Water management in the age of climate change world

Sunita Narain

Centre for Science and Environment

New Delhi

Unprecedented Times

- **We have never seen such disruption**
- **We have never imagined such a collapse of our economies – like a pack of cards the world around us has been wiped out**

In all this..

We have understood also the role of clean water as a preventive measure when it comes to health

Government of India has rightly included access to clean water and sanitation as part of the health sector’s spending

This is a game-changer

Climate change: changes water

- **In this pandemic, when governments have little ability to handle the 'normal' there is the 'other' global catastrophe looming; and showing up – climate change**
- **We need to understand that this is not going away and will make our world more vulnerable to shock and disruption.**
- **It also has huge implications for the way we will manage our water systems; even as demands will grow and stress will increase**

Scientific evidence is unequivocal “Attribution” is easy to dismiss

- We hear the following:
- Bush fires always happened;
- Floods and droughts always happened;
- Cyclones always happened
- Locust attacks always happened

So why are we linking to climate change?

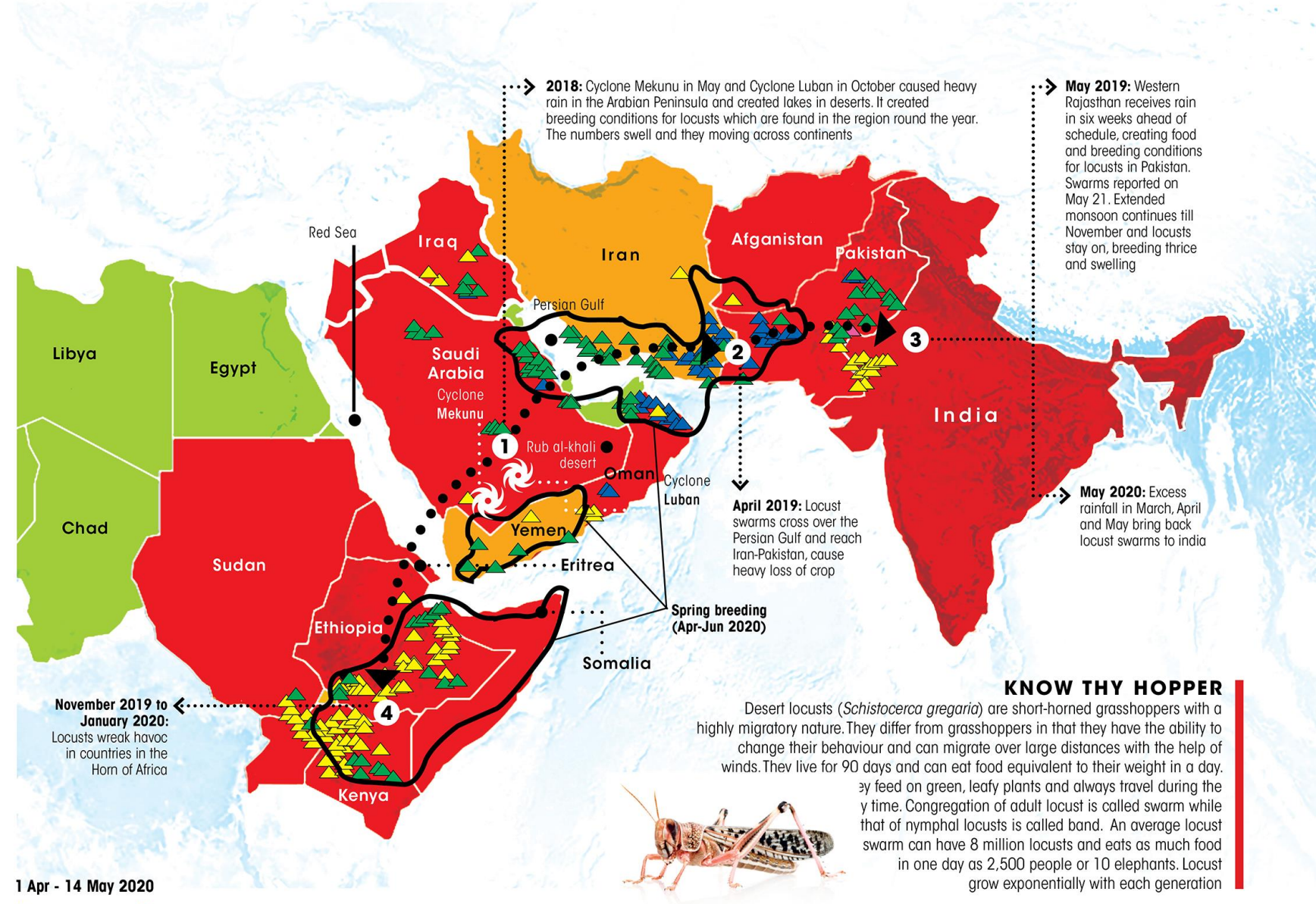
Because what is clear is that the intensity and frequency of these events is no longer in the ‘normal’ range of variation

Take locusts: desert creature that multiply exponentially when conditions are right

- Right conditions

- Rain in the desert conditions; unexpected; prolonged so that it creates ‘right’ conditions for multiplication
- Vegetation – food when there should have been scarcity
- Higher temperatures – for movement and growth

NOW THEY ARE BACK AGAIN DUE TO UNUSUAL RAINFALL IN ALL REGIONS

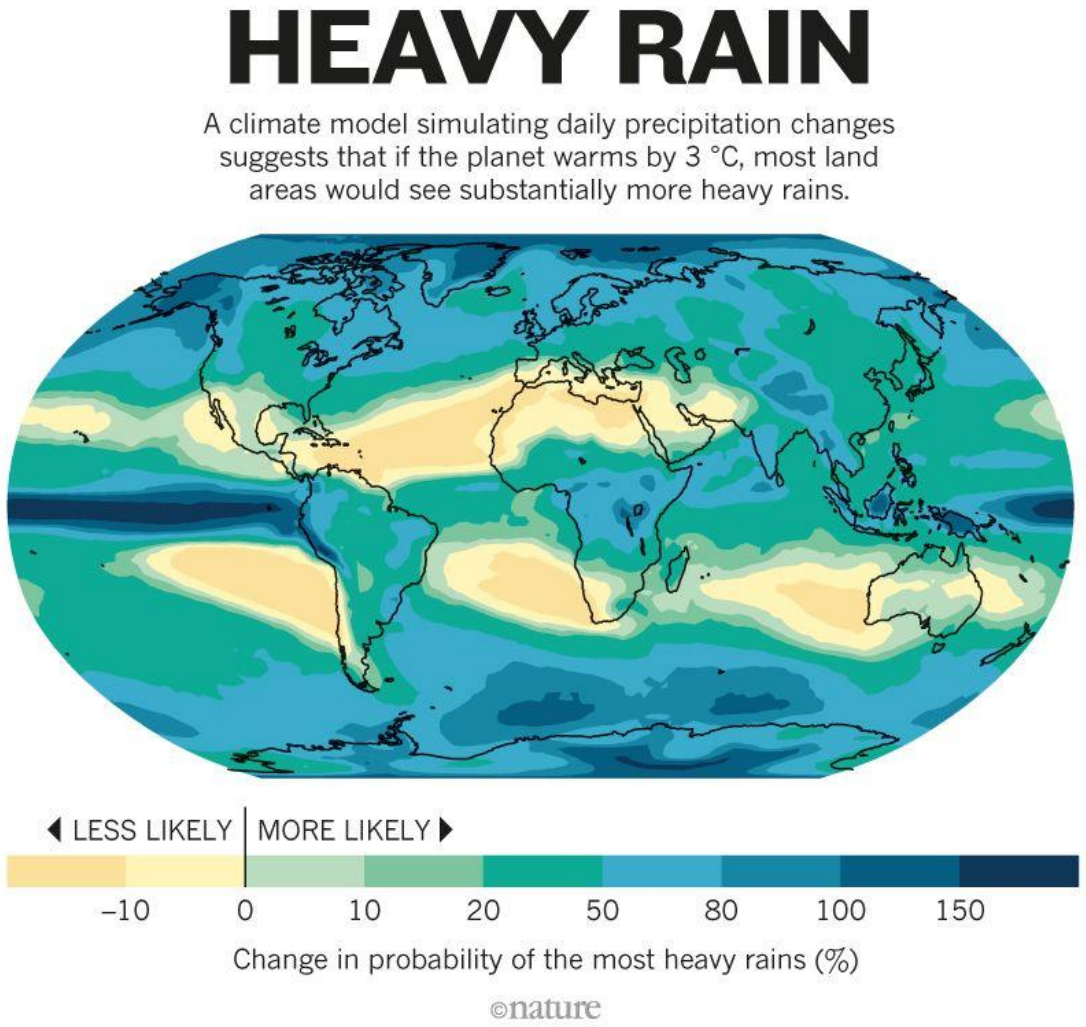


KNOW THY HOPPER

Desert locusts (*Schistocerca gregaria*) are short-horned grasshoppers with a highly migratory nature. They differ from grasshoppers in that they have the ability to change their behaviour and can migrate over large distances with the help of winds. Thev live for 90 days and can eat food equivalent to their weight in a day. ey feed on green, leafy plants and always travel during the y time. Congregation of adult locust is called swarm while that of nymphal locusts is called band. An average locust swarm can have 8 million locusts and eats as much food in one day as 2,500 people or 10 elephants. Locust grow exponentially with each generation

Climate change and extreme rain

- More than enough evidence to show that extreme and variable rain events are linked to climate change – increase of floods and then droughts



1000 extreme rain events in first 12 days of August

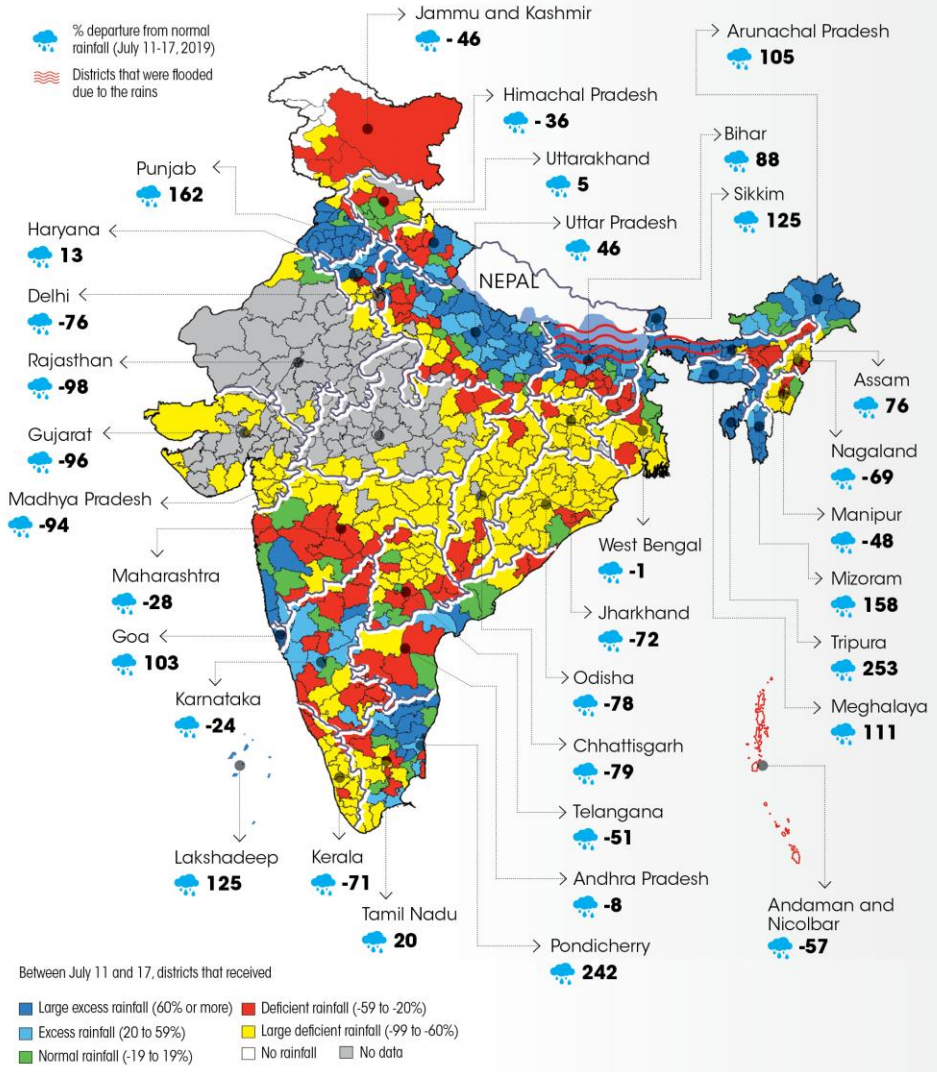
It does not rain
It pours

More rain
Fewer rainy days

https://www.downtoearth.org.in/dte-infographics/extreme_rainfall/index.html

A week of rains wreaks havoc

Twelve states in India received over 60 per cent surplus rains in the second week of July this year. The resultant floods in Bihar and Assam affected over 10 million and claimed 168 lives



KNOCKOUT SPELL

Within a span of 11 days, seasonal rainfall in Bihar went from deficit to surplus

July 7

171.5 mm

rainfall recorded in Bihar. Till then, 27 of its 38 districts had more than 40 per cent deficient rains

July 13

6 districts

in Bihar—East Champaran, Sitamarhi, Madhubani, Kishanganj, Araria and Sheohar— flooded due to incessant rainfall

July 14

0.3 million

cusecs released from the Koshi Barage in Nepal that gushes to downstream Bihar

July 16

10 districts

in Bihar reel under floods. The four additional districts are Purnia, Katihar, Saharsa, Darbhanga

July 17

12 districts

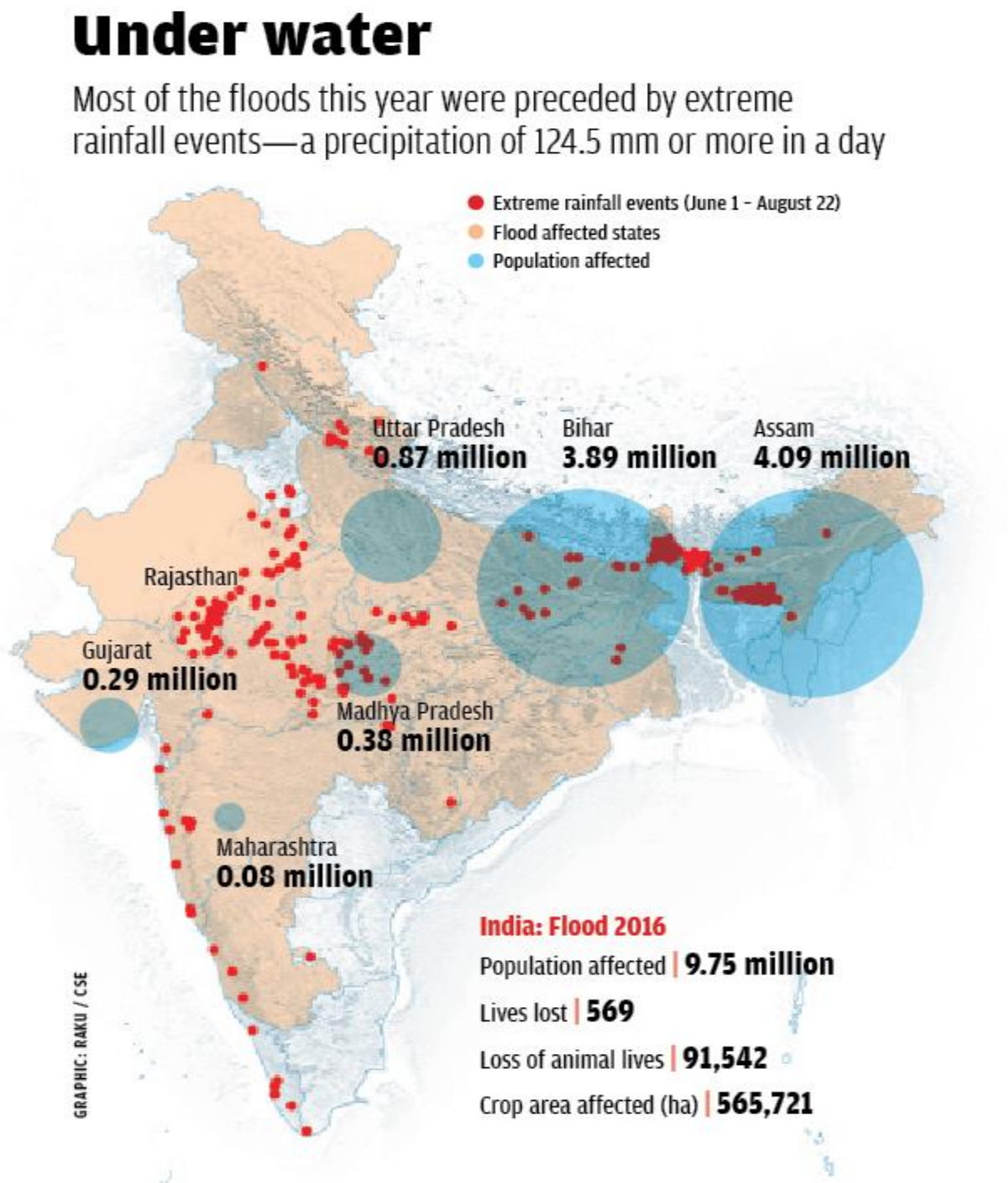
in the state report floods. Bihar becomes a monsoon-surplus state. The two additional districts are Supaul, Muzaffarpur

Map not to scale
Source: *India Meteorological Department; International Water Management Institute; and media reports*

Extreme-rain floods
Double-whammy
Flood at the time of drought

- Cannot hold water
- Leads to flood
- Leads to drought

Will need enhanced efforts to contain floods by recharging ground and surface water and using it during prolonged drought period



Rising heat..

- Every year is the hottest year, breaks records, till the next year comes
- 2021 temperatures touching 40 degree as early as February in parts of the country
- Scientists are now saying that even in the year of La Nina – Pacific currents that bring cooler temperature as compared to El Nino – there is no respite from soaring heat
- **Global warming has offset this cooling impact**
- This means things will get worse

..will add to water stress

Rising heat means

- Dry moisture in soils – increase the need for irrigation; add to land degradation and dust formation
- Increased evaporation rate – water will depleted faster that is stored in surface water structures
- Drive up the use of water – from drinking to irrigation to fighting fires in forests and building

Water management will be crucially important in the age of climate change

Dust storms kill: join dots to heat/water

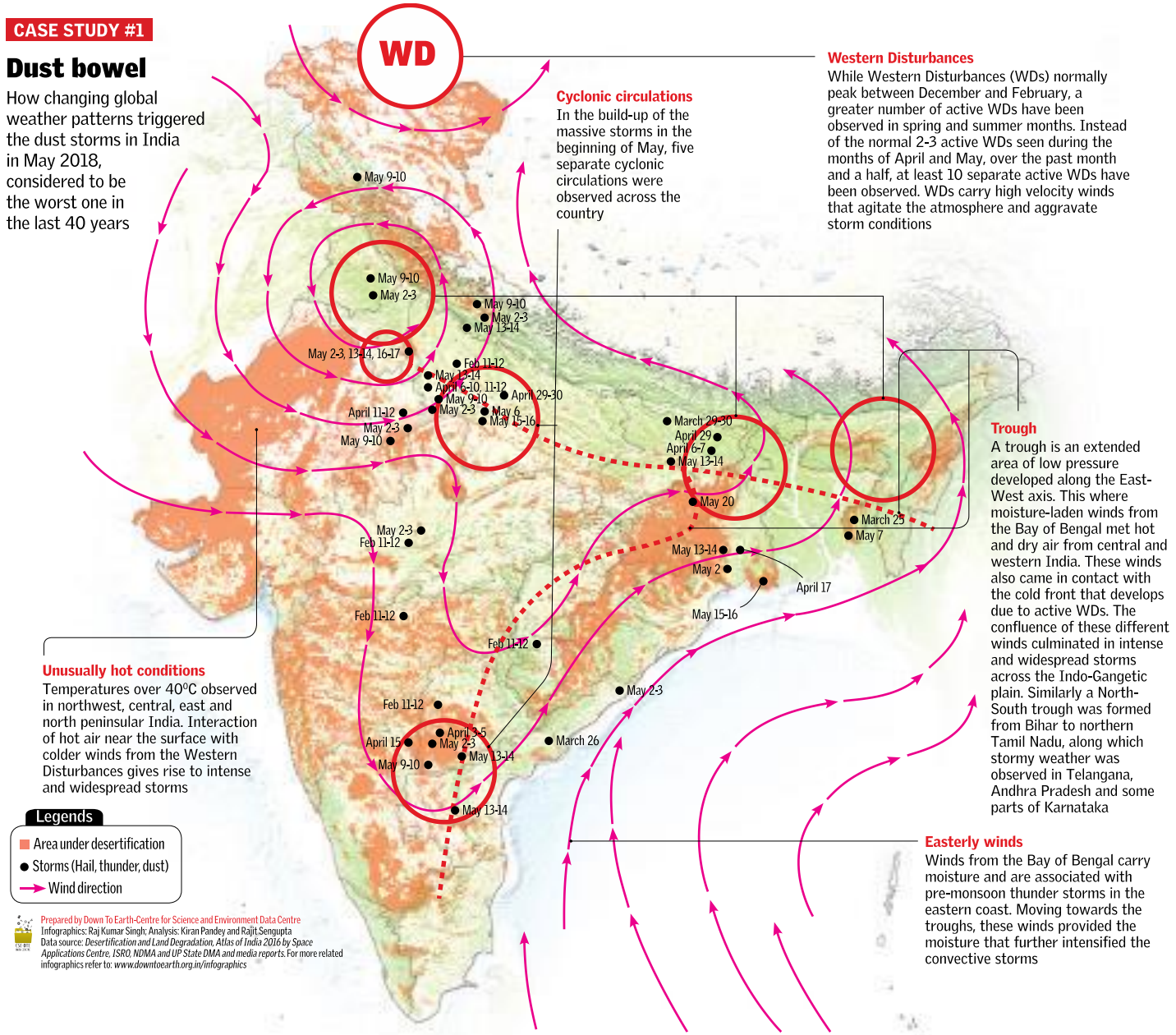
- **New Abnormal**
- Dust storms 2018: April-May
- Over 50 dust storms killed over 500 and destroyed homes and crops
- Why: global-local connections

- **A**. Western Disturbance changing – getting longer; link to weakened Arctic Jet Stream – warmer Arctic and difference reduced ocean
- **B**. Bay of Bengal getting warmer – more cyclones; more heavy rain. Colliding with WD, that are more frequent and late
- **C**. **Intense heat spikes** (Pakistan/north India) which is making ground dry
- **D. Combined with groundwater overuse; lack of moisture; deforestation**
- **Deadly**

CASE STUDY #1

Dust bowel

How changing global weather patterns triggered the dust storms in India in May 2018, considered to be the worst one in the last 40 years



Western Disturbances
While Western Disturbances (WDs) normally peak between December and February, a greater number of active WDs have been observed in spring and summer months. Instead of the normal 2-3 active WDs seen during the months of April and May, over the past month and a half, at least 10 separate active WDs have been observed. WDs carry high velocity winds that agitate the atmosphere and aggravate storm conditions

Cyclonic circulations
In the build-up of the massive storms in the beginning of May, five separate cyclonic circulations were observed across the country

Trough
A trough is an extended area of low pressure developed along the East-West axis. This where moisture-laden winds from the Bay of Bengal met hot and dry air from central and western India. These winds also came in contact with the cold front that develops due to active WDs. The confluence of these different winds culminated in intense and widespread storms across the Indo-Gangetic plain. Similarly a North-South trough was formed from Bihar to northern Tamil Nadu, along which stormy weather was observed in Telangana, Andhra Pradesh and some parts of Karnataka

Unusually hot conditions
Temperatures over 40°C observed in northwest, central, east and north peninsular India. Interaction of hot air near the surface with colder winds from the Western Disturbances gives rise to intense and widespread storms

Easterly winds
Winds from the Bay of Bengal carry moisture and are associated with pre-monsoon thunder storms in the eastern coast. Moving towards the troughs, these winds provided the moisture that further intensified the convective storms

Legends
- Area under desertification
- Storms (Hail, thunder, dust)
- Wind direction

Prepared by Down To Earth-Centre for Science and Environment Data Centre
Infographics: Raj Kumar Singh; Analysis: Kiran Pandey and Rajit Sengupta
Data source: *Desertification and Land Degradation, Atlas of India 2016 by Space Applications Centre, ISRO, NDMA and UP State DMA and media reports.* For more related infographics refer to: *www.downtoearth.org.in/infographics*

Between February and May in 2018, India witnessed an unprecedented storm season—more than 44 s in 16 states. This brings out the linkages of geographically distant events related to climate change. "Climatologically, these storms were anything but typical. Initial analyses have revealed several reas for the stormy weather, including the activity of t Western Disturbances (WDs), the low pressure o Indo-Gangetic plains and the intense heating in w and northwest India," said M Mohapatra of the India Meteorological Department (IMD), New Delhi.

As the Arctic warms, the difference in temperature between the Arctic and the equator has reduced, particularly during recent winters which have seen highly anomalous heating around the North Pole. A warmer Arctic has been correlated to the extended winters punctuated with blasts of frigid weather in the northern hemisphere. The weakening temperature gradient is, in fact, causing the jet streams to meander rather than take a straight course which, in turn, affects the seasonality and movement of the WDs. Additionally, steep increases in temperatures in the Western Himalayan region and the Tibetan Plateau have been linked to a further destabilisation of climatic patterns in the region. Western Himalayas and the Tibetan Plateau are considered to play a crucial role in maintaining the hydrological and weather cycles over the Indian subcontinent. Rapid warming, which has caused temperatures to increase by up to 3.5°C since 1951, have been linked with increased variability in the distribution and direction of WDs and associated precipitation.

There are clear indications of how the general trend of warming is exacerbating stormy weather during the pre-monsoon season. The general physics behind storms unequivocally points at a higher incidence and intensity. A review of the EM-DAT Disaster Database that compiles information regarding disasters the world over reveals a worrying trend. One has to go back 40 years to see the last time convective storms during this season caused comparative loss of life. In 1978, storms in March and April across North and East India caused the deaths of over 600 people. But large-scale convective storms in the pre-monsoon season were few and far between. Between 1980 and 2003, just nine deadly convective storms were recorded in India in the March-May period. However, a steep increase has been observed in the last 15 years. Between 2003 and 2017, 22 such storms were observed over the Indian region accounting for nearly 700 fatalities compared to 640 fatalities in the preceding 22-year period. In 2018, 423 people have died owing to extreme weather systems. ■

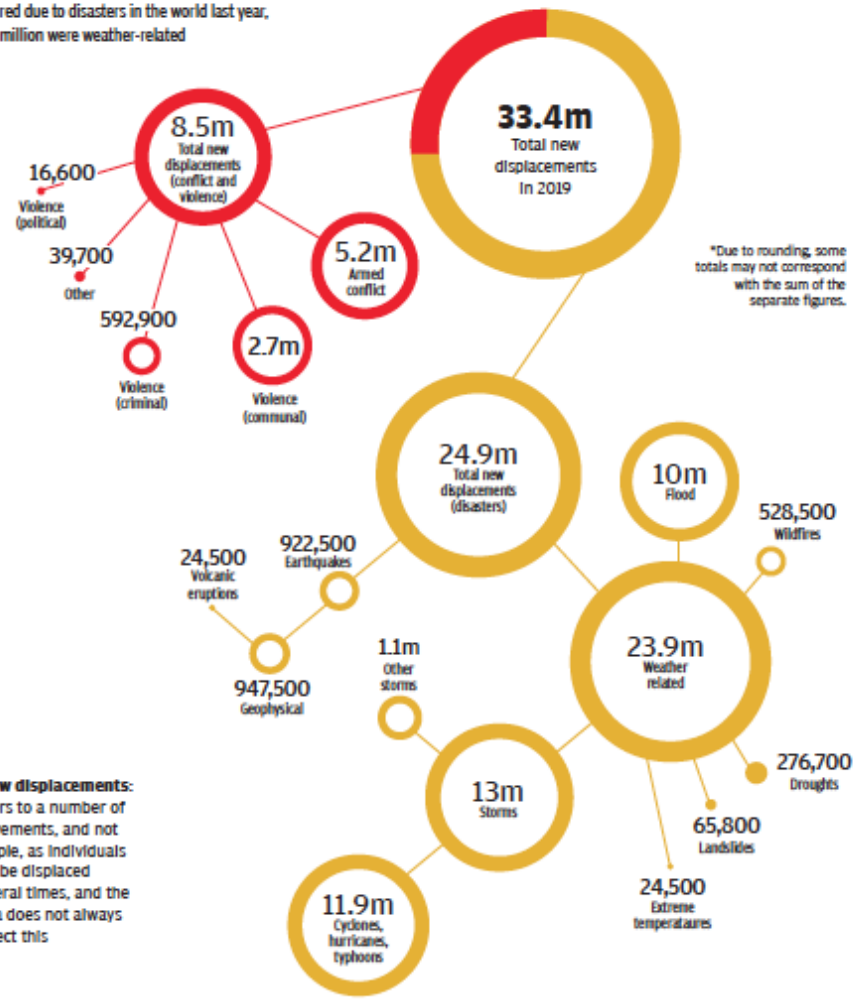
Internal displacement
Drought-flood-crop loss-cyclones
not single day events

- Cripple people
- Destroy livelihoods
- Take away development dividend
- As events become more frequent, survival becomes more difficult
- No option but to move – migrate – **to cities to new countries**

INTERNAL DISPLACEMENT

by disasters and conflicts

Of the 24.9 million new displacements* that occured due to disasters in the world last year, 23.9 million were weather-related



*Due to rounding, some totals may not correspond with the sum of the separate figures.

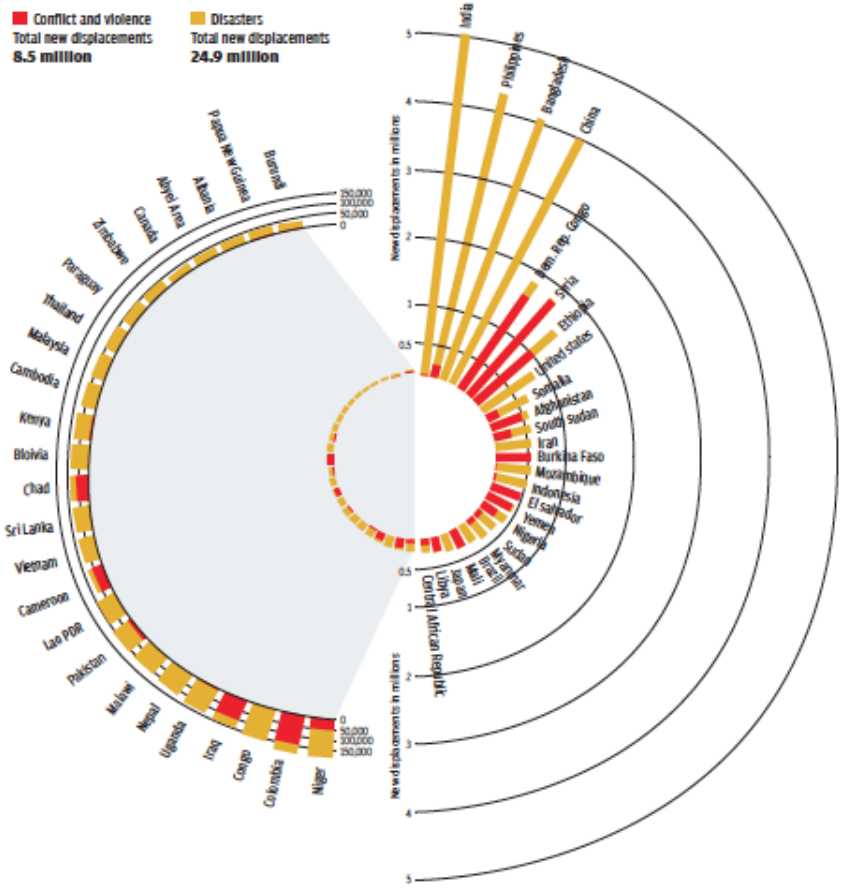
***New displacements**: refers to a number of movements, and not people, as individuals can be displaced several times, and the data does not always reflect this

Source: Internal Displacement Monitoring Centre,2020

Sourced from upcoming State of India's Environment 2020: In Figures to be released on June 5

50 WORST HIT COUNTRIES

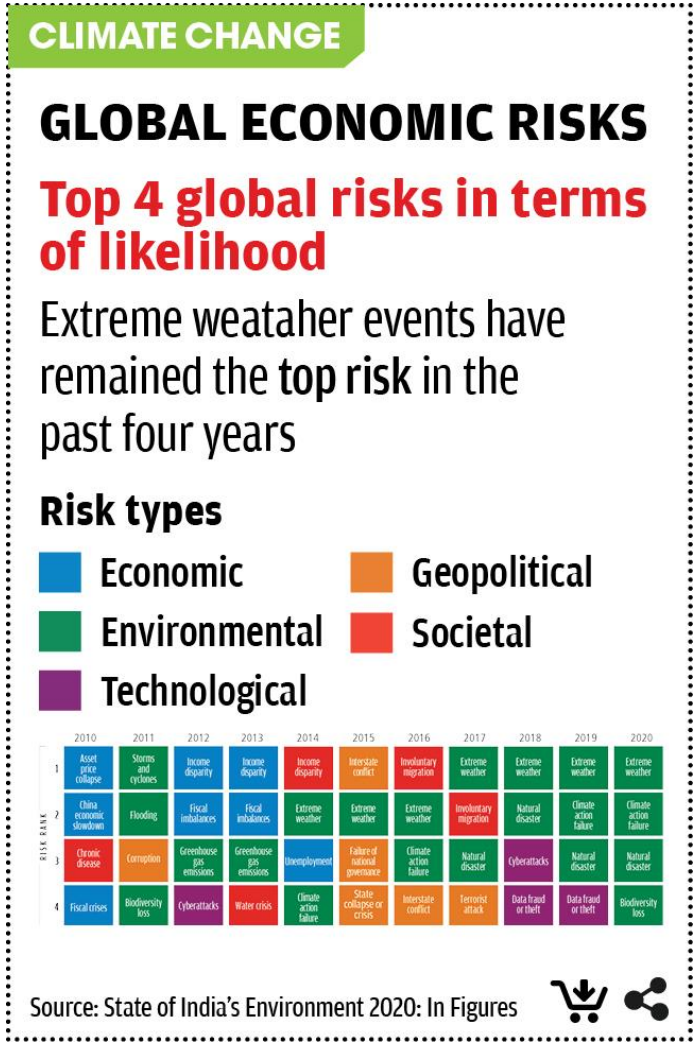
India alone accounted for over 20 per cent of all new displacements in 2019

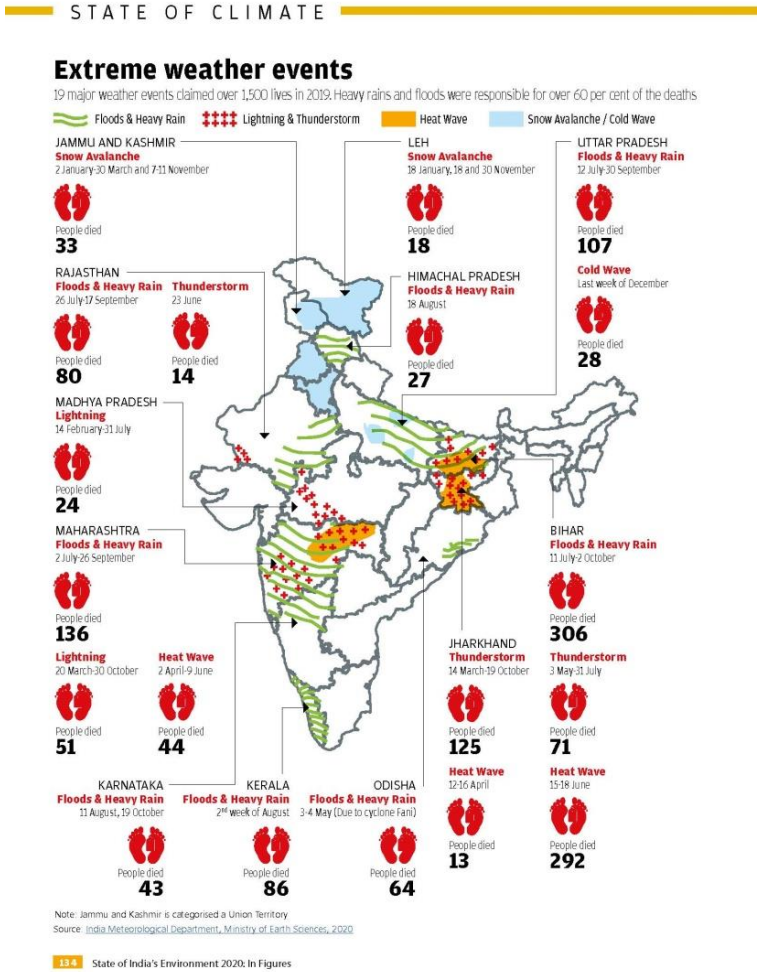


Source: United Nations Environment Food and Agriculture Organization and others

Sourced from upcoming State of India's Environment 2020: In Figures to be released on June 5

Multiple crisis: climate change is real



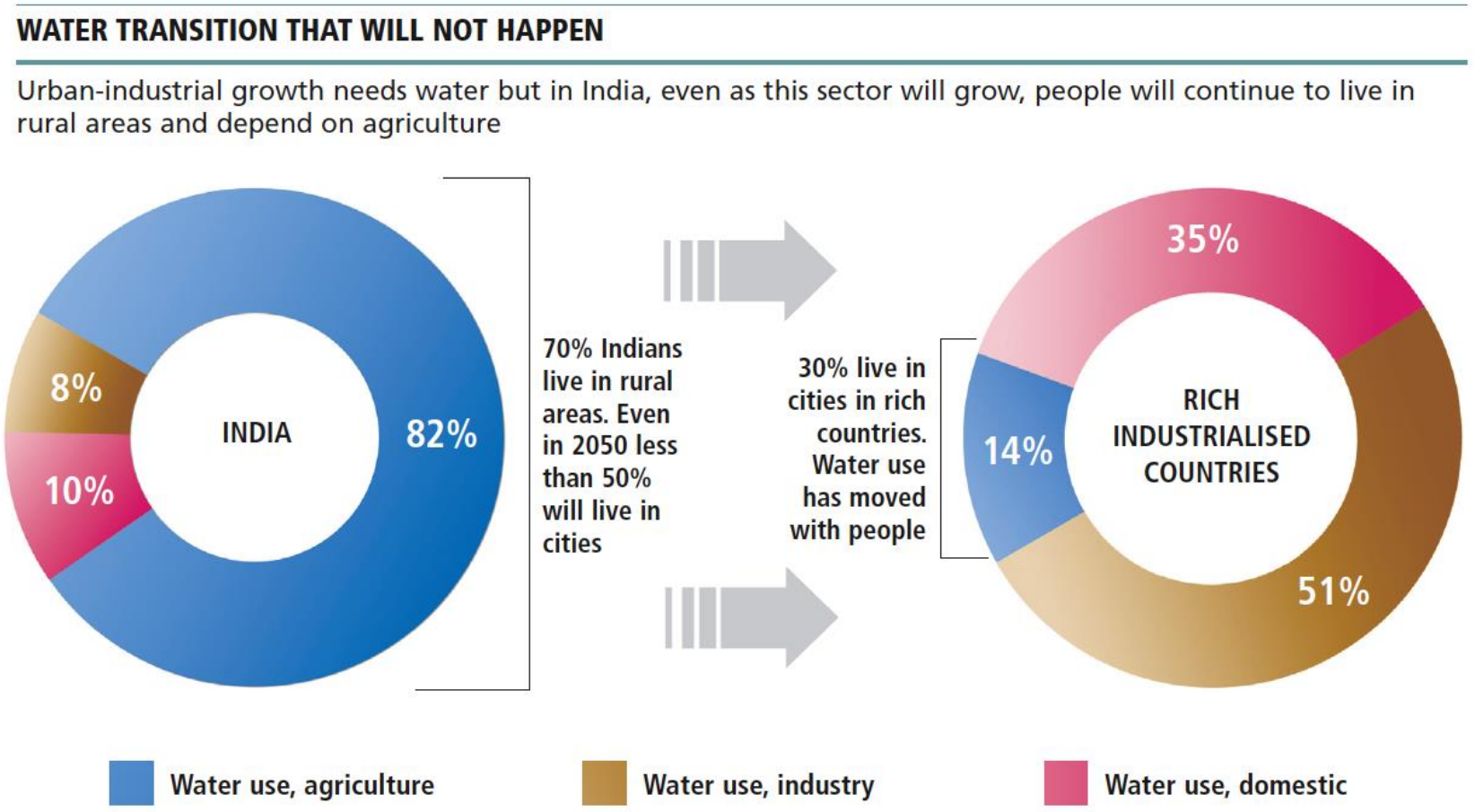


Agenda for water future

- **Management of competing demands** – between agriculture and industry – **augment supply** by catching water where it falls; mitigate flood risk and build resilience of rural communities to deal with variable rain and for cities to deal with water stress
- Management of water demand **so that it is efficient** – need more water per drop – not just in agriculture but also in urban and industrial water management. Must reduce the length of the pipelines so that we can reduce wastage and make water supply and sewage management affordable for all and so sustainable
- Management of **pollution** – ensure water is not degraded and so unusable

- **The old agenda is the new agenda but we need to move with speed, scale and we need to reinvent the paradigm so that it can meet the needs**

India will not follow transition of rich world – people move to cities; economies move to service-industry; water moves with it



Secure water for growth

- Agriculture will remain critical for livelihoods – 60% dependence
- But cities-industries will grow. Will need water for growth
- Unless we manage competing needs; violence will grow
- Already cases of protest and police firing over water allocation to industry or city

Augment supply

- Water for agriculture must be secured
- Recognise groundwater provides bulk of irrigation
- Recognise there are over 19 million well owners – they take decisions on water
- They are more efficient in use
- But crisis is growing – **groundwater levels falling**

Groundwater: needs recharge

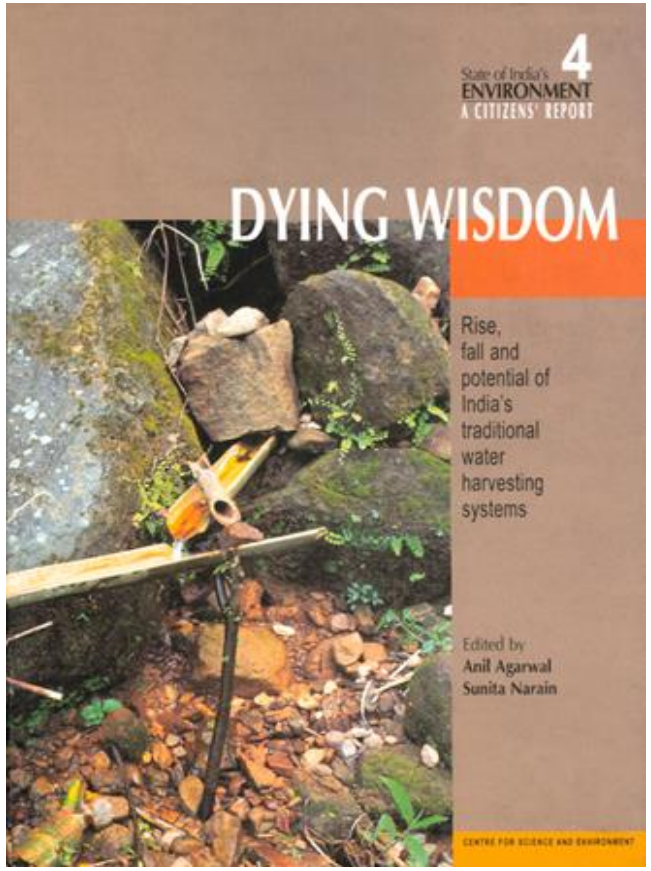
- Recognise recharge is critical
- Large reservoirs centralize recharge
- **But rain is decentralised**…

Learning from traditions…

In 1997 we published Dying Wisdom:

Rich learning of our traditions.

Enormous diversity, technological sophistication. Each region had its own system to hold, capture rain. *Zings, ahars, johads, tankas, phad*…..



Catch water where it falls

#MGNREGA: India's Jal Jodhas

WORLD WATER DAY 2021

THE CHASE AND THE CHANGE

To probe

How districts that implemented MGNREGA first in 2006 performing on water conservation

15 YEARS of MGNREGA

14 reporters

16,000 KM journey

16 VILLAGES in 15 states

www.downtoearth.org.in

#MGNREGA: India's Jal Jodhas

WORLD WATER DAY 2021

BARMANI

Sidhi dist., Madhya Pradesh

"We have become food surplus"

2006

When DTE first visited this village it was abandoned and distressed

Then it invested in water security under MGNREGA

By 2021

Revisit by DTE we found:

7 big ponds;

39 dug wells revived with year-round water

All residents are established farmers;

spend 10 months/year

Women don't spend time

to fetch water

The village gives priority

to water in its 5-year-plan

www.downtoearth.org.in

CSE

#MGNREGA: India's Jal Jodhas

WORLD WATER DAY 2021

VASNA

Sabarkantha dist., Gujarat

"Migration has reduced by 40%"

2006
Started with small dams/ponds

2021
Has extensive irrigation system using water from these dams

Was completely
rain-dependent

The new ponds/tanks
ensure surface water for 10 months

Farming is back
as the main occupation; annual family saving up to Rs. 2 lakh

www.downtoearth.org.in

CSE

#MGNREGA: India's Jal Jodhas

WORLD WATER DAY 2021

What these villages teach us

More than drought relief; relief against drought

Water conservation is the key to economic growth

It is possible to regenerate the land; it needs minimal investment

---

But it needs community involvement; people must be part of this effort

---

In these villages, employment is important, but what drives change is the investment in ecological asset

www.downtoearth.org.in

CSE

#MGNREGA: India's Jal Jodhas

WORLD WATER DAY 2021

Water secures economic opportunity

Every tank/pond is an economic opportunity

Every village has shown how migration has been reduced; how wealth and wellbeing have been secured

---

This is the opportunity; the promise of water conservation

www.downtoearth.org.in

Same for water; same for waste

- **If technology cost is unaffordable for many it cannot be sustainable**

- Water is crucial determinant of health in our country
- But availability of clean water is connected to our ability to treat human and industrial waste
- Today we are failing in this, in spite of all government programmes; interventions and technologies
- **Failing because we do not recognize our reality**

‘Shit’ Flow Diagrams

- Helped to map the flow to excreta in our cities and to understand policy/practice implications

- Determine systems in terms of on-site; off-site
- Determine if excreta is collected and how
- Determine if excreta is transported and how
- Determine if excreta is safely disposed off

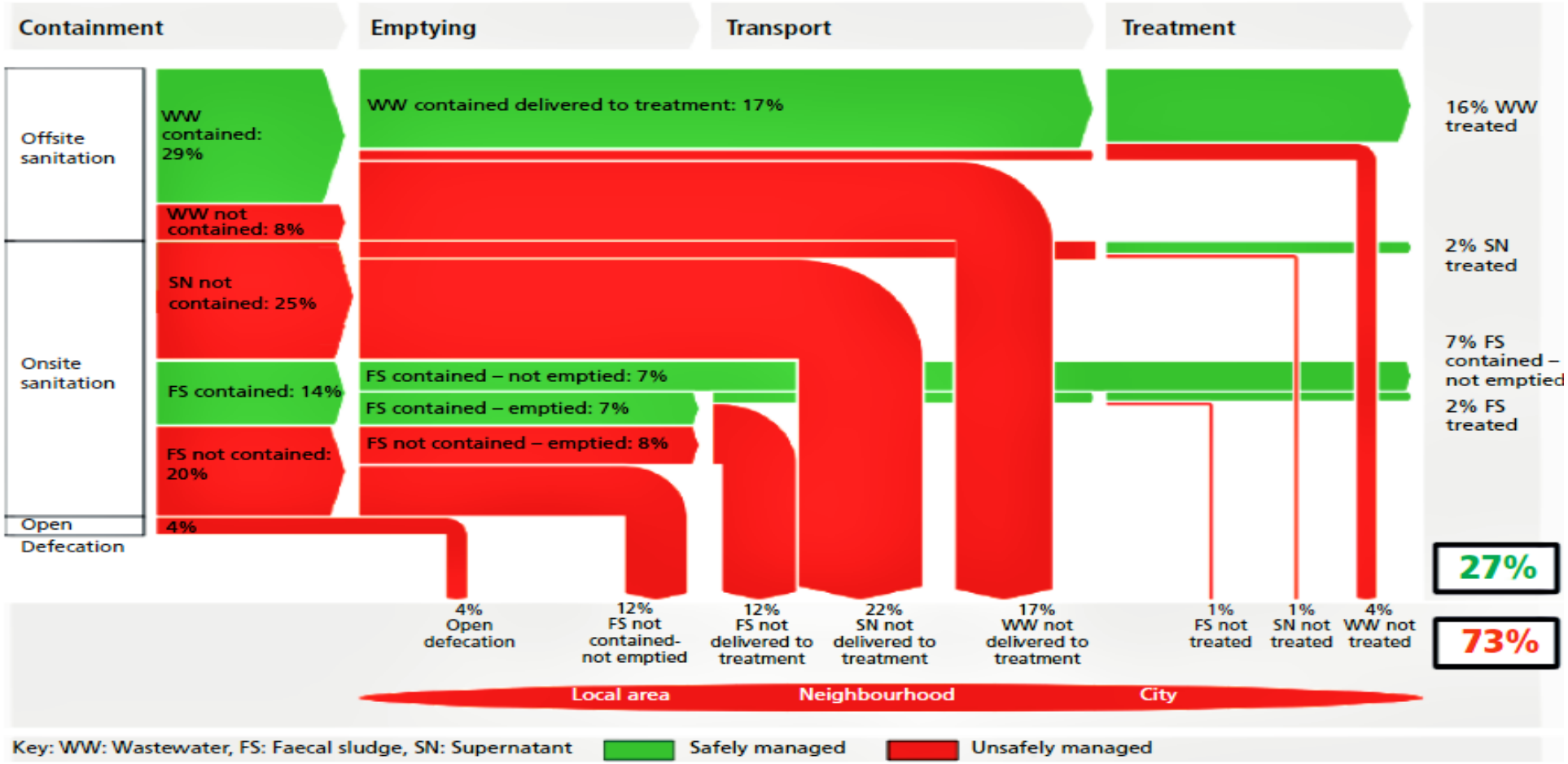
We found: need to build on reality

- We found most in our cities (over 100 SFD's done) are **not** connected to sewage system
- They have 'on-site' treatment
- Toilets are connected to soak pits or connected to drains or septic tanks with no underground lining
- Excreta is then transported from 'tanks' to drains which make way to river; or river
- Reality is an opportunity for **new paradigm**

Uttar Pradesh (Urban), India

SFD Level: 2 - Intermediate SFD

Date prepared: 23 December 2018
Prepared by: CSE



Key: WW: Wastewater, FS: Faecal sludge, SN: Supernatant Safely managed Unsafely managed

Note: This SFD is done based on study of 66 towns and cities, representing 60% of urban population in UP

Reality is our opportunity

- Majority of households are connected to on-site systems (quality indifferent)
- These systems are cost-effective
- Governments do not have to build underground sewerage
- People are managers
- If septic tank is overflowing then people will have backflow – will call and get cleaned
- **NIMBY**
- **Already exist – do not have to re-engineer entire cities for sewerage networks**

Reality: Landline or mobile?

- 20 years ago, India was building landlines to connect people with phones
- Today, we go through satellites – mobile phones
- 10 years ago, world was building energy grids to connect people with electricity
- Today, people are installing solar systems on rooftops
- If we can **jump-skip-leapfrog** the landline-grid route in connectivity in telephones and energy access then **why not in sanitation**?

Re-use and re-invent for land

- **Todays' sewage system is water-based – water for flush and water to convey sewage and then after treatment disposal into water**
- This destroys the nitrogen-cycle of world
- Nutrients lost
- Food security lost
- Water polluted
- **Land-based** sewage systems can repair this

Land-based sewage:
circular economy

- Nutrients-Food-Excreta-Nutrients-Food
- Excreta can be used as nutrients for soil – reused in agriculture or compost
- If we design to remove pathogens and deliberately design for re-use
- Option to combine compost; make pellets for energy…
- Need to scale up; otherwise we will collect, even treat; but have vast amounts of sludge to handle

Water managers will be key to change

- **Needs all our ability to push the solutions; be bold; imaginative and at all times, to find answers that work for all**

- **Crisis is clear; now action has to be determined and impactful**

- **Water managers must make us water secure; water is most replenishable resource; it does not have to be wanted or wasted**