-rickshaws charged ₹150 for a 15 km ride; now they charge ₹400. Worse, the promised developed plot is not likely to be delivered anytime soon," Narayan laments.

He lost his mother and brother in the last two years and says he spent more than ₹1.25 lakh on their medical expenses, which have also shot up exponentially. "If the

PHOTOGRAPHS: VIKAS CHOUDHARY / CSE



The road to the proposed Andhra Pradesh capital of Amaravati is lined with posters that claim it is a city of hope. But displaced farmers tell a different story

government had provided free healthcare facilities, as it promised, I could have saved my mother and brother, and escaped being neck deep in debt," says Narayan.

Similar is the story of J Suresh of Uddayamrapalem village, who was forced to earn livelihood by becoming a daily wage labourer. Suresh gave 0.8 ha of irrigated land and got ₹1.22 lakh a year in return. "I had to take care of my six family members with this amount," he says. There are many others like him who have farming skills, but find themselves unsuited to other professions and end up becoming daily wage labourers at construction sites which are mushrooming after the announcement of the new capital.

Wrong choice

When Andhra Pradesh decided to have a new capital, the Union Ministry of Home Affairs constituted a committee to look for options. The committee submitted its report in August 2014 and recommended one administrative capital city and development of bigger cities as industrial, investment and technology hubs. It also recommended Martur-Vinukonda-Donakonda region in southern part of Andhra Pradesh for capital and cautioned against building the capital in the well-irrigated, fertile Vijayawada-Guntur region in central Andhra Pradesh, which is used for agriculture. But Naidu ignored the advice. Farmers say they watched while standing crops of sugarcane and maize were uprooted under police protection to make way for buildings.

"The cadres of the ruling party spread a rumour that those who do not give up land under LPS would be forced to give it up without compensation. This helped them get land," says G Naresh Reddy, who owns 0.8 ha in Penumak village but did not give it to the government. He has been organising farmers of Penumak and Undavalli villages to protests against LPS. "We are getting threats from the ruling Telugu Desam Party cadres and government officials to describe our land as dry, instead of irrigated, so that the government can buy it at a lower rate," claims Reddy.

M Seshagiri Rao, president of Capital Region Farmers' Federation (CRFF), contests the claim of LPS being a success and says it violates constitutional rights of the people



"It's been three years and we don't know when we will get plots in return for the land we gave. The government had also promised free healthcare and educational facilities, but these too are not to be seen"

— Y Lakshmi Narayan, farmer, Lingayapalem village, Guntur district

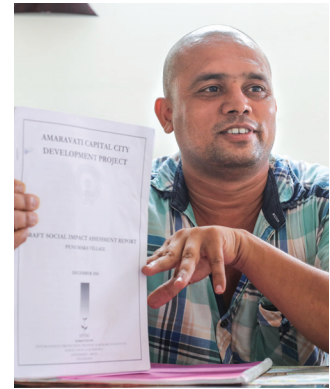
because it denies them livelihood. CRFF has also filed a complain with the World Bank to stop funding projects in Amaravati.

"A World Bank team is visiting next month in response to the complaints to assess the violation in providing resettlement and rehabilitation facilities to the affected people," claims Rao. He also says that the government might have compensated farmers, but it has no plan for rehabilitation of village artisans and landless labourers. "There are around 140,000 affected people but government took into account only 100,000 farmers," says Rao. Telephone calls by *Down To Earth* to the Capital Region Development Commissioner, Sreedhar Cherukuri, inquiring about landowners' complaints against LPS went unanswered.

Several corruption cases have also been reported in the past two years. In August, Y S R Jaganmohan Reddy, Leader of Opposition in the Andhra Pradesh Assembly, raised the issue of arbitrary allotment of land to ruling party leaders and bureaucrats.

Caste play

Remarkably, almost the entire population of the 28 villages where land acquisition is being undertaken belongs to the Kamma



"The cadres of the ruling party spread a rumour that those who do not give up land under the Land Pool Scheme would later be forced to give it up without compensation. This helped them get land"

— G Naresh Reddy, farmer, Penumak village, Guntur district

caste, the caste of Chief Minister Naidu. Experts say playing the caste card helped the chief minister convince people to give away land. Party leaders from these villages have also been offered posts in the government to manage whatever dissent was there at the ground level. For instance, when this reporter visited Belakonde village in Guntur, marginal farmers were quite vocal about their problems, but big landowners refused to say anything against LPS. "Everyone is happy in this village over LPS. I have contributed my 2.4 ha and am happy," says P Kotesw Rao of Belakonde village. He also informed the village head, Narsimha Rao, about the arrival of this reporter. "Avoid talking to village residents. I will come and talk you in detail later," Rao said over phone.

Vijayawada-based social activist Ramakrishna Raju says TDP cadres are trying to muzzle dissent and keep briefing the media about the "success" of LPS. "These cadres keep telling farmers that the chief minister's initiatives will help them become millionaire overnight."

"If the chief minister does not deliver what he had promised, the ramifications would be visible in the 2019 Union elections," warns Narayan. ■ @journalitendra



Goa undermined

As mining resumes in eco-sensitive Goa amid protests, a village tries to implement the cooperative model

SHREESHAN VENKATESH
PANAJI

ANEERIE silence envelopes Sonshi village in North Goa district. This tiny tribal village is nestled in hills that are home to 13 iron ore mines, operated by mining giants such as Sesa Goa and VM Salgaocar. On August 13, the Goa bench of Bombay high court directed the state government to ensure that 12 of the 13 mines, whose licences were suspended by the state pollution control board four months ago, should be allowed to resume operation only after they comply with all pollution-control measures laid down by the Indian School of Mines. While this has brought relief to Sonshi's 300-odd population, they say it would not be long before the mines return to their old ways. And their fear is not unfounded.

In 2012, the Supreme Court banned iron ore mining across Goa because of large-scale corruption and general mine mismanagement. A year earlier, a public accounts committee appointed by the state Assembly had found that nearly half the active iron ore mines in Goa were illegal. Though the court lifted the ban in 2014, it prescribed fresh clearances and approvals for all mines from the Union Ministry of Environment, Forest and Climate Change and state agencies, and capped the annual production for the state at 20 million tonnes (MT). But Sonshi residents allege that most companies operating around the village put aside the apex court orders while resuming operations in September 2016.

"An incessant rumble of machines and



SAMRUDDHA GHADI AMONKAR

The only school in Sonshi village is next to the road on which over 1,000 trucks ply, making six-seven trips a day, when mining activities are undertaken. Noise and air pollution dissuades students and teachers from coming to the school

a thick layer of red dust would cover the air throughout the day. The 7 m-high plastic barriers erected alongside the road to keep dust and pollution in check hardly served the purpose. People in the village are now suffering from tuberculosis and cancers,” says Mahesh Gawde, a village resident. Stepping onto the road, the only route through the hills, became fraught with danger as about 1,000 trucks, each loaded with 10 tonnes of iron ore, would make six-seven trips daily, says Vaman Gowda, another resident. He was among the 45 people arrested in April during a road blockade to protest against pollution and to demand clean water, employment and health facilities. Before 2012, mining operations had contaminated all lakes and creeks, turning them red. Surface runoff, carrying waste soil and other debris left behind after digging the ore out, had made agriculture unviable. This forced people to work as labourers in distant towns. Now

aquifers in the region are also running dry. Since March, tanker water provided by one of the mining companies is their only source of drinking water.

Though their protest triggered the shut down of 12 mines in May, residents say mining would recommence as soon as the monsoon draws to an end. After all, iron ore is the biggest revenue source for Goa, which has urged the Supreme Court to raise its annual output cap from 20 MT to 30 MT.

Sonshi is not the only village in Goa trying to protect itself from the hazards of open-cast iron ore mining. Residents of another village in South Goa are trying to improve their lot by taking matters into their own hands.

Action in cooperation

Welcome to Caurem, a tribal village not far away from Quepem town. The village, surrounded by four open-cast iron ore mines, has historically been at the forefront

of anti-mining demonstrations in Goa. Before 2012, at the peak of illegal mining in Goa, 15,000 trucks loaded with iron ore would ply the area, say Caurem residents. “Wastes from the mines had ruined agriculture. To top it all, these mining firms rarely provide any livelihood opportunity to the village residents,” says Kush Velip, a resident who used to rent out his two trucks to mining firms but has now stopped in solidarity with village residents.

This prompted the residents to make mining more sustainable and equitable by claiming a stake in it. “We started discussing the idea about five years ago,” recalls Ravindra Velip, tribal leader fighting against mining firms. The first step was to form a cooperative society and get it registered. “In April this year, after repeated requests, we finally obtained the registration for our cooperative, the Sadhana Multipurpose Cooperative Society Ltd (SMCSL). The society, with 300 members, is an attempt to create a sustainable mining environment where affected people are adequately compensated and damaged environment restored,” says Pravas Velip, another resident.

Analysts say there is a long way to go before SMCSL can achieve its dream. The first hurdle is that the Mines and Minerals (Development and Regulation) Amendment Act, 2015 does not have the provision for mining of notified minerals, such as iron ore, by cooperatives. Though cooperative mining has given people a greater voice, so far, it is limited to sand mining in Andhra Pradesh and stone quarrying in Rajasthan. “To allow cooperative mining of iron ore, the Union government has to first amend the mining Act,” says Prasanna Acharya, director of Goa’s Directorate of Mines and Geology.

Caurem residents believe otherwise. In 2012, the apex court passed a judgement that gives the state primary authority to decide on the fate of mining leases that are up for renewal. Besides, Goa Chief Minister Manohar Parrikar in April had expressed support for mining through cooperative societies. “We hope the state government would grant SMCSL the rights to mine iron ore during the renewal of mining leases,” says Ravindra Velip. ■ [@shreeshanV](https://twitter.com/shreeshanV)

Time to define the new normal

The monsoon of 2017 has challenged India's conventional and simplistic definition of the complex tropical circulation

SHREESHAN VENKATESH | NEW DELHI

IT WOULDN'T be inaccurate to say that the 2017 monsoon has been all about floods. At least 11 states experienced floods since the onset of the monsoon in June. Till the magazine went to print, 150 districts, or over a fifth of the country's districts, have received more than 100 mm of rain in a single day. More than 1,000 people have died and several millions affected. The situation has not abated.

But as we enter the final month of the monsoon, it would seem paradoxical to say that the monsoon of 2017 is also about a drought looming over large parts of the country. Around 40 per cent of the districts have received deficient rainfall. Parts of north, central and south India are about to face a drought. The distribution map issued by the India Meteorological Department (IMD) shows a large corridor of deficient rainfall areas (see map).

Consider this: only less than a fourth of the 400-odd weekly monsoon observations from June 1 at the 36 meteorological subdivisions recorded a normal rainfall. Yet, IMD has categorised all four geographical regions within the margins of a "normal" rainfall. That means extreme rainfall for a few days has compensated—and in some cases over-compensated—for the striking deficiency, indicating widespread imbalances in rainfall distribution.

Rajasthan is a glaring example of this imbalance. In the third week of August, the state registered an excess of 20 per cent rainfall. While western Rajasthan, primarily a desert, recorded an excess of 58 per cent, eastern Rajasthan recorded 1 per cent deficit. Chandigarh, on the other hand, did not get a decent spell of rain till August 21, and had a rainfall deficit of over 24 per cent. The deficit reduced to 8 per cent after the

city received heavy rainfall on August 21. So sudden and heavy downpours are marking the new "normal". Even Bengaluru, which faced unprecedented floods recently, has a rainfall deficit of about 8 per cent.

The Gujarat subdivision has seen four weeks where rainfall exceeded the normal levels by more than 50 per cent, two weeks where it exceeded the normal by more than 20 per cent, and, five weeks where rainfall was deficient by more than 60 per cent. So not a single week registered a normal rainfall! Ditto for Suarashtra and Kutch.

In stark contrast, the rain-rich regions of Kerala and coastal Karnataka received deficient rainfall, while the rain shadow region in southern Tamil Nadu received rainfall far above the normal, thanks to heavy downpours in August.

In drought-prone Marathwada and Vidarbha, the deficit stands at 32 and 28 per cent, despite strong pre-monsoon showers. Farmers in the regions have faced heavy deficit in seven of nine weeks—five of which recorded more than 60 per cent rainfall deficiency. Despite a third wave of floods, Assam has recorded a near normal rainfall. And while Tripura and Mizoram have received excess rainfall, Manipur and Nagaland have suffered heavy deficits.

Wholesale forecasts?

Since April, IMD has been saying in all its forecasts that it will be a normal monsoon this year. But the performance of the monsoon can no longer be only accounted by the amount of rain as extreme rainfall days are increasing, triggering floods and crop damage. A "normal" monsoon should take into account the changing distribution patterns as well as atmospheric conditions. Only such forecasts will be able to predict floods

GUJARAT

Dead **229** Affected **500,000**

- At least 60% excess
- Excess (20% to 59%)
- Normal (-19% to 19%)
- Deficient (-59% to -20%)
- Large deficient (-99% to -60%)
- Data not available

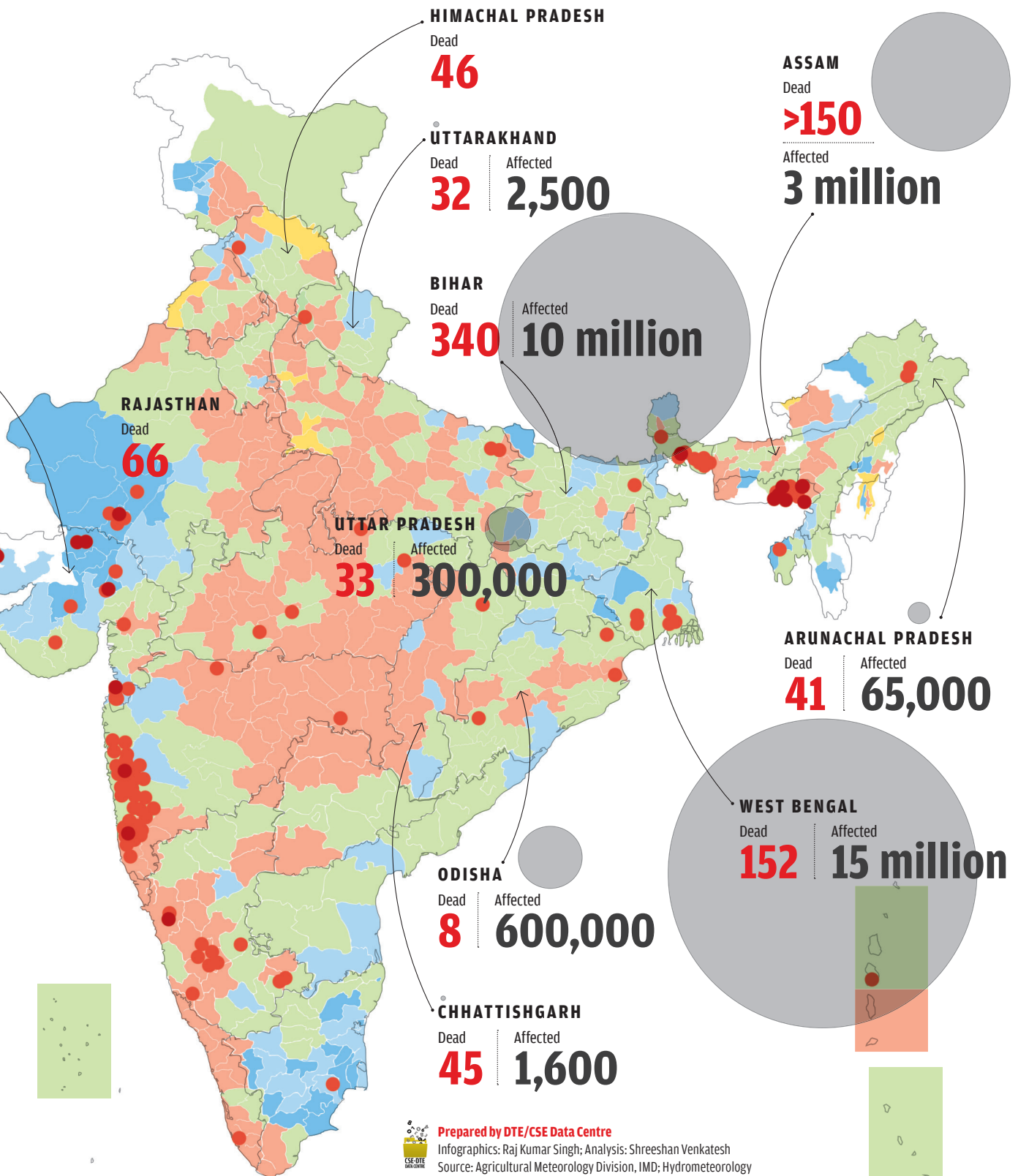
- Very heavy rain day (124.5 mm to 244.5 mm in 24 hours)
- Extreme rain day (>244.5 mm in 24 hours)
- People affected (June 1 to August 23, 2017)

as well as help farmers know when to sow.

There are damning errors too. For instance, pre-monsoon showers in Marathwada and Vidarbha were announced as "monsoonal rains" in the beginning of June. Thousands of farmers, who undertook sowing following the announcement, now stand to lose their crops following heavy rainfall deficits in the subsequent weeks.

Incorporating wind directions in its forecast and assessment methodologies would have enabled IMD to make an accurate prediction. Another atmospheric pattern that influences the monsoon, but finds little mention in IMD's assessment is the western disturbances. It usually arrives in August but this year it arrived in July, causing heavy rainfall in several parts of north, northwest and central India.

It is time, the IMD defined its new "normal" as floods are taking a heavy toll on lives and property across the country. Meanwhile, farmers elsewhere await another year of drought. ■ [@shreeshanV](https://twitter.com/shreeshanV)



Sowing adaptation

Farmers in eastern Indian states are replacing paddy with alternative crops to prevent elephant attacks. Can this experiment be replicated?

DEEPANWITA NIYOGI
PALAMU, EAST SINGHBHUM

SAMARJIT SAHU
ANGUL

FOR thousands of India's farmers this is the time to live in fear. If drought has not already damaged their crops, they dread an unpredictable assault: elephant raids. In and around India's 101 elephant corridors, the animals damage crops spread over 1 million hectares of land. In Konkadasa, a picturesque village in Dalma Wildlife Sanctuary, Jharkhand, elephant raids are common. Pointing to her tiny plot of land, Phoolmani Singh says elephants destroy the maize and paddy crops. Phoolmani's story is no different from other farmers, who are at the mercy of hungry elephants.

The Union Ministry of Environment, Forest and Climate Change points out that in the past three years, 1,224 people have died across 15 states due to elephant attacks. In these intense human-elephant conflicts,

around 400 people die and 100 elephants are killed in retaliation every year, says R K Srivastava, director, Project Elephant.

Changing cropping patterns

In a few corridors, farmers are waging a war against elephant raids in a peaceful way. In a bid to protect crops from regular raids, some farmers have given up traditional paddy and vegetable cultivation. Take for instance, Kumud Chandra Pradhan, a farmer from Odisha, who grows lemon. A resident of Bimripal—a buffer village in Satkosia Gorge Sanctuary in Angul district—he is a contented man. "More than two decades ago, I started growing lemon to increase my income. But I did not know it would act as an elephant-repellant crop. It has benefitted me, as over the years I have noticed that elephants hardly enter my fields," says Prad-

ADITHYAN PC / CSE

The Oraon brothers of Armu village in Palamu Tiger Reserve have dumped paddy cultivation for lemongrass to evade elephant attacks



han. He has over 1,100 lemon trees on 2.8 hectares (ha) and his annual income is about ₹25 lakh.

In the 1990s, the Odisha government launched a drive to encourage farmers to try alternative crops. “We persuaded farmers to try ginger, turmeric, onions and garlic to minimise losses. We also experimented with chilly fencing on crop fields,” says Lala A K Singh, a former researcher with the wildlife wing of the state forest department.

Experimentation such as this is not limited to Odisha alone. In Jharkhand’s Palamu district, two brothers from Armu village inside the Palamu Tiger Reserve started growing lemongrass in 2013. According to Anil Kumar of the Nature Conservation Society, a non-profit based in Daltonganj, the leaves of lemongrass are hardy, and so, elephants avoid eating the plant. It is also a profitable, low-cost venture. A single plant yields citronella oil for five years, which is used as an insecticide and in soap making. It is a good source of income for farmers, as the oil sells for around ₹2,500 per litre.

However, lemongrass is currently being grown only on two plots in Armu, covering 2.2 ha. Lalji Oraon and his brother Ramesh, who took up lemongrass cultivation, rue the absence of an extraction plant in the area. The Oraons shifted to lemongrass, as elephants used to damage paddy. “Once the extraction plant comes up more farmers will join us. Elephants have not entered my field since I started growing lemongrass. Paddy and vegetables are susceptible to regular elephant attacks,” Lalji adds.

In the 2000s, the Wildlife Society of Orissa (wso), a non-profit, carried out alternative crop experiments in Kanaka and Khajuria villages in Dhenkanal district by promoting a special paddy variety. “We promoted a scented variety of paddy called awn among farmers. We noticed that elephants avoided it due to its aroma,” says Biswajit Mohanty, secretary of wso. However, the project was abandoned two years later, due to fund shortage.

As paddy is a staple crop, it is difficult for farmers to give it up. So, the alternative is to plant varieties that mature quickly. For instance, in Bota village inside Dalma, Budheshwar Singh cultivates *gora*, a coarse variety of paddy that is ready for harvest within 70–80 days. The normal variety takes

more than 90 days. “I used to grow *chana*, *kaddu* and *sem*. Now, apart from *gora* paddy, I also cultivate *masoor* and mustard, which elephants do not damage. *Gora* paddy is ready for harvest by September before elephants start their migration back to Bengal around October. “When it comes to crop damage, the conflict increases between September–October and February,” says Ananda Kumar, a scientist at the Bengaluru-based Nature Conservation Foundation.

Do crop experiments work?

Singh feels it is difficult to keep elephants at bay permanently with alternative crops. After a season or two, the animals always learn how to adapt. According to noted elephant expert Ajay Desai, “The crops we grow are important. Most farmers grow paddy, *ragi* and millets for their survival. How is it possible for them to suddenly change their crops?”

Citing the example of Kodagu in Karnataka, Desai adds that even 5 to 10 years ago, elephants did not eat coffee beans, but now they have started consuming them. This can be due to a gradual learning process on their part or reduction in traditional foods. “If you grow something new in a particular area, elephants do not eat it. But later, they start experimenting. The behaviour gets passed on to the entire herd.”

According to Raman Sukumar of the Centre for Ecological Sciences, Indian Institute of Science, Bengaluru, though alternative crops have been suggested since several decades, it has never been implemented on a large-scale. But alternative crops can only play a limited role in providing farmers with a source of income. One must remember that the choice of crops depends on many factors—need for foodgrains by farmers, local conditions and the economics of alternative crops that are governed by market forces. Agriculture experts must demonstrate lower damage rate by elephants and increased income to farmers on a sustained basis when it comes to alternative crops, Sukumar says.

Expert Ujjwal Bhattacharya feels if cropping pattern has to change to effectively reduce conflicts with elephants, it must be a community movement, and not just individual efforts. ■

 @deepanwita_t

Trench causes conflicts, confusion

West Bengal's efforts to check elephant movement have backfired



A 6.5 KM trench, built by West Bengal, to control inter-state elephant movement has given rise to twin problems: increased human-animal conflicts in Jambad village along the Bengal-Jharkhand border and a drop in elephant count in the Dalma Wildlife Sanctuary, Jharkhand. There are three entry points to Dalma. Most elephants, however, enter the sanctuary from Bengal through a traditional 6-7 km wide corridor situated near Ghatsila. But this year, the trench confused the animals. As a result, Dalma counted lesser number of elephants during the census conducted on May 9-12, as compared to previous years. However, official figures are unavailable. Besides reduced count, Jambad is facing increased raids. Village *pradhan* Gouranga Gope says after the trench was dug, more elephants are entering the village and destroying houses and crops.

Elephant expert D S Shrivastava feels such problems cannot be treated in isolation, as one should keep in mind elephants’ behavioural pattern. When elephants face obstruction during migration, they raid villages which come in their way.

“Due to the trench, elephants are using different routes, which has increased conflicts in new areas. I have already written to West Bengal’s principal chief conservator of forests (PCCF), wildlife. The trench is causing more conflicts in Jharkhand and it will be harmful for Bengal too. The traditional route should not be blocked,” says L R Singh, PCCF, Jharkhand.

THE AFRICA FILE



Africa is the only continent that imports more food than it produces, despite having the potential to feed the whole world. And the cost of food import is so high that it cannot invest in health and other welfare activities. With ground reports from 10 African countries, ***Down To Earth's*** editorial team speaks to experts and policymakers on how Africa can achieve food security

Nigeria

CHINEDUM UWAEBULAM

Botswana

BABOLOKI SEMELE

India
RICHARD MAHAPATRA
VIJETA RATTANI
RAJIT SENGUPTA
KIRAN PANDEY
SUBHOJIT GOSWAMI

Ghana
SAMUEL HINNEH

Uganda
FREDRICK MUGIRA

Ethiopia
MURALI PAI

Kenya
MAINA WARURU

Tanzania
JOYCE KISAKA

Malawi
TIKONDANE VEGA

Zimbabwe
ANDREW MAMBONDIYANI

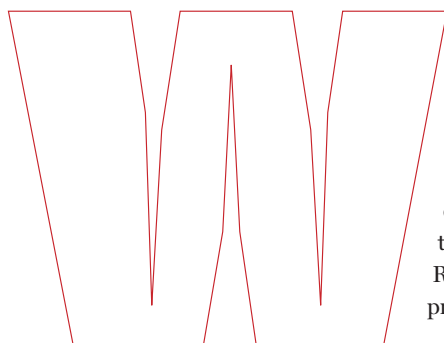
Zambia
CHRISTINE CHISHA



Prepared by DTE/CSE Data Centre
Maps and Infographics: Raj Kumar Singh

A continental crisis, and a few green shoots

African countries are fighting an addiction: import of food items, which happens at the cost of domestic farmers. Despite the unprecedented import volumes, the continent faces famine and extreme food insecurity. Countries have started taking definitive steps to become self-sufficient in food, but the transition could be counter-productive if it is not backed by investments in agricultural infrastructure and measures to improve soil quality



HEN CHARLES Tawazadza, a farmer in eastern Zimbabwe's Middle Sabi area, tried to borrow money from the bank to finance his farming business, the bank rejected his application. He has land but doesn't have title deeds to use as collateral for the loan. Tawazadza is one of the thousands of beneficiaries of President Robert Mugabe's controversial land reform programme launched in 2000.

The programme brought Zimbabwe's once vibrant agricultural sector to its knees.

The government seized farms from up to 4,000 commercial white farmers but most of it was distributed to members of the ruling party. Mugabe argued that the programme was necessary to address the colonial imbalances that saw minority white farmers controlling the country's prime agricultural lands. But this terribly disrupted the agriculture economy. Before this reform, farmers of the Middle Sabi area met the country's wheat requirements; but not anymore. In just two decades, the country has become a net importer of basic crops, such as maize, which is imported from as far as Brazil and Mexico. Chronic drought and unpredictable weather due to climate change compounded the problem. Zimbabwe is no longer southern Africa's breadbasket.

Since financial resources are limited, most farms have been lying fallow. These include big farms, which once earned millions of dollars by exporting crops like sweet corn and baby corn, a variety of beans and horticultural products like Kondozi in Manicaland province. This has pushed the country into the import trap.

Eddie Cross, the country's leading economist and agriculture expert says the country's agricultural output is down by about 70 per cent and Zimbabwe is importing over 80 per cent of all its foods, which are now priced at import parity. Zimbabwe's food import bill ballooned to more than US \$1.5 billion at the height of the El Niño-induced drought in 2016, according to the country's Vice President Emmerson Mnangagwa.

Cross says if all food imports could be produced locally, the benefits would be huge. "Replacing the import means creating 0.35 million jobs locally and saving some US \$2.5 billion per annum in foreign exchange." Take the case of the lucrative poultry business. Enock Mbendani of the Manicaland Poultry Producers Association, a group of poultry producers in Manicaland province, says there are enough locally produced poultry products for domestic consumption; but they are more costly than the imported ones.

Due to the rising food import bill, there have been some efforts to make farming tenable again. But they have failed due to corruption and abuse of government facilities. For instance, in 2007, through the Reserve Bank of Zimbabwe, the government introduced the Farm Mechanisation Scheme, but it failed because most farm mechanisation resources were given to the political elite.

And late last year, the government came up with another programme, the Targeted Command Agriculture, aimed to ensure food self-sufficiency. Under the three-year-scheme, targeted farmers are given agricultural inputs by the government, with each participating farmer committing 5 tonnes of maize per hectare towards repayment of



In just two decades, Zimbabwe has become a net importer of maize, a staple crop. The country imports over 80 per cent of all its foods

Across most key crops, the rate of consumption has outstripped production in Nigeria. The deficit has been met by imports, a trend visible since 1975

loans. Though originally the Targeted Command Agriculture, spearheaded by Vice President Mnangagwa, targeted maize production, it has also been extended to livestock production, wheat farming and fishery. "Command Agriculture is a policy intervention by the government informed by the imperative to substitute grain imports through increased agricultural production and productivity, thereby revitalising various agro-processing value chains and helping the country to re-industrialise," Mnangagwa said during a public lecture at Midlands State University in Zimbabwe's city of Gweru early this year.

NIGERIA: new efforts, new results

AGRICULTURE REVOLUTION is the new buzzword in Nigeria, Africa's largest economy. For a country that came to treat oil as its main economic crop, it is an unusual turnaround.

Though agriculture remains the largest sector of the economy and employs two-thirds of the labour force, production hurdles have stifled the performance. Between 2011 and 2015, agro-processed exports declined by 41 per cent. Over the past 20 years, it is estimated that Nigeria has lost US \$10 billion in annual export opportunity from groundnut, palm oil, cocoa and cotton due to a decline in their production.

Across most key crops, the rate of consumption has outstripped production in Nigeria. The deficit has been met largely by imports, making the country a net importer, a trend evident since 1975. Currently, Nigeria imports about US \$3-5 billion worth of food annually, especially wheat, rice, fish and fresh fruits. Wastage remains high in production areas, reducing supply of feedstock to processing factories, requiring them to keep importing supplies. The effect has limited job growth across the agricultural chain. Import dependence has also made Nigeria vulnerable to global agro-price fluctuations.

Emmanuel Oladipo, an environmentalist and Nigeria's consultant to Global Environment Facility's Food Security Programme, says, "When the oil money started coming, we became affluent and discarded the local brand of rice." This left marginal farmers in limbo. Local production could not match the price of cheaper imported rice. Oladipo says the current situation is encouraging for farmers because they are regaining importance. In the 1990s, people could get money from the oil,

and there was no policy to guide farmers, which led to massive desertion, he says.

After an initial effort by the past administrations that turned out to be a false start, fresh policy changes have been introduced in Nigeria. For instance in 2012, the government introduced the Agricultural Transformation Agenda (ATA) to improve farmers' income, food security and to generate employment. ATA is said to have increased agriculture output by 11 per cent, to 202.9 million tonnes, between 2011 and 2014. It also reduced the 2014 food import bill by US \$1.29 billion.

More recently, the government launched the Agriculture Promotion Policy aimed at overcoming food shortages and improving the output quality. In addition, the Economic Recovery and Growth Plan (ERGP) prioritises food security and aims to achieve self-sufficiency in tomato paste, rice and wheat, by 2017, 2018, and 2019/2020 respectively. ERGP projects that the value of agricultural production would increase by 31 per cent in 2020.

But still the agriculture sector faces many challenges, notably an outdated land tenure system that constrains access to land (on average, a farming household has 1.8 ha) and a very low penetration of irrigation facilities (less than 1 per cent of cropped land is under irrigation). Other factors include limited adoption of technology, high cost of farm inputs, poor access to credit, inefficient fertiliser procurement and distribution, inadequate storage facilities and poor access to markets. These have kept agricultural productivity low (average of 1.2 tonnes of cereals/ha). According to Bala Dogo, coordinator of Kaduna-based Care and Action Research, a non-profit, there was a misplaced priority. "It was an issue of planning 'for', and not 'with' the people," Dogo says.

KENYA: overreliance on rain, maize

THE LAST harvest in October 2016 was one of the worst for Justus Mutai, a 54-year-old Kenyan farmer from Kericho county in the country's Rift Valley region. From his 4 hectares under maize, he only managed 100 bags of the staple food, a far cry from the 300 bags he would usually harvest in a good season. Poor rains and sub-standard government-supplied subsidised fertiliser were partly to blame for this. "The crop hardly improved as it should have after the use of fertiliser, and the situation was made worse by inadequate rains," says a dejected Mutai.

UNDERSTANDING ENVIRONMENTAL LAWS FOR BETTER COMPLIANCE

TRAINING PROGRAMME September 18-22, 2017

Centre for Science and Environment (CSE) New Delhi, is conducting a five days training programme on 'Understanding Environmental Laws for better Compliance' to be held between September 18-22, 2017.

India has a comprehensive system of regulations to protect its natural environment and the health of its people. From the enactment of Water Act in 1974, a number of laws and regulations have been put into force in this regard. However, the intended purposes of these laws are far from being fulfilled due to various reasons. One of the issues which stands out is a holistic understanding of the different laws and how they should be looked into in a concerted manner for better environmental management.

The primary objective of the programme is to develop a better understanding and knowledge of the laws and their interrelationship.

Laws related to environmental preservation, pollution abatement, forest clearance, coastal zone regulation, and international treaties will be discussed during the programme.

On completion of the training, the participants will have:

1. Better understanding of environmental governance structure of the country, major institution, and their implementation statistics
2. Increased understanding of the obligations of industry and individuals under various environmental laws and regulations and how to meet these obligations
3. Participation of concerned internal and external stakeholders in the compliance process
4. Understanding the impacts of violations and non-compliance
5. Role of National Green Tribunal (NGT), environmental courts and public interest litigation (PIL)
6. Understanding of international treaties and agreements Government of India subscribes to and the impact of non-compliance with such agreements on business
7. A clear understanding that environmental compliance is not a financial burden but a clear business opportunity

Training methodology: Lectures, case studies, class exercises, discussions, and role play.

COURSE FEES

Rs 18,000 (Accommodation can be arranged nearby the training centre; it would incur extra charges)

COURSE DURATION

September 18-22, 2017

TIMING

9.30 am to 4.30 pm

COURSE VENUE

Centre for Science and Environment, 41
Tughlakabad Institutional Area, New Delhi - 110062

LAST DATE FOR APPLYING

September 15th, 2017

OPEN FOR ALL

Industry professionals; Environment Regulators and Experts; Environment Auditors; Environment Consultants; Environment Engineers and Academicians

FOR REGISTRATIONS mail at: s_rahul@cseindia.org



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Kenya received poor rains in 2016 and witnessed a severe food crisis. It had to rely on food imports almost throughout 2017

Most of Kenya received poor rains in 2016, leading to one of the worst food crises in the country since the 1990s, with the country having to rely on food imports almost throughout 2017. The Kenya National Bureau of Statistics (KNSB) says that the country spent a whopping US\$1.146 billion on food imports, or 8 per cent of the total import bill in 2016. The figure is predicted to rise in 2017 due to the drought. 2017 being one of the worst years in terms of Kenya's food security, KNSB statistics indicate that by April the country had spent about US\$0.33 billion on buying food, mainly cereals—maize, wheat and rice. The figure could triple in the remaining quarters of the year.

According to Agriculture, Livestock and Fisheries Minister Willy Bett, the government is doing all it can to ensure the country is food self-sufficient, by, among others, significantly increasing land under irrigation. "We agree that these past two years have been very bad as far as food production is concerned, with weather being the biggest culprit, says Bett, and adds that the country is trying to reduce its dependence on rains.

At the height of the shortage this year, a 2 kg packet of maize flour cost US \$2, an amount that nearly caused food riots in the country. By August the Food and Agriculture Organization put the number of people in urgent need of food aid at 3 million in Kenya, and 16 million people in the Horn of Africa countries of Kenya, Uganda, Tanzania, Somalia and Ethiopia.

"Over-reliance on rain-fed maize production is one key cause of suboptimal production, which occurs during years of drought. This is because arable land accounts for less than 20 per cent of the land mass in Kenya, and over time, it has been declining due to increasing population and other competing alternative land uses," says Dennis Otieno, research fellow at Tegemeo Institute of Agricultural Policy and Development, Egerton University in Nakuru city. According to Otieno, Kenya has been unable to meet its domestic maize demand since 1994, with the average annual maize production standing at about 40 million bags while consumption is over 50 million bags. The country needs to cut post-harvest losses, which stand at 30-40 per cent of all yields across Africa, increase agriculture budget, raise numbers of extension officers, and modernise agriculture by investing in technologies.

According to Anne Mbaabu, head of Markets and Harvests, Alliance of Green Revolution in Africa, an organisation that seeks to improve

agriculture across Africa, Kenya needs more investment in agriculture, including private sector investment, protection of farmers through crop and livestock insurance, investment in irrigation, storage and roads infrastructure, and a boost in its ability to respond to epidemics. More important is the political will to implement farmer-friendly policies and good prices to motivate farmers to produce more.

ZAMBIA: missing infrastructure

IN MARCH, Zambia created a flutter when it banned the import of certain fruits and vegetables. The decision was made to promote the agriculture sector. For a country that is not known for its domestic agriculture, the decision shows how desperate the situation is. In fact, the scenario is the same across the continent, with one country after another becoming dependent on imported food.

It's important to take into account the political context that led to the ban. Historically, Zambia focused on mineral exports as the dominant economy sector. It helped Zambia earn enough to pay for food import. But during his third term, President Levy Mwanawasa was forced to diversify the economy when global copper markets tanked in the late last century and the economy collapsed.

Just like other African countries, Zambia's imports of agricultural produce affect the local market. The list of banned items includes tomato, onion, carrot, mango, potato, pineapple, lemon and watermelon, and local farmers have greeted the decision with the hope that their produce will now have a market. But there is also a rider: farmers need right infrastructure to package, process and deliver the produces.

Frank Kayula, president of the National Union for Small Scale Farmers in Zambia, agrees that lack of infrastructure is a serious drawback, especially for small-scale farmers who produce the country's 80 per cent food. Poor infrastructure in agriculture at sowing, harvesting or selling stages resulted in agricultural countries like Zambia not being able to meet the domestic demand, which led to net import of food, Kayula says.

For companies dealing with food produce, the absence of a robust supply chain is the biggest hurdle to benefit from the ban. Food Lovers Market, a South African fruit and vegetable supermarket that has outlets in Zambia, has cited inconsistent supply and bad quality of produce from local

2017 was one of the worst years in terms of Kenya's food security. By April, the country had spent about US \$0.33 billion on buying food, mainly cereals. The amount could triple in the remaining quarters of the year



From a 42.7 per cent share in GDP at independence in 1966, agriculture fell to 1.9 per cent in 2008 in Botswana

farmers as one of the reasons for its disapproval of the ban. Calestous Juma, a professor at Harvard University, questions the ban as an instrument of achieving food sovereignty. According to Juma, in many cases, imbalances in agricultural trade exist because the country has not invested enough on storage facilities and capacity building.

Julius Shawa, permanent secretary in the Ministry of Agriculture and Livestock, says the ban follows concerns raised by local farmers. "Just recently, we received complaints from farmers that some tomatoes from neighbouring Tanzania were being imported cheaply, hence under-cutting our farmers. Our concern as a ministry is to encourage the sourcing and supply of these products from within the country; so we have imposed an administrative restriction for now," Shawa says. He says the country has the capacity to satisfy local demand. "We are telling our farmers, here is the market. We want to make our farmers rich," he says.

BOTSWANA: climate-proofing agriculture

WITH A population of 2 million and one of the highest per capita GDP in Africa (\$18,825), Botswana shouldn't have been worried by the rising food import bill. But it has reached such proportions that it can cause a collapse of the country's economy, say experts.

Botswana lies in the Sub-Saharan Africa (SSA) region, where the gap between cereal consumption and production is the largest in the continent. Further, it is projected that the demand will triple between 2010 and 2050. This is much greater than in other continents including Asia. Indeed, SSA, including Botswana, is the region with the greatest risk to food security because by 2050 its population will increase 2.5 times. The region already depends on import. To meet the future demand, it would have to import even more.

What's worse, the agriculture sector has seen a steady decline over past four-five decades. From a 42.7 per cent share in GDP at independence in 1966, agriculture fell to 1.9 per cent in 2008. Add to this the threat of climate change. Jimmy Opelo, permanent secretary in the Ministry of Environment, Natural Resource Conservation and Tourism, says, "What we need to ask ourselves is: are we ready for climate change and how can we adapt to it so as to reduce its effect in our country." The country no longer receives normal rainfall and this has changed its agriculture cycles, he adds.

So, the government's focus has been to not only make agriculture viable again but also to make it climate change-resilient. In an interview to *Down To Earth*, permanent secretary in the Ministry of Agricultural Development and Food Security Boipelo Khumomathlare, says, "Botswana is serious about more localised food production. So, we have included food security in the mandate of the ministry of agriculture."

Its impacts are visible. Some 1,000 km from the capital city, Gaborone, the village of Shakawe hosts some incredible stories of making the country self-sufficient and also to fight climate change. The non-profit, Trust for Okavango Cultural and Development Initiatives (TOCADI), is implementing a programme to facilitate and mobilise community-based organisation to practise subsistence farming since 2003. The initiative has resulted in slow agro-industrial and supply chain development that is needed to drive the growth of associated sub-sectors such as food processing, transport and manufacturing. This is the most important investment to make domestic food production viable in the face of rising import. Conversations with local communities indicate a turnaround in local food production.

However limited this initiative might be, it has resonance in the country's agriculture sector. About 70 per cent of rural households derive their livelihoods from agriculture, through subsistence farming. The government has also introduced a young farmer's fund to encourage the youth to venture into farming. The loan may be used for infrastructure development needed for the project.

UGANDA: a systemic overhaul

WHEN 65-year-old Emmanuel Ssempila of Rwentondo village in Kakoba division of Uganda's Mbarara district joined coffee farming 42 years ago, he never envisaged how much his life would change four decades later.

In these 40 years, coffee farming has enabled him to send his six children to get university education, build a house and live a middle-class life as per Ugandan standards. He is now his village's "nucleus coffee model farmer". In that capacity, introduced under the government's agriculture zoning approach, Ssempela provides some basic services to his fellow village residents, such as distributing coffee seedlings supplied by the government. With this approach—just one of an

I AM DownToEarth

FORTNIGHTLY ON POLITICS OF DEVELOPMENT, ENVIRONMENT AND HEALTH

ARUN SHARMA | Banker



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**As per the
Malawi
Vulnerability
Assessment
Committee,
6.7 million
Malawians are
"food insecure"
this year**

array of initiatives that it has set up—the Ugandan government hopes to boost coffee production from the current 4 million bags to 20 million by 2025.

But as Uganda strategises to increase coffee, cotton, tea and tobacco exports, its food imports have steadily increased. This is taking a toll on the market for local produce. Take for instance vegetable oils. Uganda imported crude palm oil worth US \$149.4 billion in 2015 according to the Uganda Bureau of Statistics. "It means the market for indigenous oils gets drastically reduced. So while a farmer labours to produce oil crops, he won't get a good price because the demand is greatly reduced," reasons Sydney Ongwali, Regional Supervisor, Uganda Oil Seed Producers and Processors Association. Another example is maize. Although Uganda is one of East Africa's leading maize producers, it has continued to import it from its neighbours. "When maize from Tanzania and Rwanda comes in, the cost of a kilogram of Ugandan maize reduces from US \$0.08 to US \$0.04," says Asaph Mugizi, former chairperson for Mbarara District Farmers Association.

But some traders of food crops in Uganda do not see this as a problem. Ali Mukiibi, the chairperson of an association in Mbarara's Ruti Banana market, says imported foods help to stabilise the market. "Lack of imported rice, maize, and wheat in the market causes the demand of our bananas to hike. This hikes prices too."

But whereas Ali looks at increased food imports as an advantage, Wilson Twamuhabwa, an economic advisor to Uganda's minister for finance and economic planning, disagrees. "At times, food comes into Uganda at a lower price, which kills the farmers' incentives to produce more," he notes.

Uganda is currently in the throes of drought. According to a government survey done between December 2016 and January 2017, Uganda's crop production suffers from limited access to irrigation, low rates of adoption of modern farm practices, lack of insurance schemes, and inadequate meteorological and agricultural advisory services.

Uganda's current food insecurity, contends Twamuhabwa, has taught a big lesson to the government. "We will revamp agriculture." This, he says, will be done by providing extension services, quality seeds and water for irrigation to farmers, availing long-term financing and conserving the environment. For example, according to Wilson, this financial year, the government has provided US \$22 million for irrigation. It has also set aside, US \$8.3 million to fund agriculture extension services.

MALAWI: irrigation, crop diversity are key

T IS mid-morning on a dusty road leading to the Nsangwe market in southern Malawi's Chikwawa district, and Alexander Fombe is resting under the shade of an acacia tree, a 10-kg bag of maize by his side. Fombe travelled 6 km from his house to the depot of the state-run Agricultural Development and Marketing Corporation to buy subsidised maize. The journey is not his primary concern; feeding his five children and the next harvest are.

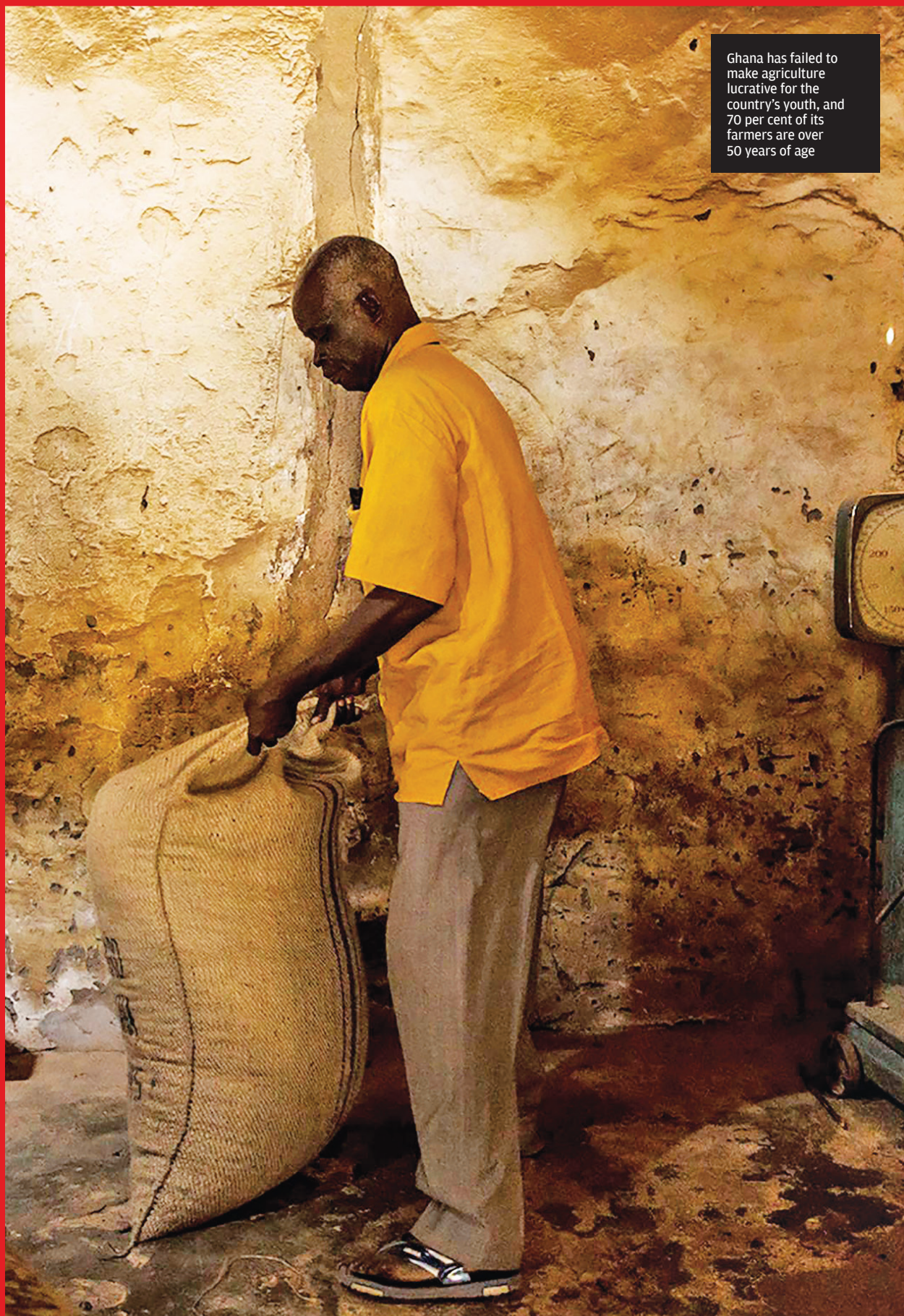
As a result of last season's failed crop in Chikwawa and other districts in Malawi, Fombe is among thousands who will face hunger in 2017. As per the Malawi Vulnerability Assessment Committee's evaluation, this year an estimated 6.7 million Malawians are "food insecure".

"Domestic production is low and erratic. It leaves us depending on imports," says Prince Kapondamgaga, CEO of the Farmers Union of Malawi. "On the other hand, increasing food imports means we are rendering, whatever little is produced locally, useless. This is because Malawians consider imported food to be better than local produce. The country also projects maize as the strategic food item to fight food insecurity. We need to change this mindset," he adds.

Experts cite various reasons for hunger being a perennial problem in Malawi. Economic analyst Henry Kachaje blames policy failure. "There must be a key political champion at the head-of-state level to steer and champion a vision on agricultural revolution," he says. John Kapito, executive director of the Consumers Association of Malawi, a Blantyre-based consumer rights watchdog, agrees that attaining its national food requirement has been a major challenge for the government. The last time Malawi had a grain surplus of 0.5 million tonnes was in 2005. Agriculture expert Tamani Nkhono notes that a combination of inadequate infrastructure, geographical realities, an ineffectual political system and changing weather patterns have created food scarcity in Malawi.

So what can Malawi do? "We need to extend cropping opportunities and facilitate crop diversification for both total and supplemental irrigation, create an enabling environment for irrigated agriculture and optimise government investment in irrigation development," says Nkhono. Malawi's principal secretary in the Ministry of Agriculture, Irrigation and Water Development Erica Maganga

Ghana has failed to make agriculture lucrative for the country's youth, and 70 per cent of its farmers are over 50 years of age



Tanzania imports food worth US \$42 million annually, about half of it just on cooking oils

says new policies and leadership are key for a solution to hunger. She also emphasises the need to adopt irrigation farming as the solution to food challenges arising from climate change. "With support from the World Bank and other donors, the Malawi government is developing a new national agricultural policy to refocus smallholder subsistence farming to commercial approaches. It promotes commercialisation to help sustain growth in the agriculture sector," she says.

Government plans are underway to intensify solar power irrigation in all irrigable areas. The country's first-ever Irrigation and Investment Master plan seeks to irrigate over 100,000 hectares in the next 20 years.

TANZANIA: a story of neglect

TANZANIA IS a large country covering 947,000 sq km from the Great Lakes to the Indian Ocean and has a population of 45 million people. Over 75 per cent of Tanzanians depend on agriculture for their livelihoods.

Most of Tanzania has a single wet season which occurs between December and April. The country's various regions produce different crops: maize in the southern highlands; coffee and horticultural products in the northern highlands; sorghum, tobacco and cotton in the relatively drier centre and northwest and cassava and cashew (for export) in the southwest.

However, despite the major role played by agriculture in the economy, Tanzania imports food worth US \$42 million annually, about half of it just on cooking oil. Other major import items include wheat, sugar, dairy and poultry products. Experts say that Tanzania has the potential to cultivate all the food items it imports. Audax Rukonge, Executive Director of Dar es Salaam-based Agriculture Non-State Actors Forum says, "Tanzania spends a lot of money importing cooking oil whereas they can easily cultivate surplus quantities of sunflower, cotton, African oil palm, sesame and various types of nuts that can produce enough oil for consumption and export." He adds, "If the country invests heavily in agriculture, it would not be importing food, but would rather be exporting it and earning precious foreign exchange." Lenny Kasoga, a veteran economist and a farmer as well, seconds this. "Tanzania is still poor because it has been neglecting agriculture. If it wants to move to being

a middle income economy as is being vowed by current President John Magufuli, it should stick to agriculture, not to industry."

The government's neglect of the agriculture sector is quite evident. Tanzania has over 44 million hectares of arable land, but only a quarter is put to effective production. Agriculture contributes 25 per cent of the country's GDP. But Tanzania spends only 0.85 per cent of its national budget on agriculture. Recently, the government pumped in US \$9.3 billion into the Tanzania Agriculture Development Bank. But experts say the amount is simply inadequate as it is meant not just for farmers but for the whole agricultural chain. Another instance of neglect is irrigation: only 5 per cent Tanzania's cultivated land is irrigated. This is because surprisingly little attention has been paid to irrigation in the country. Minister for Agriculture, Livestock and fisheries, Charles Tizeba has now promised to expand irrigation to 1 million hectares by 2020.

Rugemeleza Nshala, Managing Director of Dar es Salaam-based environment protection organisation, Lawyers' Environmental Action Team, says Tanzania needs to take immediate measures to accelerate the processing of agricultural raw materials. Tanzanian governments (of the mainland and Zanzibar) must play a greater role in industrial promotion, particularly in small-scale industries of which those related to animal feed deserve special attention. Nshala says Tanzania's efforts in achieving agricultural growth are hindered by corrupt agricultural bureaucracy. That is the biggest problem that needs to be fixed, he says.

GHANA: Start-ups, IT to rescue farm sector

THE PRIMARY issue in Ghanaian agriculture is farmers' age. Most Ghanaian farmers are semi-literate smallholders above 50. Over the past few years, many Ghanaian youth have failed to venture into agriculture, largely due to the sector's unattractiveness. It is modernising at a slow pace, with farmers still using regimented tools and approach to farming.

"About 70 per cent of our farmers are above 50 years. It means the youth are not getting into agriculture. It is they who can introduce innovations," says Francis Danso Adjei, content manager at Ghanaian agriculture startup, Esoko.

The government of Ghana is seeking to address the problem of youth in agriculture with its flagship

policy called Planting for Food and Jobs Campaign. It was launched by the country's president, Nana Addo Dankwa Akufo-Addo, in April 2017. It would be implemented in 216 districts, with an aim to target 0.2 million farmers and create over 0.7 million jobs. However, the new policy cannot be implemented single-handedly by the government. There has to be involvement of the private sector. That is where agriculture startups come in. They are growing rapidly in Ghana. Currently, there are about six in the country. With most of them being led by the youth and having a lot of youth in their operations, it presents an opportunity to get the youth involved in agriculture.

But to remain relevant, the startups will have to be innovative. Esoko started in 2005 as an experiment to see how the emergence of mobile technology could improve the lives of rural communities. Today, it provides smallholders inputs and finance through its virtual marketplace, while driving business for dealers and financial service providers. Adjei says, "We are giving farmers weather forecasts. You need to innovate, to add on to whatever you have. Otherwise, it will be impossible to survive."

Image-Ad, a company formed in 2009, has a platform called Mfarms Agribusiness Solution—a mobile and web-based system for managing and communicating within the agricultural value chain. "Mfarms was previously sending price information to farmers through messages on mobiles. After research, we realised that most farmers are illiterate. We then came out with a solution to give farmers information in their local dialect," says marketing manager Michael Anderson.

"Information technology is built on infrastructure, which requires servers to run without interruptions. It means that electricity issues need to be addressed. Mobile network operators would have to be efficient... We should not have periods where calls drop or fail to connect," says Adjei.

ETHIOPIA: balancing ecology and agriculture

ETHIOPIA'S GROWTH story has caught the imagination of Africa and the world. But the truth about one of the globe's top five emerging economies lies beyond the headlines. It is about the thin thread of food security that could snap any day, given droughts and famines that happen with cyclic regularity in the Horn of Africa. It is also about the diversion of water and land and the loss of

biodiversity, all for the sake of development.

Ludwig Siege, an expert on sustainability and protected areas in Ethiopia, drives home the point on the crisis. "No amount of riches can replace the biodiversity of Ethiopia, most of which has lost out to urbanisation and unsustainable growth. When 85 per cent of arable land is owned by small landowners, big corporations simply buy them out to put factories, breweries and livestock farms on prime crop lands," he says.

The economy is being upended by industrial production and cash crops. One is coffee, which accounts for 40 per cent of Ethiopia's exports, with an estimated 15 million people involved in its production. Another crop is sugarcane. Ethiopia could soon have 40,000 hectares under sugarcane and produce up to 1,500 tonnes of sugar per day. For this, vast swathes of tribal farm and grazing lands have recently been leased out to sugar factories and water diverted from scarce wetlands when more cereals and pulses ought to be grown to feed the malnourished. The effluents from sugar factories are a big concern as well.

There has been a drastic loss to Ethiopia's unique biodiversity, often because of agricultural reasons. Take, for instance, the Senkelle Hartebeest Sanctuary, a 58 sq km protected area providing refuge to the critically endangered antelope, the Swayne's hartebeest. The sanctuary is hemmed in by dairy farmers and pastoralists graze their livestock, collect fuel wood and hunt for game in the protected area. The fringe of the Bole National Park, home to the world's rarest canid, the Ethiopian wolf, has been heavily settled upon and witnessed slash-and-burn cultivation of barley and pearl millet. Not surprising, only 300 wolves survive in the middle of all the human activity.

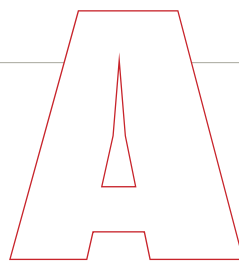
There are people in Ethiopia who are trying to reverse the tide. Tarekegn Habte, a college student who belongs to the Hamar tribe of the Omo river valley, talks about an eco-friendly indigenous practice that his people practise. "To counter the loss of pasture, we recoup grasslands by fencing in vast stretches of land called *darr*. Inside the *darr*, wild grasses will eventually grow again. The *darr* is a good example of controlled grazing practised to this day," he says.

Ethiopia's predicament is also true for the rest of Africa. The continent needs to promote farming to curb food imports, but this cannot be at the cost of environment. Climate change-triggered weather events and rising population of Africa will only make the food shortage more acute. ■

A grain revolution for Africa

In just a few decades, Africa has become a net food importer. But it has to feed more and more people in the future. Estimates suggest the continent may end up spending more on importing food than on any other development needs

Farm yields in Africa are at about 23 per cent of global levels and agricultural productivity is growing at about half the rate of population growth



AFRICA NEVER ceases to surprise the world with its existential contradictions. We know

about its “resource curse”, the generic term that bundles all these contradictions. But, as the previous article points out, the contradictions in the agriculture sector are stark.

The continent has 65 per cent of the world’s arable lands that are yet to be cultivated. If cultivated, it could feed over 9 billion people, more than the world’s population. Yet, it has one-third of the world’s underfed population. By 2030, its agri-business potential would be US \$1 trillion, but this will be only because of being the world’s only continent to be a net food importer.

While Africa has other pressing developmental challenges such as malnourishment, growing



health burden and the threat of climate change, the continent spends the most on importing food, which otherwise could have been spent in such programmes. Moreover, the continent will have the world's largest population in a few years; it already records the fastest population growth. For a continent where agriculture still employs the most, it is no more an existential contradiction, but a real threat to a decent existence.

For more than three decades the continent has been a net importer of agricultural products. But what is stifling is the change in the nature of food imports. The continent has been importing basic foodstuffs such as dairy products, edible oils and cereals, implying that food imports have become increasingly important to ensure food security. In the continent's most densely populated region—the Sub-Saharan Africa (ssa)—40 to 60 per cent of smallholder farmers are absolute buyers of staple foods. They spend more on food than they earn from selling agricultural produce.

Growing imbalance

But it was not always like this. In 1980, despite Frankenstein famines that killed thousands and near non-existent resource in many countries to spend on human goods, Africa reported a near balanced agricultural trade. The continent imported and exported the same worth of agricultural produce—the food import bill was US \$14 billion. But that was also the last time the continent witnessed a healthy trade scenario. At present, Africa spends US \$35 billion a year on imports of agricultural produce, while exports are negligible (see 'Africa survives on imports' p54). The share of intra-African trade is less than 5 per cent. By 2050, the African population is expected to be about 2 billion. To feed this population, and going by the current import trend, the food import bill would be US \$110 billion in 2025.

Various regions of the continent are emerging as the world's biggest food importers. West Africa, for instance, imports 20 per cent of the world's total rice. Or take Nigeria. While domestic production of rice has stagnated at 28 kg per capita since 1990, consumption has nearly tripled in this period. It now spends more than US \$2 billion annually on rice imports. While export growth has not been as high as expected, the value of agricultural imports has increased five times since 1998.

"But Africa cannot eat potential," says Akinwumi Adesina, the president of the African Development Bank and Nigeria's former agriculture and rural development minister. "What Africa does with agriculture is going to determine the future of food in the world," he says.

Contradictions within

Africa remains a predominantly agrarian economy. The average contribution of agriculture to the national economy of an African country has been about 30 per cent since the 1980s. The poorest countries of the continent are importing the least, even though they are net food importers. This has ramifications for the continent's poor.

For example, a comparatively richer country like Nigeria with oil wealth reported the highest per capita food import of US \$185 annually between 2000 and 2005 on an average. On the other hand, a poor country in ssa had a per capita annual import of US \$17 annually. But the difference between these two scenarios is that in Nigeria's case, the government had the resource to pay for the import through revenue from exporting oil, but in countries in ssa, governments don't have the



Surviving on IMPORTS

Close to 70 per cent of countries in Africa are net food importers

- Total agricultural imports in 2012 (billion US \$) \ increase from 1980
- Total agricultural exports in 2012 (billion US \$) \ increase from 1980
- Total cereals imports in 2012 (billion US \$) \ increase from 1980
- Total cereals exports in 2012 (billion US \$) \ increase from 1980

AFRICA

Import dependency ratio (2012) **1,707*** Increase from 1980 **100%**

83,376\460%
Total imports \ increase from 1980
(in billion US \$)

42,666\214%
Total exports
(value)

AGRICULTURAL

27,485\450%
Total imports
(value in billion \$)

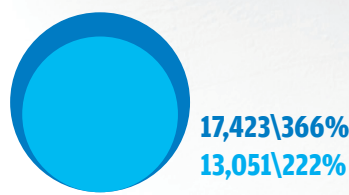
1,685\119%
Total exports
(value)

CEREALS

* Import dependency ratio shows the extent of dependency on imports in relation to an area's domestic consumption. It is calculated by $\text{imports} \times 100 / (\text{production} + \text{imports} - \text{exports})$

West Africa

Import dependency ratio (2012) **436** Increase from 1980 **91%**



AGRICULTURAL

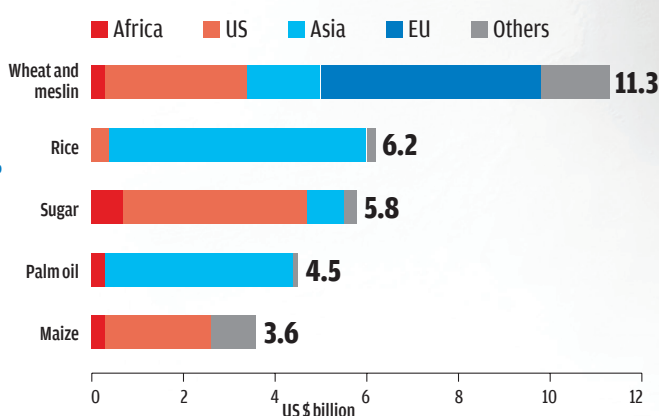
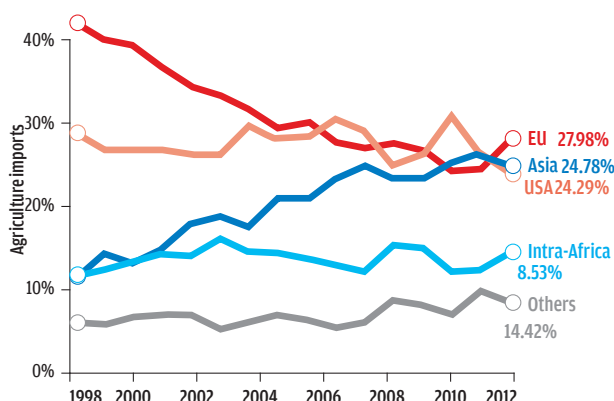


CEREALS

Africa's import story | cereals account for the bulk of Africa's agriculture imports

EU, Asia and the US account for 77% of Africa's agriculture imports

Top 5 agricultural commodities imported in 2013



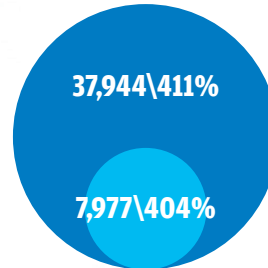
North Africa

Import dependency
ratio (2012)

311

Increase
from 1980

177%



AGRICULTURAL

13,376\390%
205\360%



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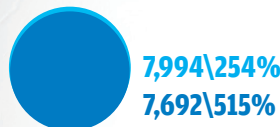
East Africa

Import dependency
ratio (2012)

282

Increase
from 1980

225%



AGRICULTURAL

2,578\461%
309\250%

CEREALS

Central Africa

Import dependency
ratio (2012)

150

Increase
from 1980

33%



AGRICULTURAL

1,137\639%
4\79%

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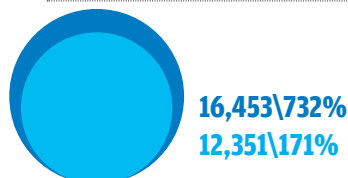
Southern Africa

Import dependency
ratio (2012)

529

Increase
from 1980

70%



AGRICULTURAL

3,322\523%
1,002\61%

CEREALS

Data sources: African Development Bank's Socio
Economic Database, 1960-2016 and African
Agricultural Trade Status Report 2017

capacity to pay for the import bill. So parts of the continent with the poorest population have been witnessing uncertain food availability.

The pessimists believe that the continent, particularly countries in SSA, will find it more difficult to attain food self-sufficiency. So, the import will continue in greater volumes, further draining the state exchequers. It will be a vicious circle for the rural population who will suffer the most due to the continent's inability to produce more food. And, the result: the much-feared slide on the path to dependency, unemployment, rural exodus and desertification, leading to famine. As we know conflicts just need these type of triggers.

Reports from the 10 countries carried in the previous article indicate a revival of policy interest in agriculture. But what is worrying is that the crisis needs immediate action. This is because food imports and the general decline of the domestic agriculture are having disastrous impacts.

Africa is predominantly a rural continent.

economic conditions. This demand will add to the already increasing food demand from rural areas. In fact, a significant percentage of imported food is consumed by the urban population. But as UN data point out, there were three African farmers for every urban dweller in 1990, but in 2020, one full-time African farmer will be expected to feed two urban dwellers. Projections by the Organisation for Economic Co-operation and Development and the Food and Agriculture Organization (OECD-FAO) on Africa's consumption and production of high value commodities over the period 2011 to 2023 indicate that an increasing share of the region's growing demand for high value food products associated with rising consumer incomes will be met by imports.

Agriculture has another crucial role to play in this continent. The continent needs to revive agriculture to provide livelihood to the booming young population. According to the FAO, agriculture still accounts for 58 per cent of Africa's eco-

More than 60 per cent of the continent's population is under the age of 25. Some 220 million youth will join the labour workforce by 2035, most of them from rural areas, who will need livelihood options

Unlike other continents, Africa will have 60 per cent more rural population in 2050 than now. The rural population of Africa is already more than 500 million, 80 per cent of them living in poverty. Rural population depends on agriculture for survival. Even though Africa is witnessing fast economic growth, there seems to be no proportionate impact on poverty reduction. Countries like Ethiopia and Zambia, for instance, outpace India and China in economic growth. It is clear now that without growth in the agriculture sector, pure economic growth doesn't have the capacity to turnaround the situation for the people. Agricultural growth is way behind services and industrial sector in term of growth. During 2000-09, per capita agricultural income reported less than 1 per cent of annual growth. Besides, more people mean more quantity of food for consumption. But without a productive local agriculture, the prohibitive import bill would surely lead to a serious scarcity of food.

There is another aspect to this crisis. Africa's urban population is also increasing and the urban Africans are vociferous consumers due to better

nomically active population. In countries such as Burkina Faso, Guinea, Mozambique, Niger and Rwanda, agriculture provides employment to over 80 per cent of the population. More than 60 per cent of the continent's population is under the age of 25. Some 220 million young people will join the workforce between now and 2035 in SSA. According to projections by UN's Economic Commission for Africa, wage jobs can absorb up to 25 per cent of them. This leaves farming and related self-employment to absorb the employment needs for at least 70 per cent of young Africans entering the labour force (more than half of whom live in rural areas) till at least 2030, says the estimate.

Extent of degradation

Africa's agriculture is a victim of both environmental degradation and a lack of political will (see 'Low on farm growth' p58). Like rural India, the continent too is witnessing land fragmentation due to population rise and rising dependence on farming due to lack of other economic opportunities. Though there are visible signs that

small farmers are responding to this situation by increasing cropping intensity, but this is also limited to a few high-yielding varieties, leaving no time to take up activities like crop rotation to increase soil fertility.

It is estimated that 65 per cent of the arable land in SSA is already degraded. This costs farmers about US \$68 million annually due to loss in income. According to the Montpellier Panel, a group of African and European experts from the fields of agriculture, trade, ecology and global development which was chaired by Gordon Conway of Imperial College, London, the economic loss due to soil degradation impacts 180 million people, mostly smallholder farmers who are now depending on imported food.

Africa is already battling the impacts of climate change. According to a report by the Montpellier Panel, mean temperatures in Africa will rise faster than the global average, and agricultural losses will amount to 2 to 7 per cent of GDP by 2100. “By 2050, hunger and child malnutrition could increase by as much as 20 per cent as a result of climate change, reversing the gains achieved through the Millennium Development Goal (MDG) process whilst jeopardising the success of the Sustainable Development Goals (SDGs),” says the panel’s report.

Low investment in agriculture is a key bottleneck. Development and distribution of improved seeds, fertilisers, insecticides, improved extension service delivery and market infrastructure require capital investments. Walter Sandow Alhassan, director, Biotechnology and Stewardship for Sustainable Agriculture in Africa (BSSA), says a Green Revolution like that in Asia offers a dramatic increase in food production through the introduction of high-yielding seeds, insecticides, fertilisers, farmer credit and irrigation facilities. Farm yields are still low, at about 23 per cent of global levels. Agricultural productivity in Africa is growing at about half the rate of population growth. This is largely due to the continued low modern input supply—seeds, fertilisers, insecticides, continued reliance on rain-fed agriculture—and less exposure to new management practices.

States in action

In 2003, a definitive step was taken to start a Green Revolution in Africa with the adaptation of the Maputo Declaration. The declaration calls for a minimum investment of 10 per cent of the annual budget into agriculture and rural development, and a target of 6 per cent agricultural

growth. The Comprehensive Africa Agriculture Development Programme (CAADP) is Africa’s framework to transform the agricultural sector under the declaration. A number of initiatives put into place by development partners have helped considerably. These include the constitution of the African Agricultural Technology Foundation (AATF) in 2003, Alliance of Green Revolution in Africa (AGRA) in 2006 and the Drought Tolerant Maize for Africa (DTMA) programme in 2012. These initiatives did revive interest in agriculture.

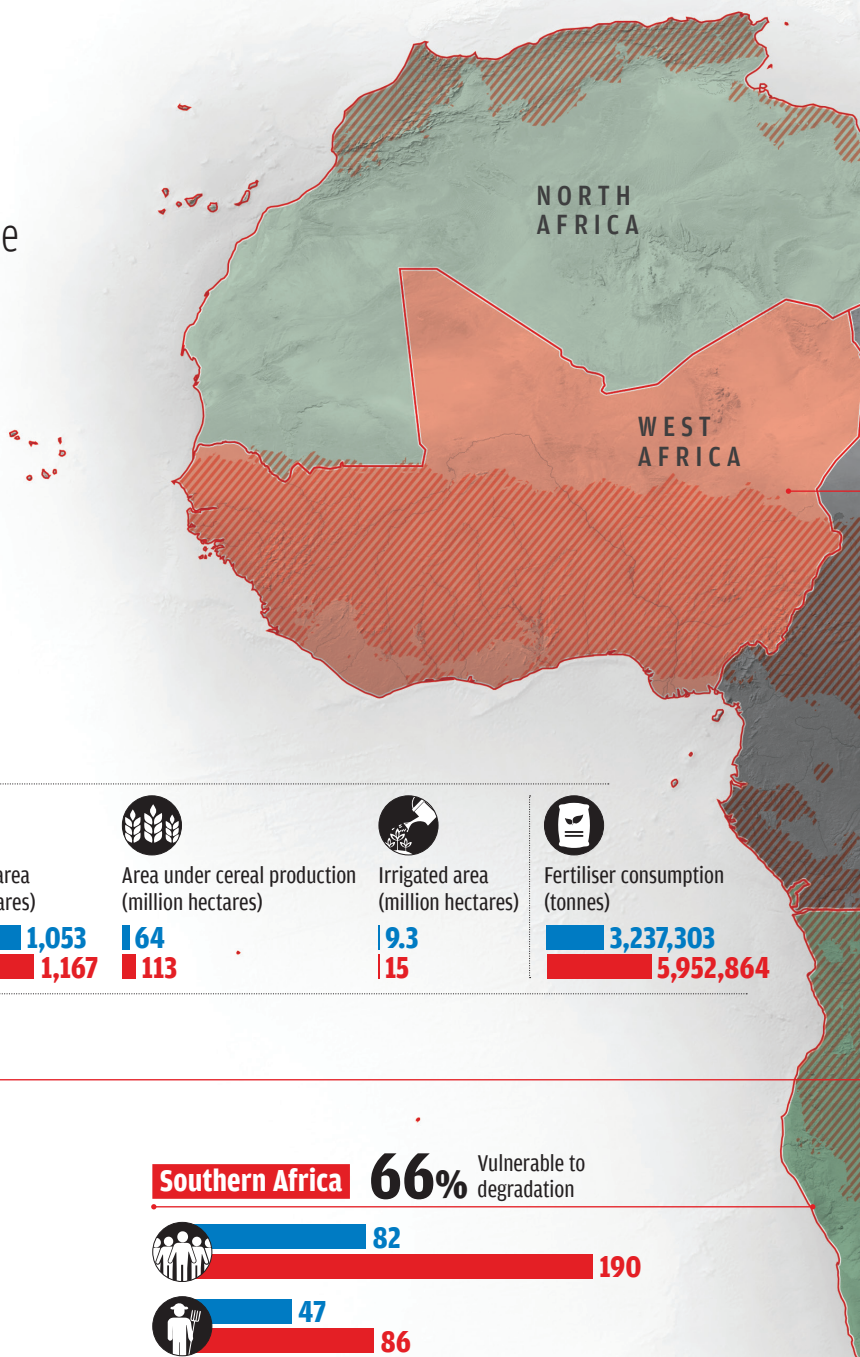
But after 14 years, only a handful of countries—Ghana, Ethiopia and Burkina Faso—have made the 6 per cent agricultural growth target made under the Maputo Declaration. “In most African countries, progress has not been remarkable as evidenced by the huge portions of national budgets spent on food imports,” adds Alhassan.

Together, NEPAD and CAADP represent a departure from externally-driven development strategies and programmes characterised by shifting priorities and the absence of the necessary consistency and continuity to produce solid results. CAADP is not a “one-size-fits-all” plan, but a strategic framework that provides a set of shared principles, targets and operational milestones to guide programme planning and implementation by country governments, regional economic communities (RECs), and other stakeholder groups.

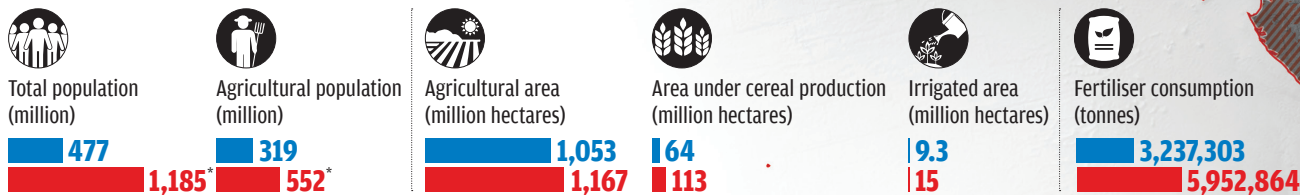
Barring a few exceptions, African countries and RECs have embraced the agenda. Major innovations of CAADP include the practice of evidence-based policy and programme planning and implementation linked to mutual accountability through peer review, benchmarking and mutual learning. The 2014, the Malabo Declaration significantly expanded CAADP’s agenda in terms of thematic coverage and mutual accountability requirements. In the declaration, African Union (AU) Heads of State incorporated issues dealing with reducing child undernutrition, post-harvest losses and vulnerabilities of livelihoods, and reaffirmed their commitment to mutual accountability by calling for a continental agricultural biennial review to assess progress on commitments. The first biennial review is scheduled for the AU Summit in January 2018. With the CAADP implementation agenda now in its second decade, work is underway to incorporate commitments of the Malabo Declaration into CAADP planning, implementation and review, dialogue and the mutual accountability processes. ■

Low on farm GROWTH

Africa's farm sector has been unable to feed its ever-growing population due to rapid land degradation and limited irrigation

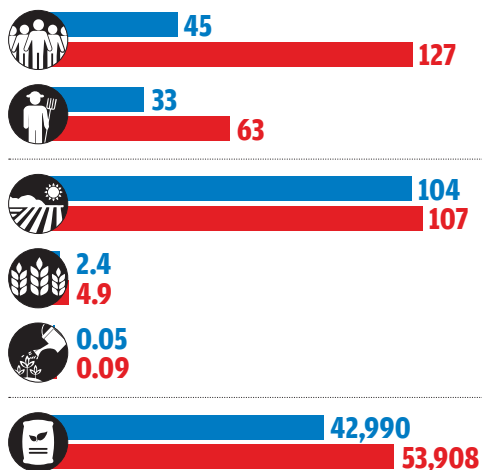


AFRICA 46% Vulnerable to degradation

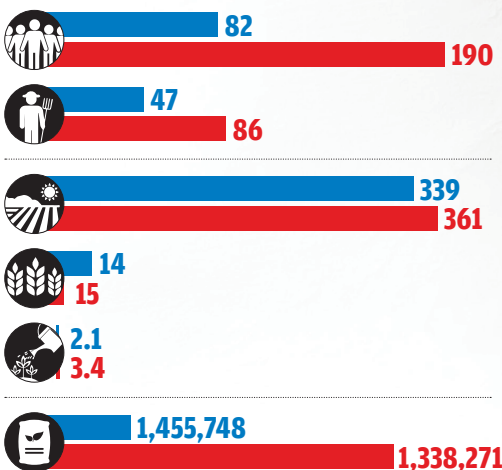


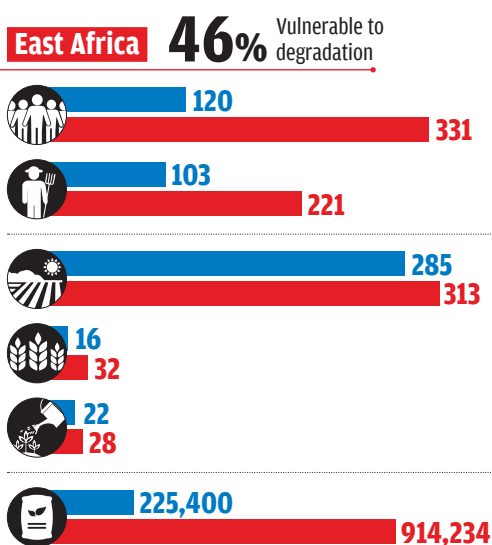
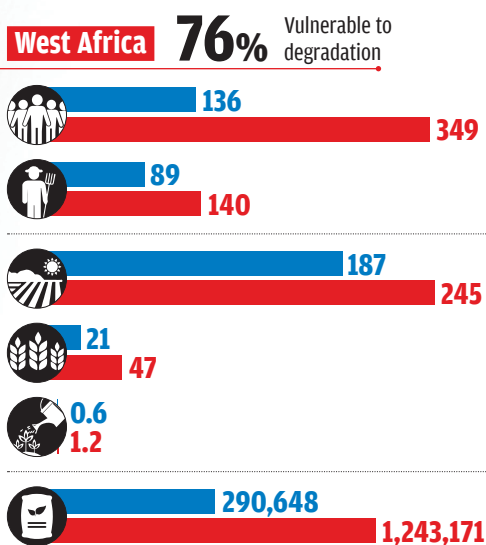
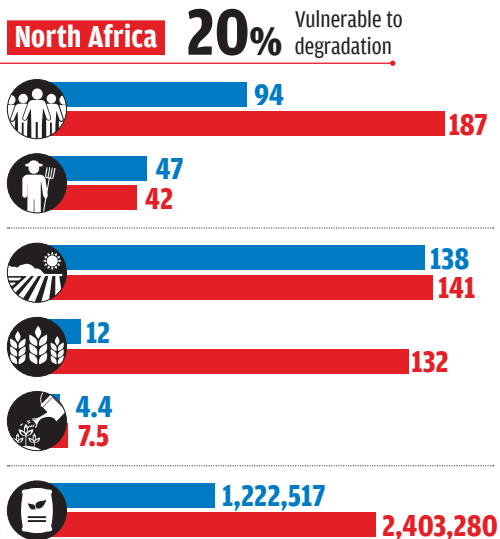
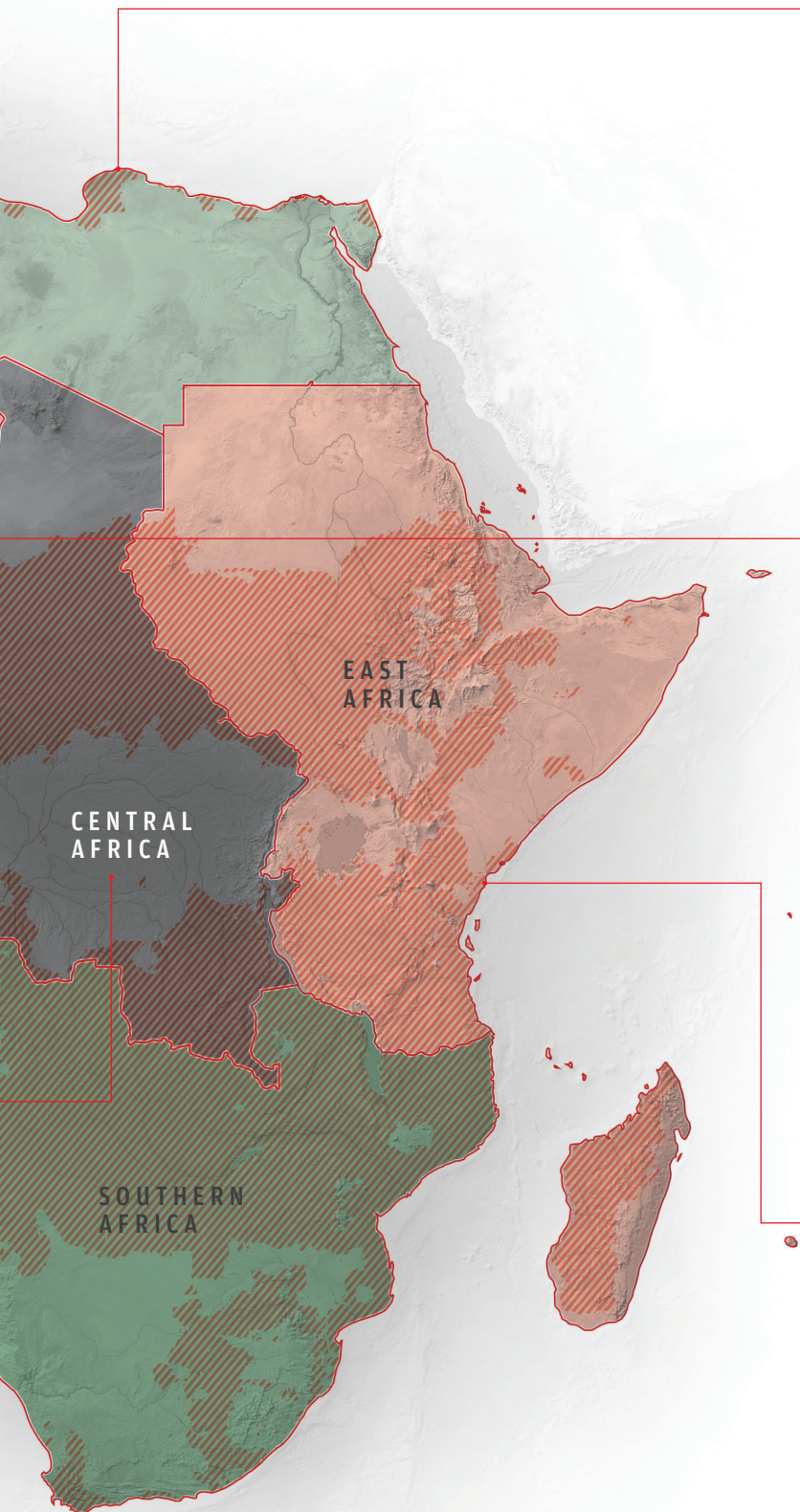
* In 2015

Central Africa 49% Vulnerable to degradation



Southern Africa 66% Vulnerable to degradation





Data source: African Development Bank's Socio Economic Database, 1960-2016 and paper on Land Resource Stresses and Desertification in Africa published by the US' Natural Resources Conservation Service Soils

Climate disruption

Global warming has compromised Africa's ability to feed its population. It's time African nations adapt to the changing scenario

SOMETHING STRANGE is happening across East Africa. The region, which receives rainfall twice a year, is reeling from the worst drought in a century. Kenya, Somalia, Ethiopia, Tanzania and Uganda, which boast of rich agricultural lands, have received below-average rainfall for the third year in a row. This has caused food prices to skyrocket to record levels, doubling the price of staple cereals in some areas, and exacerbating the acute food insecurity prevailing over most parts of the continent. "Over the past six months, severe drought conditions have contributed to the displacement of more than 700,000 people within Somalia, 300,000 in Ethiopia and over 41,000 in Kenya," says Jemal Seid, Director, Climate and Geospatial Research, at the Ethiopian Institute of Agricultural Research.

In some places camel carcasses are being stacked up as even the world's most robust animal has not been able to survive this persistent drought. High number of people at the risk of starvation prompted South Sudan, a largely water-surplus region, to declare famine in February—the first such declaration anywhere in the world since 2011. In March, the World Health Organization warned that Somalia is at the risk of third famine in 25 years. According to the UN, 12 million people in the region are now dependent on humanitarian aid.

The persistent dry conditions are partly linked to the Indian Ocean dipole, which is similar to El Niño weather phenomenon in the Pacific and pushes away the moist air that brings rain to East Africa. But scientific studies show that the severity of the problem is due to changing climate. "The impacts of current and recent droughts in East Africa are likely to have been aggravated by climate change," notes the 2017 report by Oxfam, an international confederation of charitable organisa-

tions focused on the alleviation of global poverty.

The latest Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (ipcc), released in 2014, had warned of such an eventuality in Africa. Over the past century, temperatures across the continent have soared by 0.5°C or more, with minimum temperatures rising faster than the maximum temperatures. Higher temperatures result in greater evaporation, causing soil moisture depletion, reinforcing drier conditions and intensifying the impacts of failed rains, noted the ipcc report. According to the 2016 report by Berlin-based policy institute Climate Analytics, summer monsoon rain, which brings maximum precipitation to East Africa, has decreased in recent years due to rapid warming of the Indian Ocean. These changing climatic conditions pose the third whammy for a continent, already struggling with the need to feed more and more people and rising food import bill.

"Climate change has compromised Africa's ability to feed herself," says Oscar Magenya, chief research scientist at the Kenya Agricultural and Livestock Research Organization, Nairobi. "Climate change affects many physical and biological systems, disrupting growing seasons, fluctuating plant and animal ranges and resulting in the emergence of virulent pests and diseases," Magenya explains. In Sahel, for instance, most farmers depend on rain-fed crops. But these days rains do not last long enough to grow a full crop. This shrinking rainy season is affecting food security and exacerbating malnutrition in the region. In an April report to ipcc, experts have said that in some countries, yields from rain-fed crops could be reduced by up to 50 per cent by 2020.

Recurrent droughts is fuelling desertification. Sahel region, which alternately experiences wet and dry seasons, has been suffering from drought on a



REUTERS

regular basis since the early 1980s. As a result, says Peter Tarfa, acting director of the climate change department under Nigeria's environment ministry, semi-arid Sahel is not only fast turning into a desert but also encroaching on northern Nigeria, affecting farming and pastoral activities in the region.

While there is no study to link climate change with dwindling water resources, the fact is the Congo, the world's second-largest river, is experiencing a 50 per cent drop in its water levels. Lake Chad has shrunk by nearly 90 per cent since 1963. A prolonged drought could affect large parts of the shoreline of Lake Victoria—the world's largest tropical lake and the source of the Nile—which depends on rainfall for 80 per cent of the water. This would destroy fish breeding grounds and traditional agriculture, putting millions of lives at risk. In West Africa, as rising sea levels redraw the shoreline and ocean acidification damages coral reefs, fishing and agriculture that form the foundation of livelihoods suffer a blow. The coast accounts for 56 per cent of the region's GDP.

WHY AT THE RECEIVING END

What countries across Africa are experiencing is nothing unusual in this age of Anthropocene. Then why does the continent bear the insurmountable

loss and damage? Munich-based reinsurance company Munich Re offers an explanation. While climate change is a global problem, its impacts are unevenly distributed, with poor and developing countries bearing the maximum brunt. The impact of natural disasters is much greater on developing countries—currently 13 per cent of their GDP—than on rich nations, where it is 2 per cent, according to Munich Re. There is also a disparity among different parts of the developing world. While Asia is highly exposed to natural disasters, Africa is most vulnerable to its impacts. According to the Natural Hazards Vulnerability Index by risk analysis and research company Verisk Maplecroft, nine of 10 countries found most vulnerable on the index are in Sub-Saharan Africa.

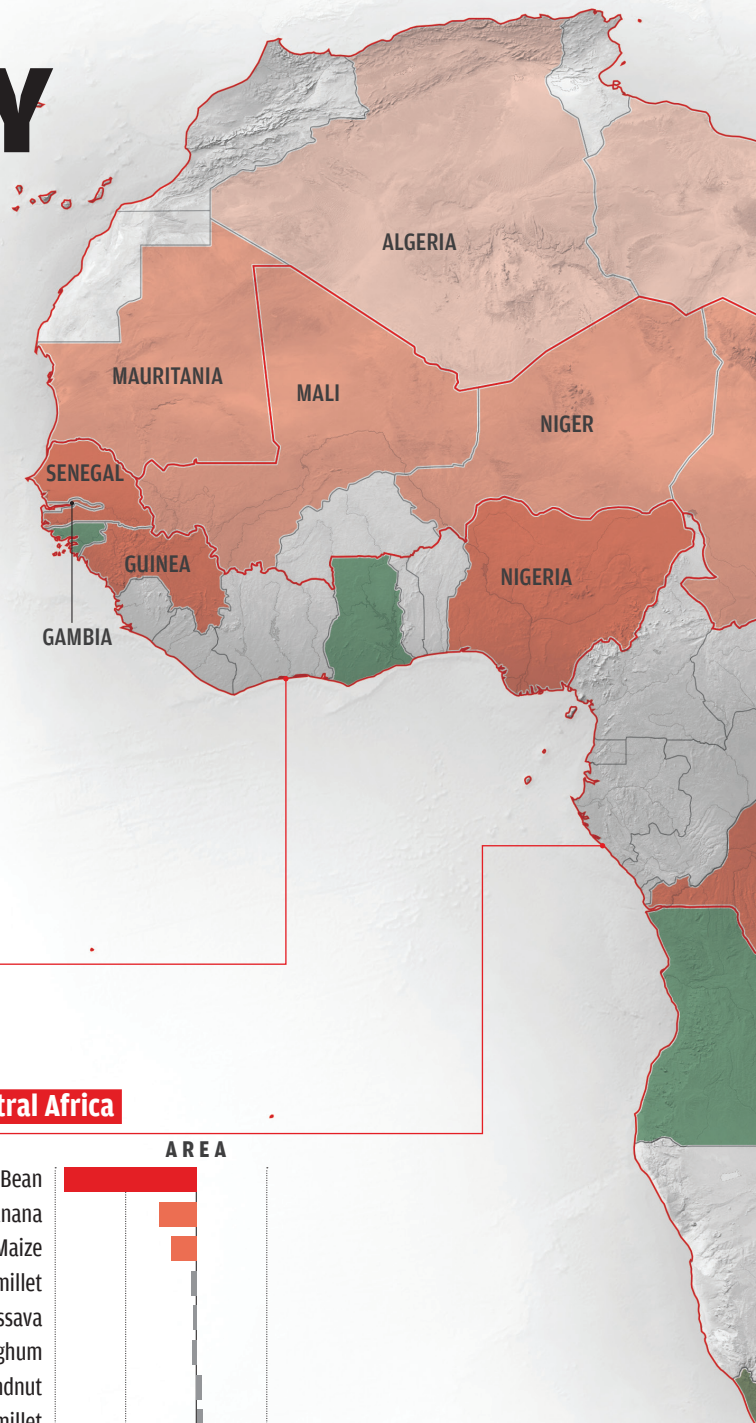
Analysis by *Down To Earth* shows that climate change impacts are more pronounced in Africa because of a few reasons. One, agriculture is largely rain-fed and underdeveloped; two, 90 per cent of the farms are small yet contribute to 80 per cent of the total food production; and three, a majority of the farmers have few financial resources, limited access to infrastructure and extremely limited access to weather and technological information.

According to the UN Food and Agricultural Organization (FAO), in developing countries the

Displaced people gather at an artificial water pan near Habaas town of Awdal region in Somaliland in April 2016. As East Africa reels from the worst drought in a century, scientific studies show the impact of drought is more severe because of climate change

Growing food INSECURITY

Africa's agriculture is predominantly rain-fed and based on small landholdings. This makes it highly vulnerable to climate change. With changing rainfall patterns and degrading land, productivity of beans, maize, banana and millet could suffer a huge setback across the continent



10 African countries most affected in 2015

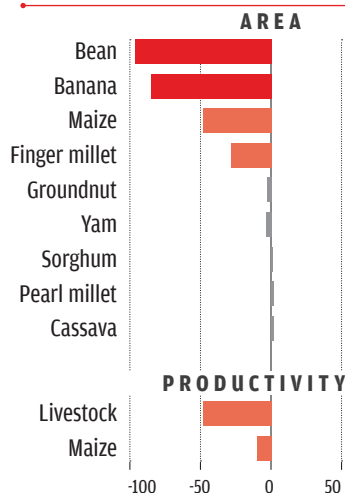
High and very high vulnerable countries in Africa, according to Climate Change Vulnerability Index 2017

Medium risk High risk Extremely high

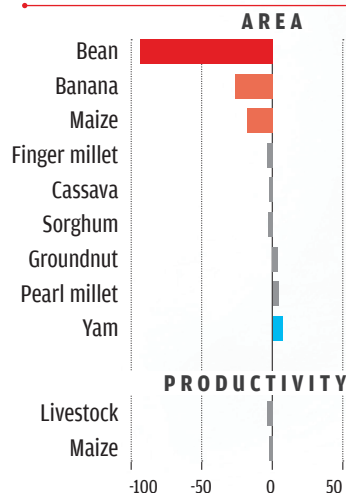
Median change in suitable area of productivity (%)

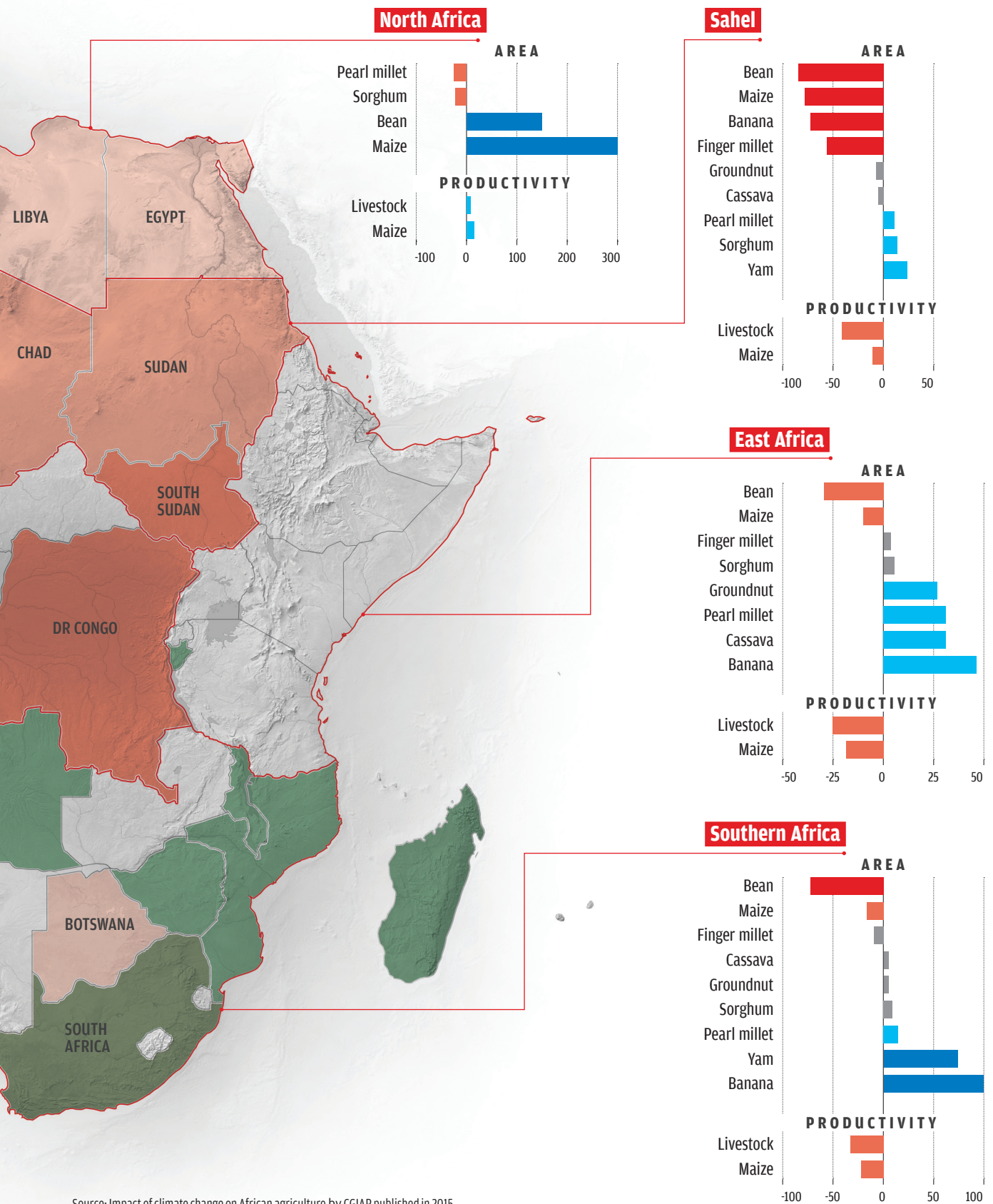
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West Africa



Central Africa





Source: Impact of climate change on African agriculture by CGIAR published in 2015

agriculture sector, including crops, livestock, fisheries and forestry, absorbs 22 per cent of the economic impact caused by natural disasters. But in Africa, the sector only adds to the impact. Africa's crop and livestock losses caused by natural disasters in 2003-13 were US \$26 billion. Kulthoum Omari, Coordinator, Adaptation of African Agriculture (AAA), a 27-nation coalition, cites the enormity of the problem: "About 80 per cent of people in Africa depend on agriculture for their livelihood and sustenance. Therefore, boosting agricultural activities will have a positive impact on local and national economies in Africa. However, this is being hampered by the impacts of climate change."

The latest IPCC report also states that climate change is worsening the already deplorable state of agricultural systems in Africa. The white paper on the initiative for the Adaptation of African Agriculture (AAA) to climate change, presented at the Marrakech UN Climate Change Conference in 2016, says the continent has 500 million hectares

of agriculture, such attempts are limited to certain pockets. For instance, farmers in Bankass district of Mali are infusing vigour to the degraded soil by growing trees as well as staple food like millets on the same farm. In Northern Ghana, several non-profits are sensitising women farmers about the effects of pesticides on food crops as well as soil.

There is an urgent need to replicate such initiatives across the continent as extreme weather will significantly disrupt the agricultural calendar and affect crop yields and livestock production.

TIME TO STEP UP ACTION

Going by the latest IPCC report, changes in average temperature would be greater over northern and southern Africa and relatively smaller over central Africa. This means, Sahara and southern parts of Africa would get warmer in coming years. Extreme precipitation changes, such as droughts and heavy rainfall, that eastern African has been experiencing more frequently in last 30-60 years, is likely to

Two-thirds of African countries have little or no capacity to manage weather-related risks. It has fewer weather stations when compared to Asia and is the world's lowest consumer of agricultural inputs

of severely degraded land—this accounts for 27 per cent of the world's total degraded soils. The paper cites water erosion, chemical degradation and soil compaction as the prime reasons for land degradation. Further, about 66 per cent of African lands are located in arid or semi-arid areas, and suffer from water shortages. Due to uneven distribution of water resources, around 25 per cent of the population faces water scarcity, especially in North Africa and the Sudano-Sahelian region, and only 2 per cent of arable land is irrigated in Africa against 42 per cent in Asia, highlights the white paper.

Worse, Africa is least prepared to tackle weather-related risks. Two-thirds of its countries have little or no capacity to manage these risks. According to the AAA white paper, there are only 781 synoptic weather stations (that collect meteorological information every six hours) in Africa as compared to 1,696 synoptic weather stations in Asia. Besides, Africa is the world's lowest consumer of improved agricultural inputs, such as seeds resistant to heat, drought or diseases. Though some farmers are adopting climate resilient agricu-

batter the region in future.

By 2080, arid and semi-arid areas could expand by 60-80 million hectares. Viable arable land is predicted to decline, with 9-20 per cent becoming less suitable for agriculture. Suitable land for corn (maize) and beans—staple crops in the continent—could reduce by 20-40 per cent. Conversely, sorghum, cassava, yam and pearl millet could show little loss, or even gains, in the area suitable for production. Western Africa appears to be a highly vulnerable region, where suitable land for maize, sorghum, finger millet, groundnut and bananas are likely to reduce by 10 per cent.

This will impact crop productivity. A study by international research firm CGIAR predicts that because of climate change, maize yield could reduce by 22 per cent, groundnut by 18 per cent, sorghum and millet by 17 per cent and cassava by 8 per cent. Banana production could also decline in western Africa and in the lowlands of eastern Africa. In arid Egypt, production of paddy would decline by 11 per cent and that of soybean by 28 per cent by 2050.

While rising sea levels will affect fisheries

productivity by 50-60 per cent, substantial reductions in forage availability in some regions would alter productivity of livestock. It is projected that at temperatures above 30°C, cattle, sheep, goats, pigs and poultry reduce their feed intake by 3-5 per cent for each 1°C increase. These impacts will have varying effects on the millions of African farmers who depend on livestock for incomes and food security. "Temperature changes also have a much stronger impact on yields than precipitation changes. It is clear that the economic cost of natural disasters in agriculture sector is expected to increase because of climate change," says Tarfa.

An estimation by the UN Environment Programme (UNEP) shows that African countries would face 2-4 per cent annual loss in GDP by 2040 due to climate change. However, there will be a strong regional variability in the degree of loss experienced in the agriculture sector. FAO estimates that parts of Sahara would suffer the maximum agricultural losses, followed by western and central Africa and northern and southern Africa.

To increase climate resilience among farmers, several African countries have introduced novel adaptation initiatives. In fact, 50 of the 54 African countries have made these initiatives part of their climate action plans submitted to the UN Framework Convention on Climate Change (UNFCCC). One such initiative is the establishment of African Risk Capacity. The specialised agency of the African Union aims to help member states improve their capacities to plan, prepare and respond to extreme weather events, and thereby improve food security and vulnerability of their populations. The other initiative is setting up Agriculture and Climate Risk Enterprise (ACRE), the largest agricultural index insurance programme in sub-Saharan Africa in which the farmers pay a market premium. The programme now spans across Kenya, Rwanda and Tanzania. A similar insurance programme in Ethiopia allows farmers to pay the insurance premium through labour. But implementation of these initiatives is still a challenge.

Says Omari, "Many African countries still lack comprehensive disaster risk management plans because of reasons, such as lack of guidelines, insufficient capacity at the regional, national and sub-national levels to assess and address loss and damage, and insufficient research in understanding the scope, magnitude and character of the climate risks and impacts." Magenyia says unless countries prioritise and integrate climate change programmes into their development plans, the

TOO MUCH WATER IN DRYLANDS

Sahel will see floods in the future, followed by droughts

I N T H E past few decades, the semi-arid tropical Savanna region Sahel, stretching from Mauritania in the west to Eritrea in the east, has seen several devastating floods. The Niger floods of 2010 and 2012 are two such deluge witnessed at Niamey weather station since record keeping began in 1929. In 1995, 1998 and 1999, five, eight and 11 countries in the region were hit by heavy rainfall respectively. A 2008 study by the University of South Wales and University of Ghana suggests that Sahelian countries "lay to rest the desertification narrative" and "consider the possibility of both floods and droughts, and mobilise local memory for anticipatory learning and practical adaptation". That suggestion has gained much relevance over the years, with the IPCC report predicting that high-intensity rainfall events could increase by 20 per cent over the next decades.

Scientists attribute this weather anomaly to global warming. As the surface temperature of the Atlantic Ocean in the west and the Mediterranean Sea in the north increases, more water evaporates. The moist air drifts onto land, where vapour is released as rainfall. A study by climate scientists at Potsdam University, Germany, and Columbia University, US, shows moisture flux from the Atlantic into Sahel will increase more strongly than from the Mediterranean by the end of the 21st century. "We looked at 30 climate models to understand projections of summer rainfall in Sahel. Out of those, seven models showed a doubling of average summer rainfall by 2100, including three models that project an increase of over 100 per cent in average summer (July-September) rainfall across the central and eastern Sahel," says Jacob Schewe, co-author of the study. The increase in rainfall is also attributed to a northward shift in West African monsoon circulation dynamics. "West African monsoon, which generally covers the region between latitudes 9°N and 20°N, tapers off as it moves further north. But in future, it can make inroads into new territories," says Schewe. What explains this shift is the fact that the northern hemisphere has been heating up faster than southern hemisphere since 1980, largely because the former has more land and less ocean, and greenhouse trapping is larger over land than ocean at the same temperature.

effects of climate change on agriculture in Africa are likely to persist. Seid says there is an urgent need to integrate solutions offered through technologies, institutions and government policies to manage the risks of drought and climate variability in Africa.

There is also a need for the international community to safeguard agriculture from climate change impacts. The Paris Agreement, the landmark climate change deal that came into force in November 2016, talks of safeguarding food security and ending hunger, and the vulnerabilities of food production systems to the adverse impacts of climate change in the preamble. But the word agriculture finds a miss in the Agreement. ■

 @down2earthindia

Talking heads

Agriculture ministers from key African countries speak to *Down To Earth* on strategies to make Africa food-sufficient once again

“Agriculture has to be made relevant and lucrative to the youth in Africa. In Kenya, we have introduced a programme to increase youth’s access to productive lands through lease so that they can take up agribusiness. Also, the produce of small farmers must have an assured market. We should introduce programmes like the Food Acquisition Programme to create demand as well as to stabilise market prices for products from small-scale farmers. We need to change our approach, from just food to food security in all related programmes.”

Willy Bett, Kenya

“African countries must set a target, as we have done, to achieve food self-sufficiency by using local staple by 2018.

To make agriculture relevant means that we must increase its share in our national GDP. For this, we have a target of four years. Crops that are popular in other countries should be encouraged for export. This earning can be used for other developmental programmes.”

Audu Ogbeh, Nigeria

“Ghana is implementing the Planting for Food and Jobs Campaign to revive agriculture. The campaign’s five pillars are focusing on seed, fertiliser, extension services, marketing and e-agriculture platform. Despite having fertile lands, food is unnecessarily expensive in our country. Our production methods are not modern and income levels of farmers and fisherfolk remain low, making the sector unattractive to the youth as a viable means of livelihood.”

Owusu Afriyie Akoto, Ghana



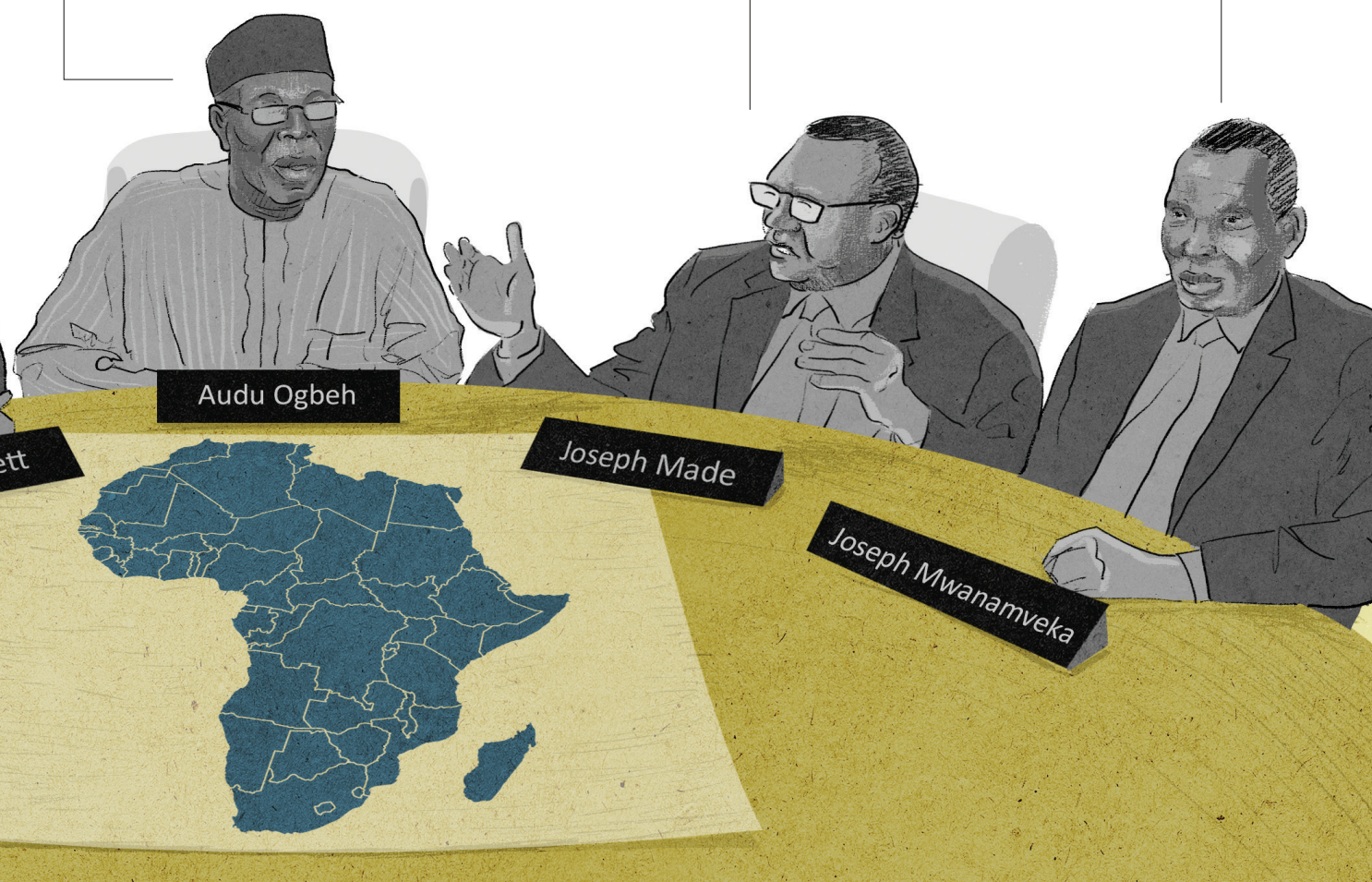
TARIQUE AZIZ / CSE

“The government must focus on bringing back the agriculture trade balance. Our programmes, like the Food Security and Nutrition, are examples of how to think strategically to become food sufficient. African governments must urgently formulate policies to improve agricultural productivity. As we have done in our country, we must start with one staple crop and then spread the programme to other crops to increase productivity.”

Joseph Made, Zimbabwe

“Malawi has met its targets under the Comprehensive Africa Agriculture Development Programme for budgetary allocations to agriculture and for agricultural growth. The impact was instant. In 2005, Malawi recorded a grain surplus of half a million tonnes. In subsequent years, we exported grain to Lesotho and Swaziland, as well as 400,000 tonnes of maize to Zimbabwe. We must move away from sustenance to market-oriented agriculture. This will increase agricultural production, create a market for surplus crops and this will ultimately lead to real income growth.”

Joseph Mwanamveka, Malawi





Namkeen (snack) manufacturers prefer *lakhori* as the yellow colour blends with the colour of the snacks, unlike red chillies

VIKAS CHOUDHARY / CSE

Hot stimulant

Known for its pungency, this yellow chilli is Uttarakhand's home-grown favourite

**CHITRA
BALASUBRAMANIAM**

WHILE RESEARCHING about unusual spices from Uttarakhand, I came across yellow chillies or *lakhori* chillies or simply *lakhori*. With a sense of heightened curiosity, I talked to H C Joshi, managing director of Divine Agro Industries Limited, a company specialising in food from Uttarakhand. He sent me a generous quantity of *lakhori*. The pungency made me sneeze the moment I opened the bag. All he could tell me was that it was grown in Uttarakhand and was high in demand by *namkeen* (snack) manufac-

turers. To know more, I began a journey. *Lakhori* gets its name from the village where it is grown—Lakhouri situated on the Garhwal and Kumaon border. There are two types of *lakhori*—*choti* and *badi* (small and big). The *choti* measures 1.5 cm or less and the *badi* measures 2.5 cm to over 3 cm. It also grows in Nainital and Champawat.

According to Davender Singh Negi of the State Training Centre for Organic Farming, Ranikhet district, Uttarakhand, the state has 50-52 varieties of traditional chillies. *Lakhori* is the hottest, though its pun-

gency has been on the decline in the last few years. It is grown like a commercial crop and many farmers do contract farming for spice companies. The chillies are plucked, and after the stalk is removed, it dried before it is sent to commercial establishments. What-ever is not sold is used in homes.

Despite its popularity, it has not been branded and it is sold largely as a generic product. Negi who hails from Kuri village, Tehri Garhwal, says, “A very interesting factor which we have witnessed is that when any other type of chilli is planted in this district, it soon acquires the property of *lakhori*. This is due to cross-pollination. Of course, there are exceptions, but in 95 per cent of cases, the other chilli crop loses its basic genetic characteristics and acquires that of the *lakhori*.”

In common parlance, *lakhori* is usually referred to as the one which is grown in large quantities, but no one knows where or how it is consumed since domestic consumption is very little. Intriguingly, its pungency or its SHU—Scoville Heat Units—is between 50,000 and 55,000. The Uttarakhand Organic Board helps farmers to cultivate as well as to market the crop. There are godowns where the farmers can stock their products. Buyers from all over India descend to pick up the stock. The planting period for

the chilli is May-June. The first picking starts in October and continues to December. After this, farmers convert the land to wheat farming. Many farmers work on a contractual basis with spice companies. It is much in demand in Andhra Pradesh, West Bengal and Tamil Nadu.

“The main qualities of *lakhori* are that it has more compacted seeds in comparison to other chilli pods and the tip of the chilli is not pointed. It is small in size and light yellow in colour. It is commercially preferred due to its pungency,” says Negi. It is very hot, so it is used in small quantities. The dried chillies are procured in large quantities by *namkeen* makers, who use it to flavour chips and *namkeens*.

Another factor which favours its use in *namkeens* is that the yellow colour of the chillies blends with the colour of the *namkeen* unlike red chillies—it does not change the colour of the *namkeen*. On the other hand, people in mountainous regions avoid consuming red chillies due to their belief that it is not good for their health. The yellow chilli is the right substitute. Nomadic communities also prefer to use these chillies.

“There has been a spurt in the monkey population in the hills. They tend to attack edible crops and plantations, especially fruits and vegetables. That’s why many far-

RECIPE

Lakhori podi

INGREDIENTS

1 small cup of *urad dal dhuli*
A tiny chunk of *hing* (asafoetida)
Salt to taste
1/2 tsp of pepper
1/2 tsp of *methi*
A couple *lakhori* chillies, depending on your resilience to the chilli

METHOD

Dry roast all ingredients. Cool it and powder coarsely. If you like the powder without its crunchiness, powder it fine. The taste is excellent, better than the regular *podi* prepared with dried red chillies.

mers have taken to growing *lakhori* as monkeys do not touch it. Growing crops which are not eaten by monkeys is a safe option,” says Joshi. His company makes pickles out of fresh green *lakhori* chillies.

The taste of the dried chilli is akin to fresh chillies. Unlike the usual red dried chillies, it tastes refreshingly like fresh chillies and the pungency hits while chewing, and it is hot.

Lakhori has more seeds than other varieties and more powder is obtained after grinding. In comparison to the red chilli, the yellow chilli is good for digestion. According to a study, *Chillies As Food, Spice And Medicine: A Perspective*, chillies hold all the best properties for which it is considered a food. It has high levels of vitamin C (about twice that of citrus fruits). Even after cooking, it loses only 30 per cent of its vitamin C. Dried chillies have high levels of vitamin A too. It is also an effective agent against cancer.

I have used it to make *podi* or gun powder, which is consumed along with *idlis* and *dosas* in all south Indian homes. ■

(The writer is a Delhi-based freelance journalist. Among other things, she writes on *unusual food*)

🐦 @down2earthindia



CHITRA BALASUBRAMANIAM

Lakhori has more seeds than other varieties and more powder is obtained after grinding

“Dialects are the avant-garde teams exploring new semantic possibilities”

Linguist **GANESH DEVY** has just published a new volume of a unique language survey that is based on geography and people’s vernacular claims. He speaks to **RAJAT GHAI** on the link between languages and ecology

Rather than the intricacies of historical linguistics or language families, your team focused on geographical distinctions and people’s claims about languages while conducting the survey. Why?

As the name suggests, the People’s Linguistic Survey of India is people centric. It is not an academic project by any group of linguists. It is born out of a deep concern for communities whose very existence is being denied. Geography appeared to me as a necessary perspective for the study. This required getting out of the historical or genealogical straight-jackets espoused by historical linguistics.

So you accepted people’s claims on languages. Did you distinguish between dia-



lects and languages? Would such a survey be considered accurate by linguistics?

The assumption in your question is that people who make a claim on a language as their language necessarily have a very narrow outlook resulting in a non-tenable splintering of a larger language into numerous self-proclaimed independent languages. This assumption, however, does not hold when one looks closely at people's attitude towards languages, particularly in a country that does not cherish monolingualism as a culturally desirable practice.

If one were to examine a contrary assumption arising out of the established practice of field linguistics, one notices that there is an unnatural tendency among professional scholars to draw boundaries between languages in a somewhat abstract manner.

In reality, the geographical spread of a standard language, its blossoming into related dialects, its increased divergence from the neighbouring languages and the distinction between two adjacent languages are subjects that cultural geographers and linguists must sort out after examining empirical data from all parts of the world. That will take time. Meanwhile, I have proposed that dialects are not the historical remnants of standard languages, but the avant-garde teams exploring new semantic possibilities.

The survey reveals that the languages of the Indian coast are particularly vulnerable. Does that also apply to languages spoken in the mountains, deserts, forests and islands?

Coastal languages are paying the price not only because of geographical reasons, but also due to economic changes. As communities have lost control over fishing rights, their traditional livelihood networks got devastated. The UN agencies place the current rate of global migration at 35 per cent. This rate was seen among the coastal communities in India way back in the 1960s and 1970s. They are now at least two generations displaced from their conventional "language-ethos".

Factors apart from migration include a general economic despondency associated with carrying forward a given lan-

guage; social stigma attached to a language community, as with nomadic communities; lack of formal patronage; indifferent educational policy; and, the absence of language domains to cope with the challenges of modern life.

The survey says tribal languages like Santali, Gondi, Bhili, Mizo, Garo, Khasi and Kokborok "are showing an upward trend because educated people in these communities have started using these languages for writing".

Fortunately, many tribal languages in the country have witnessed language-related or cultural movements. These have been constructive movements and are resulting in the local creation of scripts, production of books about their history, culture, literature and ecology.

There has also been awareness among people that language is one of the defining features of their identity. Wherever such

Coastal languages are paying the price not only because of geographical reasons, but also due to economic changes. As they lost control over fishing rights, their traditional livelihood networks got devastated. They are now at least two generations displaced from their conventional "language-ethos"

movements erupted, the language associated with that area/community has found a relatively greater acceptability within the communities. If we compare the Census statistics of 1991 and 2001, there is an upward trend of tribal languages.

In terms of language diversity, you have placed India in the same league as Nigeria, Indonesia and Papua New Guinea, countries that lie in the tropical regions of the world and are rich in biodiversity. Is there an overlap between linguistic diversity and biodiversity?

There is a close interdependence between biodiversity and cultural diversity. Diversity, whether it is religious, cultural, linguistic or gastronomical, is deeply linked with the process of natural evolution. Whenever the process of evolution is hampered, diversities dwindle. I am

not aware if any scientist has defined a proper scientific measure to assess the "diversity in its natural state".

Are languages the repository of local ecology and biodiversity?

There is no language in the world which does not store all of the sensory perceptions of all of the individuals who existed over all of the ages through which the language has transited. Literally, every word in a language is a cumulative result of the human experience of nature and objects surrounding the users of the language. In that sense, every word is an entire book of history, or a full dictionary by itself.

Give us some instances where a degrading environment contributed to the decimation of a language in India.

The coal mining areas in Meghalaya and south Gujarat and the manganese and bauxite mining in Goa have scattered lo-

cal populations. They are uprooted and now linguistically amnesiac.

You have announced the next big project "Global Languages Survey" under which over 6,000 languages being spoken in the world will be surveyed and documented. Will this survey be on the same lines as the People's Linguistic Survey of India? What about the aboriginal languages of the Americas, Africa, Asia and Oceania?

Yes and no. Yes, because the languages of communities whose population is small is more than the languages of communities whose numbers are large. In fact, about 97 per cent of the world's languages are spoken by 3 per cent of the world population. I have made my beginnings with that 3 per cent population, who live in Africa, Papua New Guinea, South America and East Asia. ■

PATENTLY ABSURD LATHA JISHNU

Nitish Kumar's IP heist

The Delhi high court has fined Bihar's chief minister for appropriating a scholar's book and passing it off as his own

PLAGIARISM IS A pretty common failing. Journalists, academics, scientists have all been guilty of this. Sometimes, it is an expression or a sentence or two that is lifted. At other times, it is a paragraph or more. There have also been cases, not so common though, of an entire chapter being appropriated. But rarely has one heard of an entire book written by another being brazenly passed off as one's own. In this case, it is a wily politician who has done the unthinkable, by a man who has proved himself adept in changing alliances and political ideology to remain in power.

Meet Bihar Chief Minister Nitish Kumar who has been fined ₹20,000 for appropriating a scholar's work and publishing it as a book that he had authored. In recent weeks, Kumar has been in the headlines for changing horses midstream when he dumped his ally Lalu Yadav of the Rashtriya Janata Dal, who was responsible for bringing him back to power in the 2015 Assembly elections, to once again team up with the Bharatiya Janata Party. In politics, such turnabouts are the norm; and don't invite moral censure. But Kumar is now in the news for something he cannot shrug off lightly.

In 2009, Atul Kumar Singh, then a doctoral fellow at Jawaharlal Nehru University (JNU), was taken aback to find his PhD thesis *Role of State in Economic Transformation: A case Study of Contemporary Bihar of 2006* was being released as a book titled *Special Category Status, A Case for Bihar* with Kumar as the author. Although Kumar later said he had only endorsed the book, he had in a press interview before the book's high-profile release by economist Meghnad Desai claimed: "I have written a book on conditions prevailing in the state and to convince the nation about the need for granting special status to Bihar..."

After Singh threatened legal action, Kumar's office changed tack and said the book was brought out by the

Patna-based Asian Development Research Institute (ADRI) and that the chief minister was just endorsing it. ADRI then began hounding him, Singh said, after he reinforced his right as the sole and exclusive author. In other words, his copyright had been violated. In 2010, Singh moved a petition in the Delhi high court against Kumar, ADRI and its director Saibal Gupta.

In an interlocutory application, the chief minister said he had no association with the other defendants and that his name should be removed as defendant—he is named as the first defendant—because he had only endorsed the book. Since there was no cause made out for instituting and maintaining the suit, he had been impleaded with "mala fide" intention.

However, the court rejected his contention and noted that two of the scholar's supervisors from JNU had certified his work as original. The facts were, therefore, cumulatively sufficient to give the plaintiff the right to sue Kumar, it said. It also said "...the present interim application [by Nitish Kumar] is sheer abuse of process of law. Same is dismissed with cost of ₹20,000".

The chief minister's counsel has been quoted as saying the order would be challenged, but it would seem that the damage has already been done to Kumar's reputation. That is, if anyone was in doubt after reading his initial claim of having authored the book and his later retraction. The plaintiff has also claimed damages totalling ₹25 lakh from the other defendants.

When the case was filed by Singh, Gupta had made some extraordinary attempts to defend Kumar. In an interview he had claimed Singh's work was advocacy material for Bihar and "we could have got maximum leverage if the name of the chief minister was associated with this." But Kumar, he said "has no academic pretensions. If he really wants to write a book, he can get the best minds to help him." Indeed. ■



RITIKA BOHRA / CSE

WATER SENSITIVE URBAN DESIGN AND PLANNING

RAINWATER HARVESTING, SUSTAINABLE URBAN DRAINAGE SYSTEM AND
WASTEWATER RECYCLE AND REUSE

September 25 – 29, 2017

Water problems jeopardise the survival of millions of people in urban India. Rapid and unregulated growth of towns and cities is a key reason for unsustainable water management. The current water model primarily focuses on supply side management and emphasis on the energy as well as resource intensive centralised urban water management. The increasing demand–supply gap and deteriorating environmental conditions are increasing the need for environment friendly alternatives. It is important to take up the challenge in controlling and judiciously using natural resources to reduce our ecological footprint. This can be done by using Water-sensitive urban design and planning (WSUDP) approach which integrates the urban water cycle, water supply, wastewater, storm-water and groundwater management. This approach contributes to sustainability and livability, particularly when considered part of an overall urban strategy.

This training will focus on the components of WSUDP –Rainwater Harvesting (RWH), Sustainable Urban Drainage System (SuDS) and Wastewater recycle and reuse followed by an optional field visit. Registration to this popular course is on first come first basis.

Programme Design: September 25-29, 2017

The training programme will follow a mix method approach involving lectures, in-class exercises, interactive discussions and audio-video training support. The participants will get the opportunity to plan and design water sensitive urban systems as part of 'Do It Yourself' - group exercise.

RWH and SuDS

The two day programme will focus on urban RWH and SuDS. These concepts will showcase the potential they hold in water augmentation and flood mitigation by using opportunities of existing green/public spaces. The training will impart skills on planning and designing of RWH systems (both storage and recharge structures) and SuDS (Swales, detention ponds, etc).

Wastewater recycle and reuse

The two day programme will focus on the wastewater component of WSUDP. This will enable participants to plan for recycle and reuse of wastewater after understanding the status of excreta in a city with the help of a Shit Flow Diagram (SFD) tool. The training will provide hands-on experience on planning and designing of decentralized wastewater treatment system for local reuse.

Field Visit (Optional)

The training programme will be followed by an optional one day field visit to demonstrate successfully implemented WSUDP structures. The field visit will provide an opportunity to interact with the real implementers to understand the benefits and on-ground challenges for its sustainability.



TRAINING FEES: ₹13,500/-

Includes one day field visit, study material, lunch, snacks and tea.

Limited discounted seats are available for representatives from NGOs, students and groups of 2 or more from same institution

Who can Apply?

Practitioners (engineers / architects / planners / representatives of non-governmental organization and government officials), academicians, consultants, students, researchers.

How to Apply?

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Last shots

The Nigeria-Cameroon Chimpanzee faces extinction as it fights a losing battle against innumerable threats


ABHIJIT MOHANTY

CHIMPANZEES, WHO share about 98 per cent of their genes with humans, are fast heading towards extinction. Among the rarest subspecies is the Nigeria-Cameroon Chimpanzee—less than 6,000 are left in the forests north of the Sanga River in Cameroon and in southwestern Nigeria. It has been designated as a critically endangered species by the International Union of Conservation of Nature (IUCN), and if urgent steps are not taken, scientists say it will become extinct in less than two decades.

The threats to their existence are many. In the drier parts of their habitat range such

as the Mbam Djerem National Park, the Bamenda Highlands in Cameroon and Gashaka Gumti and Mambilla in Nigeria, pastoralists have encouraged forest fires to provide more grazing land for their livestock, which are subsequently being converted to farmlands. Habitat destruction has increased noise disturbances, forcing the Nigeria-Cameroon Chimpanzees to move into areas occupied by other chimpanzee communities, where they face aggression, resulting in fatalities.

Conservation biologists Jennifer Arubemi Agaldo, Gwom Thomas Gwom and Paul Tersoo Aperverga conducted a survey



Less than
6,000 Nigeria-
Cameroon
Chimpanzees
are left in
the wild

in 2011-2012 and found the habitat areas littered with spent cartridges, wire snares and logged trees. This indicates that chimpanzees are under serious threat from hunting and poaching activities, and the presence of logged wood indicates habitat destruction and degradation.

Bushmeat and habitats

The threats to their survival are further exacerbated by the rapid growth of human population. As human population has grown steadily in both Cameroon and Nigeria, the ease of obtaining arms, more efficient transport systems, and higher financial incentives to supply urban markets with “bushmeat” and other forest commodities have led to a situation, where swathes of land have been cleared of wildlife and often also

their forest cover. Hunting of chimpanzees to supply the “bushmeat” market and to a lesser extent, to provide body parts for traditional medicine is one of the greatest threats to their survival.

“In recent years, hunting for bushmeat, which was once a subsistence activity, has become heavily commercialised and much of the meat goes to urban residents, who can afford to pay premium prices,” says Kari Jackson, who heads SURUDEV, a Cameroon-based non-profit that works with communities on biodiversity conservation. Interestingly, many of the carcasses found in the eastern Nigerian markets come from Cameroon, but are traded in Nigeria where bushmeat fetches higher prices.

Satellite images show that more than 3,000 hectares (ha) of rainforest bordering the Dja Faunal Reserve in Cameroon’s Southern region have been destroyed. The cleared forest, which was until recently the habitat for the western-lowland gorillas, chimpanzees and mandrills, was given to a Chinese company for palm oil plantations. The land was given to the company even though it is located in the Dja Faunal Reserve, which is a designated “UNESCO World Heritage Site”.

In 2009, a Cameroon minister awarded a 99-year lease to more than 73,000 ha of land to Herakles Farms, an American palm and timber company. Though land tenure laws prohibit leasing land more than 40 ha, a presidential decree was obtained in 2013—four years after Herakles arrived in Cameroon—to facilitate operations. Based in New York, Herakles Farms has claimed that its palm oil project in Cameroon’s South-West Region would cultivate in an area of little conservation value.

But a recent study by Dschang University in Cameroon, in collaboration with Germany’s University of Gottingen and supported by Greenpeace International, Save Wildlife Conservation Fund of Germany and WWF Germany, indicates that this claim undermines the rich biodiversity of the area. It says that the company plans to convert the neighbouring areas into palm oil plantations, which means crucial habitats used by chimpanzees and other endangered animals will be wiped out. “Our sur-

One of the greatest threats is the hunting of chimpanzees to supply bushmeat to urban markets

vey shows that the area is of high conservation value, while some parts could even act as a chimpanzee sanctuary,” says Kadir Serge Bobo of Dschang University. The destruction of habitats has fragmented chimpanzee populations, and those that remain are small and isolated.

Community efforts

In the last decade, there has been a growing concern to save and protect this endangered species, especially among some non-profits with the support of international agencies, who are playing a crucial role to involve local communities in wildlife conservation-based projects. For instance, SURUDEV has been working with the local communities in the Kom-Wum Forest Reserve. “We have established Village Forest Protection Committees who provide training to members and local people on the importance of forests, wildlife protection and the regeneration of forest cover,” says Jackson.

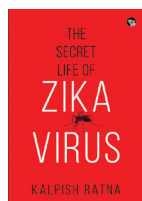
Though these conservation efforts have created an enabling environment, this is just a drop in the ocean. A pragmatic approach is needed to protect these rarest apes. Moreover, conservation research is required to steer initiatives in the right direction and attain sustainability. By identifying the ecological factors that influence distribution, ranging patterns and core habitat requirements, it is possible to identify suitable chimpanzee habitats. “Governments need to urgently develop a participatory land use planning process prior to allocating industrial concessions. Projects that are being developed without adequate community participation should not be allowed,” says Filip Verbelen of Greenpeace International. “If proactive strategies to mitigate the effects of large scale habitat conversion are not implemented soon, we can expect a rapid decline in African primate diversity,” says Joshua Linder, an assistant professor of anthropology at James Madison University, Virginia, USA. ■



The little we know

The book adds to the mystery of the Zika virus and its vector

VIBHA VARSHNEY



THE SECRET LIFE OF
ZIKA VIRUS

Kalpish Ratna

Speaking Tiger Publishing Private
Limited | ₹299 | 272 pages

IT'S a book that attempts to answer the questions around the Zika virus, its vector and the disease it causes. Where did it come from? Where has it been hiding for so long? Why has it become so deadly this time? What have researchers learned about the virus, its vector and its alternate host? When did it come to India?

In truth, there are no easy answers to these questions, but the author brings out the complexity of viral, vector-borne diseases like the chikungunya, dengue and Zika fevers. *The Secret Life of Zika Virus* puts things in perspective. Though we know that zoonotic diseases emerge from a degraded environment, we continue to wilfully destroy habitats such as forests. And each new disease is turning out to be deadlier than the one before. While the dengue virus and the chikungunya virus immobilise, and even kill, the patient, Zika goes a step beyond—it harms the unborn child. The infection triggers microcephaly in children born to infected mothers. These children are born with a small skull and a deformed brain.

The book starts with three cases—two women and a man—reported in India in May 2017. In November, 2016, one of the women had just delivered a baby when she fell sick, while the other woman tested positive in January 2017 during her pregnancy. Unless we know about the disease, we cannot protect these children.

Unfortunately, we don't. We have known about the Zika virus as far back as in 1947, when it was isolated from the Zika Forest in

The Zika virus usually attacks the placenta as the defence of this tissue is not very developed. Since it does not make evolutionary sense for the virus to kill the foetus, it infects the foetus and deformed babies are born



Uganda. Researchers at the Uganda Virus Research Institute were trying to understand the yellow fever. But they did not explore the unrelated symptoms such as inactivity, rough coat and paralysis in inoculated mice and also ignored that the younger mice were more affected.

There is a reason the virus affects the baby profoundly even though the symptoms experienced by the mother are very benign. Three places in the human body are easier to invade: the brain, the genital tract and the placenta. The Zika virus usually attacks the placenta as the defence of this tissue is not very developed. Since it does not make evolutionary sense for the virus to kill the foetus, it infects the foetus and deformed babies are born.

Since 1947, the virus has been spotted across the world. It was reported in India in 1954. But there were no reported cases of fever caused by the virus anywhere outside Africa. It was only in the early 1970s that fever cases were reported from Indonesia.

The book talks about the disease in the Americas, much before the virus was identified in the Zika Forest. Information about Christopher Columbus' second journey to America in 1494 suggests he suffered an illness that led to arthritis. The authors say that this could be due to chikungunya, dengue or the Zika virus. Images of the microcephalic Aztec man are common and Columbus had even mentioned the fact that people in the area lacked intelligence and were easy to control. This could mean that the virus is of American origin.

Then the authors go on to figure out where the vector, *Aedes aegypti*, came from. It is quite likely that it came from Africa and equally likely that it originated from Asia. But the more pertinent question that one would ask is whether the *Aedes* is actually the vector. Though three cases in India have been reported in India, the 12,647 mosquitoes tested for the presence of the virus in the country have tested negative for the presence of the virus. In 2007, the island of Yap in the Pacific Ocean reported a fever. The population of the island is small and it was possible to test each person for the causal pathogen. When they tested, it was found that three-fourths of the population had the Zika virus. However, none of the mosquitoes tested positive for the virus. This could mean that the disease not only spreads through the very common *Aedes*, but it also spreads through an alternate vector, about which we know nothing.

Now consider this question: does the Zika virus cause microcephaly? In Brazil's current epidemic, of the 4,783 babies initially identified as microcephalic, 1,103 were investigated. But viral particles were found only in 19 babies. What then is causing the disease? There are no answers.

As you go through the book, be prepared to be drawn into a world of history, science, war and slaves. Everything is threaded in a single narrative. Often, you may find interesting information, which has little significance to the disease. But surrender to the story and it will make sense, even the personal anecdotes. ■

 @vibhavarshney

AUTHORS SAY

The emergence of Zika virus is a planetary alarm

KALPISH RATNA is the pseudonym of surgeons Kalpana Swaminathan and Ishrat Syed

THIS BOOK tracks the emergence of the Zika Congenital Syndrome, but

it's also our journey to understand how an innocuous virus can turn virulent enough to kill or maim the next generation. The book is meant for everybody. We are all impacted by this threat that might destroy our children.

Over the last decade, we have examined the links between emerging diseases and environmental destruction with growing dismay. Our first book in this direction, *Uncertain Life and Sure Death*, examined Bombay's epidemics between the 16th century and the beginning of the 20th century. History has tediously repeated itself.

The Zika outbreak is different because of its wide geographic swathe, and the abrupt transformation of the pathogen. Zika virus once caused no more than a vague fever. Now it damages the developing foetal brain. As paediatric surgeons dealing with malformations, we found it particularly distressing that we know so little about how the Zika virus operates. We spent all of 2016 keeping track of new research and mining older information. A pattern emerged, too distinct to be ignored.

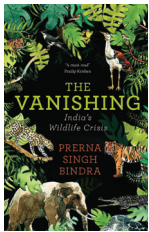
The experience of writing this book was humbling. We were shown, once again, how misguided we humans are in thinking we have sole rights over the planet. The emergence of Zika virus is nothing less than a planetary alarm. If our species continues to ravage the environment, we are indeed doomed to self destruct. We have not focused on the politics of science. Whatever policymakers might achieve, prevention and containment will depend on individual action. Transparency is everything. Once people have enough information, they will act with intelligence and with responsibility.



Wildlife homicide

The book lays bare wildlife mismanagement and chronicles the demise of nature in the world's most biodiverse country

SHREESHAN VENKATESH



THE VANISHING:
INDIA'S WILDLIFE
CRISIS

Prerna Singh Bindra
Penguin Random House India
320 pages | ₹ 464.23

IT IS a story of the systematic assault and abuse of India's biodiversity, which have left it on the brink of collapse. Prerna Singh Bindra wastes no time in diving right into what this means for us and how we have faltered both politically and practically in assessing the value of this immense wealth. She uses case studies from across species and across the country to not only illustrate the real impacts of decisions made in boardrooms, but also highlight the flawed and broken political system of decision-making.

From 2010 to 2013, Bindra served on the National Board for Wildlife (NBWL), which evaluates and assesses the suitability of projects near protected areas, and she writes about her bittersweet experience during this time. She gives several striking examples of the severely compromised decision-making processes, which have contributed to the depletion of India's natural habitats—its rivers, hills and forests. Her frustrations with the board are undercut somewhat by an almost apologetic belief that despite resounding failures and existential flaws, India's official bodies for protection are still among the few places where change can be driven from “within the system”. While the ambiguous stand on the value of such bodies might confuse readers as to what the author means, Bindra, to her credit, does not pull punches as she narrates specific instances and incidences of deceit, official apathy and downright resentment. She stresses on the astoundingly high clearance rates from environmental boards, and resilience with which rejected projects keep coming back for approval.

The author's experience in the NBWL provides readers a vantage point to India's unfolding wildlife crisis. The bulk of the book follows Bindra's travels into the hinterlands of India, and she weaves together stories in protected areas and wildlife reserves. The chapters revolve around landmark individual species such as tigers, elephants, gharials, turtles, leopards and the Great Indian Bustard, and their relationship with their habitats. One of the most exciting chapters of the book, *The Shadow Cat*, is on India's most abundant and poorly understood big cats, the leopard. Bindra uses the leopard to underline the fickleness of the dichotomy of tame and wild. Leopards are perhaps the most adaptable of the big cats, ma-

TARIQUE AZIZ / CSE

king themselves at home in jungles, grasslands and urban sprawls alike. In each of these settings, leopards show grace, restraint and tremendous calm to navigate habitations with only an ethereal presence. The author uses Mumbai, where leopards are frequently spotted in densely populated areas, as an example of the possibility of human-wild coexistence.

In fact, cohabitation, human-wild interactions and conflict are the enduring themes of the book. This is where Bindra, the conservationist, is most visible. While the book delves deeply into how India's growth story is decimating its wildlife, it also takes a hard look at what this means for people living inside and on the edge of forests. The chapter *Failing our Gods* is an unmissable read of Bindra's beautiful narration of the relationship and interdependence between a herd of wild elephants and their primary points of human interaction in Odisha—vital for each to navigate the contours of rapid urbanisation. While the author marvels at the resilience of the human relationship with the wild at these points of direct contact, she is not unaware of the sacrifices and risks involved in being neighbours with the wild. The author is a proponent of voluntary relocation of people from protected areas and proposes a more robust facilitation.

One chapter in the book, *Lines in Blood*, explores the impact of road construction and the fragmentation of pristine habitats. According to Bindra, this remains one of the least studied and poorly understood human interferences in protected areas and forests. She says that not only do roads and railway lines fragment pristine habitats and reduce their ecological value, they are also death traps for unsuspecting animals. The last chapter, *Sounds of Silence*, is a haunting take on how this decimation is not just limited to forests and the fringes of civilisation, but is unraveling also in urban settlements. The author is poignant in her assessment of the situation in cities, where wildlife is fast dwindling, a clearly visible trend for any discerning city-dweller.

While the book is an engaging read, it is clearly written from a predominantly conservationist perspective. It contains all aspects of vulnerability and fragility in conservation. Though it details several examples of how wildlife is being decimated, the subject of forest rights and how it plays into conservation is a glaring miss in the book. Bindra has also skirted critical issues like poaching and wildlife trade, evidently to focus on habitats. In this regard, though the book offers a rich mix of species and habitats, one can't help but notice the long list of misses that would need to be added to truly do justice to the diverse tapestry of the Indian subcontinent.

Having said that, Bindra is successful in challenging a key assumption of our times—one that pitches the environment against development. As she asks in the last chapter, *Deceptions of Development*, while writing about a proposed yarn factory in the vicinity of the Karnala Bird Sanctuary: "But the project, we were told, was, apparently, in the 'national interest'. It would contribute to the growth and development of the nation. The implication being that it should be green-lit. I remember asking if this, therefore, also meant that protection of a sanctuary and its rare wildlife was not in the national interest." While suffering from a few limitations, *The Vanishing* is an important piece of work in environment and wildlife decision-making. ■

 @shreeshanv

Environment is seen as a liability to development

On why she wrote the book:

It is an unacknowledged fact that wildlife is in a crisis. India has done a remarkable job with conservation, with all the pressures considered. But that has set in complacency. I also sense a hypocrisy because how else would you explain the Ken-Betwa project, when conserving the tiger is a national commitment? We do not consider the impact on the natural world in our development trajectory, and that's what mainly drove me to write this book. Environment is seen as a liability to development and that is frightening.



On development v environment:

We need to rethink beyond our narrow definition of development. The GDP is too limited a measure. Among other things, it does not consider ecological services. We need to reintroduce concepts like the green GDP, which takes into account the environmental costs of growth. We talk of development without destruction, yet we have rejected less than 1 per cent of projects in wildlife areas between 2014 and 2016.

On incentives for forest conservation:

The truth is money talks, but forests are not a priority for any state government. Forests are even perceived as an obstruction to development. I believe forests are priceless as they provide both tangible and intangible services, and some critical habitats must be sacrosanct. We may need to use incentives to preserve them, but this can only be part of a comprehensive and nuanced strategy. Incentives come with an accompanying problem of putting a price tag on forests, which is also a source of livelihood for local communities.

On the extent of habitat destruction:

Habitat destruction is a key driver of extinction and we are all culpable in it. Though about 5.6 per cent of India's areas are protected, effectively it is about two per cent. Even this is now threatened by a plethora of massive projects—from highways to dams. The National Board for Wildlife is increasingly becoming a clearance body, allowing damaging activities in even the most pristine areas.

On forest-dwelling communities:

Voluntary and fair relocation is a win-win solution for both wildlife and forest communities. We need to ensure communities benefit and do not bear the brunt of conservation—their support to protect wildlife is vital.



CHAMBAL WITHOUT RAVINES

The ravines of Chambal used to provide multiple livelihood options for its poor and marginal farmers. Leveling of land is triggering conflicts and increasing social inequity

PADMINI PANI

THE CHAMBAL region in central India is one of the most densely populated regions in the country. It has a very complex socio-economic structure, where more than 80 per cent of the population is primarily dependent on agriculture. The region's major lifeline is the Chambal River, where nearly 4,800 sq km land has been affected by severely dissected ravines. There are no major industries in the region and alternative livelihood options are also very limited. Therefore, the dependency on land is very high.

A new trend has emerged over the past decades—large parts of the Chambal ravines are being leveled. During the last 40 years, around 600 sq km of these degraded ravines, locally known as *bi-hads*, have been leveled in the Chambal region. The intensity of land leveling has enormously increased over the past decade.

The ravines are among the most vulnerable regions in the country. Faced with land erosion and gully formation that shrinks their lands, farmers are opting for various coping mechanisms. These include contour bunding, channelling, gully path



TARIQUE AZIZ / CSE

modifications, changing cropping patterns, and most importantly, land leveling. With increasing availability of heavy machinery, land leveling has expanded phenomenally.

But during a field survey, I found many farmers disillusioned about the efficacy of land leveling. “Often the leveled lands are unproductive and leveling is a costly affair,” said a middle-aged farmer who had borrowed heavily to hire earth removers to level a portion of his land. Except for a few well-to-do farmers with pump-sets, agriculture is entirely rainfed. The irrigated leveled lands are productive and profitable only in the initial years. However, regular irrigation in the leveled land creates further erosion as rills and small gullies develop inside the agricultural fields. Managing leveled land is highly labour-intensive, as the land needs constant maintenance by refilling, compressing, bunding, and fencing. It costs ₹800 per hour to rent an earth remover to break the soil mounds. The choice of land to level is based on considerations such as proximity and accessibility of the land. Such ad-hocism often leads to increase in the cost of land management in the leveled land.

Disturbing an ecosystem

Bihads (ravines) are part of an integrated ecosystem. Flattening not only destroys the ecology, but also loosens the top soil, making it prone to erosion and susceptible to further gullying. It takes a year to level a land and to start cultivation. When there is erratic rainfall, the situation worsens, as the heavy and continuous rain initiates headward erosion—erosion at the origin of a stream channel. Severe erosion and gully encroachments are more prominent in leveled lands. Even the untouched ravine lands are engulfed by the gully headward erosion in a very short period of time.

Land leveling has implications for the overall socio-economic situation in the region. Given the high costs of land-leveling, it is not surprising that only people with resources or access to cash can afford to level the land and keep it in a cultivable state. Also, maintaining the leveled land requires constant supervision and monitoring, and only rich farmers can afford maintenance.

One of the major impacts of large-scale leveling is the disappearance of common lands, which include grazing lands. Leveling *bihads* has given an opportunity to wealthy farmers to privatise commons. During our survey, we found that many landless people, who earlier used the *bihads* to graze their cattle, could no longer do so. This has led to a decline in the livestock population, and the organic links between rainfed agriculture and livestock rearing have collapsed. Due to this, many landless and marginal farmers are migrating to nearby cities in search of work.

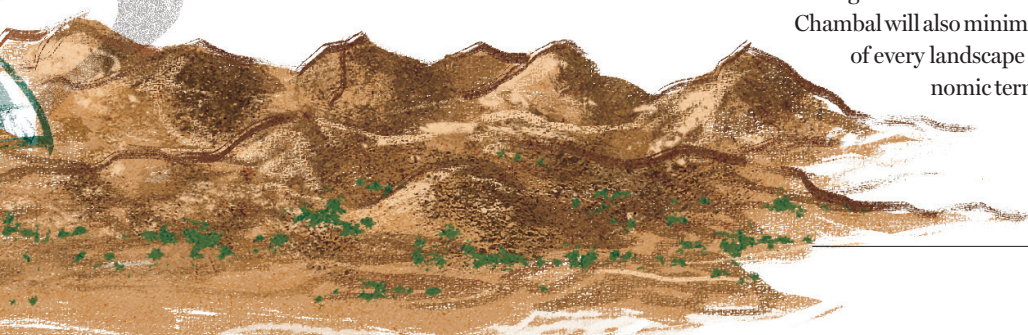
In geomorphological terms, this area is not in an equilibrium state yet. It is still under the control of geological erosional processes. Leveling these lands will not only result in destroying unique landscapes, it will also disturb social harmony

Earlier, wild fruits like *tenti* and *berr* were collected by poor people to make pickles for household consumption as well as to sell in nearby markets. Clearing of land has wiped out indigenous trees. The capture and the leveling of *bihads* by rich farmers, powerful locals and other influential people have gender dimensions as well. As collecting fuelwood from *bihads* has become difficult, the use of crop straw has increased, particularly among poorer households. During our group discussions, we found that a large number of women had developed health problems due to indoor air pollution caused by the use of crop straw. This has implications for their children's health as well.

Such changes have led to a further disintegration of the local economy and society, leading to rising social inequality and conflicts across the region, which has a long history of oppression and crime. On the other hand, due to the destruction of the natural habitats wild animals regularly stray into agricultural fields and damage standing crops. Some farmers have stopped growing crops like *arhar* (pigeon pea or green pea), which has a longer growing season and requires protection for a longer period. A number of farmers shared their agony and said they have abandoned their lands due to this problem.

At the same time, renting machinery for land leveling has emerged as a business opportunity for powerful people. There are also plans to use these lands for industrialisation. Such plans need to be carefully scrutinised for their long-term implications for this fragile ecology. In geomorphological terms, this area is not in an equilibrium state yet; it is still under the control of geological erosional processes. Further disturbance will cause more soil loss, and the Chambal River and its tributaries will receive a huge amount of sediments during the rainy season. The entire river ecosystem will be severely affected in the coming years, and this will undoubtedly lead to further flooding. A more scientific, systematic and sensitive planning for conservation and development of this ecological region is the need of the hour. The ecological impact of leveling badlands will not only result in the destruction of unique landscapes, it will also disturb social harmony, increase conflicts and cause distress migration. A more holistic approach towards the ravines of Chambal will also minimise the effects of soil erosion. The value of every landscape cannot be reduced to its value in economic terms. ■

(The author is assistant professor,
Jawaharlal Nehru University,
New Delhi)



CIVIL LINES RICHARD MAHAPATRA

Can farmers' income be doubled?

For that, farmers will have to make an investment of ₹463 billion in the next five years

A “NEW INDIA” is the latest national agenda. Prime Minister Narendra Modi in his fourth Independence Day speech made an appeal with his trademark gesture of both hands pointing towards the gathering: “A new India that would fulfil the dreams of the young and women, and see the income of farmers double.” Modi first promised doubling farmers’ income by 2022 two years ago. This is the first time he has added it to his “New India” agenda. At a time when farmers are found more on the streets than in farms protesting for better pricing and relief from the agrarian crisis, it is a promise everybody would desperately pitch for.

Though many have doubted that this promise would be fulfilled, an official committee to lay the roadmap—Committee on Doubling Farmers’ Income led by Ashok Dalwai—has recently submitted its report. It reveals the challenges of fulfilling the promise. Starting from a historical background of progress in agriculture to what needs to be done, the report is very expansive as well as specific in suggestions. Going by the committee’s general observation, the target is achievable, which this magazine also recently estimated.

First, the report says that during 2004-2014, agriculture reported a historic growth rate. The agricultural growth was an impressive 4 per cent during this period as compared to 2.6 per cent during 1995-2004. Four per cent growth is considered as the gold standard as far as agriculture is concerned. But in recent years, the sector seems to be slowing down which is widely known. Second, the report says that this growth rate was possible due to better minimum support price, increased public investment and also better market price. Third, it

says that the real income from farming has to be doubled which is around 60 per cent of a farmer’s total income. This means only this source of the total income would be doubled as per the target fixed for 2022. Interestingly, the report says that this involves a change in the ratio of a farmer’s income from farm and non-farm sources: from the present 60:40 to 70:30 in 2022. This means that India has finally accepted the dominance of farm income in farmers’ overall wellbeing. The other way to look at this

is to accept that the dream of adopting non-farm income as an alternative to dwindling agriculture is now junked.

But let’s look at the cost of achieving this target. This is important because agriculture is a private venture supported by official policies and programmes. It means both private and public investments are needed to double farmers’ income. While estimating the private and public investment required, the committee has assumed that the sector would grow at the same rate as of 2015-2016 till 2022 with the same efficiency. Practically, this means an annual growth of 9.23 per cent of a farmer’s income. For this to happen,

farmers need to invest ₹46,299 crore (at 2004-05 prices) in the next five years. Farmers invested ₹29,559 crore in 2015-16. For governments, the investment has to be ₹102,269 crore; up from ₹64,022 crore in 2015-16.

This raises a few questions: do farmers have the capacity to invest such a huge amount of money on agriculture without any profits? A large chunk of public investment is for spending on irrigation projects which, as is widely known, are not taking off. Farmers already have a huge debt. This strategy will just add on to their debt. In an ideal situation, the agenda of doubling farmers’ income should have started from cleaning up farmers’ debt. But the Union government wants the states to take care of that. Another round of *Tu tu main main*? ■



TARIQUE AZIZ / CSE



Training programme on CORPORATE SOCIAL RESPONSIBILITY – PLANNING, IMPLEMENTATION AND REPORTING

COURSE FEES

Rs 12,000 for CSR foundations, companies, public sector undertakings and consultants; Rs 9,000 for academicians, NGOs and researchers; Rs 6,000 for students.

Note: Accommodation can be arranged nearby the training centre; it would incur extra charges

COURSE DURATION

September 20-22, 2017

TIMING

10.00 am to 5.30 pm

COURSE VENUE

CSE, 38, Tughlakabad Institutional Area,
New Delhi – 62

LAST DATE FOR APPLYING

September 15, 2017

OPEN FOR ALL

CSR practitioners, officials from companies, PSUs, consultants, academicians, students, NGOs

Centre for Science and Environment (CSE) is pleased to invite you to a three-day training programme on 'Corporate Social Responsibility—Planning, Implementation and Reporting', to be held on 20-22 September, 2017.

CSE recognises CSR as a key component of inclusive and responsible business. In view of CSR (addressing and reporting) becoming mandatory as per the Amendment of the Companies Act in 2013, it is desirable for all stakeholders to formulate a CSR policy, and implement and monitor its effectiveness. This training programme is designed based on the provisions of the Act and Rules. It aims to give practical exposure on CSR to the participants, with specific references to the regulatory framework and process to formulate a CSR policy—need-based assessment, stakeholder engagement, methodologies for implementation, performance evaluation and statutory reporting.

The objective of the training programme is to build a cadre of CSR professionals who would assist in effective development and implementation of CSR activities of organizations for the benefit of communities as well as businesses. This training programme would be relevant to the CSR leaders, senior- and middle-level managers, practitioners and implementation partners, NGOs, students, etc.

What is the take away for the participants from this programme?

1. Regulatory Framework for CSR—Companies Act 2013 and CSR Rules 2014, international guidelines and best practices
2. CSR Implementation status—Challenges, risks, and learning of past two years.
3. Approach for identification of CSR activities through needs assessment.
4. Developing CSR policy
5. CSR planning and implementation
6. Monitoring, measurement and evaluation of CSR activities for outputs and outcomes
7. Success stories in CSR in India
8. Assessment of capacity of implementing partners
9. Grievances redressal (processes and practices)
10. Techniques for strategic and effective corporate communication
11. CSE guidelines for CSR reporting

Training methodology: Lectures, case studies, class exercises, discussions and role play

For registration: Kindly email at: vikrant@cseindia.org



For details contact: Vikrant W., Programme Officer, Impact Assessment

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Prakriti ka Aashirwad

100% GUARANTEE OF PURITY

**Patanjali Honey Certified by FSSAI
across more than 100 parameters**

When Patanjali saved you from brands which were looting your money in the name of pure honey, they went on to spread rumours about FSSAI. And that's why Patanjali Honey now comes with guarantee of purity. Patanjali natural honey meets more than 100 parameters set for purity by FSSAI of Govt. of India. And now Patanjali Honey is the choice of all India(Bharat).

Saving your money and giving you pure honey.

Intertek

No. GB Udyog Vihar, Phase-4,
Gurgaon -122 016, Haryana, India

Telephone: +91-124-4840600
Facsimile: +91-124-4147881
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www.intertek.com

Intertek India Pvt. Ltd (Food Services)

ISSUED TO
Patanjali Ayurved Ltd.
Maharshi Dayanand Gram,
Beside Divya Nursery, Near
Patanjali Yog Peeth, Bahadradab,
Haridwar-249402

TEST REPORT

LAB REFERENCE No.: IFS-160122051
Issue Date: 05/02/2016
Your Ref: Email
Dated: 22/01/2016

Doc. No. IFS/DOC/003_02

Kind Attn: Mr. Giriraj

Sample particulars: Honey

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Sample Registration Date: 22/01/2016
Analysis starting Date: 22/01/2016
Name of the Product: Honey
Quantity received: Approx 500ml in commercial pack
Sample details: Code: A
Sampling done by: Sample not drawn by intertek
SAMPLE TESTED AS RECEIVED

Analysis Completion Date: 05/02/2016

Reporting code: FS/CR/MT;

Sr. No.	Test parameters	Units of Measurement	Result	Specification as per FSSAI	Limit of Detection	Method of testing
1.	Sulfaguanidine	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
2.	Sulfanilamide	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
3.	Sulfacetamide	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
4.	Succinylsulfathiazole	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
5.	Sulfaphenazole	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
6.	Sulfadimidine	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
7.	Sulfadiazine	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
8.	Sulfathiazole	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
9.	Sulfapyridine	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
10.	Sulfamerazine	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
11.	Sulfamethazine	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
12.	Sulfamer	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
13.	Sulfamethoxypropidine	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
14.	Sulfachloropyridazine	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
15.	Sulfamonomethoxine	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
16.	Sulfisoxazole	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
17.	Sulfamethoxazole	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
18.	Sulfadoxine	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
19.	Sulfquinolaxine	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
20.	Sulfadimethoxine	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
21.	Sulfabenzamide	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
22.	Sulfamoxole	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
23.	Sulfisozine	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057
24.	Sulfamethizole	µg/Kg	Not detected	5.0	2.0	IFS/C/COP/IC/057

DAVID ANTHONY
(Authorized Signatory)

PATANJALI HONEY	OTHER BRANDED HONEY
250 grams ₹70	250 grams ₹122



Read the entire report on
www.patanjaliayurved.org

CRYSTALLISING OF HONEY IS A NATURAL PROCESS.