Water Pollution Sources

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Water Pollution: Sources

Point Sources
(Specific locations, Can be traced)

Non-point Sources
(Storm water runoff, Can not be traced)

Water Pollution Sources and Causes			
Municipal	**Industrial**	**Agricultural**	**Sea water intrusion**
Sewer leakage	Liquid waste	Irrigation return flow	Seawater is the pollutant in the coastal aquifers due to over-exploitation of coastal aquifers
Liquid waste	Tanks and pipe-line leakage	Animal waste	
Solid waste	Mining activities	Fertilizers and Soil amendments	
Septic tanks and cess pools	Oil-field brines	Pesticides	
Roadway-deicing	Stock piles		

Sources and Causes of Water Pollution

Domestic waste

Sewage system

Solid waste

Industrial waste

Acid Rain & Acid Mine Drainage

Oil industry: Oil spills

Aquatic plants

Religious means

Prawn Hatcheries:

Types of Water Pollution

(Pollutants found in Storm Runoff)

Chemical Indicators

- Sediment
- Toxic Substances
  - Hazardous chemicals
  - Heavy metals
  - Radioactive materials
- Oil Spill Pollution
- Petroleum Hydrocarbons
- Thermal Pollution
- Plastics
- Salts or Dissolved Solids

Biological Indicators:

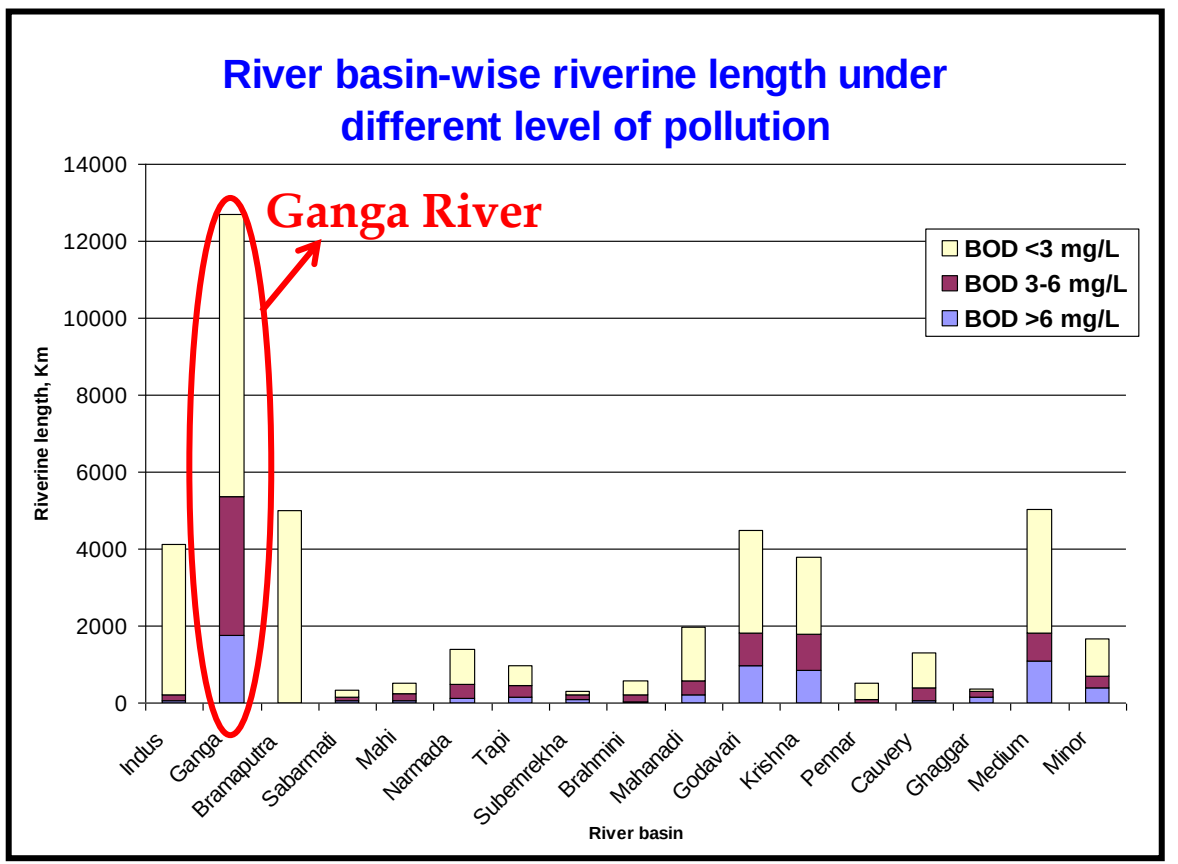
- Biochemical Oxygen Demand (BOD)
- Chemical Oxygen Demand (COD)
- Dissolved Oxygen (DO)
- Nutrients
- Bacteria/ Pathogens

- **Industrial pollution:** Each year, the world generates perhaps **5-10 billion tones of industrial waste,** much of which is **pumped untreated** into rivers, oceans and other waterways.
- **Atmospheric pollution:** Chemicals released by smokestacks (*chimneys*) can enter the atmosphere and then fall back to earth as rain causing water pollution.
- **The biological (organic) pollution level still gets diluted in the river, but the chemical pollution by industries destroys river's self cleaning properties.**

Water Pollution: Pollutants Contribution

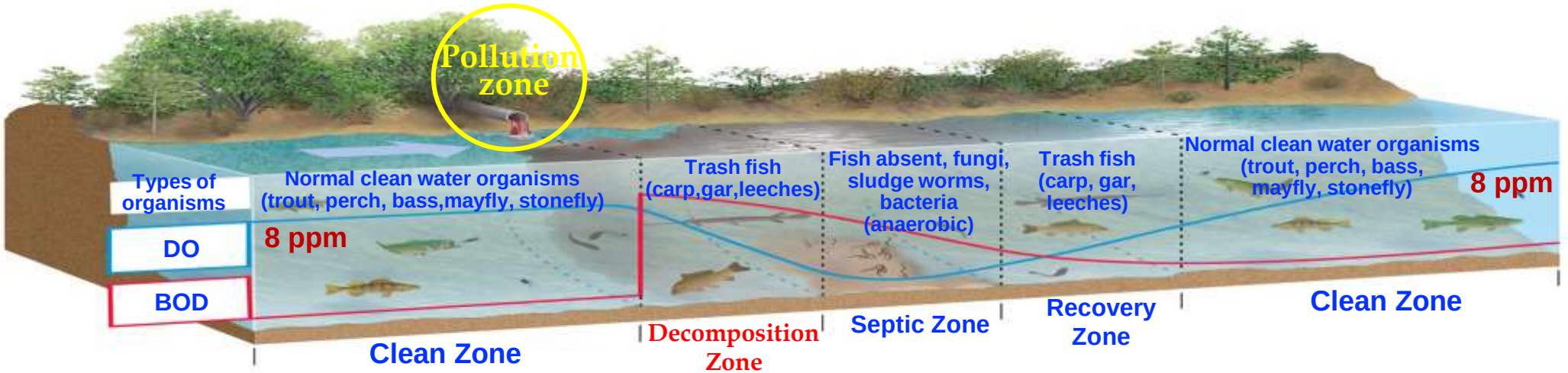
Pollutants contribution to River & Lakes

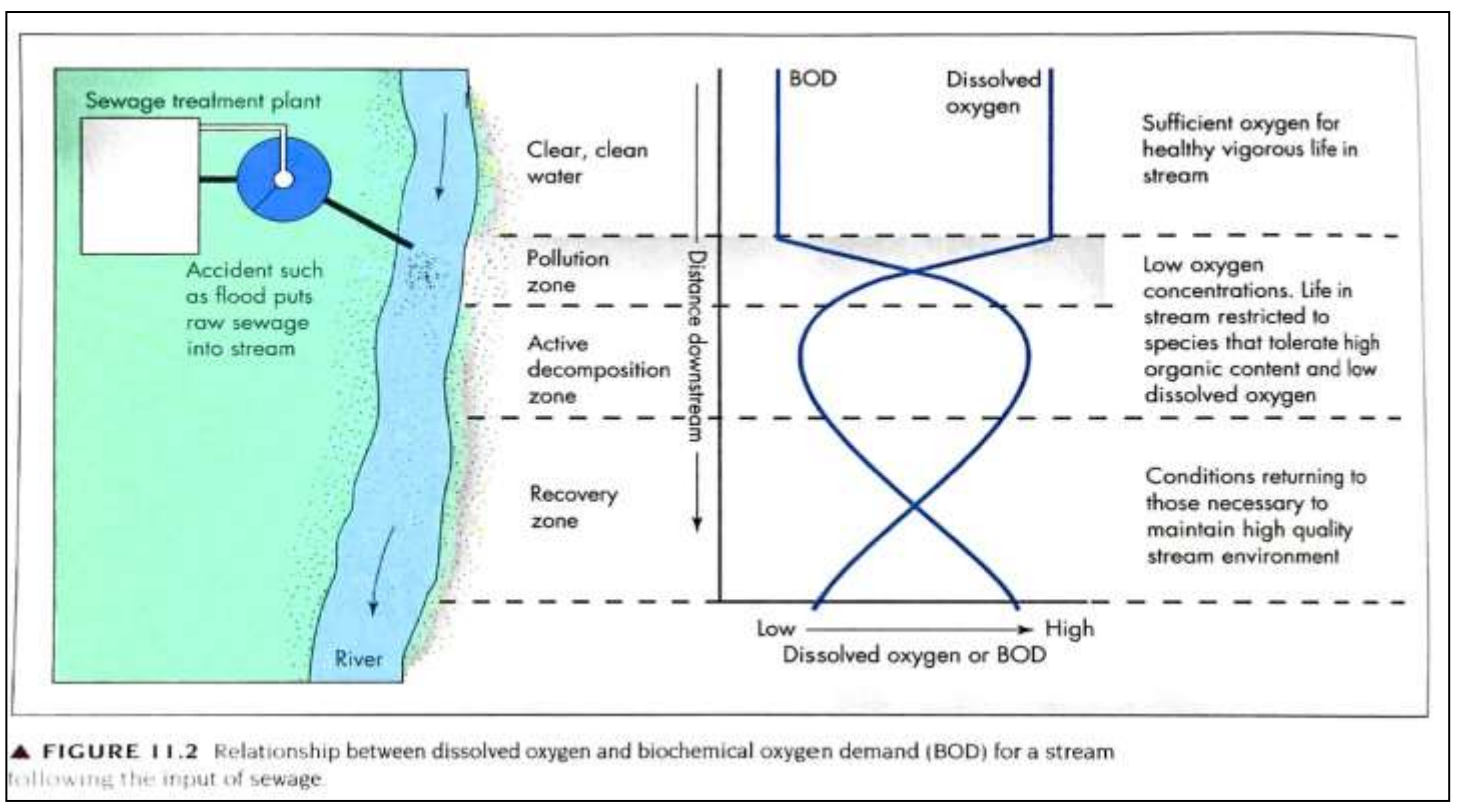
River & Streams			Lakes & Reservoirs	
Pollutant	*%*		*Pollutant*	*%*
Pathogens (bacteria)	**35**		**Nutrients**	**50**
Siltation	**31**		**Metals**	**42**
Habitat alterations	22		**Siltation**	21
Oxygen-depleting substances	21		TDS or Salts	19
Nutrients	20		Oxygen depleting substances	15
Thermal modifications	17		Excess algal growth	12
Metals	15		Pesticides	8
Flow alterations	9			



Biochemical Oxygen Demand (BOD) Variations in Indian Rivers

Pollution in Streams : Biological Indicators

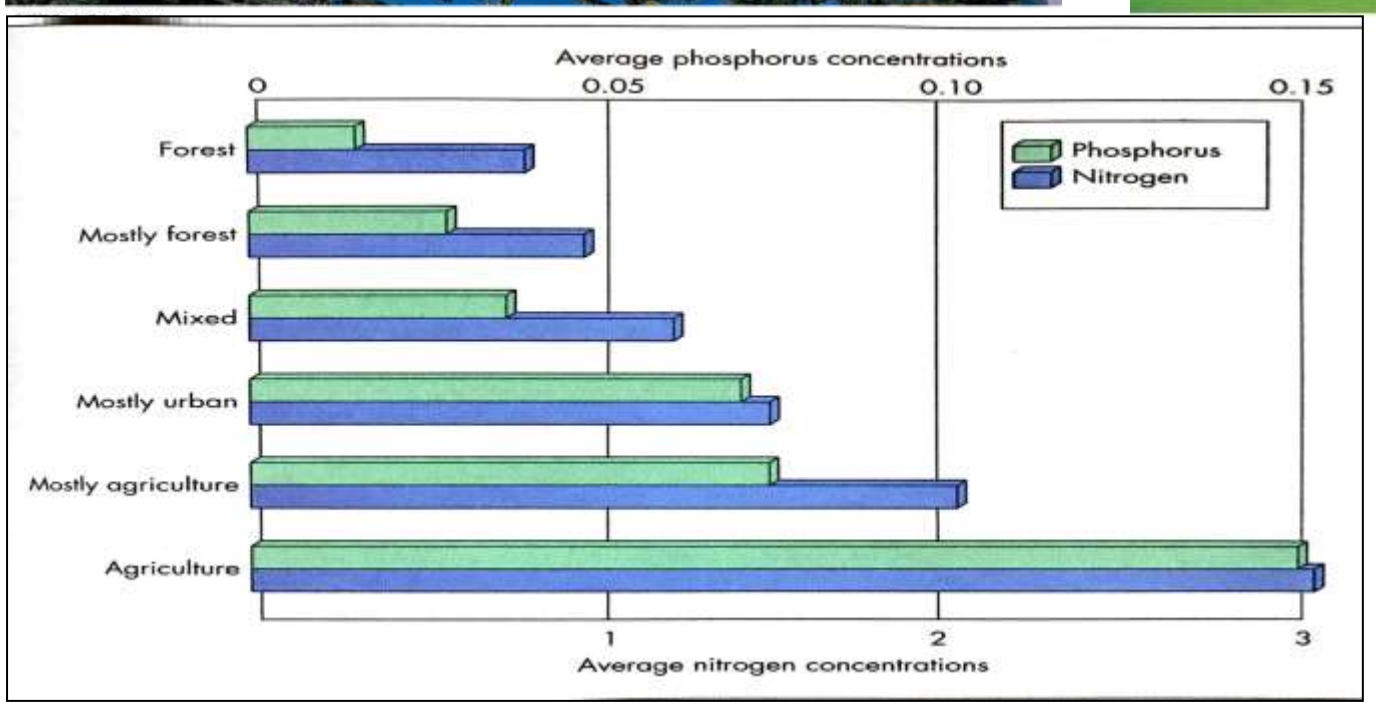




▲ FIGURE 11.2 Relationship between dissolved oxygen and biochemical oxygen demand (BOD) for a stream following the input of sewage

Relationship between BOD and DO for a stream following the input of sewage

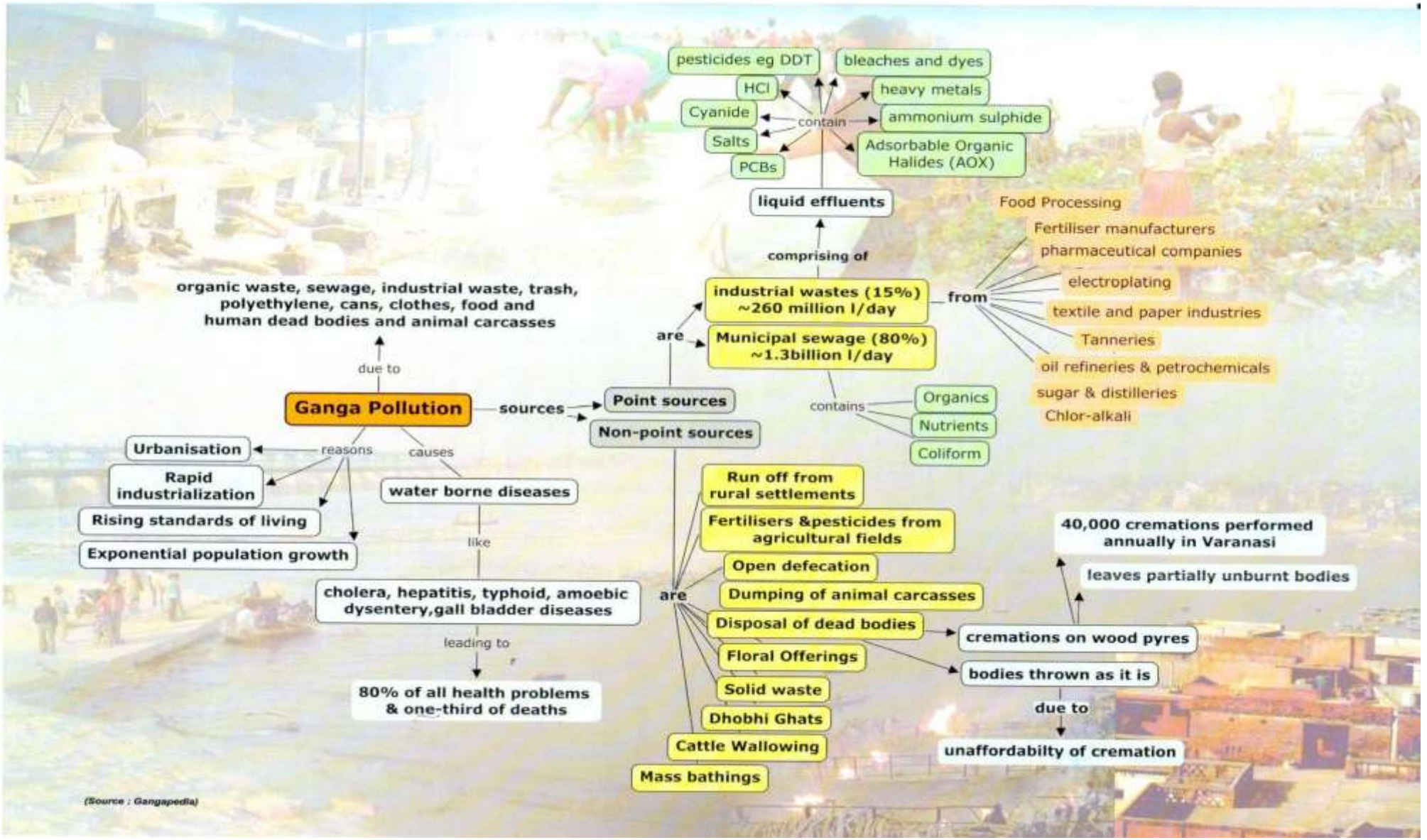
Oligotrophic and Eutrophic Lakes: Nutrient Pollution



Nutrients (N, P) pollution loads by different sources

- Eutrophication
- Cultural Eutrophication

Example: Pollution threat in Ganga River



In the Ganga basin approximately 12,000 million litres per day (mld) sewage is generated, for which presently there is a treatment capacity of only around 4,000 mld. *(80% domestic sewage and 20% industrial effluents)*

Example: COVID-19 Lockdown: *A ventilator for rivers*

Biological indicators during Lockdown (March 28, 2020) in the Ganga River

MONITORING STATION	PARAMETER	VALUES
UPSTREAM OF **GANGA** BARRAGE	**DO**	**8mg/litre**
	BOD	**2.1mg/litre**
	pH	7.90
	Ammonia	0.49mg/litre
DOWNSTREAM OF **GANGA** BARRAGE	**DO**	**7.9mg/litre**
	BOD	**1.2mg/litre**
	pH	7.91
	Ammonia	1.1mg/litre
SHUKLAGANJ	**DO**	**8.5mg/litre**
	BOD	**2.1mg/litre**
	pH	7.68
	Ammonia	0.79mg/litre

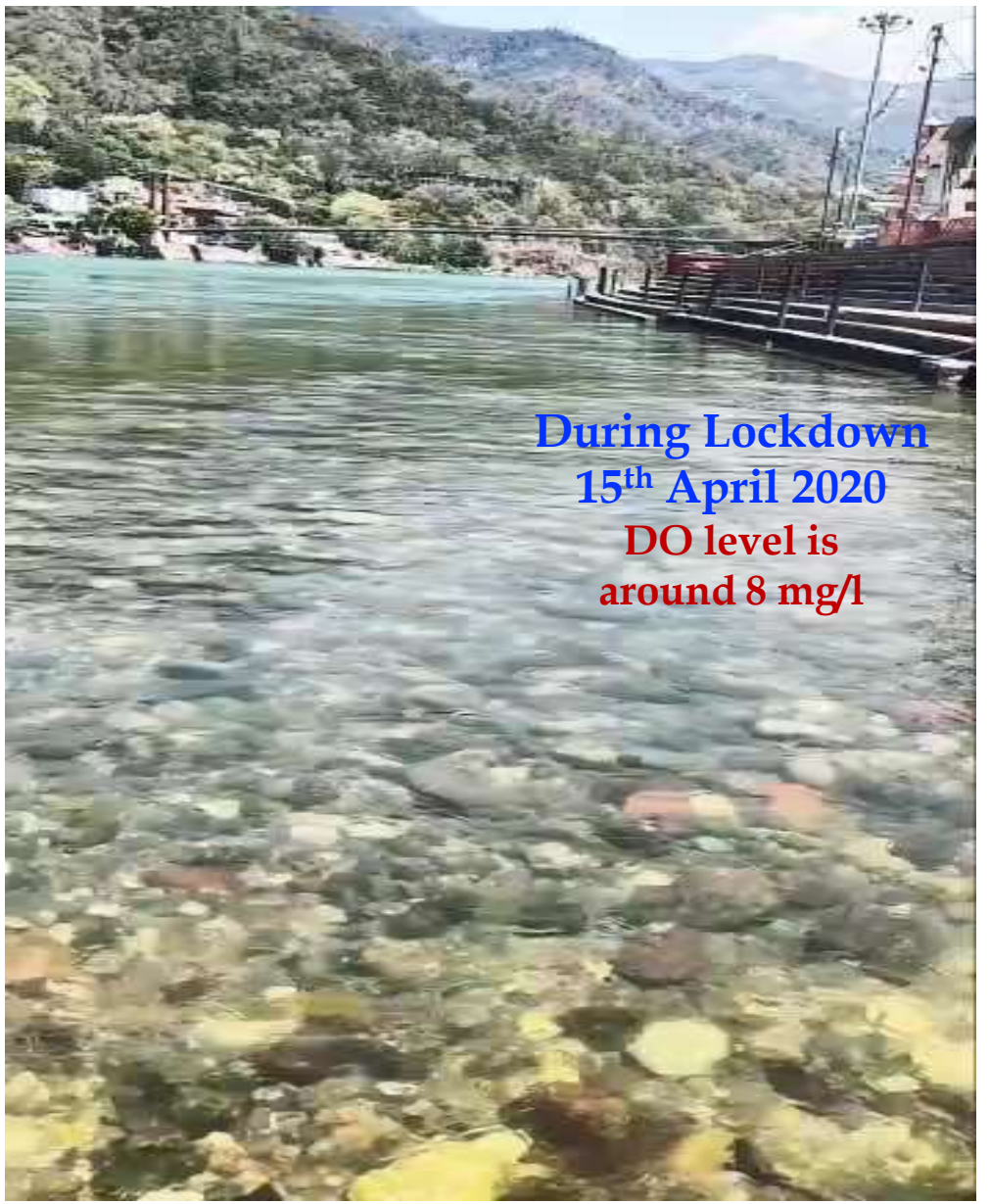
Source: CPCB data on March 28, 2020

Covid-19 is gift to Ganga:

- Under **Namami Clean Ganga Project (2014),** the GOI has invested thousands of cores of rupees to clean Ganga River and its tributaries, but failed to achieve the goal.
- **During lockdown,** Ganga water at Haridwar was reported **fit for drinking**, a unprecedented success *due to decrease in sewage and industrial effluents and dip in the number of visitors at ghats in Haridwar.*
- ***When compared to ambitious Clean Ganga River project*, the lockdown has certainly improved the health of River Ganga in the upstream, since all factories are closed due to the lockdown.**
- In 27 monitoring units, Ganga river water found suitable for bathing and propagation of wildlife and fisheries in the lockdown period.

Example: Ganga River Water Quality in the Haridwar City

(Before and During Lockdown)



- During lockdown, the water quality of river Ganga at Haridwar is '**fit of drinking**'.
- The remarkable level of river water purity is due to the **absence of any industrial pollutants and domestic garbage and also 'melting of snow'.**

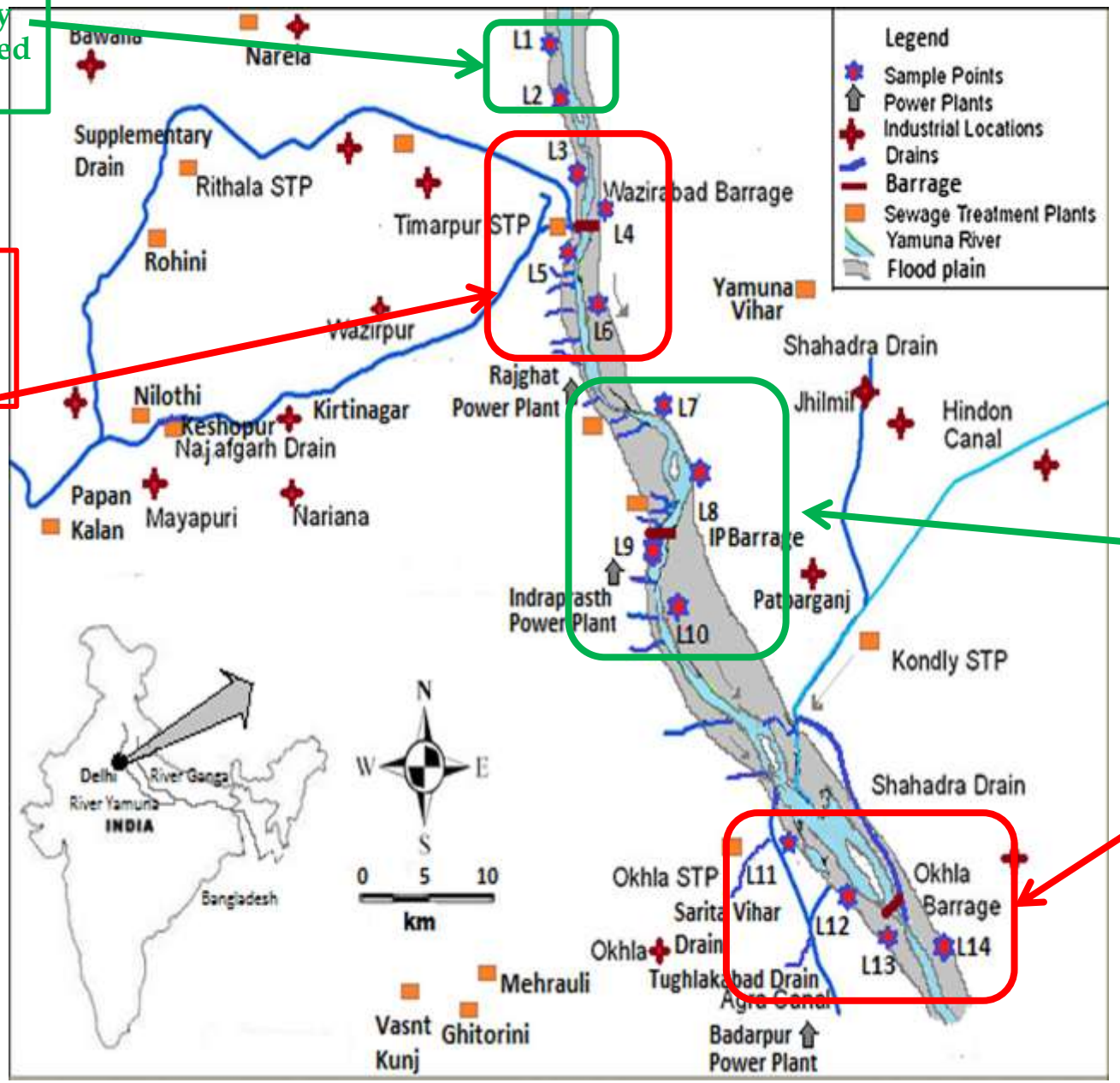
Example: Pollution Sources along Yamuna River in Delhi

- Rural agricultural activity
- Relatively unpolluted region

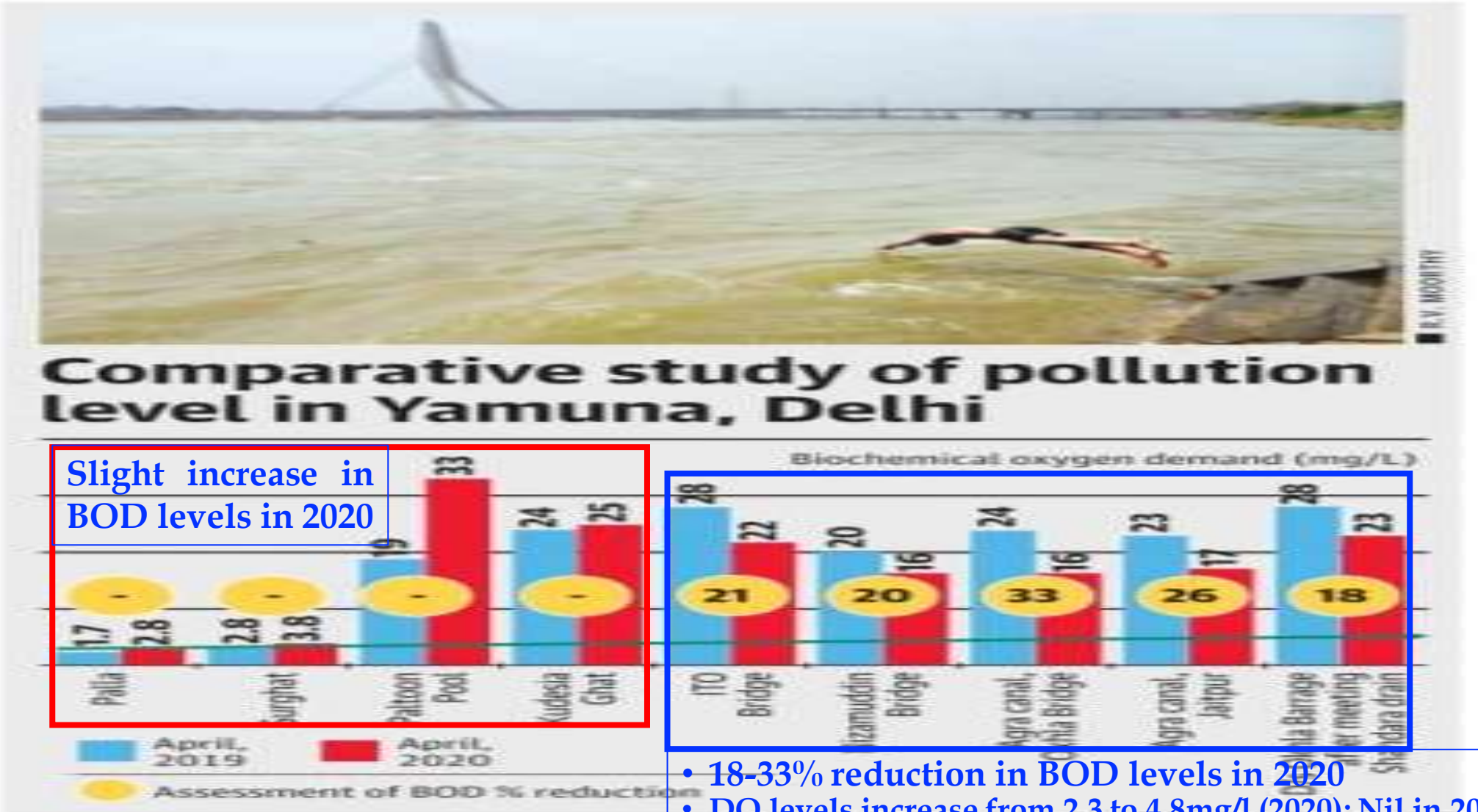
- Urban industrial effluents
- Sewage discharge from major drains (Najafgarh)

- Urban agricultural and sewage drains
- Ash pond effluents from Power plants

- Urban industrial effluents & Agricultural runoff
- Effluents from Sewage Treatment Plants (STPs)
- Hindan canal wastewater



Example: Yamuna River Pollution Levels (Comparison: 2019-2020)



Yamuna river water quality (*6th April, 2020*) has improved during the lockdown, compared to *April 2019,* but still not met the required water quality criteria

Pollution back in Yamuna River

Industries back, to hit water supply

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New Delhi: With industries resuming operations in the upstream areas of the Yamuna, the pollution level has spiked and work at three water treatment plants was hit twice on Thursday and Friday.

A senior Delhi Jal Board (DJB) official overseeing quality control said that in the past two days the ammonia level reached 3.5ppm, while the treatment plants have the capacity to treat raw river water with a maximum limit of 0.9ppm. Toxic froth was also visible at Okhla barrage, indicating that pollution in the river had again started rising.

"The ammonia level is currently around 3ppm in the raw river water. In the last three months, around 2,000-3,000 cusecs of water was being released due to which the pollution load was reduced. But now, the water being released has reduced a lot and industrial pollutants are back in Yamuna," the official said.

Senior DJB officials said that release of industrial waste from Haryana, algae growth and low quantity of water had hit 25% of the processing capacity at Chandrawal and Wazirabad WTPs. Operations were also briefly affected at the Okhla plant.

"As the ammonia level rises, we reduce the operation of the plants in a graded manner. We dilute the raw water and keep operation at 50% to maintain the supply," the official said.

In a statement, DJB said it was trying to rationalise supply, so water would be available at low pressure till the situation improved. "The affected areas include parts of west Delhi, north Delhi, central Delhi, south Delhi, Delhi Cantonment and New Delhi Municipal Council areas. The public is advised to make judicious use of water," it added.

By Friday evening, the operations at Chandrawal and Wazirabad were normalised. However, due to less treatment the entire day, supply in the evening from associated underground reservoirs was affected. Officials said the problem could return in the coming days till flooding started in the Yamuna.

Industrial pollutants and spike in the ammonia level have become a recurring phenomenon with neighbouring states regularly indulging in blame game. High ammonia levels first impact Wazirabad, Chandrawal and Okhla plants, which draw water directly from the river.

ANI

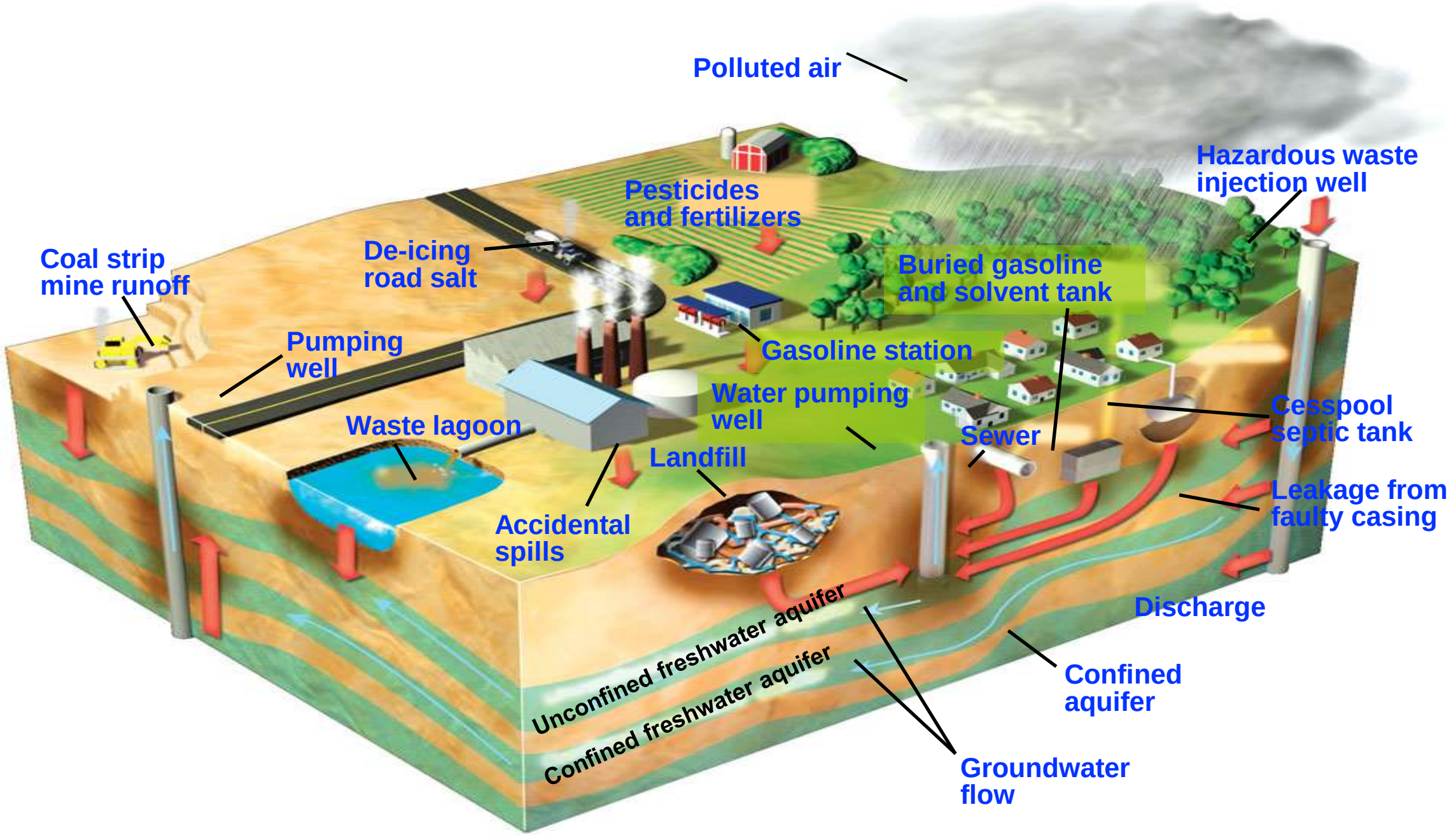
DIRTY PICTURE **Friday, 24.07.2020**

Yamuna River water quality variations:

6th April 2020: Water quality has improved during the lockdown

24th July 2020: Pollution level increased due to resuming industrial operations

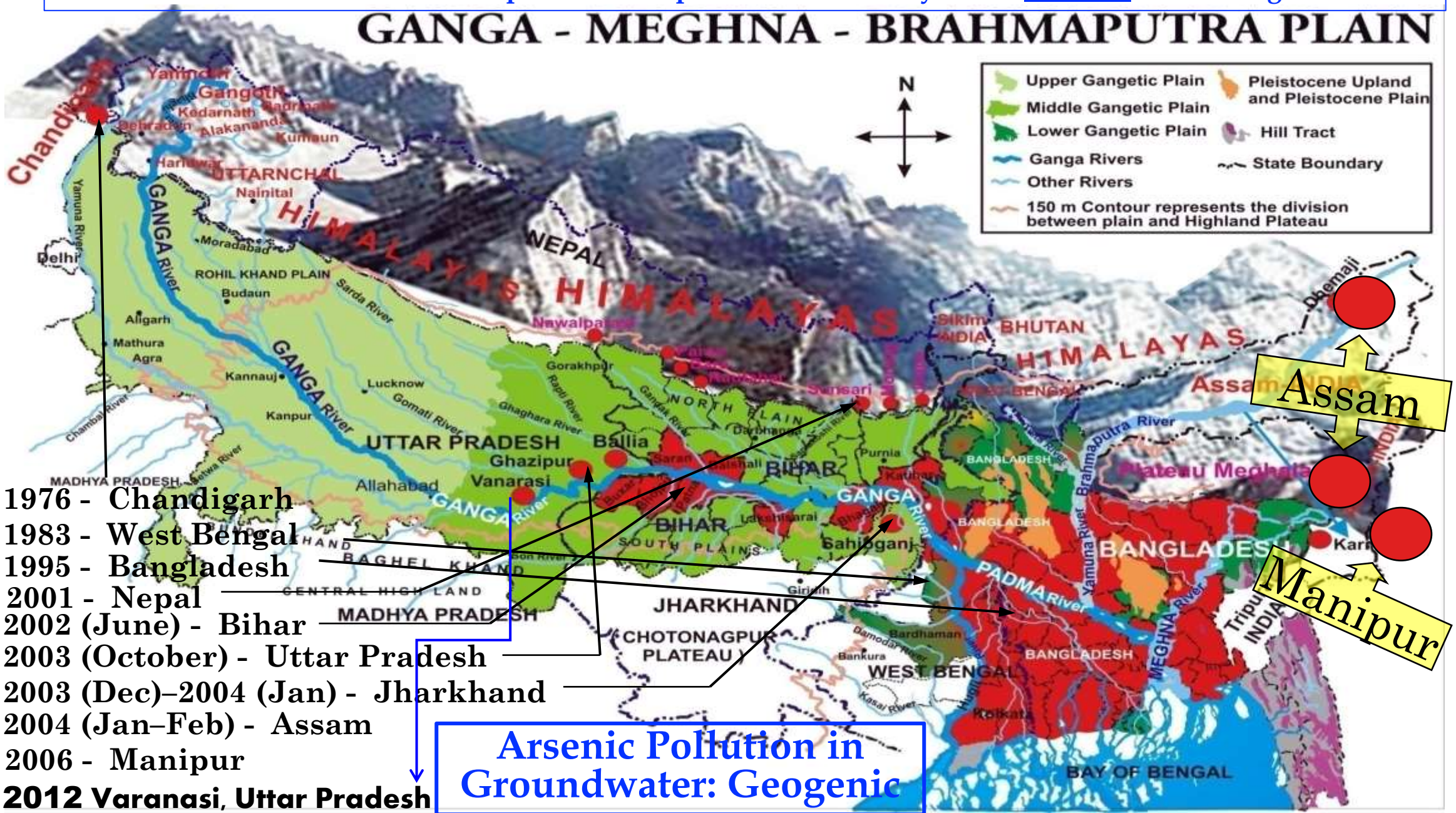
Groundwater Pollution: Human activities



Ganga-Meghna-Brahmaputra Plan

Area = 569749 sq km; Population = > 500 Million

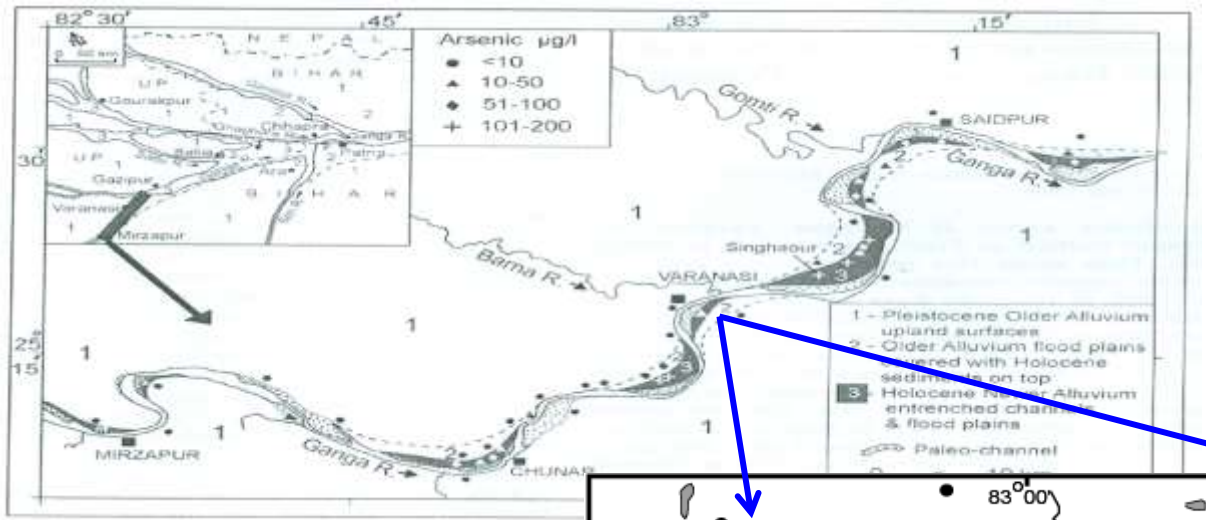
India has well established two acute public health problems induced by excess As and F content in groundwater



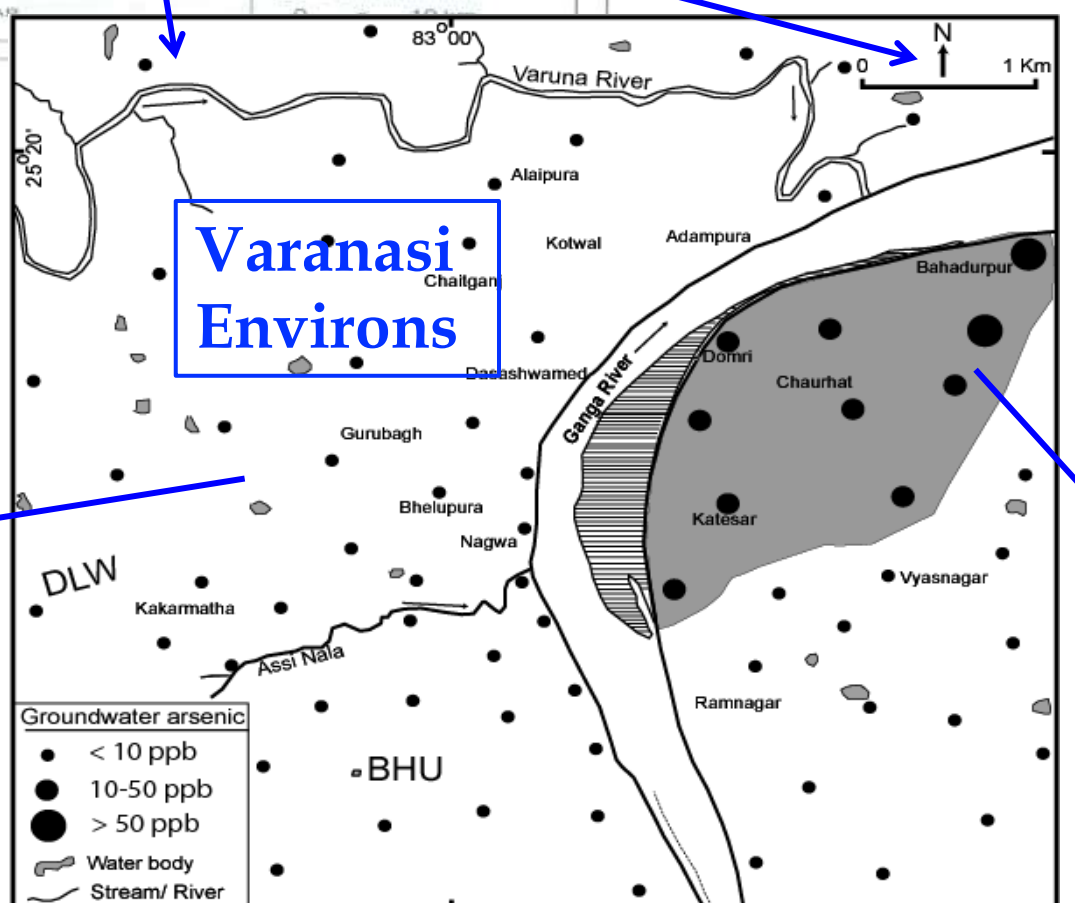
1976 - Chandigarh
1983 - West Bengal
1995 - Bangladesh
2001 - Nepal
2002 (June) - Bihar
2003 (October) - Uttar Pradesh
2003 (Dec)–2004 (Jan) - Jharkhand
2004 (Jan–Feb) - Assam
2006 - Manipur
2012 Varanasi, Uttar Pradesh

Arsenic Pollution in Groundwater: Geogenic

Arsenic Contamination in IGP: Geogenic Sources



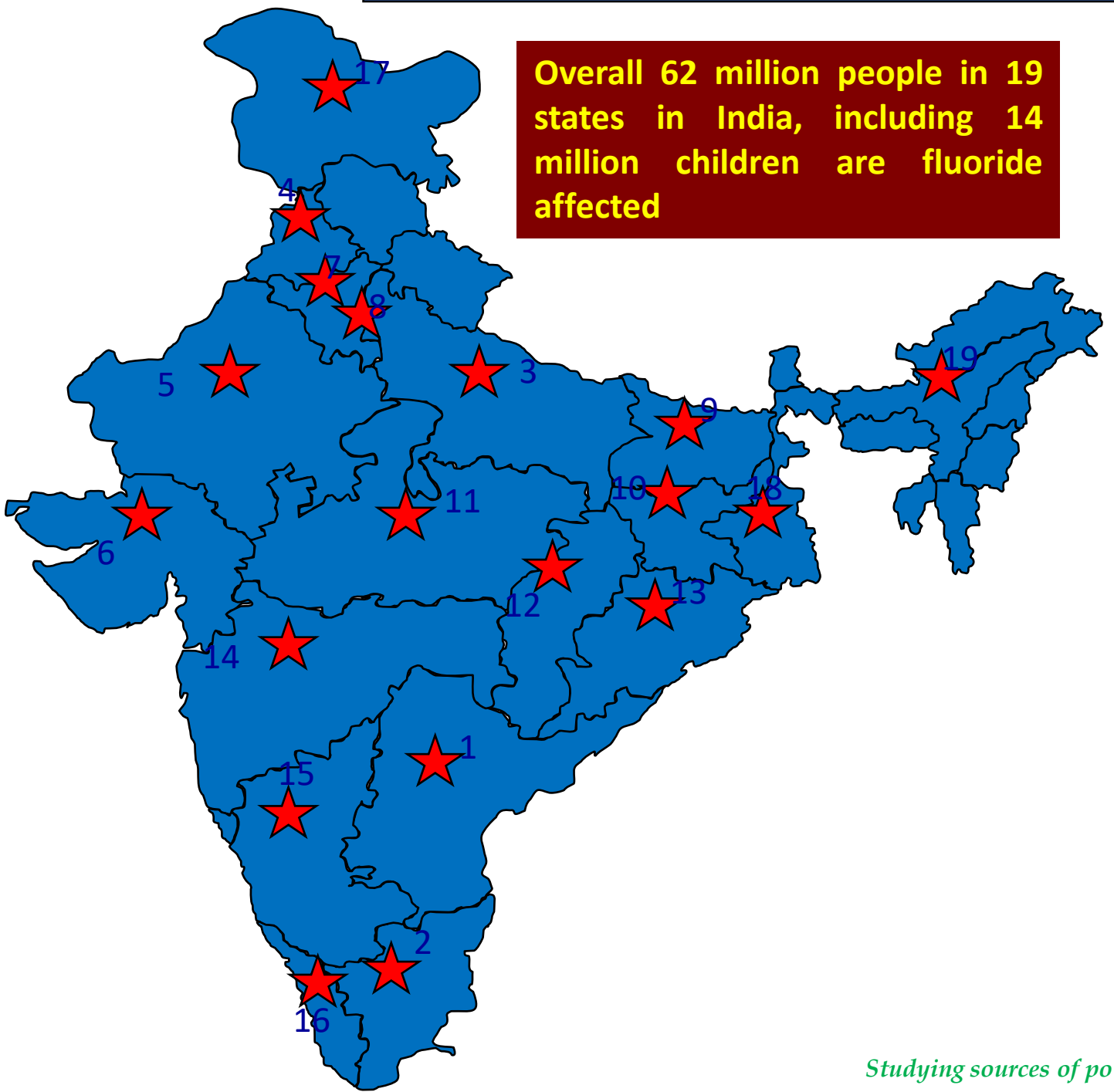
Geomorphology Control:
River meandering responsible for the localized depositions of **As rich sediments** in the Indo-Gangetic plains (IGP) **derived from Himalayas.**



The pleistocene older alluvium aquifers are arsenic safe, due to **lack of reducing conditions (i.e organic matter)** for releasing As into the groundwater

Arsenic in the Holocene newer sandy aquifers may be **due to the reductive dissolution of Fe-oxy-hydroxide** present as coatings on clay and sand grains.

Groundwater fluoride condition in India: Geogenic Sources

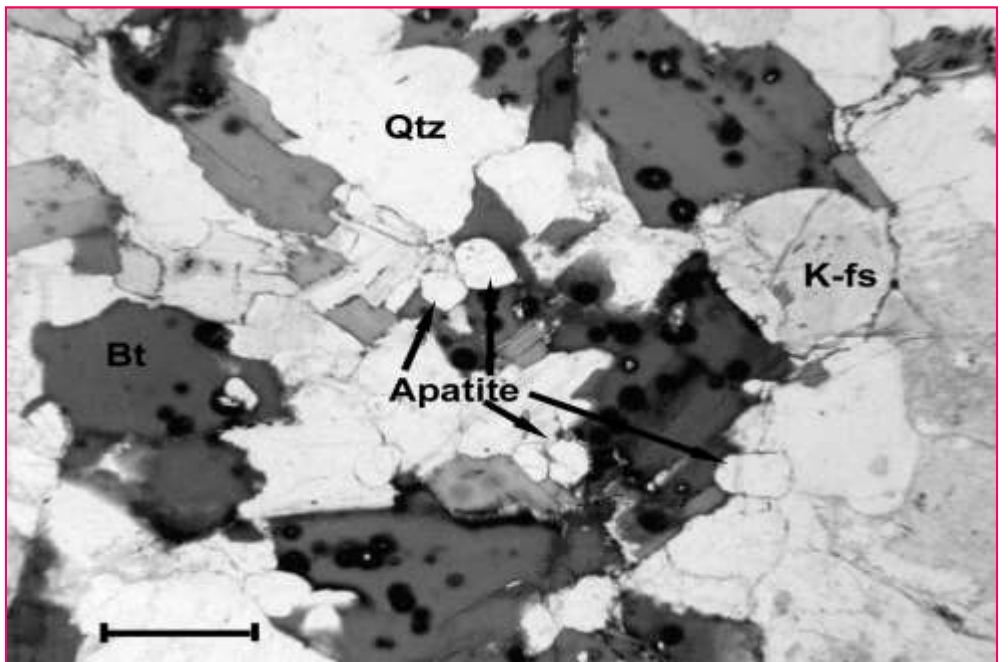


Overall 62 million people in 19 states in India, including 14 million children are fluoride affected

1. Andhra Pradesh	1937
2. Tamilnadu 3. Uttar Pradesh 4. Punjab	1950
5. Rajasthan 6. Gujrat 7. Haryana 8. Delhi 9. Bihar 10. Jharkhand 11. Madhya Pradesh 12. Chattrishgarh 13. Orissa 14. Maharastra 15. Karnataka	1986
16. Kerala 17. Jammu & Kashmir	1992
18. West Bengal	1997
19. Assam	1999

Sources of Fluoride in Groundwater

S.No.	Mineral name & Chemical formula	Association with Rocks
1	Fluorite CaF_2	Vein mineral in pegmatite and also pneumatolytic deposits
2	Fluorapatite $3Ca_5(PO_4)_3\ (OH,F)_2$	Igneous rocks especially pegmatites and metamorphic limestones
3	Cryolite Na_2AlF_6	Pegmatite vein
4	Muscovite $KAl_2(AlSi_3)O_{10}(OH, F)_2$	Micas occur in igneous rocks, pegmatites and many metamorphic rocks
5	Hornblende $NaCa_2(Mg,Fe_2)(AlFe_3)(SiAl)_8O_{22}(OH,F)_2$	Widespread in igneous and metamorphic rocks
6	Topaz $Al_2F_2SiO_4$	In cavities of acidic igneous rocks, quartz veins and gemstone
7	Tourmaline $Na(Mg,Fe_2)Al_6(BO_3)_3(Si_6O_{18})(OH,F)_4$	Pneumatolytic minerals in acid rocks, schists and gneisses



Corona virus is Earth's vaccine

We are the virus, Perhaps, it is true

During the lockdown, domestic sewage would have increased owing to increased water demand to maintain hand-washing hygiene.

There is an urgent need to:

- Reinvestigate the main source of pollution and reorient all river cleaning policies based on lockdown findings.
- Industries strictly adhere to discharge norms accompanied strong regulations and vigilance framework.
- Install sensor based real-time water quality monitoring stations along the river course in more places.
- Maintain minimum ecological flows in the river to ensure water quality.

To augment the river/lake water quality greatly:

- Interceptor sewage project (ISP) to trap sewage into the drains
- Installation of treatment plants
- Effective septage management

THANK YOU