All-Inclusive GS-2 & GS-3 MAINS 2021

Class-12

Climate change

What is Climate change?

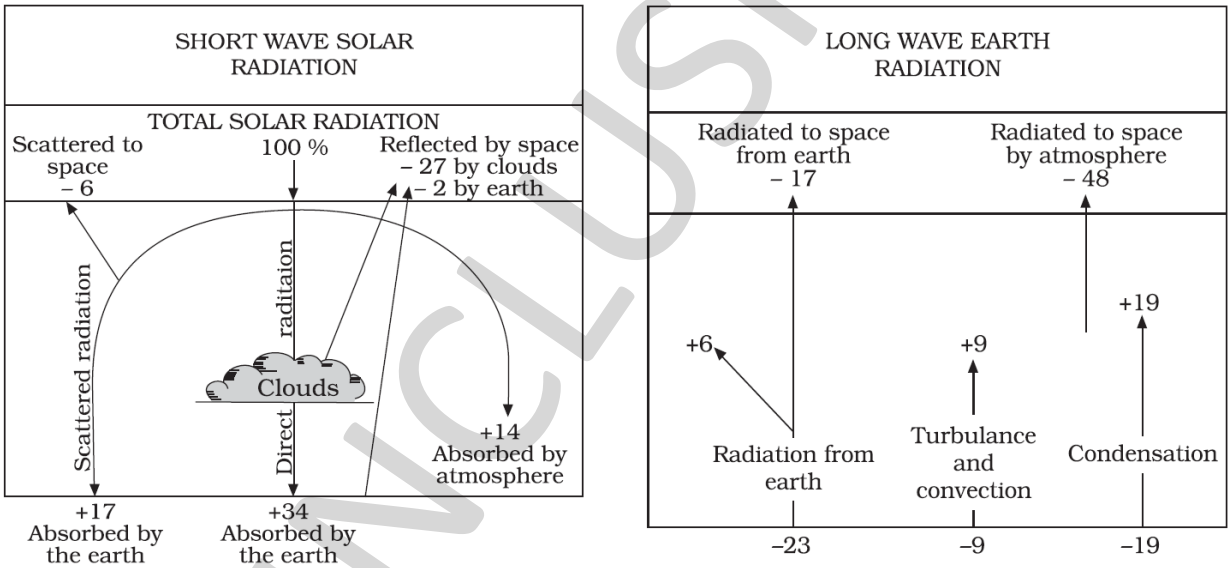
- Change of climate due to human activity that alters composition of global atmosphere. [*UNFCCC definition*]
- The biggest driver of climate change is emission of GHGs like CO_2 and Methane.

Climate change vs Global warming

- GHGs emissions → Global warming → various effects → climate change
- So, global warming is just one (but crucial) aspect of climate change.

Natural vs anthropogenic:

- Natural processes too change the climate, but that is not a cause of concern because:
- (a) spread over thousands of years; (b) not in control of humans.



Heat budget explains why earth neither warms up nor cools down naturally.

Greenhouse effect:

- A natural phenomenon responsible for heating of earth's surface & atmosphere.
- Without it, earth's average temperature will be -18°C instead of present 15°C.

How GHGs cause global warming?

- Earth's surface absorbs short wave radiation and emits long wave radiation.
- GHGs are transparent to short-wave radiation, but absorb long wave radiation emitted by earth's surface.

(Sun is extremely hot, so it emits short wave radiation. Earth is cool, so emits long wave radiation)

Impact of Climate change:

- **Food security:**
  - Change in rainfall pattern; rain & drought
  - Less water in rivers, impact on irrigation
  - Less food production in tropics due to high temperature
  - Less fish production due to ocean acidification and ocean deoxygenation
- **Water crisis:**
  - Change in rainfall pattern, e.g. monsoon
  - Melting of glaciers: initially more water in rivers, later less water
- **Electricity:**
  - More demand for air conditioning
  - Less water in dams, so less electricity
  - Restrictions on coal burning
- **Health:**
  - Intense heat waves
  - Vector borne diseases will spread to higher latitudes
- **Conflict/war:**
  - Due to migration of people
  - Inter-state / Inter-country river water disputes
- **Social:**
  - Competition over shrinking resources
  - Distress migration from rural to urban areas; from coastal areas due to sea level rise; from disaster struck areas to cities.
- **Economic:**
  - Loss to life and property due to frequent disasters
  - Money spent on eco-friendly measures [electric cars!]
  - Use of expensive energy sources
- **Environmental:**
  - Loss of biodiversity; can't adapt so fast to high temperatures
  - Melting of glaciers (500 Swiss glaciers have disappeared since 1850)
  - Salt-water intrusion in coastal areas
  - Damage to coral reefs (ocean acidification)
- **Disasters:**
  - More frequent & severe Cyclones due to higher sea surface temperature
  - Frequent droughts and floods due to change in rainfall pattern
- **Examples:**
  - Kerala floods August 2018
  - Australia bushfires 2019-2020
  - Russia Arctic oil spill due to melting of permafrost in May 2020
  - Antarctica heat wave March 2020
  - 50 lakh people were displaced in India in 2019 due to disasters and extreme weather conditions. ['State of India's Environment 2020 by Centre for Science and Environment]

Biotech

Use of living processes, to make technology products, to improve human life.

Biotech in India:

- DBT: Department of Bio-Technology established in 1986
- BIRAC: set up by DBT; Biotech Industry Research Assistance Council
- India has 3% share in global biotech industry
- Mainly in five major sectors:
  a) Bio-pharma (55%) : vaccines; medicines
  b) Bio-services : clinical research; R&D
  c) Bio-agri : GM crops; bio-fortification
  d) Bio-industrial : use of microbes in paper, pulp, textiles, etc.
  e) Bio-informatics : using advanced computing to study biotech

How can biotech solve India's problems?

- Food security:
  - GM crops: high yield; more tolerant to stress (water, pests, etc.)
  - Nutrition: Enhance food nutrition by bio-fortification, e.g. Golden rice enriched with Vitamin-A
- Animal husbandry:
  - control diseases; improve milk productivity; improve breed
- Energy security:
  - use of biofuels as additive/substitute of fossil fuels
- Waste management:
  - Bioremediation to manage solid municipal waste
  - Plastic eating bacteria used to create enzyme to make it six times faster
- Environment:
  - convert farm stubble to ethanol;
  - Control oil spills, e.g. oilzapper
- Health:
  - Treatment for genetic disease; use of stem cell therapy
  - Use of genetically modified mosquito to reduce mosquito population.
  - Develop vaccines for malaria, dengue, HIV, etc.
  - Find treatment for new diseases like covid

Challenges:

- Low spend on R&D:
  - India spends 0.67% of GDP on R&D; China 2%; USA 3%
  - Funding gets exhausted before commercialisation
- IPR laws discourages research:
  - Section 3(d) of Patents Act 2005 makes getting patent difficult
  - Compulsory licensing that gives govt. the power to suspend a patent under certain circumstances.
- Talent:
  - Lack of quality jobs in biotech sector. This makes students less interested.

All-Inclusive GS-2 & GS-3 MAINS 2021

Class-15

Virtual Water Trade

"Third world war will be fought for water"

What is virtual water?

It is the water used to produce a product.
e.g. one kg rice needs 3,000 liters of water to grow; cotton 8,000 liters

What is Virtual Water Trade?

Trade of virtual water in the form of water-intensive products.
The concept was introduced by Tony Allan in 1993.

Virtual Water Trade and India:

❑ International:

- India is a net virtual water exporter, because of export of agricultural commodities.
- India exported 26 billion liters of VW every year between 2006-2016

❑ Inter-state:

- Punjab and Haryana are water stressed.
- Still, water-intensive crops like rice are grown there.
- These crops are sent to North-East India.
- But, NE states have better agro-climatic conditions to grow rice.

Benefits of framing a virtual water trade policy?

a) Awareness about water footprint will increase.
b) India can save precious fresh water for drinking purpose.
c) Reduce pressure on scarce water resources in water stressed areas.
d) Reduce the need for river inter-linking (expensive financially and environmentally)

Challenges:

a) Estimating quantity of virtual water is difficult.
b) Estimating movement of water-intensive products.
c) Convincing farmers to change cropping pattern permanently.

Way forward:

- Create awareness about water footprint.
- Review the MSP and FRP regime which encourages water-intensive rice and sugarcane production.
- Improve farming methods: micro-irrigation; mulching; direct seeding of rice.
  - ✓ To grow 1 kg rice, India needs 3,000 liter water; USA only 1,200 liters.
  - ✓ To grow 1 kg cotton, India needs 8,000 liters water; China only 1,500 liters.
- Discourage export of water-intensive crops:
  - ✓ Israel discourages export of water intensive crops like oranges. Israel has net virtual water import.
- Encourage import of water-intensive crops:
  - ✓ China is conserving water by importing water intensive crops like Soya.
- Overseas contract farming to import water intensive crops:
  - ✓ 1,300 Chinese companies have overseas investment in Agriculture. Five-fold increase between 2010-2016 [source: US Dept. of Agriculture report 2018]

Groundwater extraction

Why is groundwater the most popular source of water in India?

80% of rural and 50% of urban water needs are met by groundwater. Reason:

- **Available**: almost everywhere, irrespective of area's development
- **Accessible**: no discrimination
- **Affordable**: free / cheap
- **Alternative**: piped water not available everywhere
- **Reliable**: no disruptions in supply, 24x7x365

Govt. initiatives:

a) National Water Policy 2012
b) National Aquifer Mapping
c) Atal Bhujal Yojana in 7 states
d) CGWA guidelines 2020

Result: 22% of groundwater has either dried up or is over-exploited.
India extracts 253 bcm of groundwater every year (25% of global).

What is being done to regulate groundwater extraction?

- In 2018, CGWA had issued guidelines to regulate groundwater extraction.
- But there were some problems with the guidelines like:
  - NOC was not denied to industries in over-exploited areas
  - Violations were not subject to hefty penalties
- Hence, in January 2019, NGT struck down the 2018 guidelines.
- In September 2020, CGWA issued fresh guidelines for groundwater extraction:
  - No Objection Certificate:
    - Mandatory NOC for bulk water withdrawal for 2-5 years.
    - In over-exploited areas, NOC will be given only to MSMEs.
    - Penalty of up to Rs 10 lakh for violating NOC conditions.
  - Exemptions: individuals, rural drinking water supply schemes, agriculture, MSME up to 10 cubic m/day, armed forces
  - Charges based on amount of extraction.
  - Residential societies to install sewage treatment plants.
  - Annual water audits for industrial users.
  - States are advised to review electricity subsidies to farmers and encourage crop diversification to reduce dependence on groundwater.

Concerns:

- Exemption to agriculture despite 90% groundwater being used for irrigation.
- Does not address issue of depleting groundwater, just charges the fees.
- No separate focus on mining projects despite their impact being far more serious.
- Water is a state subject. Guidelines may be seen as interference. [EPA 1986 empowers CGWA to issues guidelines to states].

Way forward:

- Rationalize subsidized electricity to farmers. Adopt Punjab's 'Paani bachao Paisa Kamao' Scheme (Farmers get paid to use less groundwater)
- Review the MSP and FRP regime which encourages water-intensive rice and sugarcane production.
- Promote water recycling. Israel recycles 90% of its water; India only 30%.
- Incentivize private sector to use grey and black water generated in urban areas.
- Improve data collection to improve monitoring of groundwater levels.

Groundwater pollution

70% of India's fresh water (ground & surface) is contaminated with heavy metals and chemicals. India ranks 120/122 in global water quality index. [NITI Aayog 2018 report]

Issues:

1) **Pollution: un-sewered sanitation; leaching from landfills; heavy metal pollution**
2) **Salinity (inland): excessive irrigation → water evaporates → salts remain in soil → rain leaches down salts to groundwater.**
3) **Salinity (coastal): sea water intrusion due to fall in water table.**
4) **Over-exploitation: no piped water; cropping pattern**

How polluted water causes health issues?

1) **No purification of groundwater due to poverty / tight budgets**
2) **Bio-magnification in food chain:**
   - **Irrigation → food crops → human consumption**
   - **Irrigation → animal fodder → milk/meat → human consumption**

Why is tackling groundwater pollution such a challenging task?

- **Weak Laws:**
  - **Indian Easement Act, 1882 gives landowners the right to "collect and dispose" water under their land.**
  - **Landowners are not legally liable for any damage caused to water resources due to over-extraction.**
- **Difficulty in monitoring:**
  - **Decentralized nature of groundwater use.**
  - **CGWA and SPCBs lack adequate staff and monitoring stations (unlike air pollution)**
  - **Monitoring stations do not measure all necessary parameters of pollution**
  - **SPCBs monitor as well as enforce quality norms, i.e. conflict of interest.**
- ***Other reasons:***
  - **High cost of treatment discourages industries to treat effluents.**
  - **Lack of sewage treatment plants; old & leaking sewage lines**
  - **River pollution finds its way into groundwater.**

Government efforts:

- **Laws:**
  - **Water (Prevention and Control of Pollution) Act, 1974**
  - **Environment Protection Act, 1986**
- **Projects/Schemes:**
  - **2013: A Master Plan for Artificial Recharge of Groundwater by CGWA**
  - **2016: National Aquifer Mapping and Management Programme (NAQUIM)**
  - **2019: Atal Bhujal Yojana**
- **State specific initiatives:**
  - **West Bengal: Arsenic task force 2005**
  - **Gujarat: Salinity Ingress Prevention Scheme 2008**

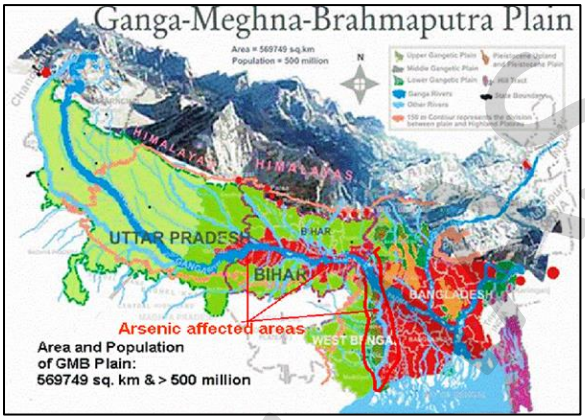
Way forward:

CAG in its Performance Audit of Water Pollution in India (2011-12) suggested:

a) **Establish enforceable water quality standards**
b) **Strict penalties be levied for violations of water quality standards.**
c) **States must control source of pollutants through sewage and agri run-offs entering water bodies.**

Arsenic Pollution

- CGWB released report on Arsenic contamination of groundwater.
- 21 states are affected by it.
- BIS limit: 0.01 milligram/liter
- Worst affected areas: Ganga-Brahmaputra-Meghna river basin



Health problems:

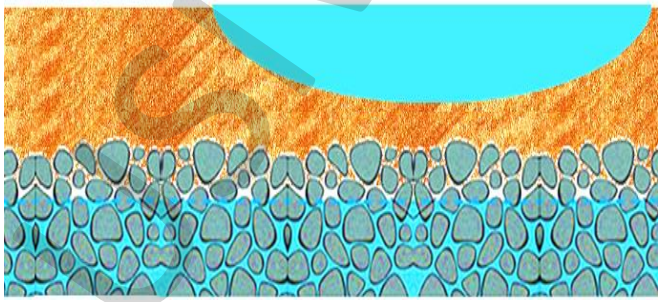
- Cancer; blackfoot disease
- Biomagnification, as it has entered food chain

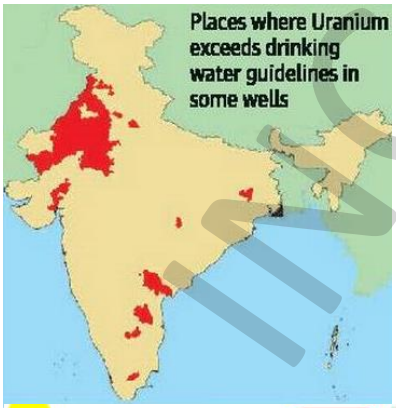
Sources of Arsenic pollution:

- Natural:
  - weathering of rocks → silt brought by rivers → leaching to groundwater
- Anthropogenic:
  - over-exploitation of groundwater; use of chemical fertilizers;
  - forest fires & burning of coal → ash deposition on soil and water bodies → leaching to groundwater

Solution:

a) Prevent fall in groundwater level.
b) Clean coal technologies; fly ash control
c) Treatment technologies like ion-exchange membrane.





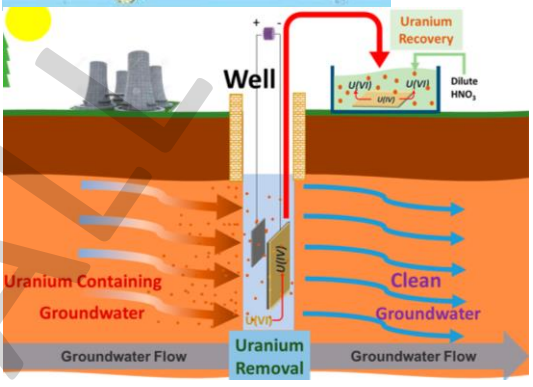
Groundwater contamination by Uranium

- WHO limit 30 microgram/liter
- No BIS standards for uranium.
- Affected: at least 79 districts of 16 states

News:

- 2020 : 10 districts of Bihar
- 2019 : Uranium Corporation of India Ltd mining polluted ground water in Tummalapalle, Andhra Pradesh. *(tailings and raffinates are radioactive wastes)*

Negative health effects? Various



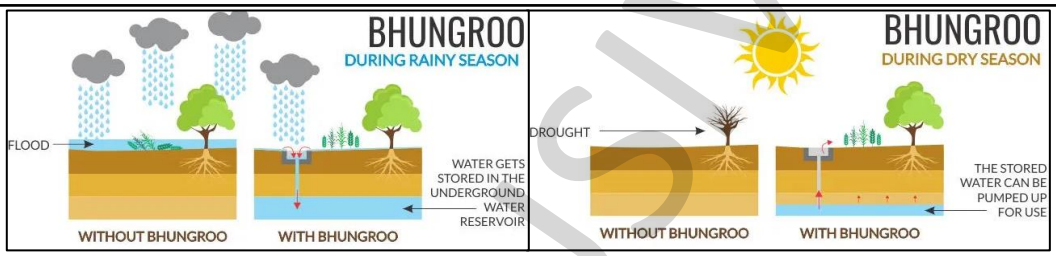
- ✓ Uranium is naturally present in earth's crust.
- ✓ Sediments brought by Himalayan rivers
- ✓ Declining water table provides oxidation condition.
- ✓ Bicarbonate and nitrate pollution enhance solubility.

Technological solutions:

- ✓ redox and flushing technologies

Some common solutions to water various water problems:

- **Reduce water usage**
  - micro-irrigation, mulching, water saving aerator taps, metered water connection (instead of fixed flat rate)
- **Reuse grey water**
  - water from washing machine and showers for gardening, car washing
- **Recycle black water**
  - install water treatment plants in housing societies, industry clusters
- **East Kolkata Wetlands**
  - Use to treat Kolkata's sewage,
  - nutrients contained in the wastewater sustain fish farms and agriculture.
- **Sewage Treatment plants**
  - on drains flowing into rivers (e.g. Namami Gange Programme)
  - Increase number of sewer connections
- **Revive traditional water conservation methods:**
  - Zabo (Nagaland): Rainwater falling on hilltops is collected in ponds.
  - Eri (Tamikl Nadu): tank system for flood control and groundwater recharge
  - Johads (North Indian plains): small rainwater storage wetlands
  - Ahar Pynes (Bihar): floodwater harvesting systems
  - Bawari (Rajasthan): stepwells to store water



Bhungroo system, Gujarat:

- Bhungroo means 'straw' or 'hollow pipe'
- During rain, it captures standing water, thus preventing waterlogging
- The water percolates down to the groundwater.
- During lean season, groundwater is used for irrigation.

Annual per capita water availability (m^3/person/year)	Classification
> 2,500	Ok
2500 – 1700	Water vulnerability
1700 – 1000	Water stress
1000 – 500	Water scarcity
<500	Absolute water scarcity

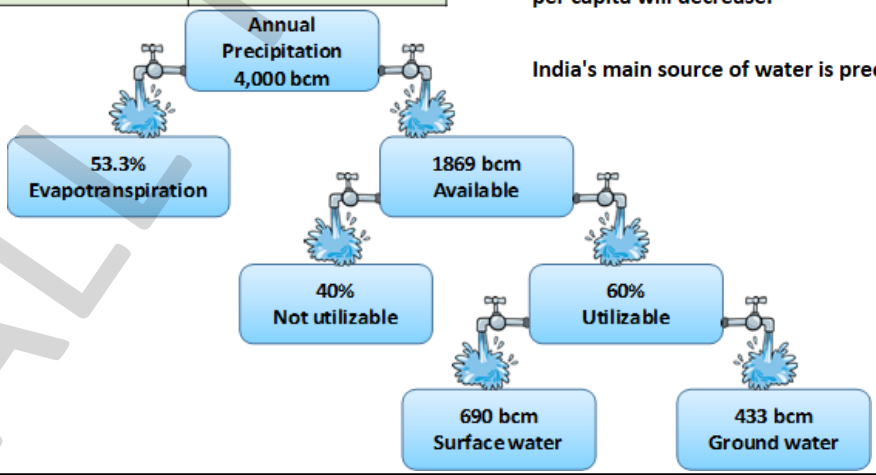
India's annual per capita water availability:

- 2001 : 1,820
- 2011 : 1,545 India is a water stressed country
- 2025 : 1,341 (expected)

Why is it decreasing?

Because it is per person.
So, when population increases, and supply is constant, per capita will decrease.

India's main source of water is precipitation



Drinking water pollution

- Puri in Odisha has become the first Indian city to give 24-hour drink-from-tap facility. Tap water can be used for cooking and drinking, without requiring further filtration.
- A Ministry of Consumer Affairs report found poor quality of piped water in many Indian cities.
  - Delhi has most unsafe water; failed in 19/28 parameters.
  - Mumbai is the only city to pass on all 28 parameters.

- Clean drinking water is a basic human right.
- SDG 6.1: Safe and affordable drinking water

Reasons for polluted piped water:

- **High demand:**
  - Insufficient water treatment capacity
  - Use of untreated groundwater
- **Focus is on chlorination:**
  - It kills germs, but does not remove toxic metals.
- **Pipes:**
  - Pipes are old; rust, leakages
  - Water pipes and sewer lines run side by side (leakage in both!)
- **Lack of accountability:**
  - water quality standards are not legally binding on agencies
  - official data on water quality tests not made public.
  - Conflict of interest as agency that tests water is the same that supplies the water.

Harmful effects of unsafe water:

- **Health issues:**
  - Waterborne diseases like diarrhea, cholera, typhoid;
  - Black foot disease due to Arsenic; Blue baby syndrome due to Nitrate
- **Loss to economy:**
  - increased healthcare costs;
  - people need to spend on RO, packaged water
- **Positive feedback loop:**
  - unsafe water → people buy packaged water → more pollution
  - people use RO → water scarcity

Government initiatives:

a) Jal Jeevan Mission: piped water to each rural household by 2024
b) Meghalaya: first state to have a draft water policy
c) Telangana: Mission Bhagiratha for safe drinking water to every household

Way forward:

- **Treatment and supply:**
  - upgrade water treatment plants; increase water charges if needed
  - replace old water pipes
- **Accountability:**
  - BIS standards should be legally binding on agencies
  - Just like air quality data, water quality data should be regular and in public domain.
- **Follow the example of Mumbai:**
  - Most water sourced from rainwater, not groundwater or rivers.
  - Use of concrete pipes, instead of steel pipes.
  - Upgraded water testing labs for better monitoring.

Water pricing

Under Jal Jeevan Mission, govt. has empowered local bodies to decide water pricing.

What is the present situation regarding pricing of irrigation water?

- Wide inter-state variations: HP Rs 50/hectare; Maharashtra up to Rs 6300/hectare
- Charges depend on area, type of crop, quantity used, etc.
- Kerala was the first state to impose irrigation water charges (1974).
- Seven states/UTs don't impose them even today.

Why does India need an efficient water pricing policy?

a) To reach millions: money will help take piped water to 82% rural households that don't have it now.
b) To improve quality: improve finances of agencies supplying water in cities.
c) To bring efficiency: people use water responsibly when they pay for it.

❑ International:
- Dublin Principles 1992 recognize water as a finite and economic good.

❑ Constitution (73rd & 74th Amendments):
- local bodies can be entrusted with water supply; they can levy tax, fees etc.

❑ Policy:
- National Water Policy 2002: pricing must cover at least operational costs.
- National Water Policy 2012: pricing should encourage efficient use.

Central govt. initiatives:

❑ *Ground Water Conservation Fee:* (notified in 2018)
- for consuming groundwater beyond certain limit.
- applies to industry and domestic users
- exempts agriculture sector (despite using 90% of groundwater)

❑ *Independent statutory water REGULATOR:*
- Union govt. is incentivizing states to set up water regulator.
- 13th FC recommended grant of Rs 5,000 crore for this purpose.
- 14 states have taken some steps, but yet to fully implement.
- For example, UP passed legislation in 2008, but is yet to make it functional.

What a water pricing policy should be like?

National Water Policy statement 2012:

- Regulator: Pricing should be set by a statutory independent regulator, to be set up by each state.
- Quantity: Pricing should be based on quantity of water consumed, for equity and efficiency (no flat rates).
- Wastewater: Tariff system for recycled water to encourage waste water treatment.
- Groundwater: prevent excessive use of groundwater in agriculture by regulating use of electricity.

National Water Framework Bill 2016:

- It lays down the principles for water pricing:
  - Charge full price for commercial agriculture and industry.
  - Graded pricing for domestic use.

Good examples to follow:

- Delhi: price is linked to consumption
- Punjab: govt. pays farmers to use less water (Paani bachao Paisa Kamao)
- Maharashtra: the only state with an independent water regulatory authority (but only for irrigation, not industry and domestic)

Wastewater Treatment

Why is waste water increasing?

- Increasing human population; will continue to rise till 2064
- Increasing urban population (55% today, 68% by 2050)
- Expanding agriculture (to feed increasing population, remove hunger)
- Rapid industrialization (and increased standard of living demanding more goods)

How can waste water be put to productive use?

- ❑ Agriculture: nutrient rich waste water can be used as input for farming. e.g. East Kolkata wetlands
- ❑ Fresh Water: Reclaim clean water from waste water. Singapore's toilet-to-tap concept meets its 40% water demand
- ❑ Clean energy: methane from sewage as fuel (CNG for cars, power plants) e.g. Xiangyang in China
- ❑ SDGs: 2: zero hunger; 6: clean water and sanitation; 11: sustainable cities
- ❑ Waste water treatment can help India:
  - Meet urban water needs (lots of sewage, lots of water demand)
  - Get water for irrigation (lessen pressure on groundwater)
  - Prevent groundwater contamination (no more drains flowing into rivers)

[World generates about 380 trillion liters wastewater every year]

Steps taken:

- NITI Aayog's Composite Water Management Index includes water treatment capacity as a parameter.
- National Policy on Faecal Sludge and Septage Management under Swachh Bharat Mission.
- Sewage Treatment Plants being constructed, e.g. under Namami Gange Programme
- Common Effluent Treatment Plants (CETPs) for MSME clusters.
- Best practice: Avadi STP by Tamil Nadu Police Housing Corporation treats sewage and provides this water for fishing, vegetable cultivation and groundwater recharge.

Way forward: (law, money, tech)

- Enact and enforce laws for water treatment
- Impose taxes based on polluter pays principle
- Cooperate with countries reusing sewage water.

From Prelims 2021 material

Water Plus city:

Indore is first water plus city under Swachh Survekshan (by MoHUA). Conditions:

1) all wastewater must be treated before release into environment
2) all public toilets be cleaned and connected to sewers
3) 30% of sewer water must be recycled and reused.

National Hydrology Project:

- ❑ since 2016; Central Sector Scheme
- ❑ Ministry of Jal Shakti; World Bank support
- ❑ est. National Water informatics Centre as repository of nation-wide water resources data
- ❑ ISRO's National Remote Sensing Centre is one of the implementation agencies.

Jal Jeevan Mission — by 2024

Ministry of Housing & Urban Affairs

Jal Jeevan Mission (URBAN) to Provide Universal Coverage of Water Supply

Swachh Bharat Mission (URBAN) 2.0 Announced For Next 5 Years

Boost to Green and Clean Urban Mobility

Metrolite and Metroneo System to Come Up in Several Cities

100% Income Tax Exemption for Affordable Rental Housing Projects

Posted On: 02 FEB 2021 3:48PM by PIB Delhi

Jal Jeevan Mission:

- Ministry of Jal Shakti
- 55 litres/person/day
- through tap connections
- to every rural household

Jal Jeevan Mission (Urban)

- Min. of Housing & Urban Affairs
- in all 4,378 statutory towns
- 2.68 crore tap and sewer
- improve water quality, etc.
- for universal water supply

Jal Shakti Abhiyan

awareness campaigns

Ministry of Jal Shakti

Target and Objectives of Jal Shakti Abhiyan

Posted On: 29 JUL 2021 5:41PM by PIB Delhi

Jal Shakti Abhiyan -I (JSA-I) was launched in 2019 in 1592 blocks out of 2836 blocks in 256 water stressed districts of the country in two phases from 1st July to 30th September, 2019 and from 1st October to 30th November 2019. Under Jal Shakti Abhiyan –

JSA-1:

- For one month in 2019
- not pan India

JSA-2: *Catch the Rain*

- For few months in 2021
- Pan India

Main goal: *water conservation*

- rainwater harvesting
- renovate traditional water bodies
- reuse and recharge of bore wells
- watershed development
- intensive afforestation

Traditional water conservation methods:

- ❖ Zabo - Nagaland
- ❖ Eri - TN
- ❖ Johad - Nothern plains
- ❖ Ahar pynes - Bihar
- ❖ Bawari Rajasthan

Virtual water

Virtual water:

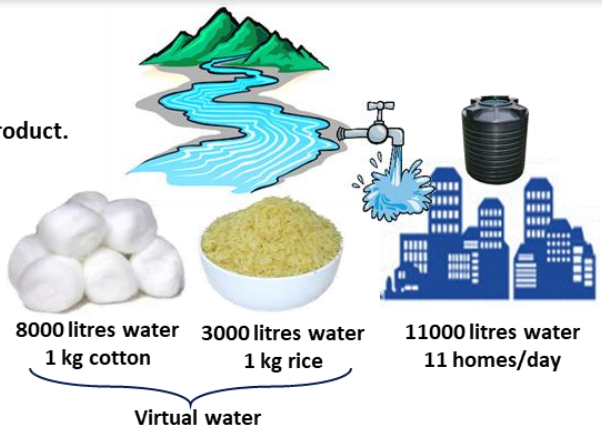
- Volume of water used to produce a product.

Virtual water exports:

- water embedded in exported goods
- water rendered unusable by production of these goods

India:

among the largest exporters of virtual water.



All-Inclusive GS-2 & GS-3 MAINS 2021

Class-19

Agricultural emissions

Source of agriculture emissions: ***(18% of India's GHG emission are from Agriculture)***

- **Tilling: carbon released from soil; fuel burnt to till**
- **Manure and fertilisers: releases methane and nitrous oxide**
- **Electricity: irrigation by electric pumps consumes electricity**
- **Rice cultivation: flooded paddy fields release methane**
- **Harvesting: machines run on diesel**
- **Crop residue: decomposition or burning; gases released CO2, methane, N2O**
- **Enteric fermentation: digestion in animals produces methane**

Problems:

a) **Global warming due to GHG emissions**
b) **Respiratory problems due to PM 2.5 and PM 10**
c) **Brown carbon reduces albedo, causes Global warming**
d) **Agri run-off pollutes water bodies**

Challenges:

a) **High population necessitates high food production**
b) **Urea subsidy encourages use of urea, responsible for nitrogenous emissions**
c) **Poverty prevents investment in micro-irrigation, biogas plants**
d) **Lack of awareness about agricultural emissions**

Steps taken:

a) **NM for Sustainable Agriculture as part of NAPCC 2008.**
b) **Compulsory neem coating of urea slows down nitrogen release.**
c) **Soil Health cards prevent excessive use of fertilizers.**
d) **Solar pumps installed under PM-KUSUM**
e) **Green-Ag project launched in 2018 in 5 states**
   - ❑ **By MoA&FW and FAO; funded by GEF**
   - ❑ **reduce agricultural emissions; sustainable land & water management**
     a) **Madhya Pradesh: Chambal Landscape**
     b) **Mizoram: Dampa Landscape**
     c) **Odisha: Similipal Landscape**
     d) **Rajasthan: Desert National Park Landscape**
     e) **Uttarakhand: Corbett-Rajaji Landscape**

Way forward:

a) **Zero-tillage farming; e.g. use happy seeder machine**
b) **Reduce fertilizers; use organic farming, Zero Budget Natural Farming**
c) **Micro-irrigation and mulching to reduce water requirement**
d) **Direct seeding of rice instead of transplanting to submerged fields**
e) **Use crop reside for biomass co-firing or biochar**
f) **Biogas plants to reduce methane emissions**
g) **Promoting agroforestry, climate smart agriculture**
h) **Conservation Agriculture:**
   a) **minimum tillage, i.e. minimum soil disturbance**
   b) **Maintain permanent Soil cover**
   c) **Diversification of plant species**

Air Pollution

Air Pollution in Indian cities:

- 22 of 30 most polluted cities of the world are in India [IQAir report March 2021]
- PM 2.5 is usually 5-7 times the WHO limit.

Reason for air pollution	Solution
Vehicle emissions	▪ Car pooling, Public transport (metro, bus) ▪ Check for Pollution Under Control (PUC) certificate ▪ Electric vehicles ▪ Bypass for trucks not destined to city, e.g. Eastern and Western Peripheral Expressways around Delhi
Coal power plants	▪ Clean coal technologies ▪ Gas based thermal power plants ▪ Renewable sources of energy
Stubble burning	▪ Machines: Happy seeder; Rotavator ▪ 'Pusa Decomposer' (decomposes stubble in 20 days) ▪ Biomass co-firing; Biochar; Ethanol
Garbage/ dry leaves burning	▪ Robust garbage collection system ▪ Mobile app for citizens to register complaints, e.g. Green Delhi
Construction activity	▪ Cover building and lose construction material
Indoor air pollution	▪ Rural homes to use smokeless chullah, or LPG cylinders

Steps taken:

- NCAP (National Clean Air Program): Reduce PM 20-30% by 2024 (2017 base)
- CAQM: Commission for Air Quality Management in NCR in adjoining areas
- PM Ujjwala Yojana: LPG cylinders to BPL families
- PM Ji-Van yojana: for 2G ethanol (from crop residue, non-food crops)
- Miscellaneous: Metro train 13 cities; BS-VI emission norms

Impacts of Air Pollution:

- India loses 5.4% of GDP due to air pollution (Greenpeace)
- Increased healthcare costs, low work productivity
- Life expectancy has reduced by 2.6 years due to air pollution related diseases.
- Acid rain, ozone depletion, etc.

Q. 15 मुंबई, दिल्ली और कोलकाता देश के तीन विराट नगर हैं, परंतु दिल्ली में वायु प्रदूषण, अन्य दो नगरों की तुलना में कहीं अधिक गंभीर समस्या है। इसका क्या कारण है ?

Mumbai, Delhi and Kolkata are the three mega cities of the country but the air pollution is much more serious problem in Delhi as compared to the other two. Why is this so ?

Mains 2015 12½

a) Delhi is surrounded by pollution generating areas (Gurgaon, Faridabad, Noida)
   - But Mumbai and Kolkata have sea on 2-3 sides.

b) Fog forms in Delhi due to low temperature during winter.
   - No fog formation over Mumbai and Kolkata.

c) In Delhi, winter high pressure keeps pollutants close to the ground.
   - No such winter high pressure formed over Mumbai, Kolkata.

d) Land breeze sweeps away pollutants from Mumbai and Kolkata.
   - No such land breeze over Delhi.

e) Crop residue burning in Punjab and Haryana.
   - No such problem near Mumbai and Kolkata.

Decarbonising Transport

What is "Decarbonising Transport" and why is it needed?

- Decarbonising Transport means reducing carbon emissions from transport sector.
- It includes GHG emissions from three things:
  - burning of fuel in vehicle
  - production of fuel/electricity
  - manufacturing and disposal of vehicle
- It is needed because transport emits 23% of energy related CO_2
- "Decarbonising Transport in India" project was recently launched by NITI Aayog and International Transport Forum.

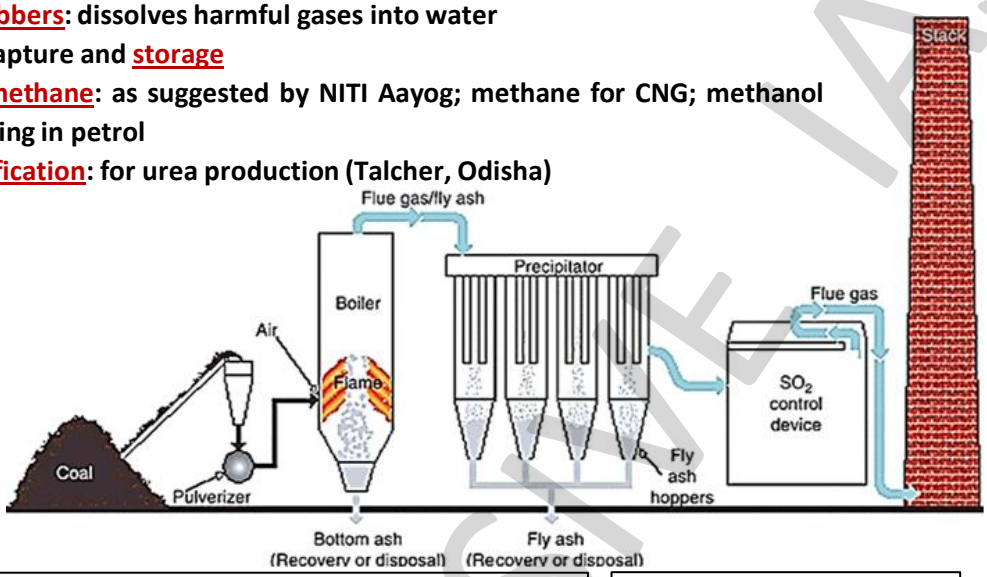
How can transport be decarbonized? (road, rail, aviation, waterways)

- Pull people towards clean transport.
  - e.g. expanded metro network, dedicated bicycle lanes, etc.
- Push people away from polluting transport.
  - e.g. higher tax on polluting vehicles, increasing parking fees, etc.
- Adopt cleaner fuels, e.g. BS-VI
- Promote electric vehicles
- Transit Oriented Development to reduce need for using private cars.
- Railway electrification to replace diesel engines. Indian Railways aims to achieve 'carbon neutrality' by 2030.
- Developing dedicated freight corridors.
- Reduce emissions from civil aviation. e.g. CORSIA initiative of ICAO.
- Developing internal waterways and using LNG powered vessels.

Clean Coal Technologies

Some clean coal technologies:

a) **Coal washing: preventing unwanted impurities from burning; less fly ash**
b) **Oxy-fuel combustion: Burning coal in pure oxygen instead of air; low NOx**
c) **Electrostatic precipitators: removes fine particles of fly ash**
d) **Wet scrubbers: dissolves harmful gases into water**
e) **Carbon capture and storage**
f) **Coal to methane: as suggested by NITI Aayog; methane for CNG; methanol for blending in petrol**
g) **Coal gasification: for urea production (Talcher, Odisha)**



Business Standard

Home Markets Companies Opinion Tech Specials F

Coal washing not mandatory for supply to thermal plants: Environment min

Shreya Jai | New Delhi | Last Updated at May 23 2020 01:54 IST

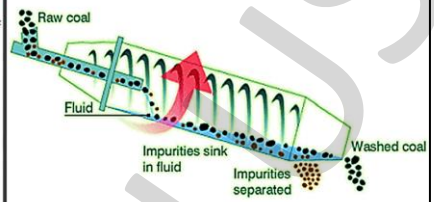
Topics

Coal ministry | environment minister | Lockdown

The move to abolish coal washing has come barely 15 days after the ministry issued a draft note for stakeholders to submit their views on this.

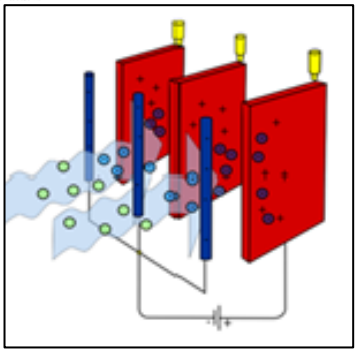
Five years after the government, in laying down its climate-change targets, committed to have mandatory coal washing, the Ministry of Environment, Forests and Climate Change (MoEFCC) has done away with it.

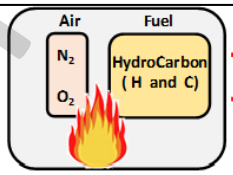
In a gazette notification on Thursday, the ministry amended the Environment Protection Act to drop mandatorily washing coal for supply to thermal power plants.



Benefits of coal washing:

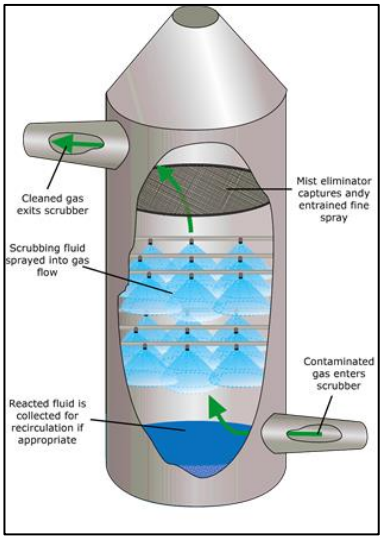
- ✓ Reduces ash content
- ✓ Better efficiency and quality
- ✓ Less emissions
- ✓ Less sulphur
- X reduces cost

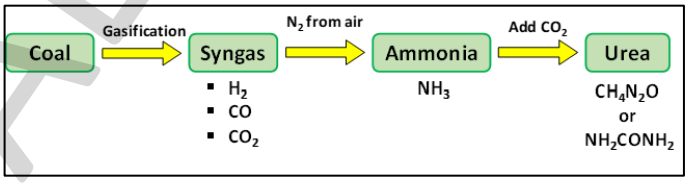




Oxy-fuel combustion:

- Burning fuel using pure oxygen instead of air
- Uses less fuel (since nitrogen is not burned).
- Less polluting, as less NOx is produced.





What are CCUS technologies? How do they work?

- **Technologies that capture carbon and then either use it store it, mainly to prevent release into atmosphere.** ***Carbon Capture, Utilization and Storage/Sequestration***

CO_2 can be separated from other gases in three ways:

a) **Pre-combustion: chemical reaction converts fuel into CO2 and other gases before combustion. e.g. Gasification**
b) **Post-combustion: absorb CO2 in some solvent after combustion**
c) **Oxy-fuel combustion: burning fuel in oxygen, not air, to produce high concentration of CO2, and less NOx**

Possible use of captured carbon:

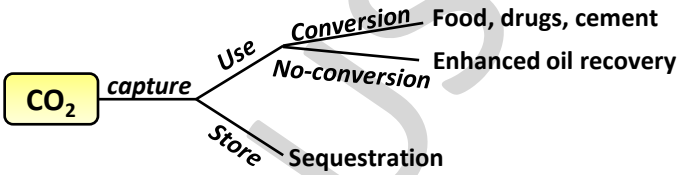
a) **In food industry; e.g. for carbonated soft-drinks**
b) **In pharmaceutical industry for synthesis of drugs**
c) **In manufacturing of cement, plastics, methanol, urea, etc.**
d) **Injecting into depleting oil and gas reserves to increase recovery.**
e) **To grow algae for biofuels**

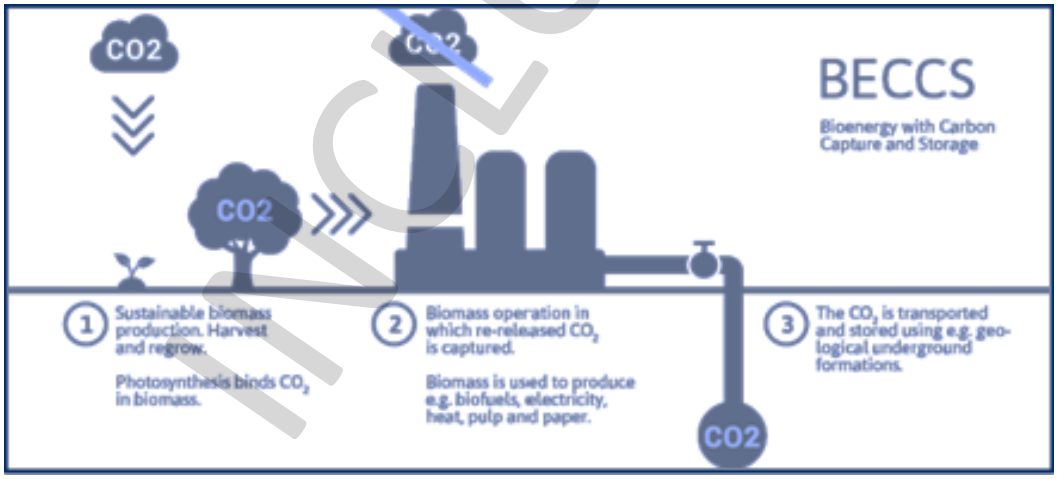
Methods to store carbon:

a) **In depleted oil and gas fields**
b) **Deep saline porous rocks**
c) **Ocean beds**

Accelerating CCUS Technologies (ACT):

- **It is part of Mission Innovation (MI)**
- **MI is initiative for R&D in clean energy.**
- **By 24 countries and EU; DST from India.**





How can technology help existing coal based power plants, to reduce their emissions?

a) **Flue Gas Desulphurization (FGD) systems to control SOx emissions.**
b) **Catalytic Reduction systems to control NOx emissions.**
c) **Electrostatic precipitators to control PM emissions.**
d) **Closed cooling water system to reduce water consumption.**

Present state of emissions from coal based Thermal Power Plants:

- **99% have not installed FGD systems.**
- **89% do not comply with SO_2 emission norms.**
- **50% do not comply with PM emission norms.**

Fly Ash

What is fly ash?

- It is a fine powder, produced as by-product of coal burnt in thermal power plants.
- It has toxic elements like Arsenic, lead, chromium, etc.
- It is a major source of air and water pollution (settles on ponds and soil, leaches into ground).

How can it be reduced?

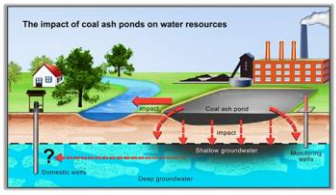
- ❑ Indian coal has high ash content (30-45%).
- ❑ Fly ash generation can be reduced by:
  - washing coal before bringing it to power plant
  - technologies that increase efficiency of power plant

Once collected, how is it disposed?

a) Dry method: Dry fly ash is transported in trucks to nearby factories to make bricks and other construction materials.

b) Wet method: Fly ash is mixed with water and dumped in a nearby ash ponds.

How can fly ash be put to productive use?



- ❑ Construction:
  - ❑ in manufacturing of cement.
  - ❑ to make fly ash bricks, tiles, etc.
- ❑ Land fill:
  - ❑ for land reclamation in coastal areas
  - ❑ to fill exhausted mines
- ❑ Agriculture:
  - ❑ to treat acidic soil
  - ❑ to increase water holding capacity of soil
- ❑ Household:
  - ❑ for handwashing as alternate to soap
  - ❑ to clean utensils

Steps taken:

- ❑ Mandatory uploading of fly ash data on power plant's website.
- ❑ Max selling price Rs 1/tonne
- ❑ Power plant to bear transport cost up to 300 km.
- ❑ All brick kilns within 300 km to be converted into fly-ash based kilns.
- ❑ Mobile app Ash Track to connect producers and consumers of fly ash.
- ❑ State initiatives; Maharashtra first state to adopt fly ash use policy.
- ❑ Due to govt. efforts, 78% of fly ash is being utilized.

All-Inclusive GS-2 & GS-3 MAINS 2021

Class-36

Climate change

Ministry of Earth Science

Assessment of Climate Change over Indian Region

Posted On: 23 MAR 2021 4:28PM by PIB Delhi

(India's vulnerability due to climate change)

Assessment of Climate Change over Indian region (MoES):

- **Temperature rise:**
  - 0.7^{O}C during 1901-2018
  - 4.4^{O}C by 2100; 3-4 times heat waves.
- **Rain pattern:**
  - 6% decline in monsoon during 1951-2015; Heavy rain frequency increased
  - 14%-22% variation in monsoon by 2100.
- **Severe cyclones**:
  - Sea surface temperature in Indian Ocean increased by 1^{O}C during 1951-2015
  - plus one cyclone per decade during last two decades
- **Sea-level rise**: 3.3mm/year during 1993-2017
- **Droughts**: 1.3% per decade increase in drought affected area during 1951-2016
- **Himalayas**: less snowfall and retreating glaciers; but Karakoram anomaly.

Implications for India:

1. **Food security**: 80% pulses and 73% oilseeds come from rain-fed agriculture
2. **Water**: less water in Himalayan rivers; saltwater intrusion in coastal areas
3. **Energy**: more demand for cooling, leading to more global warming
4. **Health**: more risk of heat stroke, stress, vector-borne disease
5. **Biodiversity**: species loss; impact of marine heat waves on fish and corals
6. **Economy**: India lost 2.5% GDP in 2014-15 due to land degradation and droughts.
7. **Society**: distress migration; crop failures leading to suicides.

Way forward:

a) Strengthen **research** on climate change.
b) Make **vulnerability** assessment part of **planning** process.
c) **Afforestation** against flash floods, landslides, coastline erosion, heat waves, etc.
d) Promote **social equality** as EWS are more vulnerable to negative impacts of climate change.

17. 'जलवायु परिवर्तन' एक वैश्विक समस्या है । भारत जलवायु परिवर्तन से किस प्रकार प्रभावित होगा ? जलवायु परिवर्तन के द्वारा भारत के हिमालयी और समुद्रतटीय राज्य किस प्रकार प्रभावित होंगे ? (उत्तर 250 शब्दों में दें)

'Climate change' is a global problem. How India will be affected by climate change ? How Himalayan and coastal states of India will be affected by climate change ? (Answer in 250 words) ***Mains 2017*** 15

***India*: Mountains; deserts; ganga plains; coasts; farmers; Food/water/electricity**

Himalayan states:

- **More warming than global average**
- **Heat waves; forest fires; permafrost thaw causing damage to infra;**
- **Change in cropping pattern: move apple orchards even higher.**
- **Small streams may dry up, so water scarcity for remote villages.**
- **More landslides; silt in water; meandering, floods (Srinagar flood 2014)**
- **Less glaciers, more glacial lakes, more GLOFs (Uttarakhand flash flood 2013)**

Coastal states:

- **Inundation due to sea level rise; damage to coastal infra; displacement of people**
- **Salt water intrusion into ground water; impact farm soil; drinking water.**
- **Problem in draining rain water due to higher sea level.**
- **More frequent and severe cyclones due to higher sea surface temperature.**

Impact of Covid on environment

- **[Lockdown]**
  - **Fall in carbon emissions [less GW]due to less traffic and industrial activity**
  - **Air quality improved; AQI fell from 300-500 to 50-100**
  - **Waste recycling reduced due to fear of spread of virus.**
  - **Increase in deforestation and poaching, due to absence of tourists**
- **[Hospitals]**
  - **Issues related to safe disposal of bio-medical waste.**
  - **More plastic waste due to use of PPE kits, gloves, e-commerce packing, etc.**
  - **More use of sanitizers everywhere; may increase AMR**
- **[Government]**
  - **Less money spent on climate resilience; due to increase in healthcare expenditure and less tax revenue**
  - **Climate negotiations delayed e.g. COP26 UNFCCC**

How fight against covid can help us fight climate change?

a) **Economic activity can go on even with less physical travel (and thus less pollution)**
b) **Focus should be on the poor; both covid and climate change impact poor the most.**
c) **Need to fight fake news about climate change, like it was done for corona [e.g. PIB]**
d) **Increase expenditure on environment conservation, like we did to fight covid.**
e) **More international collaboration in R&D to tackle climate change.**

Impact of Climate change:

- **Food security:**
  - Change in rainfall pattern; rain & drought
  - Less water in rivers, impact on irrigation
  - Less food production in tropics due to high temperature
  - Less fish production due to ocean acidification and ocean deoxygenation
- **Water crisis:**
  - Change in rainfall pattern, e.g. monsoon
  - Melting of glaciers: initially more water in rivers, later less water
- **Electricity:**
  - More demand for air conditioning
  - Less water in dams, so less electricity
  - Restrictions on coal burning
- **Health:**
  - Intense heat waves
  - Vector borne diseases will spread to higher latitudes
- **Conflict/war:**
  - Due to migration of people
  - Inter-state / Inter-country river water disputes
- **Social:**
  - Competition over shrinking resources
  - Distress migration from rural to urban areas; from coastal areas due to sea level rise; from disaster struck areas to cities.
- **Economic:**
  - Loss to life and property due to frequent disasters
  - Money spent on eco-friendly measures [electric cars!]
  - Use of expensive energy sources
- **Environmental:**
  - Loss of biodiversity; can't adapt so fast to high temperatures
  - Melting of glaciers (500 Swiss glaciers have disappeared since 1850)
  - Salt-water intrusion in coastal areas
  - Damage to coral reefs (ocean acidification)
- **Disasters:**
  - More frequent & severe Cyclones due to higher sea surface temperature
  - Frequent droughts and floods due to change in rainfall pattern
- **Examples:**
  - Kerala floods August 2018
  - Australia bushfires 2019-2020
  - Russia Arctic oil spill due to melting of permafrost in May 2020
  - Antarctica heat wave March 2020
  - 50 lakh people were displaced in India in 2019 due to disasters and extreme weather conditions. ['State of India's Environment 2020 by Centre for Science and Environment]

Impact of climate change on women

(extreme weather events, droughts, floods, less agri productivity, water scarcity, etc.)

- **Food: during food scarcity, girls given less food than boys.**
- **Water: Travel farther away to fetch water, fuel wood, etc. (e.g. water wives)**
- **Violence: Failure to arrange resources, like water, leads to violence against women.**
- **Child marriage: cases of child marriage of girls rises during economic distress.**
- **Trafficking: increase in cases of trafficking rise after disasters like floods.**
- **Migration: men migrate to cities leaving behind women with extra burden of work.**
- **Lack of alternate employment: due to low literacy and skills, women find it harder to find work other than farm labour. [Agriculture employs 80% of all economically active women in India].**

Impact of climate change on children

(frame points from women)

- **Education: no school, more time in fetching water, firewood**
- **Health: malnutrition in growing age has life-long implications**
- **Dependence: can't look after themselves**

Children's Climate Risk Index by UNICEF

It ranks countries based on children's vulnerability to climate shocks.

Pakistan (14th), Bangladesh (15th), Afghanistan (25th) and India (26th)

Impact of climate change on Tribals

- **Dependence on nature: they are more directly dependent on environment than anyone else**
- **Degradation of MFP: climate change is degrading forests, reducing net productivity of MFP**
- **No Assets: they have no economic assets to sell in times of crisis**
- **Migration: upon migration, they find it difficult to adapt to new language and culture, they lack modern skills for employment**

Their traditional knowledge should be used to learn how to live in harmony with nature.

Their rights on land and other rights should be recognized. (see class-32)

Impact of climate change on security

- **Himalayas: more infiltration**
- **Cross-border rivers: less water in rivers, and shifting of rivers**
- **Coasts: change in coastline impacting maritime zones under UNCLOS.**
- **Society: Competition for scarce resources, like water, creates tensions between communities.**
- **Terrorism: people in distress are easy recruits for terror organizations.**
- **Inter-state: river water disputes.**

Environmental Migration

Environmental migrants:

- people forced to migrate due to adverse changes in environment

Environmental Refugees:

- cross-border environmental migrants
- not recognized as refugees under UN Refugee Convention (1951) or its 1967 protocol.
- thus, they do not get similar protection as other refugees (race, religion, political opinion, etc.)

Migration due to disasters, extreme weather events:

- 1.7 crore people globally in 2018 [Global report on internal displacement]
- 50 lakh people in India in 2019 ['State of India's Environment 2020 by CSE]
- 25 crore - 100 crore in next 50 years [UNHCR]

Reasons for increased environmental migration:

- Increased frequency of extreme weather events:
  - Floods: people in Assam migrating due to floods
  - Drought: People in Marathwada region migrating due to drought
- Rising sea level inundating coastal areas.
- Competition over shrinking resources, like water well in villages.
- Over-dependence on agriculture, and agriculture being prone to climate risks.

Challenges:

- Categorizing climate as the reason for migration is difficult.
- Benefits of classifying as environmental migrant, is not clear.
- Rise in number of urban poor, and associated issues like housing, etc.
- Migrants may lack skills to earn livelihood in new place.

Way forward:

- Make agriculture climate resilient (CSA, irrigation, GM crops)
- Quick identification and relief in case of environmental distress.
- Strengthen social security schemes in rural areas.
- Develop satellite cities to reduce pressure of migration on megacities.

Some international conventions related to environmental migrants:

- Nansen Initiative Protection Agenda for Cross-Border Displaced Persons, 2015
- New York Declaration for Refugees and Migrants, UNHCR, 2016
- Global Compact on safe, orderly and regular migration, 2018

Climate change and cities

How cities contribute to climate change?

- cities consume 78% of world's energy
- cities produce 60% of GHG emissions.

How climate change affects cities?

- Mostly located near water, so vulnerable to flooding
- Coastal cities experience frequent and stronger cyclones.
- More urban floods, due to extreme rainfalls (and concretization of roads)
- Higher temperature due to heat waves (and urban heat island effect)

What can be done? (buildings, transport, parks)

- ➢ Energy efficient green buildings (China to make 50% buildings green by 2030)
- ➢ Use of heat resistant construction material
- ➢ Light colored reflective paints on road and roofs
- ➢ District cooling system
- ❖ TOD Transit Oriented Development (15% emissions due to transport)
- ❖ Promote cycling; strengthen public transport
- ❖ Imposing carbon tax (e.g. earstwhile Clean Energy Cess on coal)
- ❑ Increasing vegetative cover (Absorb CO_2, control temperature, prevent flooding)

Climate Smart Cities Assessment Framework 2.0:

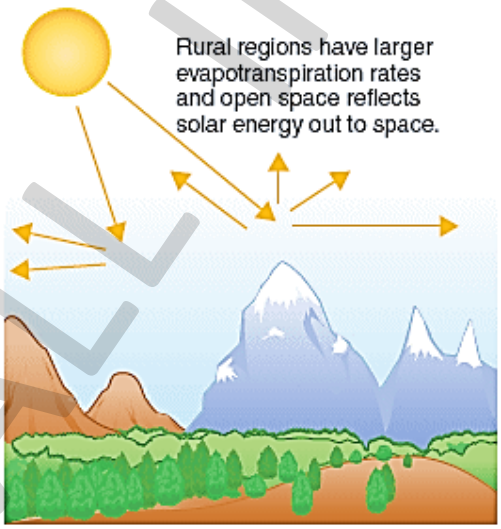
Launched by MoHUA in September 2020; has 28 indicators across five categories:

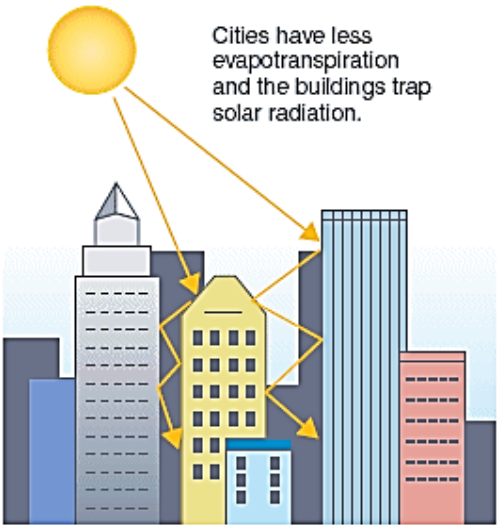
i. Energy and Green Buildings,
ii. Urban Planning, Green Cover & Biodiversity,
iii. Mobility and Air Quality,
iv. Water Management and
v. Waste Management

What is urban heat island effect?

Cities have higher temperature than surrounding areas. Reasons:

- presence of heat absorbing materials,
- lack of vegetation causing less evaporative cooling
- production of waste heat.





Impact of climate change on oceans and marine life

(Marine heatwaves frequency has doubled since 1982, impacting marine life)

- **More stratification**
  - **Less vertical intermixing of ocean water. Impact: less nutrients at surface.**
- **Ocean temperature**
  - **Net productivity of marine life decreasing**
- **Ocean deoxygenation**
  - **water at higher temperature has less dissolved gases.**
- **Ocean acidification**
  - **CO_2 absorbed in sea water decreases pH. Some animals have calcium carbonate shells.**
- **Corals:**
  - **Coral bleaching due to increase in temperature, impacting fishes as well.**
- **Impact on humans:**
  - **Less income for fishermen, less marine food, less tourism [4.5 billion consume sea food]**

Way forward:

- **Create more marine protected areas (Gulf of Mannar marine national park)**
- **Coral restoration projects (use of bio-rock technology in Gulf of Kutch)**
- **Rebuilding depleted marine fisheries, use of aquaculture.**
- **Controlling nutrient discharge to prevent dead zones.**
- **Use of Blue Bonds to finance ocean-based projects (e.g. Seychelles)**

Sea level rise

- **180-200 mm since 1900; 4 mm/year currently**
- **4-9 mm/year till 2100 even if 2^{O}C rise target met.**

Causes:

a) **water expansion due to heating (half SLR due to this)**
b) **Retreating mountain glaciers**
c) **Melting of Greenland & Antarctica's ice sheets (can cause 66 meter SLR)**
d) **Pumping out of groundwater, finally reaching oceans**

Impact: ***(roti kapda makaan sarkaar)***

a) **Flooding of coasts may impact 0.6% land and 4% population.**
b) **De-urbanization of coastal areas, e.g. Indonesia plans to shift capital from Jakarta.**
c) **Loss of economic activity, e.g. less coastal tourism.**
d) **Coastal soil erosion/salinization will impact food security.**
e) **Small island nations will face existential crisis.**
f) **More international disputes as baseline for calculating maritime zones under UNCLOS will change.**

Way forward: ***(retreat, adapt, prevent)***

a) **Regulate development in coastal areas (CRZ).**
b) **Create barriers against sea (Delta works of Netherlands)**
c) **Create enclosure dams (NEED enclosing North Sea in Europe)**
d) **Adapt to the conditions (Kuttanad Below sea level farming)**
e) **Relocate people and infra to safer regions. (Jakarta)**
f) **Reduce magnitude of global warming.**

Impact of climate change on Cryosphere

Q8. हिमांक-मंडल (क्रायोस्फ़ेयर) वैश्विक जलवायु को किस प्रकार प्रभावित करता है ? (150 शब्द)
How does the cryosphere affect global climate ? (150 words) ***Mains 2017***

- **Cryosphere is that portion of earth's surface where water is in frozen from.**
- **e.g. snow cover, glaciers, lake ice, permafrost, etc.**

Albedo:

- **High albedo of snow and ice reflects back sunlight, preventing global warming.**
- **More cryosphere → more reflection → less global warming**
- **Less cryosphere → less reflection → more absorption → more global warming**

Thermohaline circulation:

- **Cold water near poles forms ice → salt left behind → nearby water becomes salty → salty water has higher density, so sinks → a global conveyor belt is generated → it transports heat from tropics to poles and cold of poles to tropics → this mechanism regulates global climate**

Carbon storage in Permafrost:

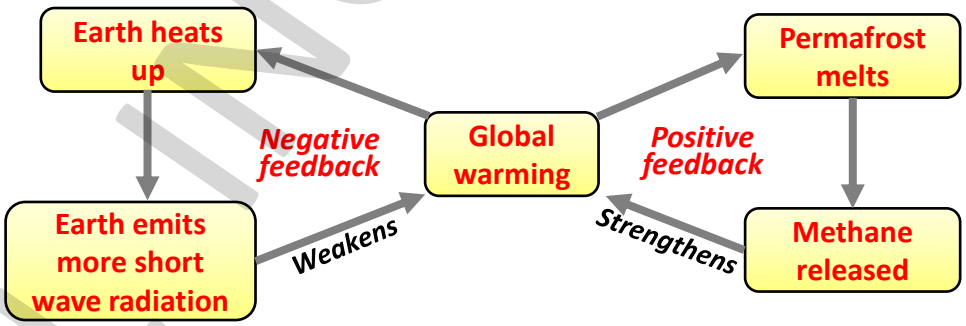
- **Permafrost is the ground that remains frozen for at least two consecutive years.**
- **Permafrost stores twice the amount of carbon than atmosphere**

Impact of permafrost thawing:

- **damage to local infra like buildings, roads (Russian oil spill)**
- **Impact biodiversity due to reduced surface water.**
- **Release methane and increase global warming.**
- **Give way to new plants and trees that will store carbon.**

Climate feedback:

- **Positive feedback intensifies the original process.**
- **Negative feedback weakens the original process.**



All-Inclusive GS-2 & GS-3 MAINS 2021

Class-37

Single use plastic

Ministry of Environment, Forest and Climate Change

Government notifies the Plastic Waste Management Amendment Rules, 2021, prohibiting identified single use plastic items by 2022.

Thickness of plastic carry bags increased from 50 to 75 microns from 30th September, 2021 and to 120 microns with effect from the 31st December, 2022.

Guidelines for Extended Producer Responsibility given legal force.

Posted On: 13 AUG 2021 3:38PM by PIB Delhi

Plastic Waste Management Amendment Rules, 2021 by MoEFCC

Govt identified items which have low utility but high environmental impact

Single Use Plastic:

- Ban from 1st July 2022; on items like:
- ear buds with plastic sticks, plastic sticks for balloons, plastic flags, candy sticks, ice-cream sticks, polystyrene [Thermocol] for decoration;
- plates, cups, glasses, cutlery such as forks, spoons, knives, straw, trays, wrapping or packing films around sweet boxes, invitation cards, and cigarette packets, plastic or PVC banners less than 100 micron, stirrers.
- Exempts compostable plastic: degrades into soil conditioning material (i.e. compost)

Minimum thickness of plastic carry bag:

- 050 micron as per 2016 rules
- 075 micron from 30-09-2021
- 120 microns from 31-12-2022

EPR:

for effective implementation, EPR guidelines have been given legal force.

Implementing agency:

CPCB & State PCBs will monitor ban and impose penalties

What is single-use plastic?

Plastic items intended to be used only once. e.g. straws, cup, plates, bottles, etc.

Impact of single-use plastic:

- Eaten by stray animals; Chokes city drains causing urban floods
- Does not biodegrade; instead breaks down into microplastics
- Microplastics have negative health impact: lungs, kidney, etc.
- Impacts marine animals (ingestion, less sunlight, pacific garbage patch)
- Disposal creates problems:
  - Incineration releases toxic gases
  - Dumping in landfills leaches down toxic chemicals to groundwater
  - In sea, it impacts marine pollution (Great pacific garbage patch)
- Rich countries dump their plastic waste in developing countries.

Why is banning single-use plastic so difficult?

- Affordability: very cheap to produce and use
- Accessibility: easily accessible by everyone everywhere
- Alternative: not available; or expensive (bio-degradable plastic)
- Attitude: people don't switch eco-friendly measures (carry own bag to shop)
- Usefulness:
  - Helps keep medical equipment sterile and safe
  - Food delivery; mass gatherings
- Packaging industry:
  - almost everything today is packed with plastic (despite using cardboard)
  - Alternatives will substantially increase price of all products.
- Job loss: 40 lakh in manufacturing, 90% in MSMEs; Ragpickers will lose income

Data:

- **Global:**
  - 8.3 billion tonne plastic generated since 1950s.
  - 60% of it went to landfill or natural environment.
- **India:**
  - 9.5 million tonnes plastic waste generated annually.
  - 43% of it is single-use plastic.

Steps taken:

- **Global examples:**
  - Ireland imposes 'Plastax' on sale of plastic bags
  - Norway gives people cashback on returning plastic bottles.
- **India:**
  - Road construction uses plastic as one of the raw materials.
  - Maharashtra banned single use plastic
  - Private initiative in Andhra Pradesh 'Rice for Plastic'
  - Zomato discourages delivery of disposable cutlery with food.
- **Technological advancements:**
  - CSIR invented a process to convert plastic into petrol and diesel.
  - Ideonella sakaiensis is a bacteria that can eat plastic.

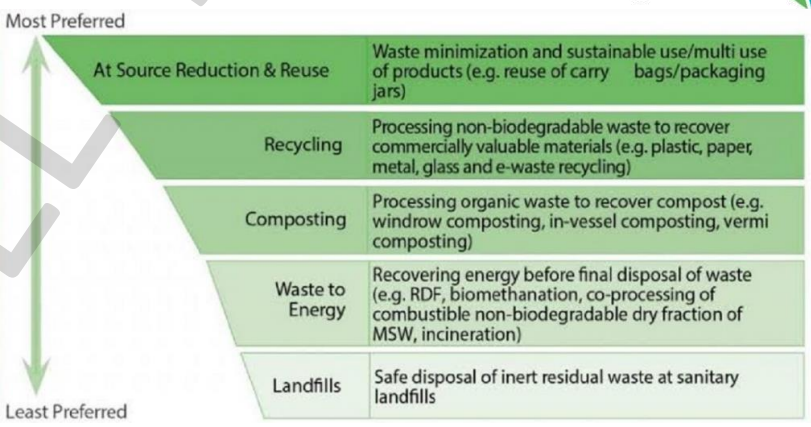
Way forward:

- 3R strategy: Reduce the production, Reuse what has been produced, Recycle so that new production is not needed
- Waste management by segregation at source and recycling
- Alternatives should be available before banning any product.
- Encourage use of biodegradable plastic, bags of cotton & jute
- Plastic Pact: private initiative to encourage circular plastic economy
- Implement EPR in letter and spirit

Circular economy aims at continual use of resources & eliminating waste

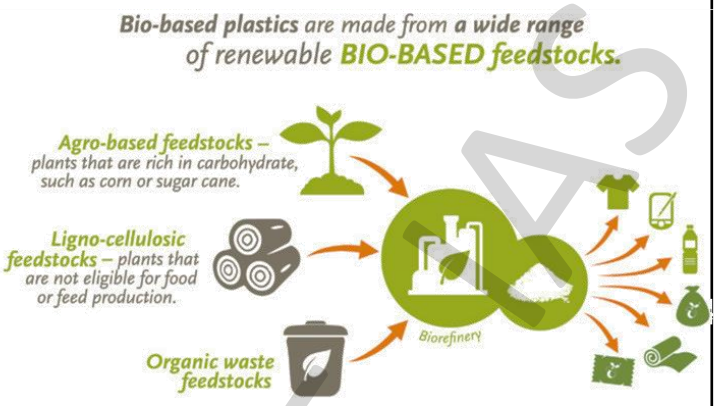
New Plastics Economy

global effort to reduce plastic pollution by focusing on reduce, reuse, recycle

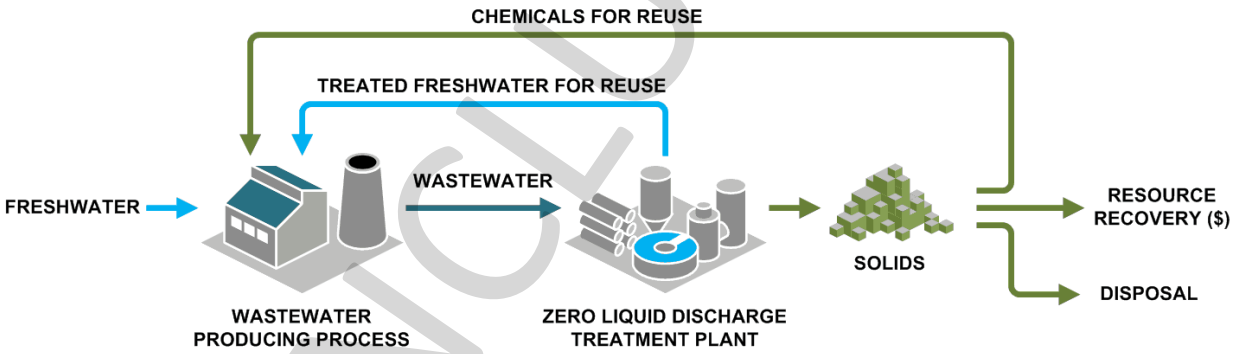


Bio-plastics

- Plastic made from biomass like vegetable oil, corn starch, wood chips, food waste, etc. [Conventional plastic is made from petroleum]
- Some bioplastics are biodegradable, some are not biodegradable.
- Drop-in bioplastic: Non-biodegradable bio-palstic
- Producing Bioplastics is energy intensive and expensive.



Zero Liquid Discharge



Water treatment process to recover all water from waste-water, giving out only solid waste.

Benefits:

- Less need for fresh water by efficient recycling of water.
- Recovery of important elements, that can be re-used in industries.

Issues:

- High cost of installation
- Consumes large amount of electricity (less water pollution, more air pollution)
- Solid waste generated may be disposed in landfill, and may leach into groundwater.

Way forward:

- Minimal liquid discharge: Purify water 70-90%, instead of 100%. This can be used in irrigation.
- Encourage processes which use less water, and thus produces less waste water.

Marine pollution

Chemical pollution: agri run-offs, city drains, oil spills
Light pollution: light from coastal cities impacts marine animals
Noise pollution: noise from sonar devices, ships propellers, oil rigs, etc.

GloLitter Partnerships Project launched:
IMO & FAO initiative to help countries reduce plastic litter from shipping & fishing industries.

What is the source of marine plastic pollution?

- Dumping solid waste from **cities** into ocean
- Litter from **beach** tourism
- Fishing nets; Pollution from **ships**; marine coatings

Why is it a problem?

- **8 million tons** of plastic waste is added to oceans each year.
  - Can triple by 2040 [*Breaking the Plastic Wave* report]
- **80%** of all marine debris is made of plastic waste
- Plastic **does not degrade**; it disintegrates into **microplastic** (< 5 mm)
- **Marine animals** ingest plastic waste:
  - **Toxic** substances accumulated on plastic harms marine life
  - **Accumulation** of microplastic in marine animals (enters the food chain)
  - Marine food brings microplastics to human's **food plate**.

What are the challenges in tackling marine plastic pollution?

- Lack of plastic waste management facilities on **land**.
  - Globally, only 15% of plastic waste is recycled.
- Unlike other wastes, plastic **does not degrade**.
- Disintegration into microplastics makes its **collection impractical**.
- Lack of **data** on marine plastic waste dumping [who would acknowledge!]

Way forward:

- **Reduce**: find alternatives to plastic [bio-plastic; jute bag]
- **Reuse**: ban single-use plastic
- **Recycle**: incentivize collection and recycling [EPR]
- **Regulate disposal**: stop dumping plastic waste in ocean [can't be undone, just like death penalty]

What has India done to address the problem of marine plastic pollution?

[India dumps 6 lakh tons of plastic waste in oceans annually]

- Signed **MARPOL treaty** [International Convention on Prevention of Marine Pollution]
- Merchant Shipping **Rules 2009** have provisions for prevention on marine pollution.
- Plastic Waste Management **Rules 2016** to reduce plastic waste.
- Ban on **single-use** plastic.

Biomedical Waste

What is biomedical waste?

- Waste generated during immunization, diagnosis, treatment of humans or animals.
- It is hazardous due to two reasons: infectivity and toxicity

Biomedical Waste Management Rules 2016:

- On-site pre-treatment of waste
- Segregation into four categories: human, animal, soiled, biotech
- On-site safe storage space
- Transport to common biomedical waste treatment facility
- Regular training and immunization of healthcare workers.

Challenges due to covid:

- Place of generation:
  - Generated everywhere: house, offices, hotels, etc.
  - Not segregated at source, can't be segregated later.
- Highly infectious, hence:
  - needs more use of PPE kits, so more quantity of waste
  - needs more precautions in handling
- Disposal system:
  - not sufficient to handle huge load
  - Extra capacity created will lie unutilized later

Biomedical waste generated in India:

- 600 tons/day before covid
- Extra 100 tons/day since covid

Way forward:

- Strict penalties on those not following guidelines.
- Greater outsourcing of waste management to private sector.
- Information Education Communication (IEC) campaigns to inform people on safe handling practices.

E-waste

What is e-waste?

- Electronic appliances that have been disposed by their users.
- It is of three types:
  i. Large household appliances, e.g. Refrigerator, washing machine
  ii. ICT equipment, e.g. Laptop, mobile
  iii. Consumer electronics, e.g. TV

Currently, biggest share of e-waste comes from (i) and (iii), but in near future ICT equipment may overtake, mainly due to Internet of Things (IoT) devices.

Global E-waste Monitor 2020:

- 53 million ton e-waste generated globally in 2019 (74 million ton / year by 2030)
- Only 17% is collected and recycled.
- Recoverable materials worth $57 billion were dumped rather than recycled.
- India is third largest e-waste generator, after China and USA.

Concerns:

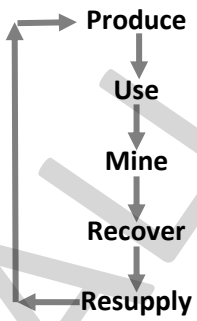
- E-waste has toxic elements like lead, mercury, cadmium.
- Adverse effect on human health like lung cancer, nervous system damage.
- Pollutes environment: air, groundwater, soil acidification.
- Recycling is mostly in informal sector: inefficient recovery, dangerous to workers.
- Waste from developed countries is dumped in developing countries.

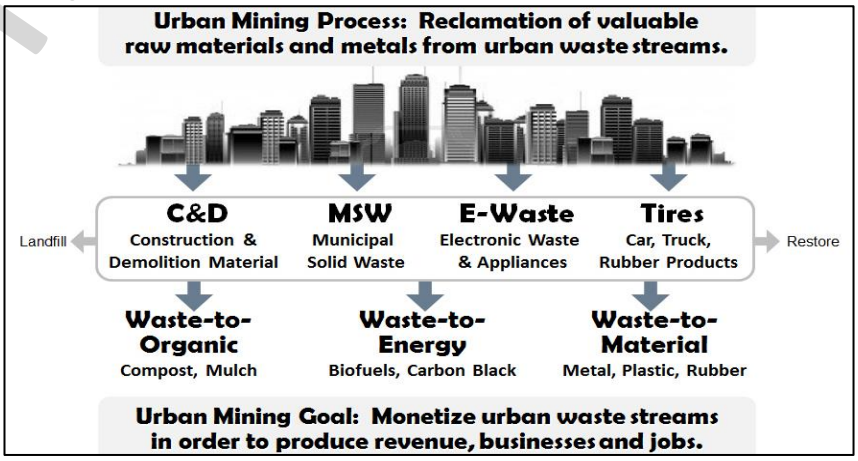
Way forward:

- Use EPR for efficient collection and recycling.
- Incentivize (e.g. tax benefits) private sector into e-waste recycling.
- Create and update a central database for better policy formulation.
- Create awareness among public, e.g. MeitY's E-waste Awareness programme
- E-waste should be seen as an urban mine supplying refined rare metals.

Examples to quote:

- Right to repair: In 2019, EU adopted Right to Repair standards. Companies have to make appliances longer-lasting, and supply spare parts for up to 10 years.
- Basel Convention on Transboundary Movement of Hazardous Wastes 1989 aims to prevent transfer of hazardous waste from developed to LDCs.
- India's first e-waste clinic set up in Bhopal by CPCB and Bhopal Municipal Corporation.
- India passed E-waste Management Rules based on EPR in 2011





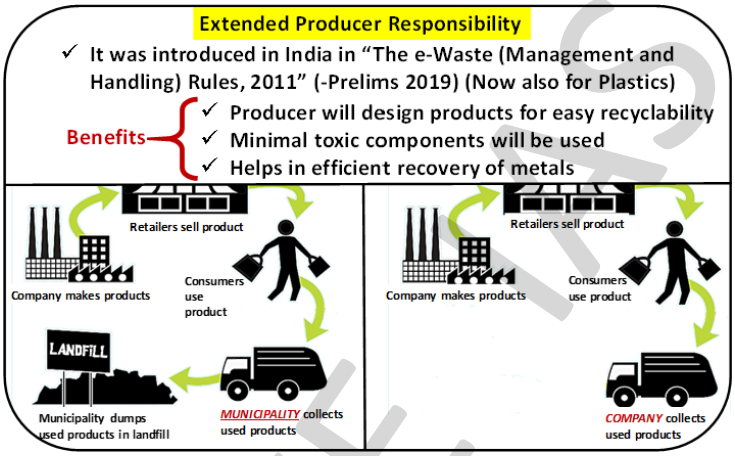
Extended Producer Responsibility

What is EPR?

Producers made responsible for disposal of post-consumer products.

Benefits of EPR:

- **Can lower the cost of products by bringing back the components to manufacturers.**
- **Works on circular economy principle, so lowers the ecological impact**



Concerns:

- ❑ **Cost of production of some items may increase.**
- ❑ **Formal reverse logistics mechanism is practically non-existent at present.**
- ❑ **Future of the existing recycling mechanism is not clear [90% of recycling happens through informal sector].**
- ❑ **Spreading awareness among the public,**
- ❑ **Getting public cooperation will be difficult [they have no incentive!]**

Way forward:

- ❑ **Integrate existing informal sector into the new mechanism [low cost, no job loss]**
- ❑ **Encourage investment into PROs by tax rebates.**
- ❑ **Find alternatives that don't need recycling and are biodegradable**

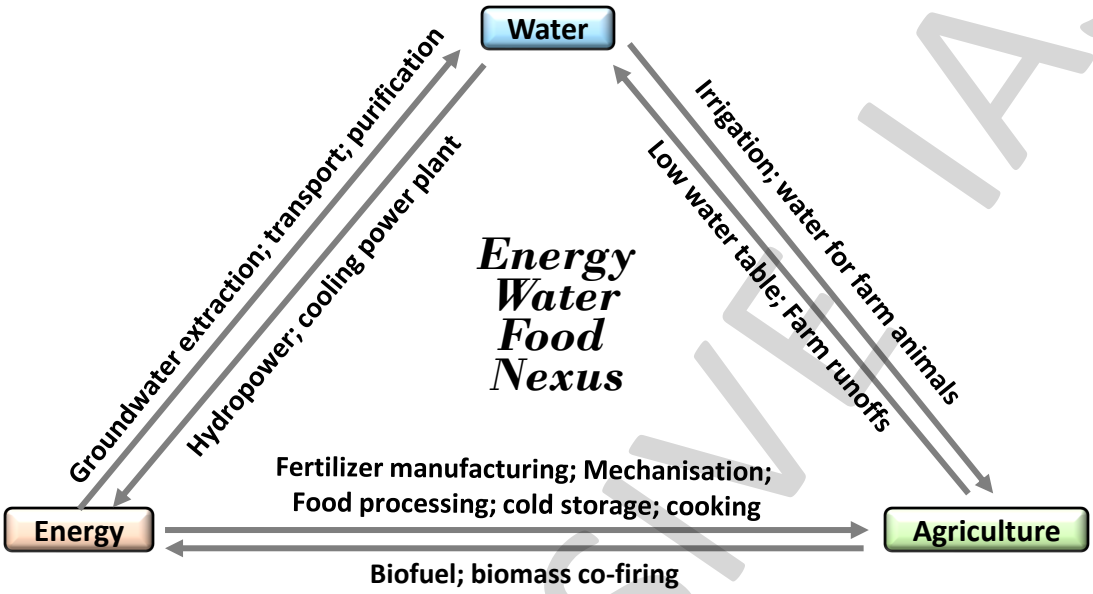
Draft EPR framework:

- ❑ **CPCB will be responsible for monitoring the EPR mechanism.**
- ❑ **Single national registry to register all stakeholders.**
- ❑ **Proposes three models:**

1) **Plastic credit model:**
   - **Producer to recycle not same but equivalent material as per obligation.**
   - **Allows trading in plastic credits.**
2) **Producer Responsibility Organizations (PROs):**
   - **Third party will manage waste on behalf of producers**
3) **Fee-based mechanism:**
   - **Producers to contribute money to central EPR corpus fund**

Energy, Water, Agriculture

NITI Aayog and World Bank organized a workshop on "Energy-Water-Agriculture Nexus: Grow Solar, Save Water, Double the Farm Income"



Conflicts:

Increase in agri production → reduces hunger
Increase in agri production → creates water scarcity (groundwater; polluted rivers)

Cheap electricity to agri → more agri production → less hunger
Cheap electricity to agri → expensive electricity to industry → less jobs

Free electricity → groundwater exploitation → imbalanced cropping pattern (Rice!)
Also, this reduces electricity and water resources for industries.

Solution:

India is trapped in energy-water-agriculture nexus. Any component of the nexus can't be preferred over other as people need all three: energy, water, food. Hence, balance needs to be brought:

- **Punjab's Paani bachao paisa kamao:**
  - **less electricity used → less water exploited → soil health improves → farmers income rises**
- **PM Kusum grid connected solar plants:**
  - **more electricity generated → farmers earn money**
- **Drip irrigation and sprinklers: less water extraction**
- **Review MSP and FRP regime which encourages water intensive rice and sugarcane production.**

Prelims 2019:

As per Solid Waste Management Rules, 2016, which of the following statements is correct?

(a) Waste generator has to segregate waste into five categories.
(b) The Rules are applicable to notified urban local bodies, notified towns and all industrial township only.
(c) The Rules provide for exact and elaborate criteria for the identification of sites for landfills and waste processing facilities.
(d) It is mandatory on the part of waste generator that the waste generated in one district cannot be moved to another district.

Municipal Solid Waste

	Pyrolysis	Gasification	Combustion
Air (Oxygen)	No air	Little air	Ample air
Temperature	350-600 ^{O}C	800-1200 ^{O}C	1500-2000 ^{O}C
Result	Large molecules break down into smaller molecules	Matter converted into producer gas (syngas)	Ash and harmful gases
	Chemical process, irreversible	Chemical process, irreversible	Chemical process, irreversible

Biomedical waste

Biomedical Waste Management Rules 2016:

- On-site pre-treatment, segregation, safe storage
- Segregate into 4 categories: human, animal, soiled, biotech
- Transport to common biomedical waste treatment facility
- Regular training and immunization of healthcare workers.

POPs / Forever chemicals

- Organic pollutants resistant to environmental degradation
- They bio-accumulate in living organisms
- They cover long distance in environment
- Restricted by Stockholm Convention 2001 Ratified by India in 2006

The original dirty dozen:

DDT; Dioxins; Furans; PCBs; Heptachlor; Hexachlorobenzene; Aldrin; Chlordane; Dieldrin; Endrin; Mirex; Toxaphene

(Some are Organochlorine pesticides)

Now 35: Dicofol; PFAO (added in 2018)

E-waste

Global e-waste Monitor report:

- UNEP & International Telecommunication Union
  ITU is specialized agency of UN, 1865, Geneva
- Top e-waste generators: USA > China > India

E-waste Mannagement Rules 2016:

- applies to all stakeholders
- PRO / EPR authorization by CPCB
- Covers more than 20 products, even CFLs
- Introduced interest-bearing Deposit Refund Scheme
- Reduction of Hazardous Substances (RoHS) testing cost borne by Producer if test fails (else govt)

India's first e-waste clinic in? Bhopal, MP

Cabinet ratified 7 PoPs:

- *Already in Convention; MEA/MoEFCC in future*

1) Chlordecone
2) Hexabromobiphenyl
3) Hexabromodiphenyl ether and Heptabromodiphenylether (octa-BDE)
4) Tetrabromodiphenyl ether and Pentabromodiphenyl ether (penta-BDE)
5) Pentachlorobenzene
6) Hexabromocyclododecane
7) Hexachlorobutadiene

Marine Plastic Pollution

Marine Plastic Pollution:
- ❑ It is 80% of all marine debris.
- ❑ Microplastic: smaller than 5mm
- ❑ Nanoplastic: smaller than 100nm
- ❑ Source: disintegration of plastic, intentional addition to cosmetics, toothpaste, clothing, etc.
- ❑ In 2018, India said we are banning microplastics, but the ban will be implemented after two years. Till now it has not been implemented.

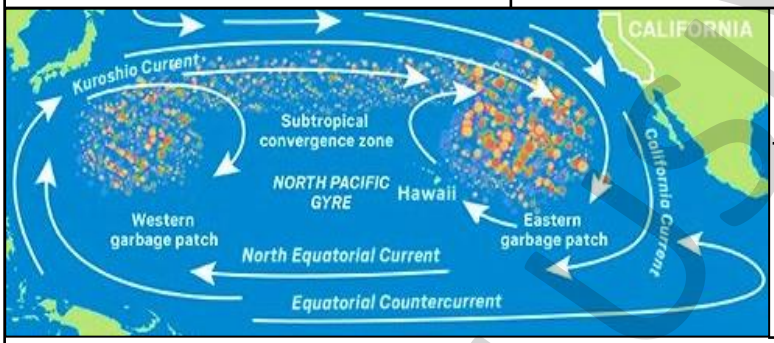
"Breaking the Plastic Wave" report:
- ❑ By Pew Trust and System IQ
- ❑ *Just remember it's not UNEP, etc.*

1972 London Convention, 1996 Protocol to London Convention, and MARPOL are related to Marine Pollution

MARPOL: International Convention for Prevention of Pollution from Ships
- ✓ Adopted at IMO in 1973 (in force 1983)
- ✓ Ratified by all major countries like US, Russia, India, China, EU, etc.

Un-plastic Collective (UPC):
- ✓ Initiative of CII, UNEP, WWF-India.
- ✓ Aim is to eliminate unnecessary use of plastic and reuse plastic though circular economy.

Close the Plastic Tap programme:
- ✓ By IUCN to tackle plastic pollution at its source
- ✓ India is not its part.



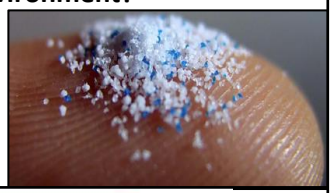
Global Partnership on Marine Litter:
- ✓ It was launched in 2012 at Rio+20
- ✓ UNEP provides secretariat services

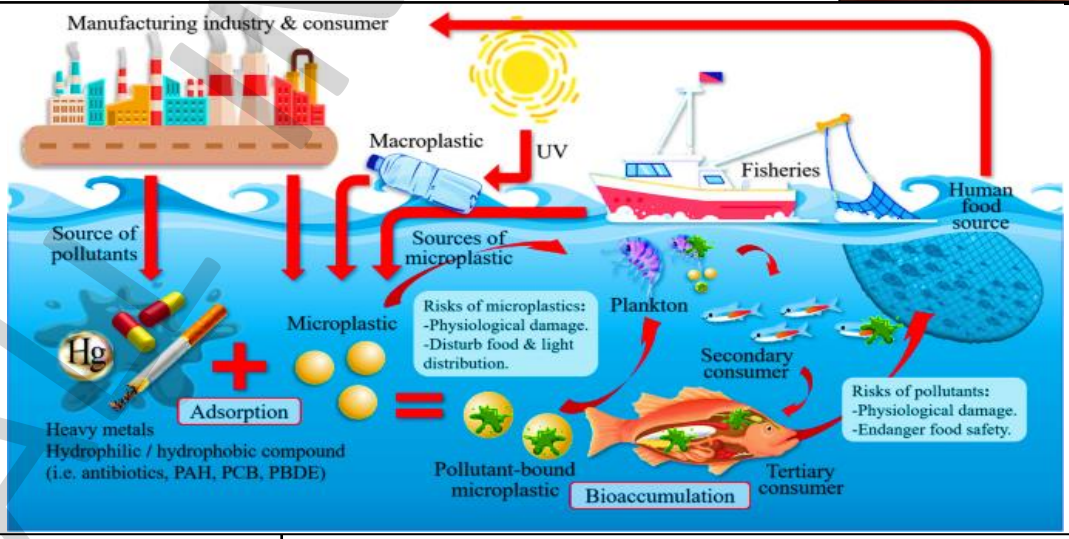
Great Pacific Garbage Patch:
- ✓ aka Pacific Trash vortex
- ✓ collection of marine debris
- ✓ almost entirely of microplastics.
- ✓ It is not visible from space.

Prelims 2019:

Why is there a great concern about microbeads that are released into environment?

(a) They are considered harmful to marine ecosystem
(b) They are considered to cause skin cancer in children
(c) They are small enough to absorbed by crop plants in irrigated fields
(d) They are often found to be used as food adulterants





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Class-38

Biodiversity

What is biodiversity?

- It is the variety of living species on earth, including plants, animals, bacteria, fungi.
- 12 lakh species have been documented, actual number is more than 10 times.

Global distribution:

- Terrestrial biodiversity is more concentrated in tropics. Tropical forests cover 10% of earth's surface but contain 90% plant species
- Marine biodiversity is higher along coasts in the Western Pacific, where sea surface temperature is highest.

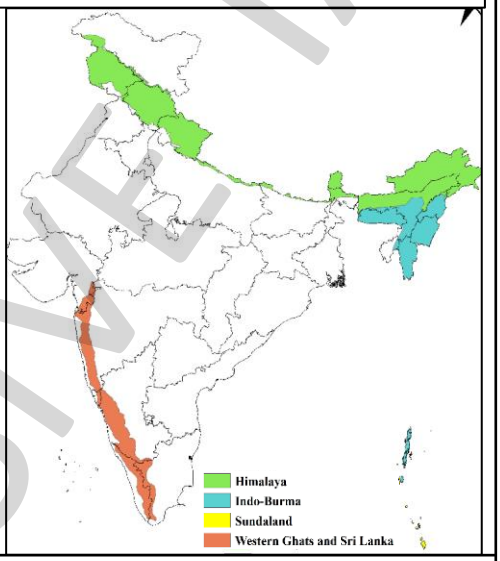
Biodiversity Hotspots:

Concept introduced by Norman Myers. Criteria:

- contain at least 1,500 species of vascular plants as endemics
- lost at least 75% of its primary vegetation
- 36 globally; four in India: Himalayas, Indo-Burma, Western Ghats, Sundaland

Four major causes of biodiversity loss:

a) Habitat loss and fragmentation
b) Over-exploitation
c) Alien species invasions
d) Co-extinctions



17. भारत में जैव विविधता किस प्रकार अलग-अलग पाई जाती है? वनस्पतिजात और प्राणिजात के संरक्षण में जैव विविधता अधिनियम, 2002 किस प्रकार सहायक है? (उत्तर 250 शब्दों में दीजिए)

How does biodiversity vary in India? How is the Biological Diversity Act, 2002 helpful in conservation of flora and fauna? *Mains 2018* (Answer in 250 words) 15

- India is a megadiverse country.
- With only 2.4% of world's land area, it accounts for 7-8% of all recorded species
- It has over 45,000 species of plants and 91,000 species of animals.

Biodiversity varies with variations in geography as:

- ✓ Himalayas: coniferous trees, orchids; snow leopard, ibex
- ✓ Gangetic plains: tropical dry deciduous forests, Mangroves; elephant, crocodile, turtles
- ✓ Indian desert: tropical thorn forest; insects and reptiles, camels
- ✓ Western ghats: Evergreen forests; Lion tailed macaque, Nilgiri tahr, amphibians
- ✓ Deccan Peninsula: tropical forests; tiger, sloth bear
- ✓ North-East: Evergreen forests; rhinos, elephants, hornbill
- ✓ Islands: Tropical evergreen forests; 200 endemic plants; 112 endemic fauna;

Biological Diversity Act, 2002:

- It aims to conserve and promote sustainable use of biological diversity
- Creates statutory bodies at national, state and local levels (NBA, SBB, BMC).
- Creates biodiversity funds at national and state levels (NBF, SBF).
- BMC prepares People's Biodiversity Register. PBR documents traditional knowledge related to use of biological resources. [2.4 lakh BMC and 94,000 PBR]
- Secures benefit sharing with local people.
- Empowers state govt. to notify Biodiversity Heritage sites.
- Violation of the act can attract up to 5 years imprisonment.

Challenges in preserving biodiversity:

- **Demand: rising human population and living standards**
- **Economic growth: need to construct roads through forests (habitat fragmentation)**
- **Weak institutions: local institutions like BMCs lack expertise regarding biodiversity**
- **Forest fire: 21% forest area is prone to fire as per FSI report**
- **Invasive species: increased with movement of people (no natural enemy)**

Convention on Biological Diversity 1992:

One of the three treaties of Rio Earth Summit 1992. It has three main goals-

(1) Conservation of biodiversity;

(2) Sustainable use of its components;

(3) Fair and equitable sharing of benefits.

- **Cartagena protocol (2000)**
  - **For safe handling, transport and use of Living Modified Organism**
- **Nagoya protocol (2010)**
  - **fair and equitable sharing of benefits arising out of the utilization of genetic resources**

Strategic Plan for Biodiversity 2011-2020 (SPB 2011-2020):

- **Adopted at CoP-10 of CBD in 2010 at Nagoya Japan.**
- **It has 20 targets under 5 goals, known as Aichi Biodiversity Targets (ABTs).**
- **Designated 2020 as "Super year for biodiversity" as ABTs end in 2020.**

India's efforts towards SPB 2011-2020:

- **Updated National Biodiversity Action Plan to align it with SPB 2011-20**
- **Developed 12 NBTs (National Biodiversity Targets) which cover all 20 ABTs.**
- **India is on track to achieve 9 out of 12 NBTs**
- **Increased number of protected areas from 771 in 2018 to 870 in 2019.**
- **Notified Access & Benefit Sharing guidelines 2014 (to implement Nagoya Protocol)**

5th Global Biodiversity Outlook report:

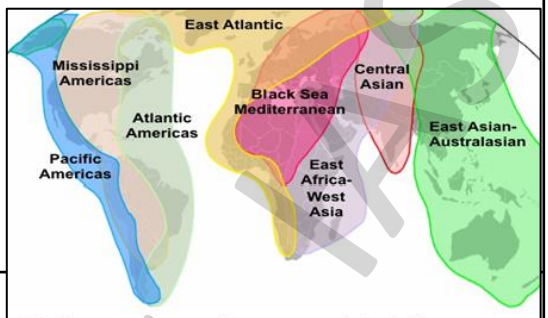
- **Deforestation fell by 33% compared to previous decade.**
- **Area under protected areas increased from 10% to 15% (land), 3% to 7% (oceans).**
- **None of the 20 targets could be fully met by the world.**
- **Proposes adoption of new 30x30 plan:**
  - **Bring at least 30% land and 30% marine areas under protection by 2030.**
- **Proposes five actions:**
  - **a) Restore degraded forests**
  - **b) Reduce use of chemical fertilizers, use organic**
  - **c) Reduce food wastage; eat more veg, less meat**
  - **d) Reduce climate change**
  - **e) Adopt One-Health approach: people, animals, environment**

Birds conservation

Draft Visionary Perspective Plan (2020-2030) for the conservation of Avian diversity.

Birds in India:

- 554 'important bird & biodiversity areas'
- 1,317 bird species recorded
- 370 of them are migratory; most of them come through three flyways:
  - Central Asian Flyway (80%)
  - East Asian-Australasian Flyway
  - Asian-East African Flyway



Eight major migratory bird flyways

Importance of birds:

- control of insect pests in agriculture and forestry
- seed dispersal and pollination of plants
- Scavenging (decline in vulture population increased stray dogs in cities)

Threats to birds:

- Loss of habitat due to rapid urbanisation, e.g. Sparrows in Delhi
- Disease outbreak, e.g. avian botulism killed 20,000 birds in Sambhar lake Rajasthan
- Destruction of stopover and rest sites of migratory birds
- High voltage power lines e.g. Great Indian Bustard
- Collisions with aircrafts and wind turbines
- Poaching, e.g. 2012 mass hunting of Amur Falcon in Nagaland

Steps taken:

- Global:
  - Convention on the Conservation of Migratory Species CMS 1979
- India:
  - Protection under WPA 1972 Schedule 1 and 2
  - Important sites have been notified as protected areas
  - National Action Plan for Conservation of Migratory Birds and their Habitats; 2018-2023; for birds using Central Asian Flyway

Way forward:

- Protect habitat and stopover sites, e.g. wetlands
- Create urban nesting spaces (poles, parks, roofs)
- Prevent hunting, e.g. Amur Falcon in Pangti village of Nagaland
- Sensitize public about importance of birds, create national network of birdwatchers

Great Indian Bustard:

- Mascot of CMS CoP-13 held in India
- Critically Endangered, only 150 left.

Main reasons for declining numbers:

- Insecticides and pesticides used in agriculture
  - it feeds on insects & food grains
- Loss of habitat (grassland)
  - exposed, attacked by dogs
- Overhead power lines
  - it has poor frontal vision

Amur Falcons:

- 2012: Global headlines of mass hunting in Pangti, Nagaland
- 2013: campaign launched: nature education, creation of Amur Falcon EcoClubs, patrolling and enforcement. Village councils called for a ban on hunting the falcons.
- Hunters paid by WTI and state govt. to guard Amur falcons.
- *Hunters turned conservationist.*

Wildlife Trade

Illegal Wildlife Trade:

- WWF estimates $20 billion/year of illegal wildlife trade
- Fourth largest illicit trade after narcotics, human trafficking, fake goods
- Examples: tusk of elephants; skin of tigers; meat and scales of Pangolin
- India's most trafficked species are pangolins, seahorse, star-tortoise

Reasons for IWT:

- Demand for traditional medicine e.g. China
- Demand for animal products, e.g. Shahtoosh shawl
- High price creates incentive for poachers.
- Porous and open borders
- Weak laws and low conviction rate.

Impact of illegal wildlife trade:

- Creates ecological imbalance (no tigers → more deer → less vegetation)
- Sanitary standards not followed; increases chances of zoonotic disease
- Poses threat to national security (links with money laundering)
- FATF's "Money Laundering and the Illegal Wildlife Trade" Report 2020:
  - IWT has links to drug trafficking, arms trade, money laundering, etc.
  - It suggests treating IWT as money laundering offences

Global steps to prevent IWT:

- TRAFFIC, 1976, by WWF & IUCN, to restrict IWT
- CITES, 1973, reduce economic incentive to poaching by closing international trade
- Wild for Life: UNEP's campaign against IWT

Steps by India:

- Constitution: Article 51A: FD to protect environment and wildlife
- Laws: PCA 1960, WPA 1972, IPC sections 428 & 429 (5 years jail for poaching)
- Agency: WCCB is a statutory body to combat wildlife crime
- Plan: National Wildlife Action Plan (2017-31)
- Campaign: Not all animals migrate by choice: campaign by WCCB and UNEP across Indian airports

Some successful operations by WCCB:

- 2017 Operation Save Kurma for turtles
- 2020 Operation Turtshield for Indian flapshell turtles

Way forward:

- Cooperate with other countries as IWT is mostly cross-border.
- To increase conviction rate, use latest forensic techniques (UK developed technique to lift fingerprints from feathers)
- Involve forest dwellers to prevent poaching.

Coral bleaching

What are corals?

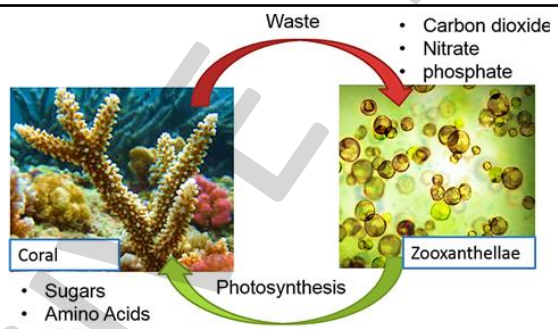
- Coral is a group of thousands of polyps.
- Polyp is an invertebrate (no backbone) marine animal.

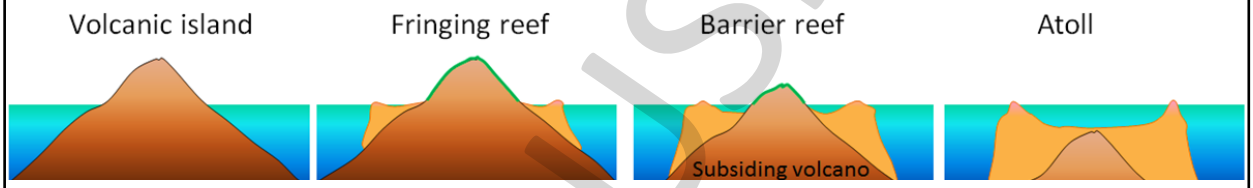
How are coral reefs formed?

- Polyps excrete calcium carbonate exoskeleton near the base.
- On dying, Polyps leave behind limestone exoskeleton
- This limestone is colonized by new Polyps.
- Coral reef is built of layers of skeletons covered ultimately by living polyps.
- Polyps form symbiotic relation with zooxanthellae algae.

What is coral bleaching?

- Coral polyps are colorless.
- Color we see is of zooxanthellae algae on polyps.
- When stressed by temperature change or pollution, corals will evict algae.
- This causes coral bleaching.
- It can kill the colony if the stress is not mitigated.





Global distribution:

- mostly in tropical waters
- 1/3rd in Australia, Indonesia, Philippines
- Great Barrier Reef: 2,600 km long, off Queensland, Australia

Coral reefs in India:

- Lakshadweep (Atolls)
- A&N islands (Fringe)
- Gulf of Kutch (fringe)
- Gulf of Mannar (fringe)

Why are coral reefs not found on all coasts?

Corals need specific environmental conditions:

- Water temperature about 20^{O}C
- Shallow water (need sunlight, but not exposed)
- Water should be salty and free from sediments.

Coral reefs are generally absent on western coasts. Why?

Western coasts have cold currents and upwellings that bring cold water.

Why are coral reefs so important?

- Biodiversity: Covering 0.1% of ocean, they host 25% of marine life.
- Food security: corals reefs are habitat for large number of fishes
- Protection: they act as natural barrier to coastlines from waves & storms.
- Carbon sink: as they are made of calcium carbonate

What are the threats faced by coral reefs?

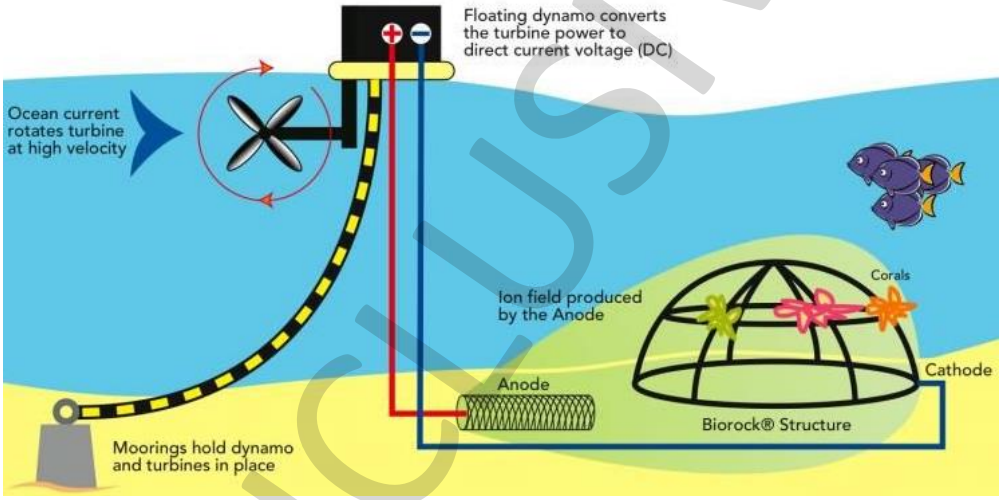
- Global warming: 1.5^{O}C rise will reduce coral reefs by 90%; 2^{O}C rise 99% [source: IPCC special report "Global Warming of 1.5^{O}C]
- Ocean acidification: calcium carbonate dissolves in carbonic acid
- Coastal pollution: (cities, tourism) Eutrophication depletes oxygen; makes water muddy
- Fishing methods: bottom-trawling near shore damages coral reefs

Steps taken:

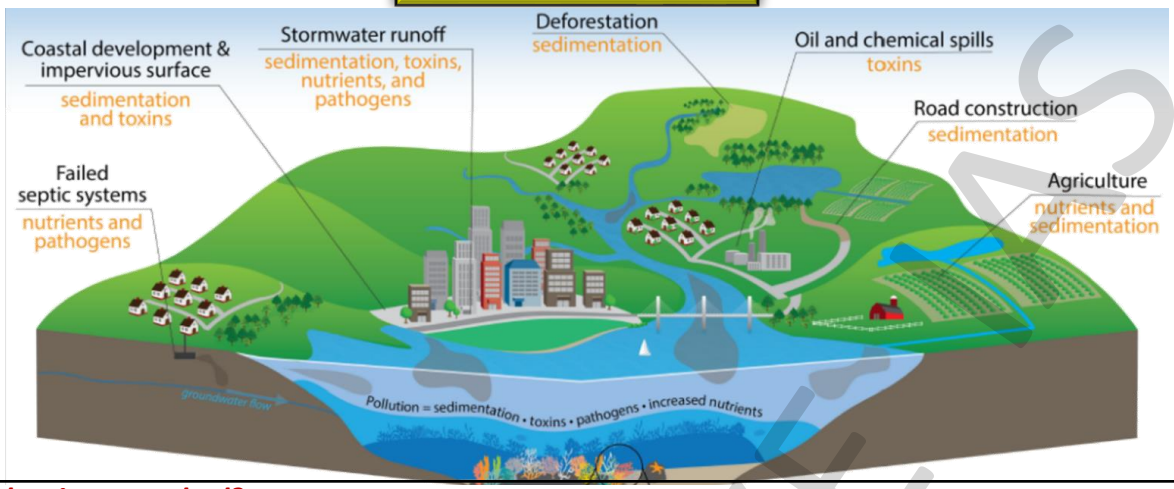
- **Global:**
  - **1994: International Coral Reef Initiative launched**
  - **1998: STAPCOR formed. STAtus and Protection of CORal Reefs**
  - **2016: NASA's COral Reef Airborne Laboratory (CORAL) mapped coral reefs**
- **India:**
  - **2008: Coral Reef Recovery Project by WTI in GUlf of Kutch**
  - **2011: Coral Bleaching Alert System by INCOIS monitors thermal stress.**
  - **2018: India hosted third international conference of STAPCOR. International Atoll research Centre will be established in Lakshadweep.**
  - **2020: use of biorock technology by ZSI for coral restoration in Gulf of Kutch**

How bio-rock technology works?

- **Steel structures are submerged to sea bed near shore.**
- **Small current is continuously passed through it.**
- **Minerals from sea water get deposited on steel.**
- **This accumulation of calcium carbonate is called Bio-rock.**



Watershed



What is Watershed?

An area of land where all the water drains into a central point, like a river or lake.

What is watershed management?

- **Efficient use of all resources of a watershed like, surface and groundwater, plants, animals, etc.**
- **It emphasizes on biomass production by scientific use of soil and water.**
- **It develops primary resources (land, water) to produce secondary resources (plants, animals) without causing ecological imbalance.**
- **Aim is to bring balance between natural resources and society.**

Benefits of Watershed development:

- **Environment:**
  - **habitat for wildlife; healthy river flow; less surface runoff; more groundwater recharge**
- **Humans:**
  - **drinking water, more agri productivity, fisheries, flood & drought mitigation, less poverty**

Challenges:

- **Focus is mostly restricted to surface water, and less on groundwater.**
- **Its success depends on community participation, but generally there is lack of participation of the locals.**
- **Availability of experts and release of funds.**
- **Farmers may opt for water-intensive crops once water table increases.**

Way forward:

- **Proper mapping of watershed at micro level for better planning. e.g. use Micro Watershed Atlas of India created by Dept of Agri.**
- **Involve locals by creating "pani panchayats" involving all water users of an area.**
- **Involve NGOs to build local capabilities e.g. Sujala initiative of Karnataka**

Examples:

- **PM Krishi Sinchayee Yojna (Watershed Development Component)**
- **Neeranchal: World Bank assisted watershed project 2016-2022**
- **National Watershed Development Project for Rainfed Areas (1990-91)**
- **Hariyali: Central govt sponsored program since 1995; helps Panchayats conserve water for drinking, irrigation, etc.**
- **Neeru-Meeru of Andhra and Arvary Pani Sansad in Alwar (Rajasthan)**

Sand mining

MoEFCC released Sand Mining guidelines, in addition to the existing 2016 guidelines.

Why were the guidelines needed?

- **Illegal sand mining is a common practice.**
- **Cases of deaths of officials who try to stop it.**
- **Need for minimum requirements across regions.**

Sand Mining Guidelines 2016:

- **Permission to be given by:**
  - **District: up to 5 hectares**
  - **State: 5-50 hectares**
  - **Centre: > 50 hectares**
- **Use technology to monitor sand mining, e.g. remote sensing**
- **Promote alternatives like M-sand, fly ash, etc.**

Sand Mining Guidelines 2020:

- **All districts to prepare mining plan and define mining and no-mining zones.**
- **Restrict mining depth to 3 meters; No mining during monsoon.**
- **District task force under DM to keep watch.**
- **States to develop online portal for trade in sand.**

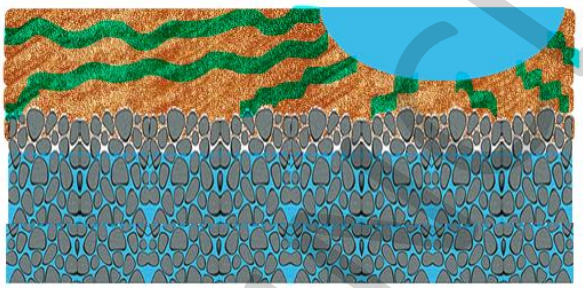
About sand mining:

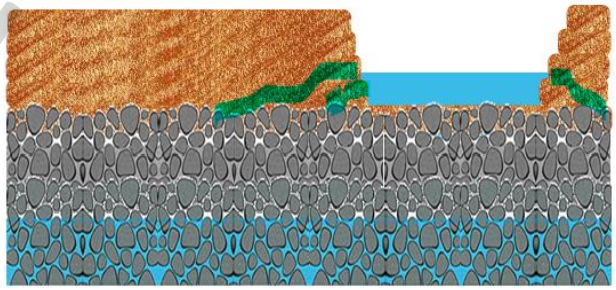
- **Under Mines and Minerals Act 1957, sand is a minor mineral.**
- **Sand mining is regulated by state governments.**
- **It is mainly done from river beds and flood plains.**

M-sand

Negative effects of sand mining:

- **Increase in salinity of river**
- **Pollution of groundwater**
- **Lowering of water-table**





Steps taken:

- **PM Khanij Kshetra Kalyan Yojana: Funds of District Mineral Foundations are used for welfare of mining affected areas.**
- **Mining Surveillance System: to monitor sand mining from space.**
- **Mining Tenement System: for online accounting of all minerals from mine to end-use.**

All-Inclusive GS-2 & GS-3 MAINS 2021

Class-39

Land degradation

- 97 million ha (30% of land area) in India is under degradation
- More than 50% in Rajasthan, Gujarat, Delhi, etc.
- Major reasons: water erosion, wind erosion, salinity, etc.

Causes of land degradation/desertification? (Nature, agriculture, industry, population)

- Natural events: forest fires, cyclones, soil erosion (wind/water)
- Deforestation: (for agri, industry, residence) exposes soil to wind and rain
- Over-cultivation: less soil fertility
- Over-grazing: loss of ground cover accelerates soil erosion
- Over-irrigation: less aeration, more salinity
- Climate change: more droughts and intense rains cause soil erosion

Impacts of land degradation/desertification:

- Increase in GHG emissions: global warming
- Loss of biodiversity: plant die; animals migrate
- Fall in water-table: due to lower water recharge ability of land
- Distress migration: rural to urban areas, conflict over scarce resources
- Food insecurity: decreased crop yield, due to low land productivity

Steps taken by India:

- Prepared Desertification and Land Degradation Atlas 2016.
- National Action Plan to combat desertification was launched in 2001 for 20 years.
- Target: By 2030, India will restore 26 mha degraded land and achieve LDN.
- Schemes like per drop more crop, CAMPA, Nagar Van Yojana, etc.

Way forward:

- Avoid: practices that degrade land, e.g. deforestation
- Reduce: impact of essential practices like farming, grazing, etc.
  - Promote agroforestry, no flood irrigation, grow cover crops, etc.
- Reverse: ecosystem restoration to restore degraded lands by afforestation
  - Land restoration done in Banni grasslands in Gujarat
- Involve locals: Joint Forest Management

Three indicators of Land Degradation:

- Land use change: e.g. forest land now used for farming
- Net primary productivity: less biomass generated per unit area
- Carbon stocks: Soil organic carbon

Carbon in soil → Organic (from remains of plants and animals)
Carbon in soil → Inorganic (from carbonates of Ca, Mg, etc.)

Benefits of Soil Organic Carbon:

- more nutrient absorption by plants
- better soil aeration
- better moisture retention
- reduced water run-off

Why do tropical soil have less SOC?

- Microbes thrive in hot & humid conditions
- More microbes → faster decomposition
- Portion of carbon of dead organic matter gets converted to inorganic carbon

Ecosystem restoration

Forest degradation: (forest are sick, not dead)
- ✓ Excessive fuelwood extraction
- ✓ excessive rearing- sheep goat eating new plants
- ✓ forest fire, acid rain, Soil erosion, Pest or disease
- ✓ Roads through forest- pollution, habitat fragmentation

Deforestation: (forest are dead)
- ✓ cutting of trees
- ✓ uncontrolled degradation

Land Degradation:
- ➢ loss of productivity of land.

Land Degradation Neutrality:
- ➢ quantity and quality of land, to support ecosystem services, remains stable or increases.

What is land desertification? [UNCCD]
- a) degradation of land in dry areas
- b) gradual loss of soil productivity
- c) thinning out of vegetative cover
- ➢ It's 'not' natural expansion of deserts.
- ➢ 30% of India's area is undergoing land degradation/desertification.

India:
- ➢ 26 mha by 2030 under Bonn challenge (joined in Paris 2015)
- ➢ Land Degradation Neutrality by 2030

2011 - 2020
- ❑ UND on Biodiversity
- ❑ UND for Deserts and fight against Desertification

2021 - 2030
- ❑ UND on Ecosystem Restoration
- ❑ UND of Ocean Science for Sustainable Development

Bonn challenge:
Launched in 2011;
by IUCN & Germany;
350 mha by 2030

CoP-14 of UNCCD:
India hosted CoP-14 of UNCCD in September 2019. Key outcomes:
- Delhi Declaration: Countries will make SDG target of achieving land degradation neutrality by 2030, their national targets.
- Peace Forest initiative: promote peace through land restoration in post-conflict areas.
- Drought Toolbox: a knowledge bank to help countries fight drought effectively.
- International Coalition on Sand and Dust Storms: to improve monitoring and response to SDS.

(UNCCD is the only international legally binding framework to address desertification)

Initiatives to restore degraded lands:
- ❑ 20x20 : Latin America; 20 mha by 2020
- ❑ AFR100 : Africa; 100 mha by 2030
- ❑ Bonn challenge: Globally 350 mha by 2030

Wasteland Atlas of India:
- ❑ first published in 2000; 5th edition in 2019
- ❑ By Ministry of Rural development
- ❑ Major findings:
  - → 17% of India's area is wasteland.
  - → Wasteland area slightly decreased 2009-16

Geochemical Baseline Atlas of India
- ❑ chemicals in top and bottom soil
- ❑ By National Geophysical Research Institute, Hyderabad (also Gravity map, seismic map)

Desertification and Land Degradation Atlas:
- ❑ Space Application Centre, ISRO, Ahmedabad
- ❑ For 2003-18; degraded land increased

Benefits of restoring degraded lands?

- Prevent soil erosion; Carbon sequestration
- Groundwater recharge; Reduce flood impact
- Livelihood opportunities; Wildlife conservation

Forest Landscape Restoration

- ❑ in 5 states; by NAEB & IUCN

National Afforestation & Eco-Development Board:

- 1992; MoEFCC; afforestation, restoration, etc.

Social Forestry:

- forestry for social/rural development

Joint Forest Management:

- state forest departments & local community
- detailed in National Forest Policy of 1988

REDD and REDD+

REDD

- ❑ Reducing Emissions from Deforestation and Forest Degradation
- ❑ It is a multilateral body
- ❑ It was formed by FAO, UNDP, UNEP
- ❑ Formed in 2008
- ❑ HQ: Geneva, Switzerland
- ❑ It helps developing countries implement REDD+

REDD+

- ❑ It is a climate change mitigation approach
- ❑ It has been developed by parties to UNFCCC.
- ❑ It incentivizes developing countries to:
  - ❑ Reduce emissions from deforestation,
  - ❑ Reduce emissions from forest degradation,
  - ❑ conserve forest carbon stocks,
  - ❑ enhance forest carbon stocks,
  - ❑ sustainably manage forests.

Forest-Plus

- ❑ Bilateral program between India and USA
- ❑ USA helps India develop capacity in forest management, to benefit from REDD+
- ❑ 2012 : Forest Plus 1.0 (for 5 years)
- ❑ 2018 : Forest Plus 2.0 (for 5 years)

Prelims 2016:

Which of the following statements is/are correct?
Proper design and effective implementation of UN-REDD+ Programme can significantly contribute to

1. protection of biodiversity
2. resilience of forest ecosystems
3. poverty reduction

Select the correct answer using the code given below

(a) 1,2 (b) 3 (c) 2,3 **(d) 1, 2, 3**

Virtual water

Virtual water:

- Volume of water used to produce a product.

Virtual water exports:

- water embedded in exported goods
- water rendered unusable by production of these goods

India:

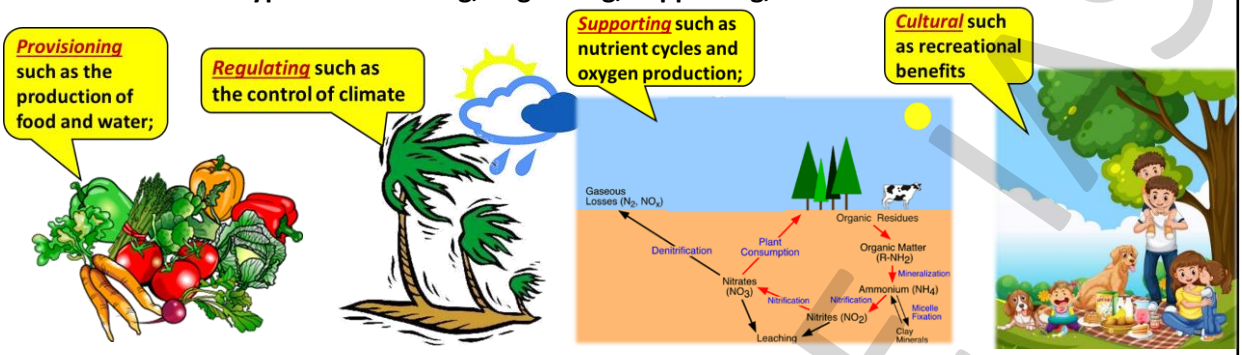
among the largest exporters of virtual water.

Ecosystem Restoration

Ecosystem: Geographic area where living & non-living components interact as a system.

Ecosystem services: contribution of ecosystem to human well-being.

These are of four types: Provisioning, Regulating, Supporting, Cultural.



Ecosystem Restoration:

- assisting recovery of an ecosystem that has been damaged (degraded or destroyed)
- It can be done by planting native trees, clearing invasive species, agroforestry, etc.

What is the need to restore ecosystem?

- 290 mha of forests lost between 1990-2015 due to clearing and wood harvesting
- 75% of Earth's land areas are substantially degraded.
- 70% of wetlands have been lost over the last century.
- Land degradation causes loss equivalent to 10% of global GDP.

What are the benefits of ecosystem restoration?

- Resources for economic activities, e.g. minor forest produce, fishing, etc.
- Protects against natural disasters, e.g. mangroves against cyclone/tsunami
- Slow down climate change, e.g. carbon sequestration by soil and vegetation
- Provide ecosystem services, e.g. air/water purification
- Financial payments to locals for restoration activities (e.g. Afforestation, PES)
- Increase in eco-tourism by landscape restoration.
- Increased land productivity will increase food security.
- Prevent distress migration from rural to urban areas.

Challenges:

- Lack of funds for restoration activities (no immediate returns)
- Lack of awareness in public about functions of ecosystem.
- Political inertia because environmental benefits are not immediate (or small vote bank). Restricting industrial activities has implications for the economy.
- Poor understanding of how ecosystems functions.

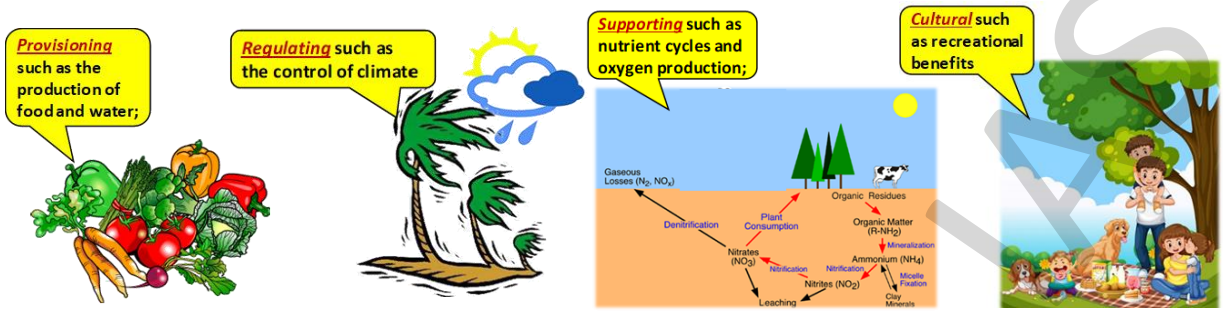
International initiatives:

- UN declared 2021-20 as Decade on Ecosystem Restoration
- Bonn challenge: restore 350 mha land by 2030
- AFR100: restore 100 mha land in Africa by 2030

India's initiatives:

- Forest Landscape Restoration project to restore degraded forests in five states.
- Raised commitment to Bonn challenge to 26 mha by 2030

Ecosystem Services



Prelims 2011:

Biodiversity forms the basis for human existence in the following ways:

1. Soil formation
2. Prevention of soil erosion
3. Recycling of waste
4. Pollination of crops *(page-72)*

Select the correct answer from below

(a) 1,2 and 3 only (b) 2, 3 and 4 only
(c) 1 and 4 only (d) 1, 2, 3 and 4 only

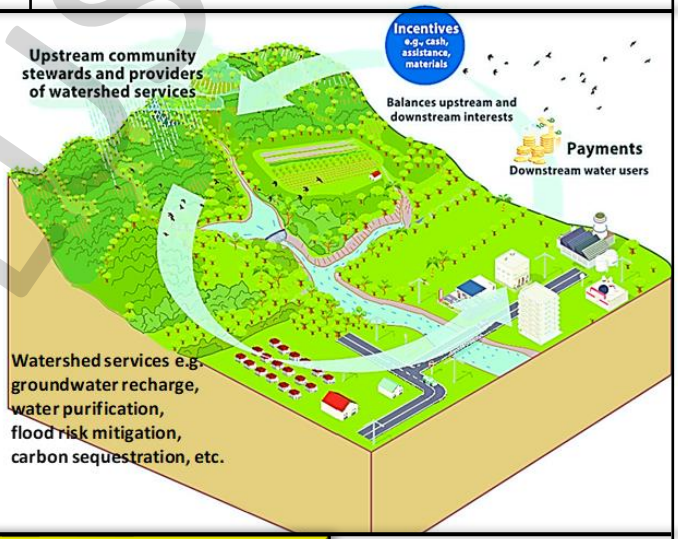
Prelims 2012:

The Millennium Ecosystem Assessment describes the following major categories of ecosystem services provisioning, supporting, regulating, preserving and cultural. Which one of the following is supporting service?

(a) Production of food and water
(b) Control of climate and disease
(c) Nutrient cycling and crop pollination
(d) Maintenance of diversity

Payment for Ecosystem Services (PES):

- beneficiaries of ecosystem services, pay to those who conserve them.
- Based on 'beneficiary pays principle'
- India's first PES agreement:
  - signed in 2010
  - between Village Forest Development Society (VFDS) and Palampur Municipal Corporation (Himachal).
  - villagers get paid to protect the catchment area.



Ecological Fiscal Transfers

Ecological Fiscal Transfers:

- Fiscal transfers from Centre to states (or state to local govt.), based on ecological indicators.
- They act as incentives for governments to perform better on environmental parameters.

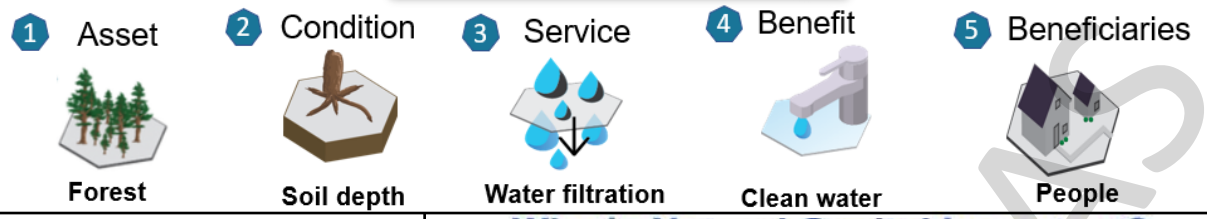
Example:

- In 1990s, Brazil became first country to use EFTs for municipalities.
- Municipalities were compensated for land use restrictions imposed by protected areas.

EFT in India:

- 14th Finance Commission gave 7.5% weightage to Forest cover
- 15th Finance Commission gave 10% weightage to Forest & Ecology

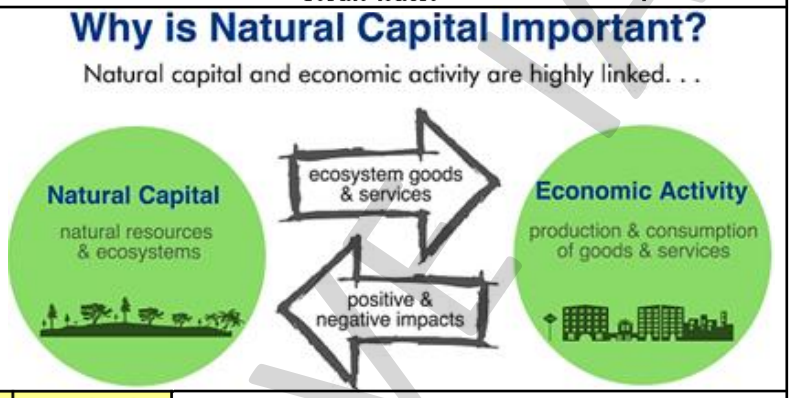
Ecosystem Accounting



Natural capital accounting:

- ❑ Calculating stocks and flows of natural capital.
- ❑ It may or may not be in monetary terms.

❖ Car is capital: comfortable transportation is the benefit
❖ Forest is capital: clean air and water are the benefits



Initiative	Organization
System of Environmental Economic Accounting (SEAA Ecosystem Accounting)	UN
EnviStats (SEEA accounts for India)	MoSPI
Wealth Accounting and Valuation of Ecosystem Services (WAVES)	World Bank
Blue Natural Capital Financing Facility	IUCN

Natural Capital Accounting and Valuation of the Ecosystem Services (NCAVES):

- ❑ by EU, UNEP, UN Stats Division, CBD
- ❑ Funded by EU
- ❑ for Brazil, Mexico, India, China, South Africa
- ❑ Implemented in India by MoSPI

Gross Environment Product: *(some overlap with GDP)*

- ❑ Value of ecosystem services in a country in a year
- ❑ measured in biophysical or monetary value
- ❑ Uttarakhand govt will measure state's GEP

Green GDP:

- ❑ Environmentally adjusted GDP
- ❑ Subtract biodiversity losses and costs attributed to climate change

Gross Domestic Happiness:
Concept by Bhutan; non-economic well being also

Happy Planet Index:
by New Economics Foundation (British think-tank)

CAMPA

Compensatory Afforestation:

- ❑ Forest land diverted
- ❑ Company pays 'Net Present Value'
- ❑ Money goes to Compensatory Afforestation Fund (10% national, 90% state)
- ❑ State Forest Dept uses money for afforestation

Green Credit Scheme:

- ❑ FAC has advised Green Credit Scheme for CA
- ❑ Pvt. company, NGO, etc. will do afforestation
- ❑ Company acquiring forest land will pay.
- ❑ Afforested land will get transferred to the forest department.

2001: SC ordered est. of CAMPA
2006: Funds and CAMPA est.

Forest Advisory Committee:

- ❑ under FC Act, 1980; MoEFCC
- ❑ It has bureaucrats as well as independent experts.
- ❑ It advises government on granting forest clearances, diversion of forest land for non-forest uses such as mining, industrial projects, etc.

Prelims 2019:
Consider the following statements:

1. As per law, the Compensatory Afforestation Fund Management and Planning Authority exists at both National and State levels.
2. People's participation is mandatory in compensatory afforestation programmes carried out under the Compensatory Afforestation Fund Act, 2016.

Which of the statements given above is/are correct?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Natural Capital Accounting

Natural capital accounting:

- ❑ Calculating stocks and flows of natural capital.
- ❑ It may or may not be in monetary terms.

Ecosystem assets: forest, wetland
Ecosystem services: air/water purification, flood protection
Ecosystem accounting: measuring ecosystem assets and services, and their benefits to humans

Importance of Natural Capital Accounting:

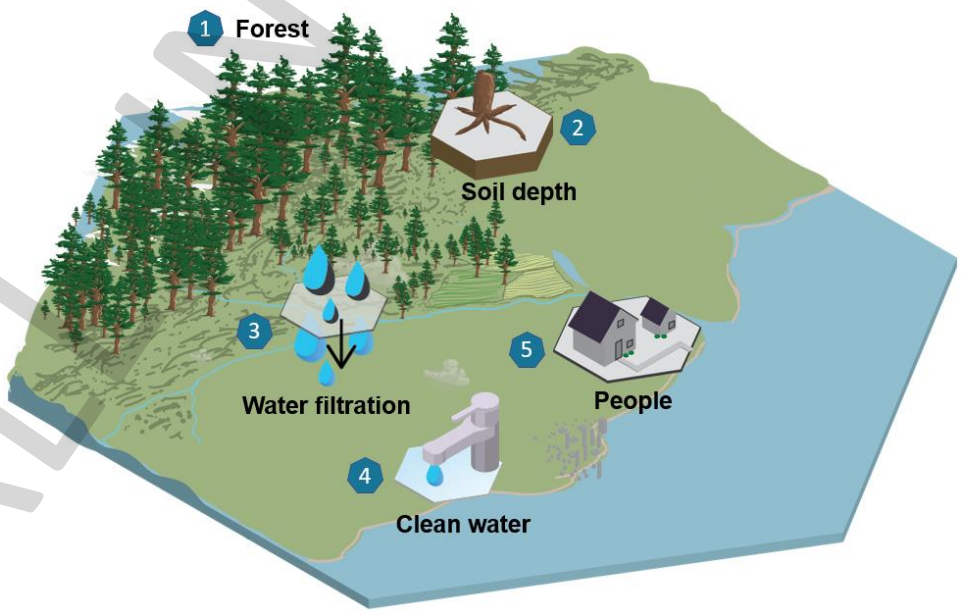
- ➢ It gives relation between economy, society, and environment.
  - ➢ e.g. pollination sustains economy and society.
- ➢ It helps create incentive-based programs to conserve nature
  - ➢ e.g. payment for ecosystem services.
- ➢ It overcomes the limitations of GDP which looks only at economic performance.
- ➢ It helps estimate nation's wealth once the state of its environment is considered.
- ➢ It can be used to check environmental degradation by monitoring status of ecosystem assets.
- ➢ It can be used to monitor progress of global initiatives like SDGs and Paris agreement.
- ➢ It can help in generating awareness about environment conservation.

Challenges in Natural Capital Accounting: (Funds, Functions, Functionaries)

- ➢ Extra cost and manpower is required for accounting of natural capital.
- ➢ Assigning monetary value to ecosystem services.
- ➢ No compensation given to people who protect ecosystem.
- ➢ Lack of use of ecosystem accounts in policy making.
- ➢ Lack of professionals qualified to do NCA.

Steps taken by India:

- ➢ EnviStats by MoSPI since 2018, based on SEEA framework by UN.
- ➢ India-EVL tool to give values of ecosystem services in different states.



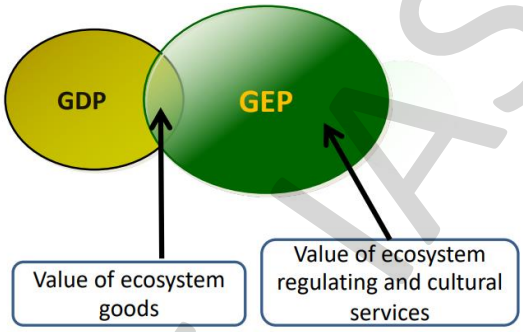
Gross Environment Product

DownToEarth

Introducing Gross Environment Product in Uttarakhand: A jargon or reality?

The Uttarakhand government should introduce a well-defined concept of ecosystem services; planting a new term raises doubts on its objectives

By S P Sati, Harish Purohit
Published: Friday 23 July 2021



GDP and GEP

For example:
- Mining
- Manufacturing
- Construction
- Transportation & storage
- Information & communication
- Wholesale and retail trade
- Financial, insurance, and real estate service
- Public administration
- Other services

For example:
- Agriculture
- Forestry
- Fishing
- Recreation & tourism
- Hydropower

For example:
- Water retention
- Flood mitigation
- Soil retention
- Sandstorm prevention
- Pollination
- Carbon sequestration
- Mental health
- Air purification
- Water purification
- Climate regulation

Compensatory afforestation

Compensatory Afforestation under Forest (Conservation) Act, 1980:

- Forest land diverted for non-forest purpose
- Company identifies land for compensatory afforestation
- Company pays 'Net Present Value' of forest diverted
- Money goes to Compensatory Afforestation Fund (10% national, 90% state)
- State Forest Department uses this money for afforestation on identified land.

Issues with Compensatory Afforestation:

- People: Forest dwellers lose their forest rights as new land is under forest department's jurisdiction.
- Wildlife: Loss of habitat for wildlife is permanent
- Time taking: New forests will take long time to grow
- Money: Computing the Net Present Value is a challenge.
- Ecology: impact on local ecosystem cannot be undone, e.g. groundwater recharge

Green Credit Scheme:

Forest Advisory Committee has advised Green Credit Scheme for CA:

- ❑ Pvt. company, NGO, etc. will do afforestation
- ❑ Company acquiring forest land will pay.
- ❑ Afforested land will get transferred to the forest department.

Concerns:

- It will make forests 'tradable commodity'.
- New forest could be monoculture, or having species not native to the area.
- It will encourage diversion of agricultural land for afforestation.

State Govt.

Company A

Company B

Namami Gange Mission

Brief background:

- 1986: Ganga Action Plan. Sewage treatment of 25 Class-1 towns. Phase-2 expanded to 59 towns.
- 2009: National River Ganga Basin Authority (NRGBA) statutory body established under EPA 1986; Chaired by PM; includes CMs of Ganga states; declared Ganga as 'National River'
- 2010: $ 4 billion plan launched to ensure that by 2020 no untreated Municipal or industrial waste flows into Ganga; Previously focus was on drains (town-centric approach), now it will be on entire basin
- 2014: Namami Gange Programme launched. Comprehensive approach; Not just Nirmal dhara (unpolluted flow), but also Aviral dhara (Continuous flow)
- 2016: NGRBA replaced by National Ganga Council

Five tier structure:

- National Ganga Council (PM, Ministers, CMs)
- Empowered Task Force (Jal Shakti Minister)
- National Mission for Clean Ganga (Director General NMCG)
- State Ganga Committees
- District Ganga Committees

Activities divided into three categories:

- Entry-Level activities (for immediate visible impact),
- Medium-Term activities (to be implemented within 5 years)
- Long-Term activities (to be implemented within 10 years).

What has Namami Gange achieved so far? (source: NMCG website)

(Same as main pillars of the programme)

- Sewage treatment projects: 68 projects completed, 69 under implementation.
- River-Front Development: creation/renovation of ~300 Ghats/Crematoria
- River Surface Cleaning: collection of floating solid waste at 11 locations
- Ganga gram: toilets constructed in 1674 villages situated on bank of Ganga
- Industrial effluent: 110 industries issued closure direction (Tanneries of Kanpur)
- Afforestation; Public awareness; Bio-diversity conservation

Some other steps:

- Bhuvan-Ganga mobile app: people can report pollution sources
- Bhuvan-Ganga portal: geospatial data about Ganga to help in policy making
- Ganga Vriksharopan Abhiyan: afforestation program by NMCG
- Ganga Praharis: by WII and NMCG, train local volunteers to spread awareness

Why is Ganga polluted?

(Point sources: drains, ghats, crematoriums; Non-point: farms, open defecation)

- Sewage treatment: Only 33% of 12,000 million liters per day treated.
- Farm run-offs: chemical fertilizers from farms along Ganga
- Crematoriums: illegal immersion of corpses unfit for cremation
- Illegal construction: concrete structures near river prevent natural water filtration
- Too much extraction: farms and cities over-exploit water, reducing the flow
- Low ecological flow: upstream dams restrict ecological flow of water

What should be done?

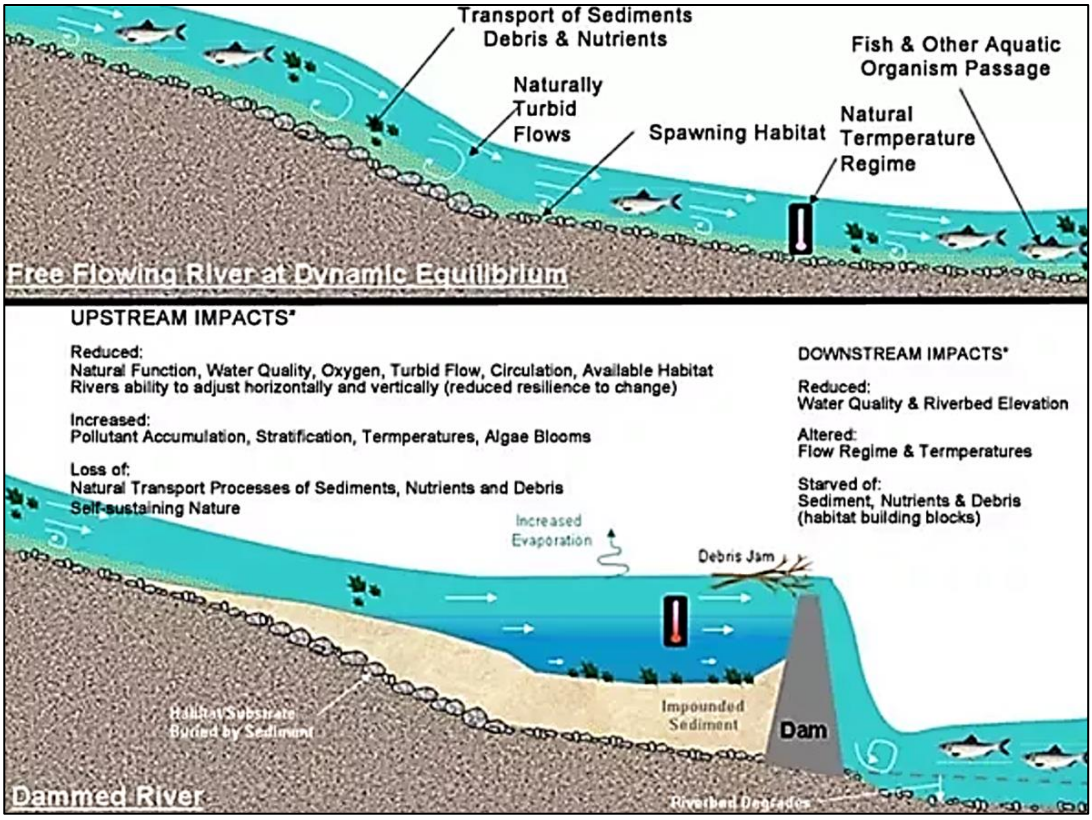
- **Cities/Villages:**
  - **Sewage connection to all households**
  - **Decentralized sewage treatment plants (dSTP) at colony level**
  - **Recycling of urban waste water for reuse.**
  - **Rainwater harvesting to reduce water extraction.**
- **Agriculture:**
  - **Only organic fertilizer for farms along Ganga.**
  - **Micro-irrigation for less water extraction.**
- **Industries:**
  - **Strict effluent treatment guidelines**
  - **CSIR developed 'waterless chrome tanning'. Less water intake & pollution.**
- **Enforce e-flow norms in upstream dams for *aviral dhara*.**

E-flow norms for Ganga:

- **for dams between glacier and Haridwar**
- **notified under EPA, 1986, by NMCG in September 2018**
- **enforced since December 2019**
- **mini and micro projects, which do not alter the flow significantly are exempted.**
- **Central Water Commission maintains this data**

Ecological Flow (e-flow):

- **It is the minimum flow of water needed to maintain river ecosystem**
- **It helps river to naturally clean itself and protect its aquatic biodiversity.**
- **E-flow norms prescribe minimum quantity of water that dams must release to rivers.**



Wetlands

7. आर्द्रभूमि क्या है? आर्द्रभूमि संरक्षण के संदर्भ में 'बुद्धिमत्तापूर्ण उपयोग' की रामसर संकल्पना को स्पष्ट कीजिए। भारत से रामसर स्थलों के दो उदाहरणों का उद्धरण दीजिए। (उत्तर *150* शब्दों में दीजिए)

What is wetland? Explain the Ramsar concept of 'wise use' in the context of wetland conservation. Cite two examples of Ramsar sites from India.

Mains 2018 (Answer in *150* words) 10

Wetland

Area saturated with water, including marshes, floodplains, rice-fields, rivers, lakes and marine areas no deeper than 6 meters at low tide.

'Wise use' of wetlands under Ramsar convention:

Using wetlands in a sustainable manner, while maintaining their ecological character.

Examples of 'wise use':

- **Catchment area: use for recreation, organic farming; no concrete constructions**
- **Water extraction: use water but put upper limit on quantity extracted**
- **Fishing: stop overfishing; encourage rice-fish farming**

Governments can take following steps for 'wise use' of wetlands:

a) **create laws and institutions for wetlands**
b) **develop mechanism for their inventory and monitoring**
c) **create plans covering every aspect of wetland, including their relation with catchment areas.**

Why are wetlands important?

a) **Home to biodiversity, stopover for migratory birds**
   - **Amur Falcon migrate between NE China and South Africa**
   - **Keoladeo NP saw Siberian cranes last time in 2001**
b) **Carbon capture ability prevents global warming**
   - **Peatlands store twice as much carbon as all the world's forests**
c) **Helps in flood mitigation; acts as sponge**
   - **Chennai floods increased due to vanishing wetlands**
d) **They act as natural filters and recharge groundwater**
e) **They are important tourism spots and sustain local economy**
   - **Deepor Beel Assam, Wular lake J&K, Ashtamudi Lake Kerala**

Threats to wetlands:

- **Converted into farmlands**
- **Over-extraction of water for farming/ urban needs**
- **Dumping of construction waste of city**
- **Sewage water drained without treatment**
- **Urban constructions on catchment areas**

Ramsar Convention:

- International treaty established in 1971 by UNESCO in Iranian city of Ramsar.
- Provides framework for conservation and wise use of wetlands
- the only treaty dealing with a specific ecosystem

Ramsar sites:

- Wetlands of international importance under Ramsar Convention
- 46 in India

Some Ramsar sites in India:

- Chilika lake (Odisha), Keoladeo National Park (Rajasthan), Loktak Lake (Manipur)

Montreux record:

- Ramsar sites under serious threat.
- Two in India: Loktak lake Manipur and Keoladeo NP Rajasthan

Wetland Rules 2017:

- Wetland management is responsibility of state governments.
- States to set up State Wetlands Authority headed by State Environment Minister.
- SWA will make list of wetlands; state govt. will notify the list.
- Prohibits dumping of waste, sewage, encroachments, etc.
- 'Wise use' to be determined by state wetland authority.

Criticism of the 2017 rules:

- Does not cover river channels, paddy fields, salt pans, and wetlands in protected areas and CRZs.
- No time limit for states to set up Wetland Authority.
- Replaced Central Wetlands Regulatory Authority with National Wetland Committee which has only advisory role.

Additional comments:

- ❑ In 2011, 'National Wetland Atlas' was prepared by MoEFCC and Space Application Centre of ISRO. It identified 2 lakh wetlands covering 14.7 million hectares.
- ❑ Only notified wetlands get protection; thus small wetlands get ignored.
- ❑ State governments need to be proactive in conservation and 'wise use' of wetlands.
- ❑ In March 2020, P&H HC had to step in to save Sukhna lake:
  - declared it a living entity
  - ordered UT administration to 'notify' it a wetland (done in June 2020)
  - ordered demolition of construction made on its catchment area

Centre for Wetland Conservation & Management:

- ❑ est. in Feb 2021; under MoEFCC
- ❑ Part of National Centre for Sustainable Coastal Management (NCSCM), Chennai

Source: PIB

Wetlands: 4.6% of land (15.26 mha)
Ramsar: ~~42 sites~~ (1.08 mha) 46 sites

Four new Ramsar sites: (42+4=46)

1) Gujarat: Thol Lake Wildlife Sanctuary
2) Gujarat: Wadhvana Wetland
3) Haryana: Sultanpur National Park
4) Haryana: Bhindawas Wildlife Sanctuary

Haryana's first Ramsar sites!
Except Sultanpur, others are man-made

Prelims 2010:

India is a party to the Ramsar Convention and has declared many areas as Ramsar sites. Which of the following statements best describes as to how we should maintain these sites in the context of this convention?

(a) Keep all the sites completely inaccessible to man so that they will not be exploited.
(b) Conserve all sites through ecosystem approach and permit tourism and recreation only.
(c) Conserve all sites through ecosystem approach for a period without any exploitation, with specific criteria and specific period for each site, and then allow sustainable use of them by future generations.
(d) Conserve all the sites through ecosystem approach and allow their simultaneous sustainable use.

Prelims 2019:

Consider the following statements:

1. Under Ramsar convention, it is mandatory on the part of the Government on India to protect and conserve all the wetlands in the territory of India
2. The Wetlands (Conservation and Management) Rules, 2010 were framed by the Government of India based on the recommendations of Ramsar convention.
3. The Wetlands (Conservation and Management) Rules, 2010 also encompass the drainage area or catchment regions of the wetlands as determined by the authority.

Which of the above statements is/are correct?

(a) 1 and 2 only (b) 2 and 3 only
(c) 3 only (d) 1, 2 and 3

Peatland: a wetland with partially decayed plant matter due to water-logging and subsequent anoxia.

Marsh: wetland with herbaceous vegetation

Swamp: wetland with trees

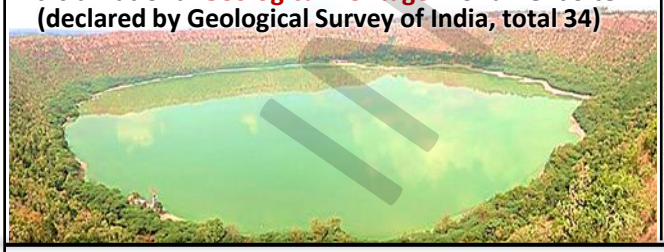
Peatlands

- covers 3% of global land surface
- largest natural terrestrial carbon store
- drained peatlands release huge amounts of GHGs

- 2016 Global Peatlands Initiative; at CoP-22 Marrakech
- 2018 Brazzaville Declaration on Peatlands; by Congo and Indonesia; To prevent degradation of Congo's peatlands (world's largest tropical peatlands).
- 2019 Global resolution on peatlands at 4th UNEP Assembly

Lonar Lake

World's largest crater in basaltic rock.
Formed by meteorite impact 50,000 years ago
Recently turned pink due to Haloarchaea
It is a National Geological Heritage Monument Site (declared by Geological Survey of India, total 34)



Loktak lake Manipur

- Largest freshwater lake in NE India.
- Phumdis (small islands) float on it.
- Has Keibul Lamjao NP (the only floating NP in the world)

Minerals, water, shelter
Fungi ⇌ Algae
Food from photosynthesis

- ✓ Lichens are not plants.
- ✓ Can grow on rocks and plants (epiphytes)
- ✓ Slow growing, can live for centuries.
- ✓ They are bioindicators of air quality.
- ✓ Don't grow in cities due to SO_2 pollution
- ✓ India's first lichen park: Uttarakhand

Lichens

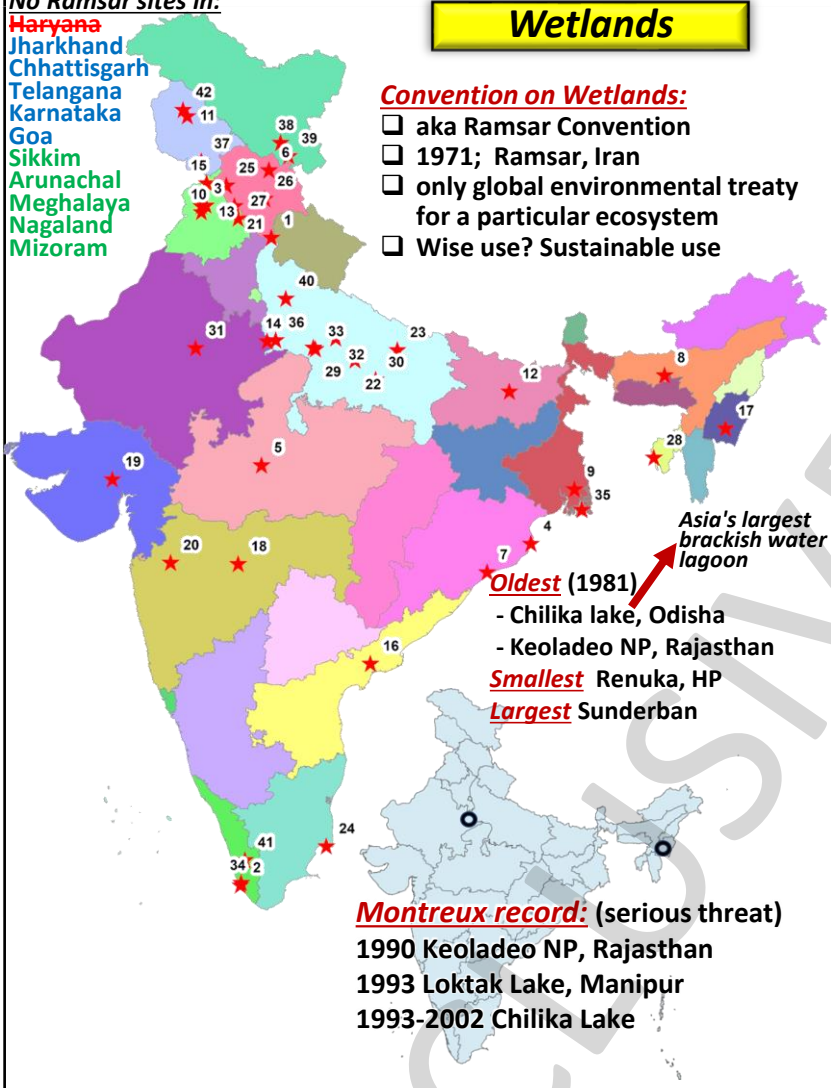
Prelims 2014:

Lichens, which are capable of initiating ecological succession even on a bare rock, are actually a symbiotic association of

(a) algae and bacteria
(b) algae and fungi
(c) bacteria and fungi
(d) fungi and mosses

Wetlands

No Ramsar sites in:
~~Haryana~~
Jharkhand
Chhattisgarh
Telangana
Karnataka
Goa
Sikkim
Arunachal
Meghalaya
Nagaland
Mizoram



Convention on Wetlands:
- ❑ aka Ramsar Convention
- ❑ 1971; Ramsar, Iran
- ❑ only global environmental treaty for a particular ecosystem
- ❑ Wise use? Sustainable use

Asia's largest brackish water lagoon

Oldest (1981)
- Chilika lake, Odisha
- Keoladeo NP, Rajasthan

Smallest Renuka, HP

Largest Sunderban

Montreux record: (serious threat)
1990 Keoladeo NP, Rajasthan
1993 Loktak Lake, Manipur
1993-2002 Chilika Lake

No.	Ramsar site	State
16	Kolleru Lake	Andhra P.
8	Deepor Beel	Assam
12	Kabartal Wetland	Bihar
19	Nalsarovar Bird Sanctuary	Gujarat
6	Chandertal Wetland	HP
25	Pong Dam Lake	HP
26	Renuka Wetland	HP
11	Hokera Wetland	J&K
36	Surinsar-Mansar Lakes	J&K
39	Tsomoriri Lake	J&K
42	Wular Lake	J&K
2	Asthamudi Wetland	Kerala
34	Sasthamkotta Lake	Kerala
41	Vembanad Kol Wetland	Kerala
38	Tso Kar Wetland Complex	Ladakh
18	Lonar Lake	Maharashtra
20	Nandur Madhameshwar	Maharashtra
17	Loktak Lake	Manipur
5	Bhoj Wetlands	MP
4	Bhitarkanika Mangroves	Odisha
7	Chilka Lake	Odisha
3	Beas Conservation Reserve	Punjab
10	Harike Lake	Punjab
13	Kanjli Lake	Punjab
15	Keshopur-Miani	Punjab
21	Nangal Wildlife Sanctuary	Punjab
27	Ropar Lake	Punjab
14	Keoladeo Ghana NP	Rajasthan
31	Sambhar Lake	Rajasthan
24	Point Calimere	Tamil Nadu
28	Rudrasagar Lake	Tripura
22	Nawabganj Bird Sanctuary	UP
23	Parvati Agra Bird Sanctuary	UP
29	Saman Bird Sanctuary	UP
30	Samaspur Bird Sanctuary	UP
32	Sandi Bird Sanctuary	UP
33	Sarsai Nawar Jheel	UP
37	Sur Sarovar	UP
40	Upper Ganga River	UP
1	Asan Conservation Reserve	Uttarakhand
9	East Kolkata Wetlands	WB
35	Sunderbans Wetland	WB

Four new Ramsar sites: (42+4=46)
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2) Gujarat: Wadhvana Wetland
3) Haryana: Sultanpur National Park
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Haryana's first Ramsar sites!
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All-Inclusive GS-2 & GS-3 MAINS 2021

Class-40

Disaster Management

DISASTER MANAGEMENT:

- management of resources to reduce the impact of disasters.

DISASTER:

- a serious disruption beyond a community's ability to cope.
- It occurs due to combination of hazard, vulnerability and incapacity.

HAZARD:

- Anything that has potential to cause damage
- Natural hazards: (naturally occurring phenomenon)
  - Geophysical: earthquake, volcanic activity
  - Hydrological: floods
  - Climatological: heat wave, drought
  - Meteorological: cyclone
  - Biological: epidemic, plague
- Anthropogenic hazards: (caused by humans)
  - Pollution, pesticides, chemical spillage

How to prevent Hazards from turning into disasters:

- Risk assessment, e.g. hazard zonation
- Risk reduction, e.g. strengthen structures, plant mangroves, awareness

VULNERABILITY:

- Conditions which increase susceptibility to hazards
- Physical vulnerability:
  - Due to geographical proximity to hazard
  - e.g. houses made on floodplain of rivers (Assam), East coast cities (Cyclones)
- Social vulnerability:
  - Some social groups are more vulnerable
  - e.g. elderly & disabled in case of floods
- Economic vulnerability:
  - Poor are more vulnerable to hazards
  - e.g. no shelter against heat wave and cold wave
- Environmental vulnerability:
  - Vulnerability due to changes in environment
  - e.g. salt water intrusion in coastal areas, agri run-offs polluting water bodies
- Attitudinal vulnerability:
  - Refusal to take preventive measures
  - e.g. not following building codes in house construction

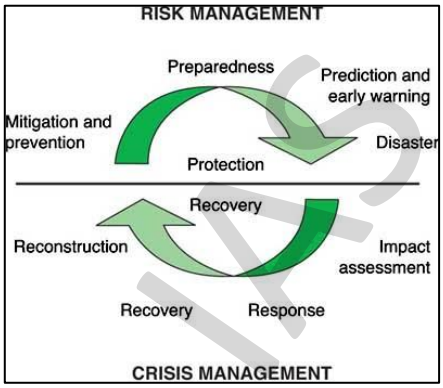
RISK:

- Probability of loss when hazard meets vulnerability
- How to deal with Risks?
  - Accept the risk: poor accepts the risk of flooding while living on floodplains
  - Reduce the risk: constructing earthquake resistant buildings
  - Avoid the risk: govt imposing ban on construction in landslide prone areas
  - Transfer the risk: transfer economic impact of risk through insurance

$$Risk = \frac{Hazard\ X\ Vulnerability}{Capacity}$$ (Think of earthquakes in Japan)

Mains 2019: Vulnerability is an essential element for defining disaster impacts and its threat to people. How and in what ways can vulnerability to disasters be characterized? Discuss different types of vulnerability with reference to disasters.

Disaster Management Cycle



Before disaster:

- Assess hazard and vulnerabilities.
- Take steps for prevention, mitigation, preparedness.

After disaster:

- Speedy response to minimize loss and suffering.
- Take steps for search, rescue, relief (food, water, shelter)
- Rehabilitation: restoring local services for immediate needs, e.g. restoring power supply
- Reconstruction: long-term development to meet present and future needs, e.g. build safer power lines that may not be damaged in future cyclones.

Most questions can be answered by keeping in mind the following diagram:

Mitigation: activities that reduce impact of disaster	Response: activities during a disaster
Preparedness: activities prior to a disaster	Recovery: activities following a disaster

PRE-DISASTER RECOVERY PLANNING:

- Reduces confusion and haphazard decisions in tense post-disaster environment.
- Allows communities to discuss reconstruction policies in calm environment.
- Ensures rapid deployment of resources for faster recovery.

PDRP is a part of recovery planning cycle.
Lessons learnt from other disasters can be incorporated.

Impact based forecasting

- Weather forecasting:
  - → predicting weather conditions,
  - → e.g. category 3 cyclone will hit in next 24 hours
- Impact forecasting:
  - → predicting impact of weather conditions
  - → e.g. category 3 cyclone will hit in next 24 hours and is may damage bridges & power lines

- Data on hazard and vulnerability is integrated to predict likely damage.
- Location specific impact is predicted, infrastructure at risk is identified.
- Warnings are issued to areas that are prone to damage.

Role of Local Bodies

Pre-disaster:

- Vulnerability mapping of local area.
- Identify safe locations for people, food & water, medicines, etc.
- Create evacuation plan, with priority for children, aged, disabled.
- Prepare and update list of youth volunteers.
- Spread awareness, train locals, etc.

Post-disaster:

- Ensure appropriate distribution of relief material.
- Assess the damage and communicate it to district administration
- Construct temporary shelters and sanitary facilities.
- Coordinate efforts of govt, private and other organisations.

Role of Community

- Their indigenous knowledge can be used in planning process.
- They are direct victims and first responders to the disaster.
- Their cooperation is necessary for coordinated response to disaster.
- Their unity helps in smooth distribution of relief packages
- Social and psychological rehabilitation of victims depends on community support.
- Where communities are prepared, disasters have less impact.

How can the community be involved?

- Knowledge of local geography and past disasters
- Location and hazard specific training program (flood, industry, etc.)
- Conduct periodic mock drills in local markets, schools, etc.
- Include Do's and Don'ts in school and vocational education

Global initiatives

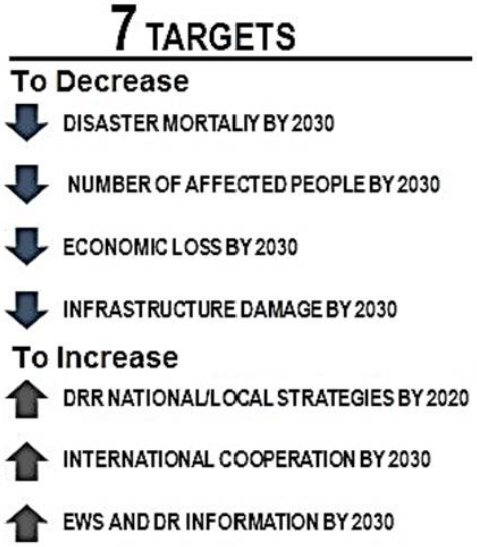
World Conference on Disaster Risk Reduction:

UN conferences, three times, all hosted in Japan.
Yokohama in 1994, Kobe in 2005, Sendai in 2015

- Hyogo Framework for Action (2005–2015) was outcome of Kobe conference.
- Sendai Framework for DRR (2015-30) is successor of Hyogo framework. It has four priorities for action and seven targets

Four priorities for action under Sendai framework:

1) Understand disaster risk
2) Strengthen disaster risk governance to manage disaster risk
3) Invest in disaster risk reduction for resilience
4) Enhance disaster preparedness for effective response, and to "Building Back Better" in recovery, rehabilitation and reconstruction.



Coalition for Disaster Resilient Infrastructure:

- ✓ Countries, agencies, etc. will share knowledge to build disaster-resilient infra.
- ✓ It was launched by India PM in September 2019 at UN Climate Action Summit in New York.
- ✓ Its interim Secretariat is at NDMA headquarters in New Delhi.
- ✓ It is the second major coalition launched by India (first being International Solar Alliance).

India's vulnerability to disasters

- India is among the world's most disaster-prone countries with 27 of its states and UTs exposed to recurrent natural hazards.
- 85% area vulnerable to single or multiple disasters
- 57% area prone to earthquakes
- 12% area prone to floods
- 08% area, and 75% of coastline, is prone to cyclone
- 68% of cultivable area prone to drought

Challenges:

- Climate change will increase frequency of disasters like cyclones, floods, drought.
- Weak compliance of law, e.g. building laws not followed (fire, earthquake)
- Poverty and low income (Rs 1.35 lakh per capita income) (disasters impact poor the most)
- Low insurance penetration to reduce financial impact
- Geographical factors like tectonic plate boundary, monsoon dependence, long coastline, etc.

National Disaster Management Plan 2016

It specifies role and responsibility of various govt agencies for all phases of disaster management (prevention, mitigation, response, recovery)

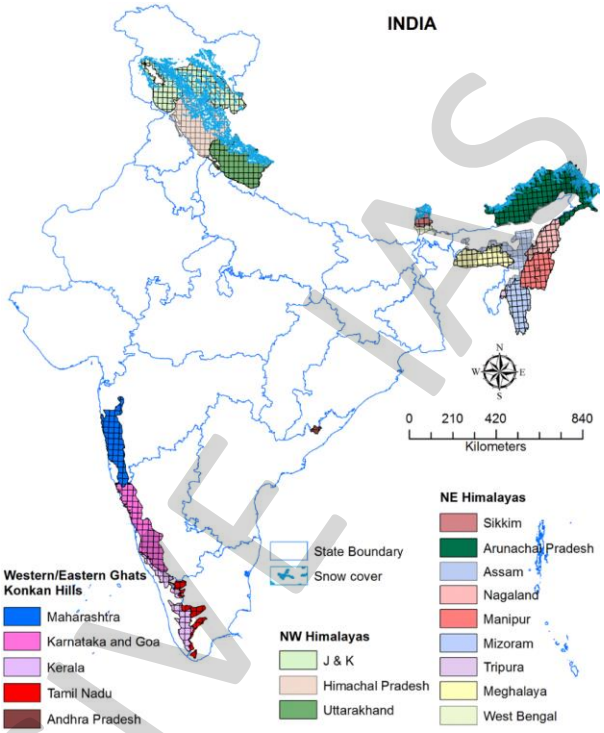
For each hazard, it includes priorities set in the Sendai Framework for DRR:

1) Understand the Risk: Vulnerability assessment, zoning, monitoring, early warning
2) Inter-agency coordination: improve disaster governance, coordinated response
3) Invest in structural measures: create physical infra to help communities cope with disasters
4) Invest in non-structural measures: create laws/rules/guidelines to increase resilience e.g. building codes
5) Capacity development: awareness, training, mock drills, etc.

Issues with NDMP 2016:

- Activities given in the plan are already mentioned in NDMA 2005
- Activities assigned to different bodies are very generic in nature
- No time frame given to undertake these activities
- No mention of source or amount of funds
- No goals/targets are set, unlike Sendai Framework

Landslide



Landslide: down-slope movement of soil and rock, under the direct influence of gravity.

12.6% of India's land is prone to landslide hazards.

World's top two landslide hotspots are in India:

1. southern edge of Himalayan arc
2. Western Ghats

States with most landslide prone areas:

1. Arunachal Pradesh
2. Jammy and Kashmir
3. Himachal Pradesh
4. Uttarakhand
5. Maharashtra

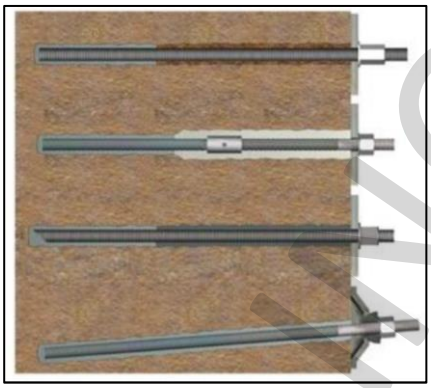
What causes landslides?

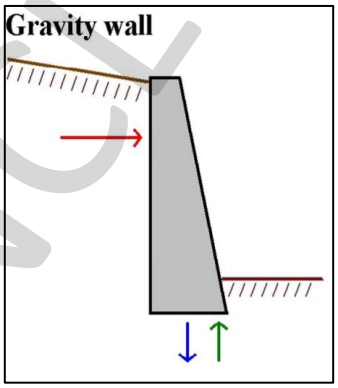
- Earthquakes
- Heavy rains
- Deforestation of slope
- Hill-cutting / construction on slope

What can be done?

- Landslide zoning to identify landslide prone areas
- Impose restrictions on deforestation and construction activity
- Use slope stabilisation measures, like growing vegetation, water drainage, etc.
- Install landslide monitoring and early warning systems.

Rock anchor





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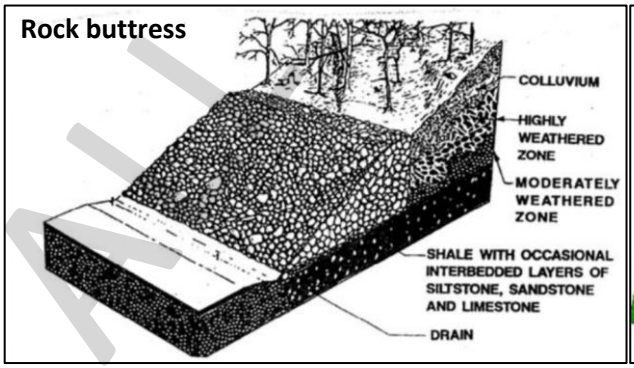
Work on for early landslide warning system

PTI

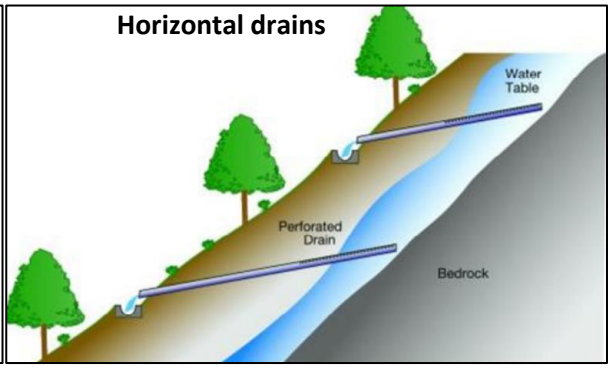
NEW DELHI, OCTOBER 25, 2021 06:13 IST
UPDATED: OCTOBER 25, 2021 04:34 IST

India has the highest number of landslides and deaths due to it in the world

Rock buttress



Horizontal drains



Floods

Flood: Temporary inundation of any area with water.
Flash Flood: Sudden local flood due to cloudburst, GLOF etc.
River Flood: Due to high precipitation, normally builds up slowly.
Coastal Flood: flood in coastal area due to cyclone, tsunami, sea level rise.

12% of India's land (40 million hectares) is prone to floods
Traditionally flood prone areas: Ganga-Brahmaputra plains
Now floods in other areas also, because: changing rainfall pattern, more cyclones, cities, GLOFs.

Use of Technology:

- Use hazard zonation mapping to identify flood prone areas.
- Forecasting of excess rainfall, Cyclone path and intensity, formation of Glacial lakes.
- During floods, satellite images give update flood conditions.
- Satellite phones can help when other means of communication fail.

Flash flood

Sudden local flood that occurs within few minutes or hours

Areas at risk:

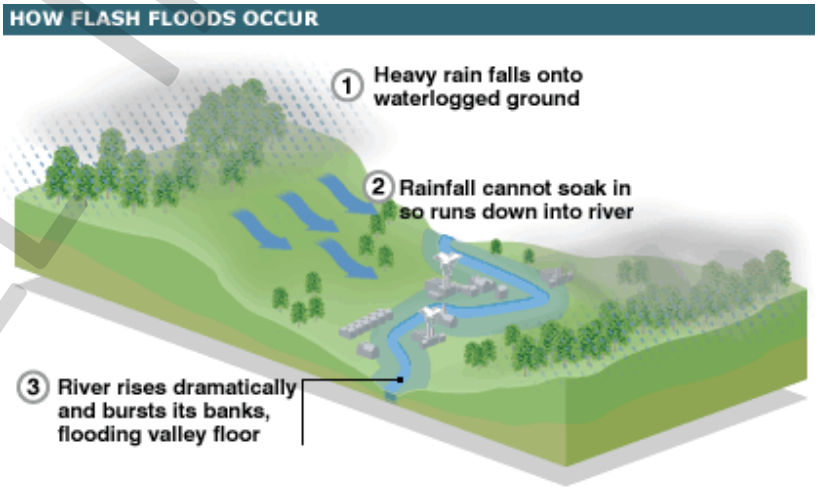
- Himalayas: due to cloudburst and GLOFs
- Cities: due to concretisation of land and choking of drains
- Habitation near rivers: due to sudden rise in water level
- Dam downstream areas: due to dam failure or sudden release of water

What can be done?

- Monitor formation of GLOFs, create drainage.
- In cities restore parks & wetlands, unclog drains.
- Real time monitoring and Early warning system.
- No construction in flood prone areas.

South Asian Flash Flood Guidance System:

- launched by IMD in 2020, for BBIN, Sri Lanka.
- warning will be issued 6-24 hours in advance



Urban Disasters

Urban Disasters:

(Flood, fire, earthquake, heat wave)

- ❑ **Census 2011: 31% of Indians lives in urban areas**
- ❑ **By 2030: 40% of Indians will be living in urban areas**

Unplanned urbanization increases risk of disasters:

- ➢ **Inadequate housing → people have to live on floodplains**
- ➢ **Expensive housing → proliferation of slums → threat of fire**
- ➢ **Poorly designed buildings → earthquake risk**
- ➢ **Change in land use → concretization of open areas → threat of floods**
- ➢ **Industrial areas close to residential complexes → industrial disasters**

What can be done? (also see class-23)

- ➢ **Create buffer areas near rivers**
- ➢ **Affordable housing for poor**
- ➢ **Urban planning, adequate open spaces**
- ➢ **Audit of buildings (earthquake, fire)**

Urban Floods

Urban flooding is different from rural flooding:

- ➢ **Faster: occurs quickly, sometimes within minutes**
- ➢ **Intensity: higher flood volume up to 6 times**
- ➢ **Impact:**
  - ➢ **High population density, so impacts more people.**
  - ➢ **Centres of economic activities, so damage can have national and global implications.**

Reason:

- ➢ **Heavy rainfall due to urban heat island effect**
- ➢ **Concretization of catchment areas, disappearing open areas and wetlands**
- ➢ **Stormwater drainage systems are of low capacity, poor maintenance**
- ➢ **Clogging of drains due to dumping of solid waste.**
- ➢ **Encroachment on natural drains and river flood plains has reduced their capacity.**

Urban Fires

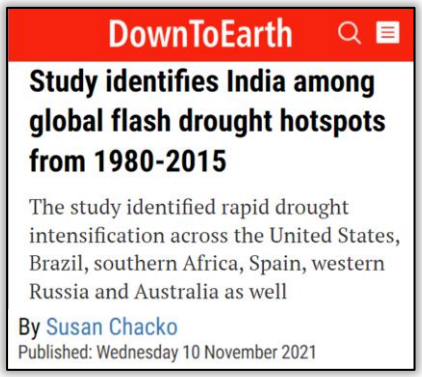
As per NCRB data, about 9000 people lost their lives in fire related incidents in 2020.

Vulnerability of urban areas to fires:

- ➢ **Proliferation of slums (unsafe electric connections, no evacuation)**
- ➢ **Industries/godowns in residential areas**
- ➢ **Narrow/congested roads, encroachments, makes movement of firefighters difficult**
- ➢ **High demand of electricity puts pressure on infra, poor wiring causes short-circuit**
- ➢ **Building laws not followed, NOC from fire department not obtained / obtained by corruption**

Note:

- ➢ **Fire department comes under state govt or municipality**
- ➢ **National Building Code has detailed provisions on fire safety.**



DownToEarth

Study identifies India among global flash drought hotspots from 1980-2015

The study identified rapid drought intensification across the United States, Brazil, southern Africa, Spain, western Russia and Australia as well

By Susan Chacko
Published: Wednesday 10 November 2021

Flash Drought

- ❑ Flash drought is rapid onset or intensification of drought.
- ❑ It occurs due to low rainfall and high temperature.
- ❑ Soil moisture rapidly reduces due to high evapotranspiration.
  (Evapotranspiration: evaporation from land and transpiration from vegetation)

Causes:

- Inadequate rainfall (climate change, erratic rain pattern)
- Dependence of agri on rain
- Growing water-intensive crops in areas with low water availability.
- Traditional water harvesting systems abandoned in most areas.

Effects of Flash drought:

- Low agri productivity due to low soil moisture
- Low rural incomes, higher indebtedness, increase in poverty.
- Low economic activity, as agri supplies raw material to many industries.
- Degradation of forests, high chances of forest fires due to dry conditions.

What can be done?

- Early warning system
- Cropping pattern as per local water availability
- Provision of irrigation in maximum areas
- Micro-irrigation instead of flood irrigation
- Relief to people, use of MNREGA, and other schemes.

Note:

- Drought is a slow onset disaster which evolves over weeks/months.
- MoA&FW is the nodal ministry to manage drought conditions.
- Also see class-15 on water

Earthquakes

Vulnerability:

- India lies at boundary of two converging tectonic plates. Indian plate still moving at 5 cm/year under Eurasian plate.
- Construction of large dams can trigger earthquakes.
- Building codes not followed, most buildings not earthquake resistant.
- Earthquakes can cause other disasters like landslides, fire, etc.
- High population density. 56% of India's area is vulnerable to moderate to major earthquakes where 82% of the population live.

What can be done?

- All new construction should be made earthquake resistant.
- Retrofitting of critical infra dams, gas pipelines, hospitals, govt offices, high rise buildings, etc.
- Strict enforcement of building codes.
- Awareness among general public, mock drills in schools.

Note:

- Earthquakes can neither be prevented nor predicted.
- But their impact can be reduced.
- Earthquakes don't kill people, unsafe buildings do.

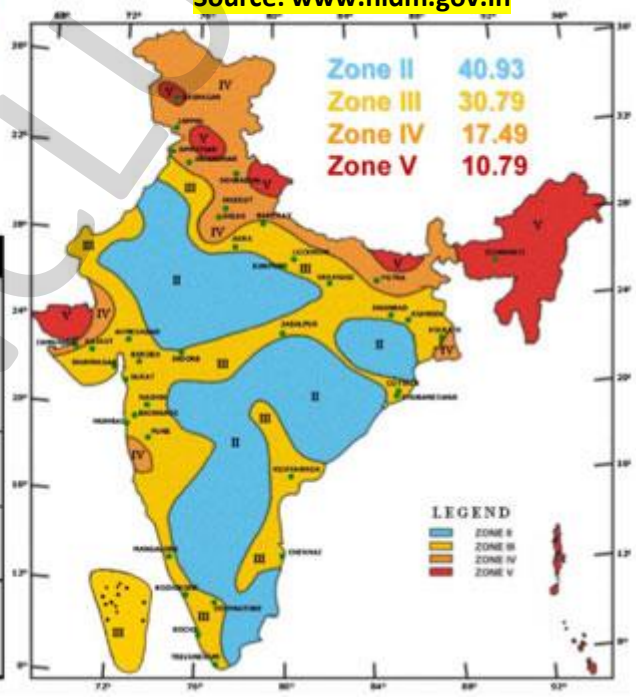
India has been divided into four seismic zones

Source: www.nidm.gov.in

Seismic Zone Map of India: -2002

About 59 percent of the land area of India is liable to seismic hazard damage

Zone	Intensity
Zone V	Very High Risk Zone Area liable to shaking Intensity IX (and above)
Zone IV	High Risk Zone Intensity VIII
Zone III	Moderate Risk Zone Intensity VII
Zone II	Low Risk Zone VI (and lower)




The Indian EXPRESS SUBSCRIBE Epaper

Things getting worse in Western Ghats, says ecologist Madhav Gadgil

Gadgil, while blaming the ecologically damaging activities like stone quarrying for disasters happening in Western Ghats, dismissed the suggestion that the time is over for implementing the report to protect the hills.

By: PTI | Thiruvananthapuram |
Updated: October 19, 2021 5:59:18 pm

Western Ghats

- Over two dozen people lost their lives in landslides and flash floods in Kerala in October 2021. (many earlier cases also, like 105 landslides in Coorg in 2018)
- Ecologically damaging activities like stone quarrying should be stopped.
- Gadgil Committee report 2011 must be implemented.

Role of people:

- 73rd and 74th amendments mandate people's participation in decision making.
- People must put pressure on elected representatives to take steps to end disasters.
  e.g. in Plachimada in Kerala, protests by locals forced Coca Cola to shut down factory in 2004.
- Gadgil report supports people's participation in decision making
- However, Kasturirangan report said locals have no role in decision making.

Western Ghats:

- Older than Himalayas, they host 30% of all species found in India.
- They are one of the four Biodiversity hotspots in India.
- They cover 1.4 lakh sq. km. in a 1,600 km long stretch.
- Spread over Kerala, Tamil Nadu, Karnataka, Goa, Maharashtra and Gujarat.


TOI OPINION WRITE FOR TOI BLOGS

All is not quiet in the Western Ghats – but despite massive ecological disturbances governments carry on business as usual

September 16, 2020, 9:23 PM IST / Viju B in Second Nature, Edit Page, India, TOI

What is damaging western ghats?

- Mining activities, Deforestation, timber mafia
- Unscientific road expansion, Construction of resorts
- Manmade forest fires
- Hydroelectric projects
- More intense rain events

What should be done?

- Conduct landslide audit of entire region
- Prepare micromaps to rehabilitate people
- Conduct river audits and mark river floodplains
- Undertake scientific reservoir management
- Stop mining in ecologically sensitive areas
- Review proposed hydro projects

Industrial Disasters

Fault on part of Government:

- ✓ Inefficiency and corruption in govt. departments allow hazardous manufacturing units to work without proper safety audits and inspections.
- ✓ Relaxation of industrial regulations which are viewed as a barrier to ease of doing business.
- ✓ Failure to stop encroachment on area around industrial areas.

Fault on part of Industries:

- ✓ Companies not aware of safe practices in handling the chemicals, or machinery they are using.
- ✓ Storing and handling hazardous chemicals by factories in unorganized sector.
- ✓ Companies not following safety protocols like not giving PPE to contract workers.
- ✓ Many factories do not regularly inform and update the nearby public about the disaster management plan in case an accident occurs.

Fault on part of workers:

- ✓ Workers avoid wearing safety kits as they may be uncomfortable.
- ✓ Workers are inattentive while during safety trainings.
- ✓ Workers disobey safety rules due to lack of respect to workplace.

Fault on part of public:

- ✓ Public living nearby factories are unaware of the nature of industry and the hazards it poses to health and life. They are also not aware of what to do when an accident occurs around.

Way Forward:

- ✓ Zoning of industrial zones on basis of hazard potential.
- ✓ Creating disaster management plan for each zone.
- ✓ Wide publicity of DM plan to all stakeholders.
- ✓ Creating and maintaining buffer zones around hazardous industries.
- ✓ Creating mechanism for inter-agency coordination for quick response.
- ✓ Investing in structural measures like creating safety shelters.
- ✓ Consolidating industrial safety rules and laws to make their execution easier.
- ✓ Regular training of employees and maintenance of machinery.
- ✓ DM plan should be regularly updated with local institutions like hospitals and fire stations.
- ✓ Strict adherence to guidelines all the times, not just after disasters.

May 2020: Styrene gas leaked from Vishakhapatnam plant of LG Polymers causing 11 deaths and affecting thousands of people. NGT invoked the principle of Strict Liability to impose a fine on the LG Polymers, which was later revised to Absolute liability.

Strict vs Absolute liability:

- ❑ Normally, a person is liable only when he is at fault.
- ❑ However, under the principle of "no fault liability" person may not have done the act, but he'll still be responsible for the damage caused due to the acts.
- ❑ Strict liability and absolute liability are two such examples.

Strict Liability Principle:

- ❑ Company is not liable and need not pay compensation if a hazardous substance escapes its premises by accident or by an 'act of God' among other circumstances.

Absolute Liability Principle:

- ❑ Company has to mandatorily pay compensation, whether or not the disaster was caused by its negligence.
- ❑ Section 17 of the NGT Act, 2010 mandates that the Tribunal should apply the absolute liability principle even if the cause was an accident.

Supreme Court in MC Mehta case (Oleum gas leak case) 1987:

- ❑ Principle of Strict liability was created before advancements in technology and the economy.
- ❑ But today companies can't claim that the accident was not due to negligence or that it had taken all reasonable precautions.

Disaster Management

Who notifies a disaster? MHA
Which law was used to impose lockdown and other orders like quarantine?
- ✓ Disaster Management Act, 2005
- ✓ Epidemic Diseases Act, 1897

Disaster Management Act, 2005
- ❑ At National, State, District level it provides for Authority (PM/CM/DM), Fund, Mitigation Fund.
- ❑ National Executive Committee headed by Home secretary (not Health secretary) .

Epidemic Disease Act, 1897
To tackle Bubonic plague in Bombay
Doesn't define dangerous epidemic disease

Strict vs Absolute Liability:
If company's equipment/chemical caused harm to people, then is the company liable?

Strict liability: Yes, but with exceptions (Act of God, Act of Stranger, etc) (old concept)

Absolute liability: Yes, no exceptions (since 1986 Oleum case)
Today there are many methods / technologies / procedures for company to protect its equipment.

India Meteorological Department:
- ❑ 1875; HQ Delhi
- ❑ Ministry of Earth Sciences

National Disaster Response Fund:
- ✓ It is defined in Disaster Management Act, 2005
- ✓ It gets money from cess, budgetary allocations, and voluntary contributions. ★
- ✓ It is placed in the 'Public Account' of Union Govt.
- ✓ It is audited by CAG. ★
- ✓ It supplements SDRF of a State.
- ✓ Disasters: Cold wave? Yes. Heat wave? No.
- ✓ Cyclone, drought, earthquake, fire, flood, tsunami, hailstorm, landslide, avalanche, cloudburst, pest attack, frost and cold waves.

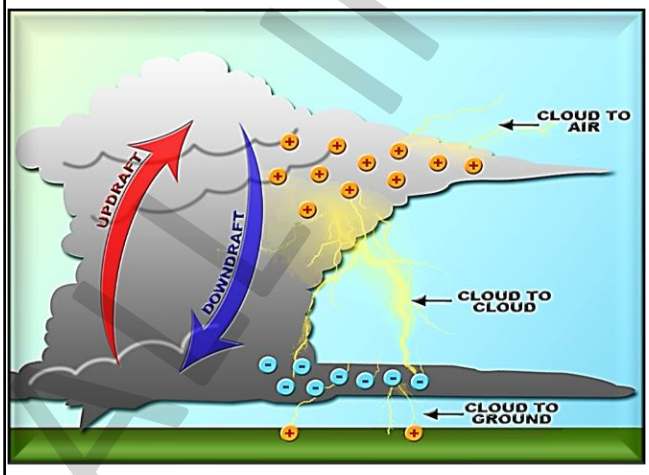
Global Assessment Report on DRR
- ❑ published biennially by the UN Office for Disaster Risk Reduction (UNDRR)

UNDDR:
- ❑ 1999 ; HQ Geneva, Switzerland
- ❑ part of UN Secretariat

Sendai framework for DRR:
- ❑ For 15 years 2015-2030
- ❑ It is successor to Hyogo Framework for Action 2005-2015

National Institute of Disaster Management:
- ❑ Statutory body; Disaster Management Act, 2005
- ❑ under Ministry of Home Affairs

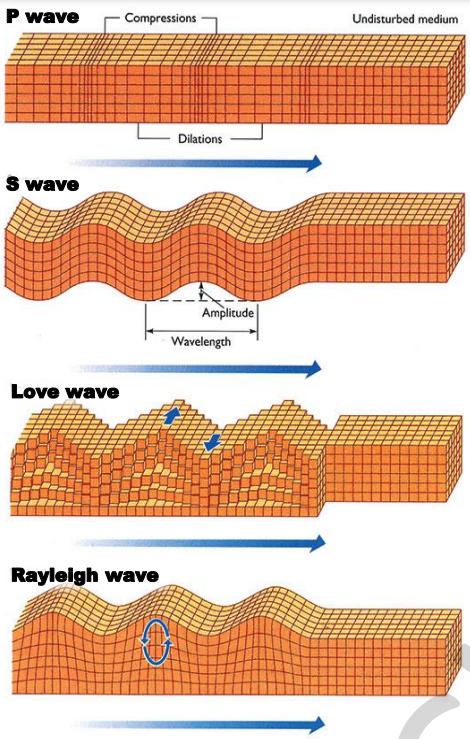
Lightning



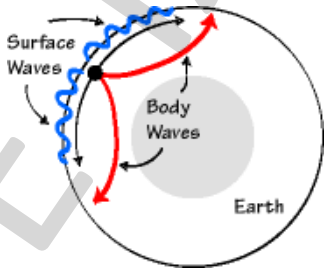
How lightning is formed:
- ➢ Winds inside the cloud are very turbulent.
- ➢ Updraft carries water droplets up the cloud.
- ➢ Downdraft push ice to bottom part of cloud.
- ➢ The process triggers release of electrons.
- ➢ Top of cloud forms positive charge.
- ➢ Bottom of cloud forms negative charge.
- ➢ Lightning occurs within the cloud, between clouds, between cloud and earth.

Styrene

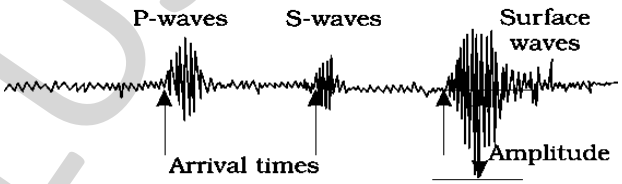
- ✓ Stored as liquid, evaporates easily.
- ✓ It is a 'hazardous chemical' under Hazardous Chemical Rules 1989. (multiple ill effects)
- ✓ Used to make Polystyrene
- ✓ Polystyrene is used in disposable cups, home appliances, automobiles, electronics, etc.

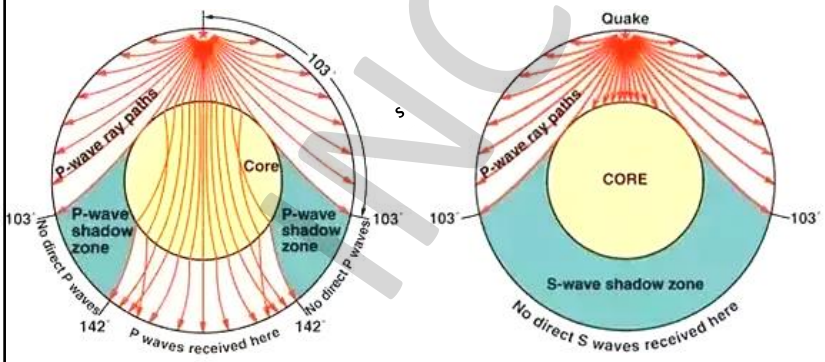


Earthquakes



- ➢ All natural earthquakes take place in the lithosphere
- ➢ Waves are faster in denser material.
- ➢ Body waves: move through the body. P-waves travel through solid liquid gas. S-waves travel only through solid.
- ➢ Surface waves: move along the surface. They are generated when body waves interact with surface rocks. Most destructive.





P-wave shadow zone = 103°-142° S-wave shadow zone = 154°

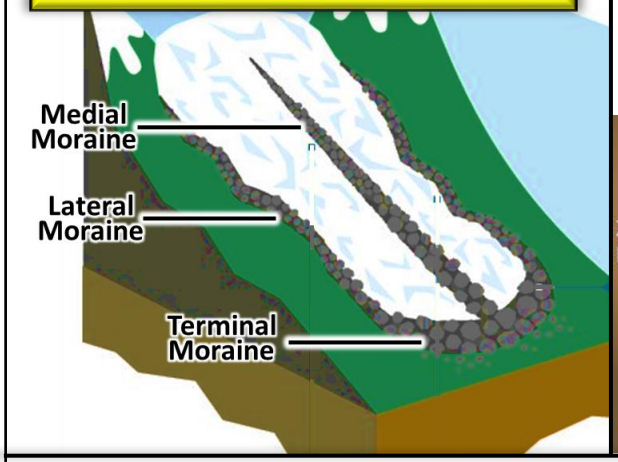
- ❑ Earthquakes can be predicted few hours before. No
- ❑ Warning can be sent seconds before an earthquake strikes? Yes (P vs S)
- ❑ Google is turning Android phones into Earthquake Detectors.
- ❑ Benefit: Elevators, gas pipelines can be shut off automatically

Mercalli - intensity - observed effects of earthquake
Richter - magnitude - seismic waves or energy released energy

If confused in exam, just recall two things:

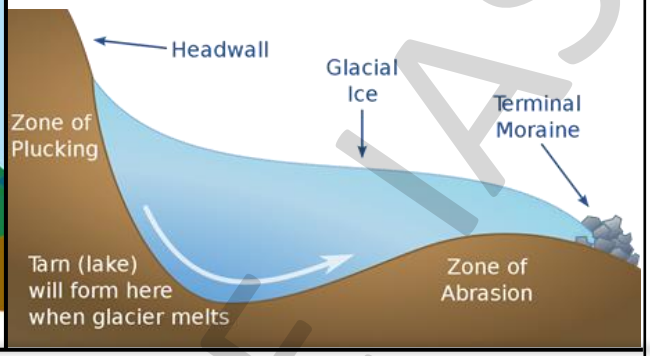
1. Which scale is mentioned in news? Richter
2. When is it mentioned? Within 5 minutes of earthquake. Within 5 minutes, we can measure magnitude (i.e. Energy, not intensity or destruction)

Glacial Lake Outburst Floods



Glacial till:
sediment deposited by glacier (can form moraine)

Moraine:
material left behind by a moving glacier (soil, rock)



Drought

- **Meteorological** drought: less **rain**
- **Hydrological** drought: less water in **dams**
- **Agri**cultural drought: low **soil** moisture
- **Ecological** drought: low **ecosystem** productivity

Flash drought:
If no rain happens, and temperature also rises abnormally, soil will lose moisture fast, leading to sudden drought, called as Flash drought. Biggest impact seen on Agriculture.

Prelims 2014

4. Consider the following pairs :

Programme/Project		*Ministry*
1. Drought-Prone Area Programme	:	Ministry of Agriculture
2. Desert Development Programme	:	Ministry of Environment and Forests
3. National Watershed Development Project for Rainfed Areas	:	Ministry of Rural Development

Heat Waves

- ❑ Heat Wave is a notified disaster under Disaster Management Act, 2005? **No**
- ❑ Heat wave is included in the list of 12 disasters eligible for relief under National/ State Disaster Response Funds? **No**

	Plains	Coastal	Hills
Precondition	40	37	30
Heat wave	Normal + 4.5 or 45	Normal + 4.5	Normal + 4.5
Severe Heat wave	Normal + 6.4 or 47	Normal + 6.4	Normal + 6.4

**** All figures indicate maximum temperature***

Forest Fires

Causes: **lightning, rockfall sparks, cigarette, camp fire, electric cables, shifting cultivation, mafia, etc.**

Impacts: **air, water, wildlife, livelihood, loss of carbon sink; increase tropospheric ozone; damage stratospheric ozone**

Benefits of light forest fire:

- ✓ Return nutrients to soil, that were stored in dead trees
- ✓ Eliminates invasive weeds, insects, diseases
- ✓ Clears forest floor for new seeds to germinate
- ✓ Some trees need light fire to flower e.g. Banksia
- ✓ Controlled fires can prevent natural fires

21% of India's forest area is prone to fire

Cyclones

Name	Region
Cyclone	Indian Ocean
Hurricane	Atlantic Ocean
Typhoon	Japan, China
Willy Willies	Australia

Temperate cyclone	Tropical cyclone	Trick to remember
Move west to east → (Westerlies)	Move east to west ← (Easterlies)	Cyclones come from Bay of Bengal to Odisha
Affects larger area	Affect less area	Mostly only Odisha is in news
Lower wind speed	Higher wind speed	Very high winds in news
Can form on sea as well as land	Forms on sea, dissipates on land	Most news comes only till it reaches coast
Formed due to fronts	Frontal system absent	Never saw this in news
Usually lasts 14 days	Usually lasts 7 days	News only for 3-4 days

Conditions favorable for the formation and intensification of tropical cyclones:

1. **Large sea surface with temperature higher than 27° C**
   - ❑ For low pressure area to form
2. **Small variations in the vertical wind speed**
   - ❑ Air rises; moisture in air condenses; releases latent heat; this energy intensifies cyclone
3. **Presence of the Coriolis force enough to create a cyclonic vortex**
   - ❑ At the equator, the Coriolis force is zero.
   - ❑ Low pressure gets filled instead of getting intensified.
4. **A pre-existing weak low-pressure area or low-level-cyclonic circulation**
   - ❑ Many Bay of Bengal cyclones are remains of typhoons
5. **Upper divergence above the sea level system**

Why more cyclones recently in Arabian sea?

Main reason is global warming, but exactly how, is under research, multiple theories, not for prelims

Why more cyclones in Bay of Bengal than Arabian sea?

1. Higher sea surface temperature
2. Many Bay of Bengal cyclones are remains of typhoons

Medicanes? Mediterranean Hurricanes; colder; smaller

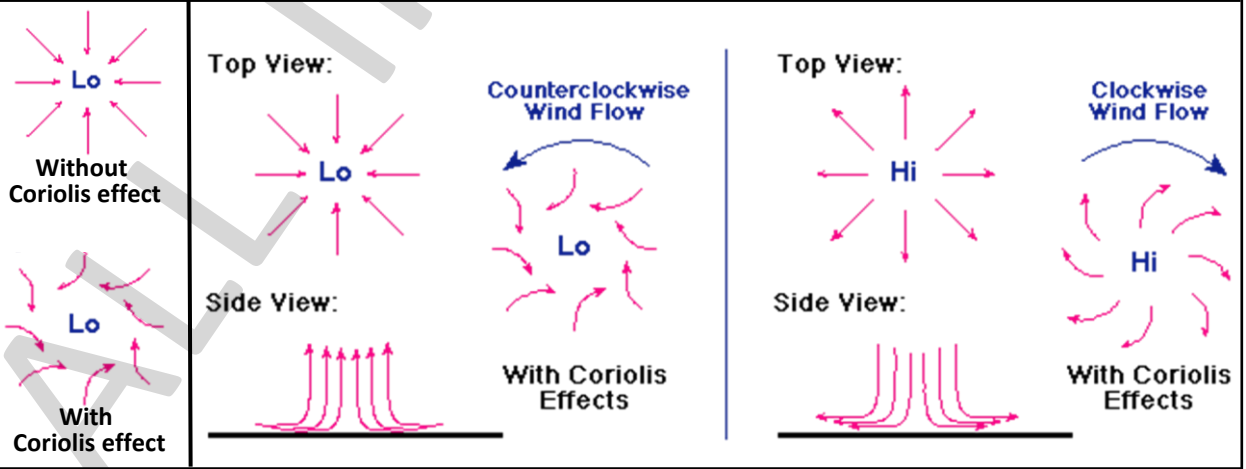
Naming of cyclones in Indian Ocean:

- ✓ Chosen from list of 169 names (13 countries submit 13 names each)
- ✓ Mechanism by WMO and UN-ESCAP
- ✓ IMD as RSMC names cyclones in Indian Ocean

RSMC: Regional Specialised Meteorological Centres

Table 10.2 : Pattern of Wind Direction in Cyclones and Anticyclones

Pressure System	*Pressure Condition at the Centre*	*Pattern of Wind Direction*	
		Northern Hemisphere	*Southern Hemisphere*
Cyclone	Low	Anticlockwise	Clockwise
Anticyclone	High	Clockwise	Anticlockwise



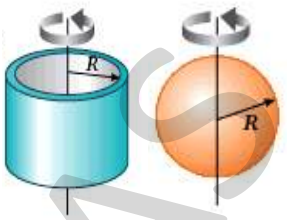
Prelims 2010:

What causes wind to deflect towards left in the Southern Hemisphere?

(a) Temperature
(b) Magnetic field
(c) Rotation of earth
(d) Pressure

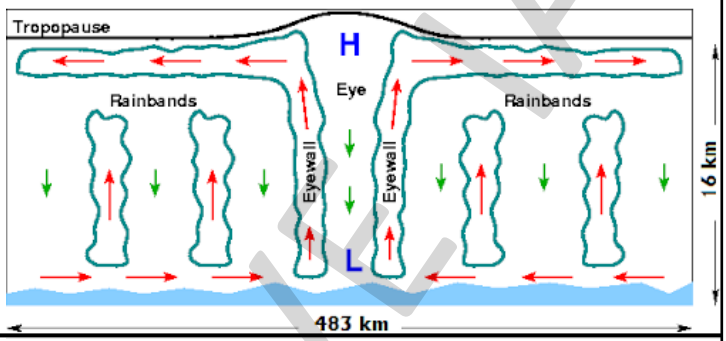
Coriolis Force

The rotation of the earth about its axis affects the direction of the wind. This force is called the Coriolis force after the French physicist who described it in 1844. It deflects the wind to the right direction in the northern hemisphere and to the left in the southern hemisphere. The deflection is more when the wind velocity is high. The Coriolis force is directly proportional to the angle of latitude. It is maximum at the poles and is absent at the equator.



Prelims 2002:

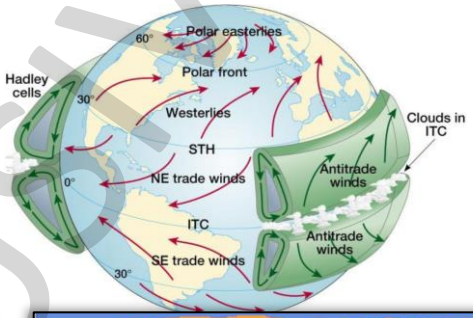
(A): Surface winds spiral inwards upon the centre of cyclone
(R): Air descends in the centre of cyclone
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT a correct explanation of A
(c) A is true but R is false
(d) (d) A is false but R is true

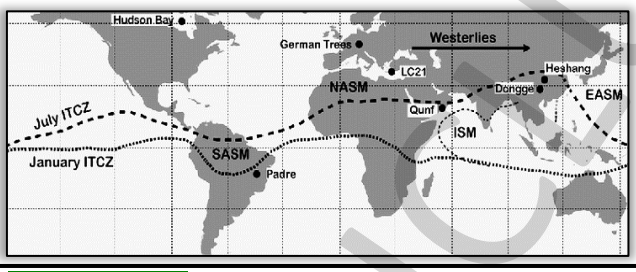


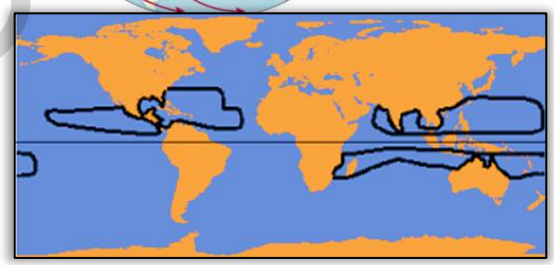
Prelims 2015:

In the South Atlantic and South Eastern Pacific regions in tropical latitudes, cyclone does not originate. What is the reason?

(a) Sea Surface temperatures are low
(b) ITCZ seldom occurs
(c) Coriolis force is too weak
(d) Absence of land in those regions





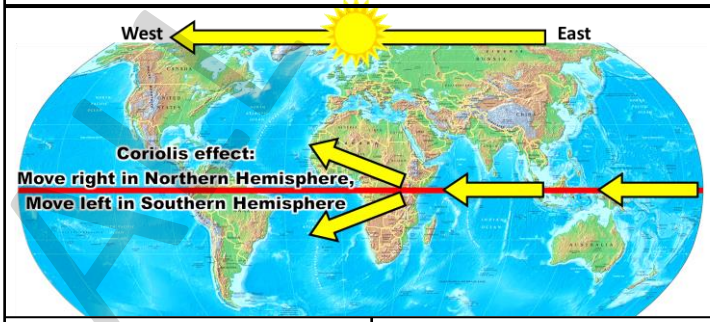


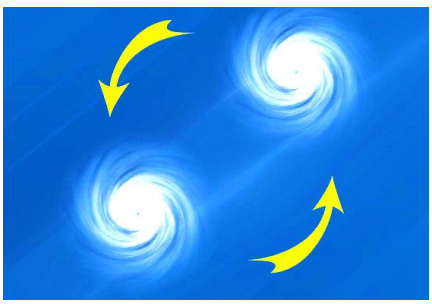
Prelims 2020:

Consider the following statements:

1. **Jet streams occur in Northern Hemisphere only**
2. **Only some cyclones develop an eye**
3. **The temperature inside the eye of a cyclone is nearly 10°C lesser than that of the surroundings**

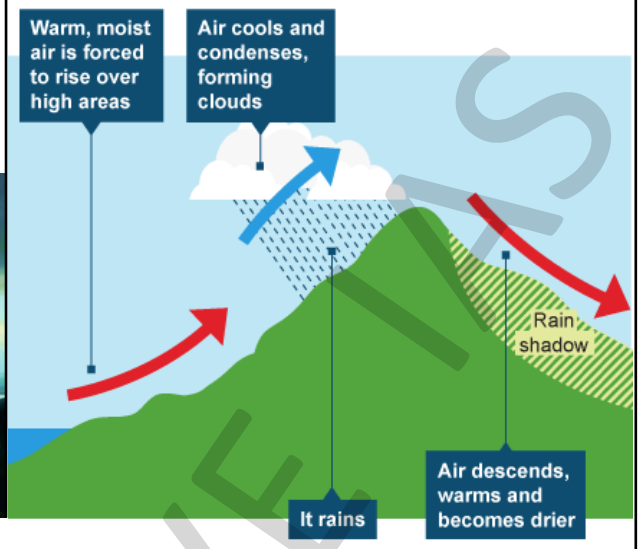
Which of the above statements is/are correct:
(a) 1 only (b) 2, 3 only (c) 2 only (d) 1, 3 only

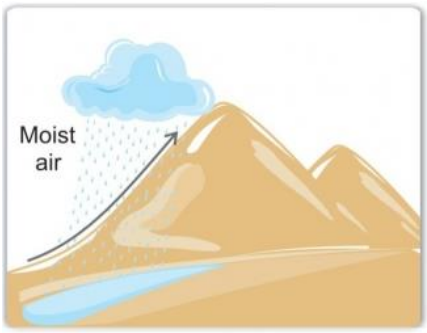




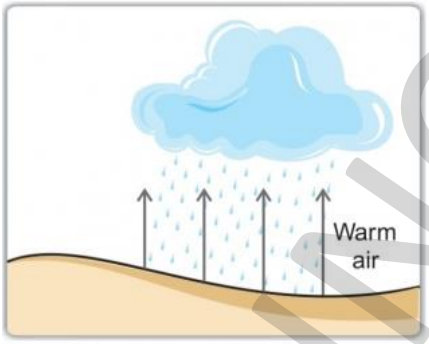
Fujiwhara effect: two nearby cyclonic vortices move around each other. They may merge, or move away on their own paths after some time.

Cloudburst

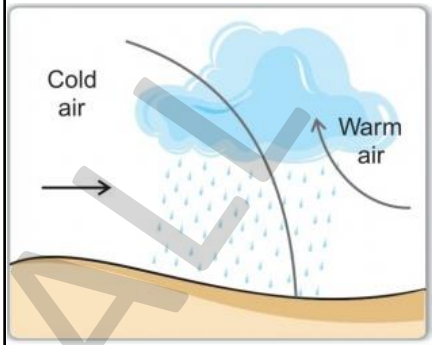




Relief (Orographic) Rainfall



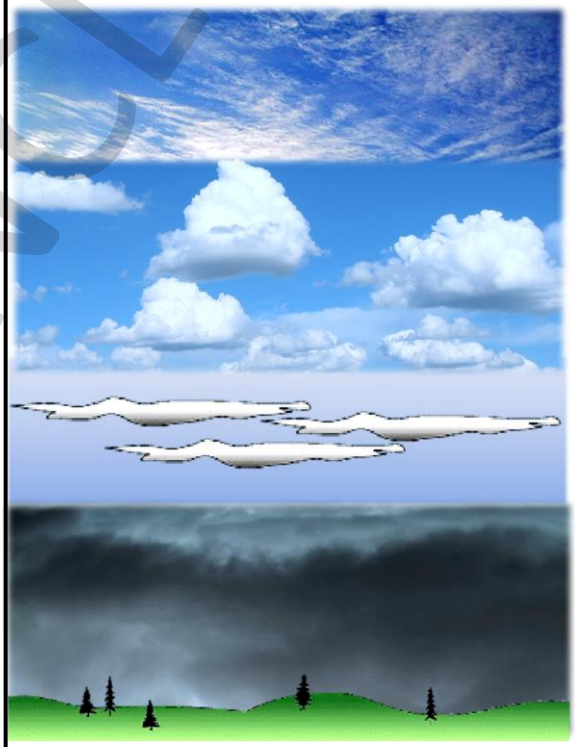
Convectional Rainfall



Cyclonic Rainfall

Cloudburst:

- moisture-rich air travels up the slope
- forms vertical column of Cumulonimbus clouds
- strong updraft may push raindrops higher
- large amount of water accumulates
- when updraft weakens, sudden rain
- IMD: 100 mm rain per hour
- usually in Himalayas during monsoon
- Reasons: cyclonic air, climate change, etc.



Cirrus Clouds
- 8-12 km altitude
- Thin & detached
- Feathery appearance
- Always white in colour

Cumulus clouds
- 4-7 km altitude
- look like cotton wool
- Have flat base

Stratus clouds
- layered clouds
- formed due to mixing of air masses of different temperatures

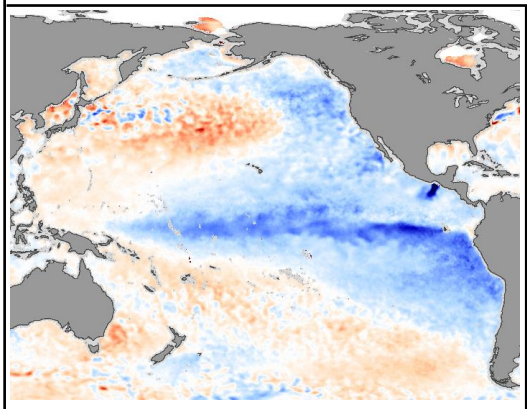
Nimbus clouds
- very near to surface
- shapeless
- black or dark grey
- opaque to rays of sun

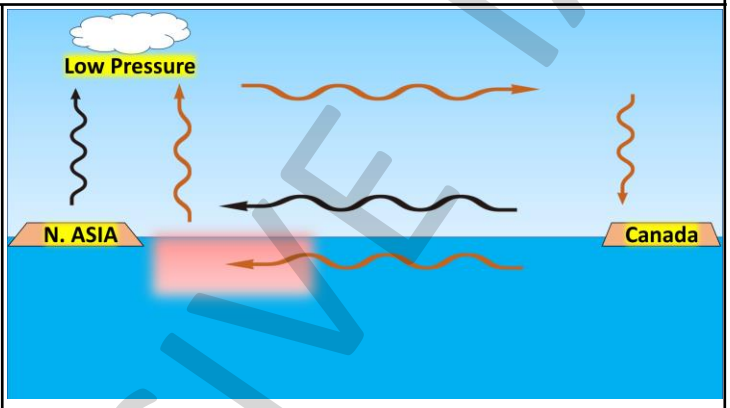
Heat Dome

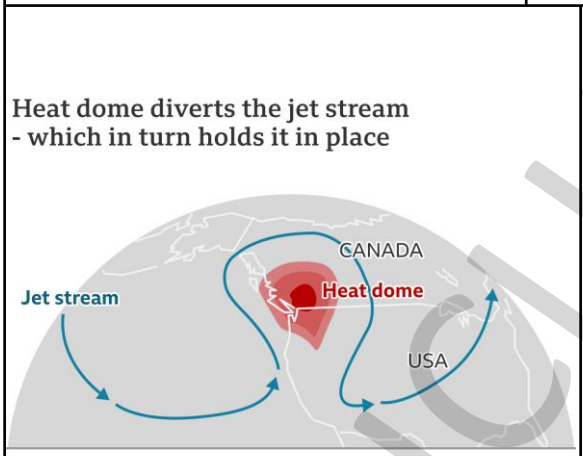
Also see page-51

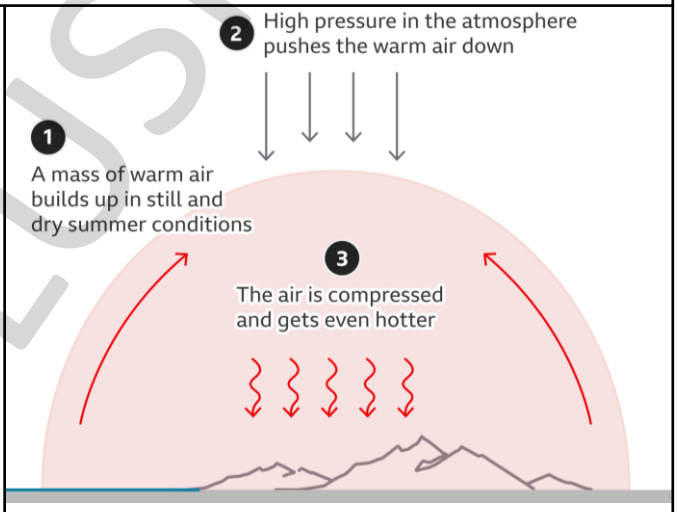
Heat Dome:

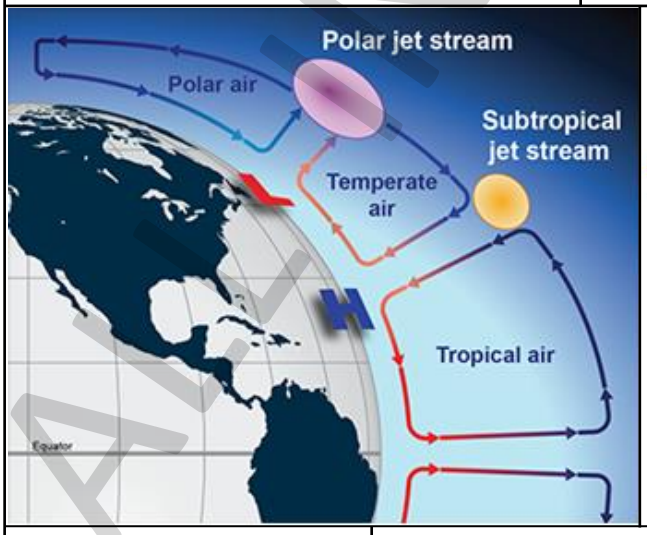
- Recently, 47^{O}C temperature were seen in Canada
- Occurs when strong high-pressure atmospheric conditions combine with weather patterns like La Niña.
- Warm western pacific; Cool eastern pacific
- Air rises in west; moves towards east; falls down.
- Prevents already rising hot air to rise.

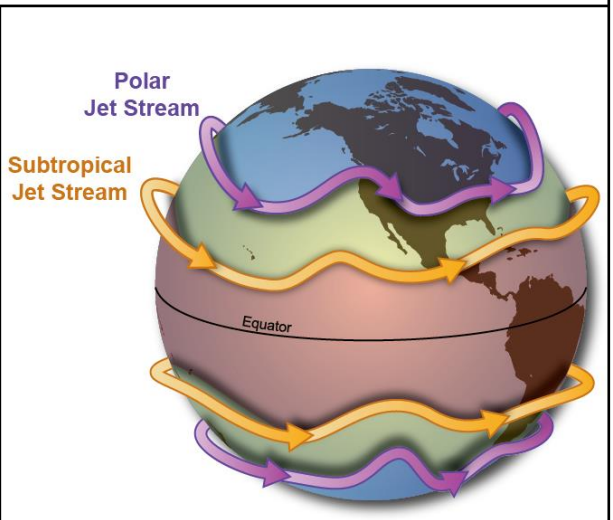












All-Inclusive GS-2 & GS-3 MAINS 2022

Class-74

CoP-26

Glasgow Climate Pact: (Global agreement reached at CoP-26)

- Countries will try to keep the 1.5 °C Paris Agreement target achievable
- Developed countries reaffirmed their pledge to provide $100 billion annually to developing countries
- Countries completed Paris Rulebook regarding Article 6
- For the first time, nations are called upon to phase down unabated coal power and inefficient subsidies for fossil fuels. [No targets or timelines] [phase-down (reduce) mentioned instead of phase-out (stop)]

India's Panchamrit at CoP-26:

(At CoP-26, India presented five nectar elements of India's climate action)

1. Reach 500 GW non-fossil energy capacity by 2030
2. 50% of power from renewable sources by 2030
3. Reduce projected carbon emissions by one billion tonnes by 2030
4. Reduce carbon intensity of economy by 45% by 2030, over 2005 levels
5. Achieving net zero emissions by 2070

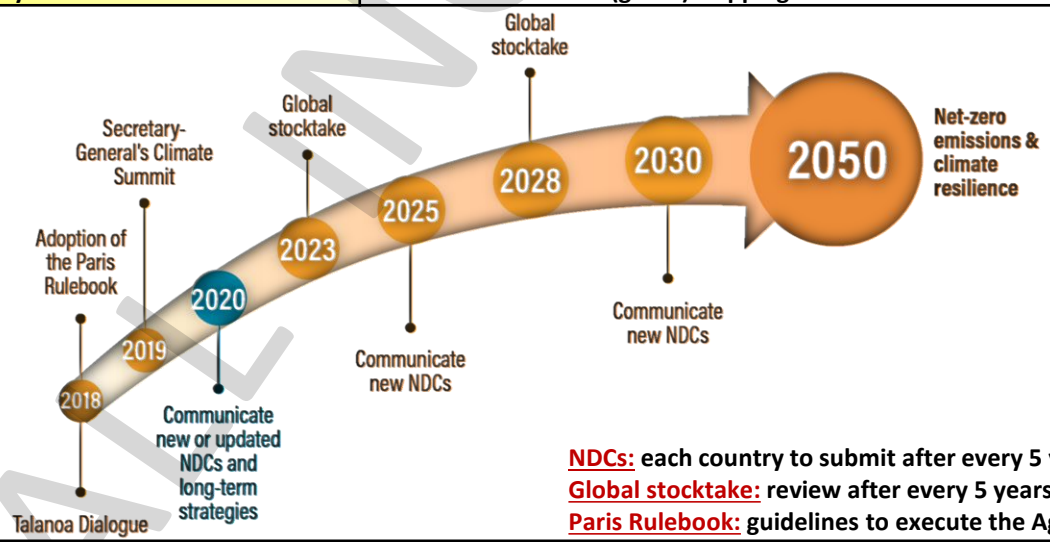
Unabated coal: Use of coal that isn't mitigated with technologies to reduce CO_2 emissions, such as CCUS

Article 6 of Paris agreement has three mechanisms for voluntary cooperation for Carbon market

Common But Differentiated Responsibility:
Developed countries have more responsibility as they are historically responsible for climate change and also have more resources to tackle it.

Polluter pays principle:
Those who pollute must bear costs of managing it.

Initiatives at CoP-26 Glasgow	Related to?	India?
Breakthrough Agenda	make clean technologies affordable in each emitting sector by 2030	Yes
Zero-Emission Cars and Vans	all sales of new cars and vans to be zero emission in 2035/2040	Yes
Declaration on Forest & Land Use	Stop deforestation and land degradation by 2030	No
Forest, Agriculture and Commodity Trade (FACT)	sustainable trade of Forest/Agri commodities	No
Beyond Oil and Gas Alliance	Initiative of Costa Rica and Denmark; Phase-out oil and gas	No
Clydebank Declaration	Create zero emissions (green) shipping trade routes	No



NDCs: each country to submit after every 5 years
Global stocktake: review after every 5 years (first in 2023)
Paris Rulebook: guidelines to execute the Agreement

- 2015 Paris Agreement: limit global warming to well below 2°C; try for 1.5°C
- 2018 Katowice Climate Package: countries adopted majority of Paris Rulebook (some issues unresolved)
- 2021 Glasgow Climate Pact: Nations completed Paris Rulebook

Loss & Damage

Loss & Damage:

- Rich countries are historically responsible for climate change.
- Developing countries are facing adverse effects of climate change.
- Rich countries are liable to developing countries for adaptation & compensation.

Issues related to L&D:

- L&D was included in Paris agreement, but without any 'liability or compensation'.
- Developing countries demand climate justice.
- Developed countries consider it same as adaptation.

Santiago Network (for technical assistance on loss and damage)

- ❑ It will connect vulnerable developing countries, with developed countries.
- ❑ They will get technical assistance and resources to address climate related Loss & Damage
- ❑ 2019: COP 25 in Madrid, Spain
  - Santiago Network was established, as part of Warsaw International Mechanism
- ❑ 2021: COP 26 in Glasgow, UK
  - Parties decided functions of Santiago Network.

Stockholm Conference

Significance of Stockholm Conference:

- ❑ UN Conference on Human Environment: 5th June 1972
- ❑ It was the first UN conference with the word "environment" in title.
- ❑ It was the first international declaration to protect environment.
- ❑ Established UNEP
  - to coordinate environmental issues within the UN system
- ❑ Civil society participation
  - It was the first UN event that supported civil society participation.
- ❑ Later international conventions
  - UNFCCC, UNCCD, UNCBD have their origin in Stockholm conference
- ❑ Environmental diplomacy:
  - It laid down principles for future international cooperation on environmental issues
- ❑ World Environment Day
  - celebrated annually since 1973 to increase environmental awareness
- ❑ India:
  - enacted WPA 1972
  - 42nd amendment added environment related FD (51-A) and DPSP (48-A)
  - established Dept of Env in 1980 and Min of Env in 1985

Ongoing debates

Some ongoing debates/issues in international climate negotiations:

- Target: NDCs for 2030 are inadequate to achieve 1.5OC target by 2100
- Finance: Lack of grant-based finance from developed to developing countries
- CBDR: Dilution of principles of Common But Differentiated Responsibility
- Loss & Damage: developed world not ready to compensate for adverse affects of climate change

Carbon Budget

Carbon budget

- ❑ It tell us how much CO2 we can still emit while keeping warming below specific limits.
- ❑ IPCC Sixth Assessment Report (AR6):
  - World can emit 400 billion tonnes more CO2 before hitting the 1.5°C limit
  - Hence, earth's Carbon budget will exhaust in 10 years at current emission levels

Carbon Market

What is a Carbon market?

- Market for buying/selling certificates of reduction in carbon emission.
- Main idea? reduce emissions where it is least costly to do so.
- How? by allowing emitters to trade certificates of emission reduction.

Article 6 of Paris agreement covers market and non-market based mechanisms:

1) **Article 6.2**: **Market mechanism 1**:
   - bilateral trade of emissions.
   - eg developed country gives money to brick kiln in India, and claim emission reduction as its own
2) **Article 6.4**: **Market mechanism 2**:
   - trade via market (Paris SDM to replace Kyoto CDM).
   - eg brick kiln will invest in tech to reduce emissions, and then sell carbon credits.
3) **Article 6.8**: **Non-market approach**:
   - Cooperation between countries where no trade is involved
   - eg collaboration on climate policy or common taxation

SDM: Sustainable Development Mechanism
CDM: Clean Development Mechanism

Key decisions regarding Article 6 were finalized at CoP-26:

- Kyoto credits will be carried into Paris mechanism, but must be used by 2030.
- Double counting shall be avoided (more than one country claim same emission reduction)
- Contributing funds toward adaptation under Article 6.2 is voluntary.
- 5% of funds under Article 6.4 must be used for adaptation.

Background (not important for Mains 2022)

Main issues regarding Article 6:

- what happens to carbon credits earned in the Kyoto regime but not yet sold
  - *Developing countries have millions of unsold CERs (certified emission reduction) India: 750 million*
  - *Developed countries say that verification process under Kyoto was not robust.*
- what constitutes double-counting, and should it be allowed
  - *Developed countries say that credits can be traded, but should be counted only at one place.*
  - *Developing countries say that the country that reduced emissions should be able to show it even after selling the credits.*

Carbon trading in India:

Carbon trading is expected to pick up in India with the passing of Energy Conservation (Amendment) Bill, 2022. As of now the mechanisms are:

- **Renewable Energy certificates:**
  - helps Discoms meet renewable purchase obligations
- **Energy Saving Certificate:** (Perform, Achieve, Trade scheme)
  - it encourages industries to become energy efficient

Challenges:

- Limited participation as only designated entities can participate
- Non transparent price discovery mechanism discourages new players
- Lack of integration with international trading mechanisms

Deli Metro: a success story

- In 2007, DMRC became the first metro to be registered under Kyoto protocol's CDM
- Till 2012. it earned Rs 9.5 crore by selling carbon credits earned from regenerative-braking tech
- During 2012-18, it earned Rs 19.5 crore by selling carbon credit by modal shift and solar power.

Carbon Inequality

Carbon inequality:

- It refers to unequal distribution of carbon emissions
- i.e. some groups have more carbon emissions / ecological Footprint than others
- Carbon inequality between nations:
  - Top three emitters (China, USA, EU) contribute 41.5% to global GHG emissions.
- Carbon inequality within nations:
  - Richest 1% people cause twice as much carbon emissions as the poorest 50%.

Wealthy people have higher carbon footprint:

- Travelling by private car/cab instead of public transport (or cycle)
- Use of air conditioners instead of desert coolers
- Consumption of more goods, which are produced in polluting factories
- Electricity consumption (produced by coal) per household is more for rich than poor

Climate Equity / Climate Justice

- Climate change is a global crisis, but it impacts different groups differently.
- Hence, Climate Justice aims to:
  - reduce unequal burden created by climate change
  - ensure fair distribution of benefits of climate protection efforts

Some examples:

Climate affects marginalised communities more, even though they have least per capita emissions.

- Tribals live in harmony with nature, their impact on environment is minimum
  - But climate change impacts them the most, as they are directly dependent on environment
- Developing countries are dependent on fossil fuels
  - By targeting coal & oil, their economic growth and poverty alleviation is impacted
- Small island developing states have no industries to cause GHG emissions
  - But they face existential risk due to sea level rise

Common But Differentiated Responsibilities

- This principle was formalized at UNFCCC Earth Summit in Rio de Janeiro, 1992
- Developed countries contributed more to environmental degradation
  - and should have greater responsibility for climate change mitigation.
- It is based on polluter-pays principle
  - as historical contribution to climate change creates responsibility for environmental protection.

Does Paris deal ensure climate justice?

Yes:

- Developed countries reaffirmed their pledge to provide $100 billion annually to developing countries
- Functions of Santiago Network were finalised

No:

- Developing countries will be affected more by phasing down unabated coal.
- Santiago network includes technical assistance, not monetary compensation for loss & damage

What can be done? Reproduce the points already learnt, like:

- Santiago Network must include compensation for loss & damage
- Common but Differentiated Responsibilities and Respective Capabilities (CBDR–RC)
- Impose Carbon tax on luxury diesel SUVs, instead of banning diesel taxi
- Instead of banning brick kiln, help them upgrade
- Instead of subsidising high end electric cars, subsidize e-scooters & public transport

1971 Ramsar Convention	1981	1991	2001 Stockholm Convention on PoPs	2011
1972 Stockholm Conference	1982 Nairobi declaration	1992 Earth Summit in Rio de Janeiro	2002 Earth Summit in Johannesburg	2012 Earth Summit in Rio de Janeiro
1973 CITES	1983 UN appoints Brundtland Commission	1993	2003	2013 Minamata convention
1974	1984	1994	2004	2014
1975	1985 Vienna Convention	1995 1st CoP of UNFCCC	2005	2015 Paris Agreement
1976	1986	1996	2006	2016 Kigali amendment to Montreal Protocol
1977	1987 Brundtland report; Montreal Protocol	1997 Kyoto Protocol	2007	2017 CoP-23 Bonn Germany
1978	1988	1998 Rotterdam convention	2008	2018 CoP-24 Katowice Poland
1979 Convention of Migratory Species; Convention on Long-Range Transboundary Air Pollution	1989 Basel Convention on Transboundary Movements of Hazardous Wastes	1999	2009	2019 CoP-25 Madrid under Chilean Presidency
1980	1990	2000 Cartagena protocol	2010 Nagoya protocol	2020

1971 • Ramsar Convention • For sustainable use of wetlands • Only global Env. treaty that deals with a particular ecosystem.	**1981**	**1991**	**2001** • Convention on POPs • aka Stockholm convention • POPs are organic pollutants that are resistant to environmental degradation	**2011**
1972 (5th June) • UN Conference on Human Environment. • aka Stockholm Conference • First declaration of international protection of environment. • Formed UNEP	**1982** • Nairobi Declaration. • To celebrate 10th anniversary of Stockholm Conference. • Envisaged creation of a special commission for long term strategies. • Declaration endorsed by UNEP in 1987	**1992** • UN Conference on Environment and Development • aka (Rio) Earth Summit • UNFCCC : (Secretariat in Bonn, Germany) To reduce emission of GHGs. No limits, no enforcement. Rather, provided for updates (Kyoto protocol). • CBD : (Secretariat in Montreal, Canada) three main goals- (1) Conservation of biodiversity; (2) Sustainable use of it's components; (3) Fair and equitable sharing of benefits. Followed by Cartagena (2000) and Nagoya (2010) protocols. • UNCCD : (Secretariat in Bonn, Germany) It is the only internationally legally binding framework to address desertification. CoP-14 was held in 2019 in New Delhi. • Agenda 21 : take actions at all three levels to achieve certain goals by 2021. Later revised to 2030.	**2002** • Earth Summit 2002 • aka Rio +10 • Johannesburg (South Africa)	**2012** • United Nations Conference on Sustainable Development • aka Rio +20 • Rio de Janeiro (Brazil)
1973 • CITES (Convention on International Trade in Endangered species of Wild flora and fauna) • aka Washington Convention • To control or prevent international commercial trade in Endangered species or products derived from them. • Aim not to directly protect, but to reduce economic incentive to poaching by closing international trade.	**1983** • UN appoints World Commission on Environment and Development • Later known as Brundtland Commission • In 1987 it released the report 'Our Common Future'. • Concept of 'Sustainable Development' crystalized.	**1993**	**2003**	**2013** • Minamata convention on mercury • To protect humans and environment against mercury emissions. • Japanese city, Minamata, had faced severe mercury poisoning. --- • CoP-19 Warsaw (Poland) • Warsaw International Mechanism for Loss and Damage. • Rich countries liable for climate change impact being faced by poor countries.
1974	**1984**	**1994**	**2004**	**2014**
1975	**1985** • Vienna Convention for protection of ozone layer. • Provided frameworks for reductions in chlorofluorocarbons (CFCs). • Became basis for further international action to protect ozone layer.	**1995** • First CoP of UNFCCC held in Berlin, Germany	**2005**	**2015** • CoP-21 Paris (France) • Paris Agreement • Countries' INDCs are not binding. • Loss & Damage included, but diluted.

1976	1986	1996	2006	2016
1977	1987 • Brundtland report / Our Common Future --- • Montreal Protocol on Ozone Depleting Substances • 1st universally ratified treaty in UN history. • Phase out halogenated hydrocarbons that contain chlorine or bromine (substances containing only fluorine don't harm ozone). • All nations should not be treated equally as some have contributed more to ozone depletion. • A nation's obligation to reduce emissions should reflect its technological and financial ability to do so.	1997 • Kyoto protocol signed under UNFCCC • World's only legally binding treaty to reduce GHG emissions • 1st commitment period: 2008-12 • 2nd commitment period: 2013-20	2007	2017 • CoP-23 Bonn (Germany), but chaired by Fiji • Talanoa dialogue: Pacific concept of "Talanoa" - storytelling that leads to consensus building. In CoP it was used for NDC stock-taking. • Gender Action plan adopted which strives for gender-responsive climate policy equal representation for women at global climate meet
1978	1988	1998 • Rotterdam convention • To control international trade of certain hazardous chemicals • Created 'Prior Informed Consent' procedure.	2008	2018 • CoP-24 Katowice (Poland) • Paris Ag. Work Programme was finalized. • Practical implementation guidelines to track progress and ensure that climate action is transparent.
1979 • CMS - Convention of Migratory Species • Cop-13 in Gandhinagar in February 2020. --- • Convention on Long-Range Transboundary Air Pollution. • Focused on Europe. • India not member.	1989 • Basel Convention on the Control of Transboundary Movements of Hazardous Wastes • To reduce the movements of hazardous waste between nations (especially developed to least developed) • Doesn't address movement of radioactive waste.	1999	2009	2019 • CoP-25/CMA-2 Madrid (Spain) under Presidency of Chile. • Adopted the "Chile Madrid Time for Action" document. • Urged to enhance NDCs. • Established Santiago Network for tech assistance to poor countries under WIM for Loss & Damage. • Did not finalize rules on Carbon Markets.
1980	1990	2000 • Cartagena protocol on biosafety to CBD • For safe handling, transport and use of Living Modified Organism • Established Advance Informed Agreement procedure • Established Biosafety Clearing House	2010 • Nagoya protocol • fair and equitable sharing of benefits arising out of the utilization of genetic resources	2020

All-Inclusive GS-2 & GS-3 MAINS 2022

Class-75

Climate Finance

What is climate finance?

It is finance that aims to:

- reduce emissions and enhance sinks of GHGs
- reduce vulnerability & increase resilience to adverse effects of climate change

What is the need for climate finance?

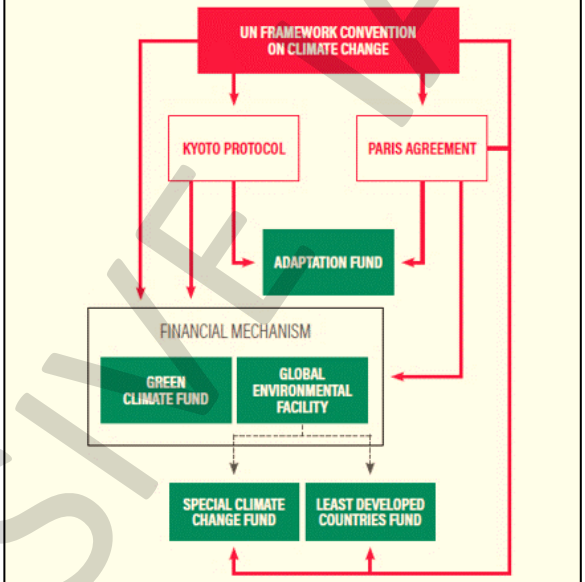
- To prevent adverse effects of climate change.
- To achieve targets set under Paris agreement.
- Developing countries lack funds to tackle adverse effects of climate change.

Financial mechanisms under UNFCCC?

Based on the principle of "common but differentiated responsibility and respective capabilities" developed countries provide financial resources to assist developing countries, by following mechanisms:

- Green Climate Fund (GCF) since 2010
- Adaptation Fund (AF) since 2001
- Global Environment Facility (GEF) since 1994

Figure 1 UNFCCC Bodies and funds



Note: The dotted arrows indicate that the LDCF and SCCF are administered by the GEF.
Source: WRI.2018. & UNFCCC 2018. https://unfccc.int/

Principles of Climate Finance:

- **Additionality**:
  - Climate finance should be additional (not substitute) to existing commitments.
- **Polluter Pays**:
  - those who produce pollution should bear the costs of managing it
- **CBDR–RC**:
  - developed countries have more responsibility as they are historically responsible for climate change and also have more resources to tackle it.

Challenges:

- **Definition:**
  - No commonly agreed definition of 'climate finance'
  - Of 5000 adaptations projects supported by OECD, 3/4th lack clear connection to climate change.
  - Guidelines at CoP-24 allows non-financial efforts (tech transfer) under climate finance.
- **Amount**:
  - amount mobilized for climate finance is not sufficient
- **Uncertainty**:
  - USA stopped contributing to GCF under Trump, will resume now
- **Verification:**
  - No strong verification mechanism to monitor end-use of money.

Way forward:

a) A clear definition of climate finance should be adopted at the earliest.
b) Verification mechanism should be made more transparent.
c) Variety of mechanisms should be explored, like carbon credits, cess, etc.

Sustainable Finance

Also see class-17 pg-5
Social Stock Exchange

Sustainable Finance / Green Finance:

- investment decisions that take into account environmental, social and governance (ESG) factors

Need / Benefits:

- Companies with social objective will have better access to funds
- Burden on govt to finance eco-friendly projects will reduce
- Social progress will be faster with better health, education, etc.
- Environment will benefit, and climate change will slow down.

Challenges:

- Measuring impact/benefits of eco-friendly projects is difficult
- Greenwashing or false claims about environmental benefits of projects
- Lower financial returns as profit is not the primary motive

Steps taken:

- ❑ RBI
  - established Sustainable Finance Group
  - joined 'Network for Greening Financial System'
- ❑ SEBI
  - notified Social Stock Exchange framework (class-17 pg-05)
  - mandated Business Responsibility and Sustainability Reporting by listed entities
- ❑ Green Bonds
  - issued by companies like Power Finance Corporation in 2021

ESG reporting / Sustainability reporting:

- ❑ Disclosing data on environmental, social and governance impacts.
- ❑ Many benefits, like, shows financial risk due to environmental or social practices.
- ❑ To be included under Business Responsibility and Sustainability Reporting
- ❑ voluntary for FY 2021-22 and mandatory from FY 2022-23 for the top 1,000 listed companies by market capitalization

GREEN BONDS:

- ✓ Bonds issued to raise money for environment related projects.
- ✓ 2007: World's first GBs issued by World Bank and European Investment Bank.
- ✓ 2015: India's first GBs issued by Yes Bank.
- ✓ 2018: India's first on INX by Indian Railway Finance Corporation
- ✓ 2021: Power Finance Corporation issued first ever Euro denominated Green Bond from India
- ✓ Guidelines by? SEBI

INDIAN GREEN BONDS COUNCIL:

- ✓ Formed in 2016 to promote green bonds
- ✓ by FICCI and Climate Bonds Initiative

CLIMATE BONDS INITIATIVE:

- ✓ International organisation formed in 2009 to promote green bonds

Blue Bond:

- ✓ To raise money for sustainable marine and fisheries projects.
- ✓ In 2018, Seychelles issued world's first sovereign blue bond

Carbon pricing

What is carbon price?

- It is a cost put on carbon pollution, to discourage GHG emissions
- Currently, 22% of global GHG emissions come under carbon pricing

How is it imposed?

- Carbon tax:
  - fee imposed on use of carbon-based fuels
  - e.g. Clean Environment Cess imposed on coal
- Emissions Trading: aka cap-and-trade system
  - Caps GHG emissions and allows low emitters to sell extra allowances to high emitters
  - e.g. SDM of Paris agreement, CDM of Kyoto Protocol

Other methods:

- Offset mechanism: reduction in GHG emission to compensate for emissions made elsewhere
- Result Based Climate Finance: payment is made after desired outcome is achieved
- Internal Carbon Pricing: companies use it to monitor environmental impact of their activities

Benefits of carbon pricing:

a) It is based on polluter pays principle
b) It engages private sector in saving the climate
c) It makes polluters adopt low emission technologies
d) It helps brings funds for climate-friendly projects

Challenges:

a) It gives polluters a license to pollute, by paying a fee.
b) Carbon tax may not be spent on climate related projects.
c) No uniformity across countries.
d) Polluting industries may simply shift to low-cost jurisdictions. (carbon leakage)

Way forward:

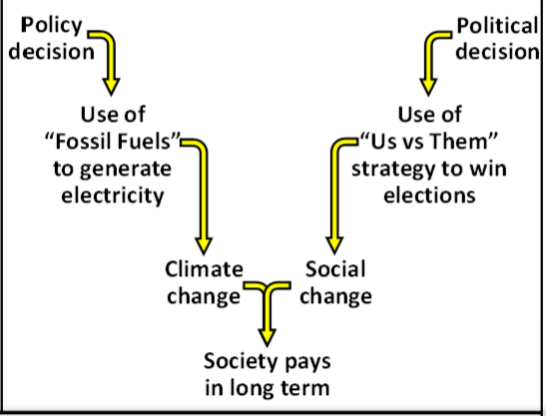
- Increasing the role of "Carbon Pricing Leadership Coalition", a voluntary international initiative for successful implementation of carbon pricing.
- For successful carbon pricing, 'FASTER' principles developed by World Bank and OECD should be used.
  - Fairness use polluter pays principle
  - Align policies with objectives
  - Stability of policies
  - Transparency in pricing
  - Efficiency to lower the cost
  - Reliability that polluting activities are reduced.

Social Cost of Carbon

Prelims 2020:

Which one of the following statements best describes the term 'Social Cost of Carbon'? It is a measure, in monetary value of

(a) long-term damage done by a tonne of CO_2 emissions in a given year.
(b) requirement of fossil fuels for a country to provide goods and services to its citizens, based on the burning of those fuels.
(c) Efforts put in by a climate refugee to adapt to live in a new place.
(d) contribution of an individual person to the carbon footprint on the planet Earth.



Social cost of carbon

- Economic damage that would result from emitting one ton of carbon dioxide
- It reflects impact of GHG emissions on human health, environment, economy.
- It helps govt evaluate whether policy designed to curb climate change is justified or not.

Sustainable Development Goals

Brundtland Report 1987 defined sustainable development as:
Development that meets **needs of present** generation, without compromising **needs of future** generations

Sustainable Development Report 2022:

- **India rank:**
  - 121 out of 163 countries
  - Consistently falling: 117:2020 → 120:2021 → 121:2022
- **India moderately improving in:**
  - SDG 1: Poverty
  - SDG 3: Hunger
  - SDG 6: Water & Sanitation
- **India facing major challenges in:**
  - SDG 11: Sustainable Cities and Communities
  - SDG 17: Partnerships for the goals

What is the nexus approach w.r.t. SDG?

Many SDGs are interlinked, or dependent on each other.
Policies must identify linkages (nexus) between different SDGs. For example:

- **SDG 2 and SDG 8:**
  - Hunger can be eliminated only when people have decent work opportunities
- **SDG 10 and SDG 16:**
  - Reduced inequalities are necessary for peace
  - Strong institutions and Justice is necessary for reduced inequalities
- **Poverty - Education Nexus:**
  - Removing poverty needs quality education for masses.
- **Health - Sanitation Nexus:**
  - Hygienic sanitation facilities are necessary to prevent communicable diseases.
- **Education - Electricity Nexus:**
  - States with low literacy rate have low electricity rate in schools.
  - Electricity → modern methods of teaching → studies become attractive
- **Health - Electricity Nexus:**
  - Positive relation between electricity consumption and fall in Infant Mortality Rate.
  - New born emergency services, pediatric care, vaccination, rely on electricity at health centers.

Localization of SDGs

Ministry of Panchayati Raj and UNDP have signed agreement for localisation of SDGs.

Why localise / Why the focus at local level?
- SDGs can be achieved only if local context is considered.
- Local needs must be the top agenda while planning and implementing programmes.

Role of NITI Aayog wrt SDGs:
- Monitor the adoption of SDGs
- Promote competitive and cooperative federalism among States and UTs.

Students can write Strategy, Challenges, Examples from Class-31 pg-07 (Aspirational Districts)

Nature Based Solutions

Related terms:
- Green Infra
- Nature-Based Infrastructure
- Nature as Resilient Infrastructure

Nature-based solutions
- ❑ Using nature to increase resilience of infra to climate change.
- ❑ It includes both natural and green infrastructure.
- ❑ Natural infrastructure:
  - Projects that improve existing natural landscapes
  - e.g. use of wetlands for water treatment
- ❑ Hybrid infrastructure: (or Green infra)
  - Projects that combine grey infra with environment
  - e.g. green roof, vertical gardens, porous pavements

Benefits:
- Helps in carbon sequestration
- Reduces Urban Heat island phenomenon
- Brings balance between development and environment
- Makes infra resilient to extreme weather events like urban floods
- More space for recreation and tourism in urban areas
- Cleaner air in urban areas, higher groundwater levels

Green Shipping

Also see Class-60 pg-12 for Port Authorities Act 2021

How to make shipping eco-friendly:
- ❑ No Ballast System:
  - Ballast water transfers microbes from one environment to another.
  - To prevent this, "No Ballast Ships" should be developed.
- ❑ Sulphur Scrubber System:
  - Install Scrubbers to remove Sulphur from exhaust
- ❑ Cleaner fuel:
  - Use LNG propulsion instead of diesel
- ❑ Fuel cell / Solar power:
  - Use newer technologies to supplement conventional engines

Initiatives by Ministry of Shipping:
- monitor environmental pollution
- deploy dust suppression systems
- waste water treatment plants
- garbage disposal system for ports and ships
- create Oil Spill Response capability
- energy generation from renewable energy sources
- providing shore power to ships at berths
- increasing green cover within port premises

Clydebank Declaration:
- signed by 22 countries at CoP-26, to develop green shipping corridors
- Green shipping corridor: shipping route on which zero-emission solutions are demonstrated

Ethanol Blending

Data:
- 10% achieved as of June 2022
- 20% target by 2025 (revised target under National Biofuel Policy 2018)

Benefits:
- **Replace imported crude oil:**
  - **Import bill** can be lowered by use of domestic biofuel
  - **Inflation** can be controlled better due to lower price fluctuation
- **Sustainability:**
  - **Renewable** nature of biofuels, unlike limited reserves of crude oil in earth
- **Less polluting:**
  - **Better combustion** due to presence of oxygen
- **Waste to Wealth:**
  - **Farm stubble**, which is a liability to dispose, can be put to productive use

Steps taken:
- **Ethanol Blending Program:**
  - Oil Marketing Companies sell petrol blended with ethanol
- **PM Ji-VAN Yojana:**
  - Financial support (Viability Gap Funding) for 2G ethanol projects
- **RUCO by FSSAI:**
  - Repurpose Used Cooking Oil
  - Transfer used cooking oil to biodiesel manufacturers

Challenges: (think chronologically)
- **Production issues:**
  - Raw material is dependent on **agriculture**
  - Inconsistent & **seasonal** nature of farm stubble
- **Food shortages, food inflation**
  - Competing demand of **foodgrains**, for food supply programs
- **Compatible infra:**
  - Modification of supporting infra like **storage tanks**, dispensing nozzles, etc.
- **Technical issues in vehicles:**
  - Ethanol can cause **corrosion** of engine parts
  - Engines need **modification** & fine-tuning to run on highly blended fuels

What can be done?
- Frame points from Challenges
- Use **kitchen waste** from cities to make biofuel
- Encourage **Bi-fuel** and **Flex-fuel** vehicle engines

Note: if question comes on Flex-fuel vehicles, the above points will fit-in perfectly.

Biofuels

FUELS

- BIOFUELS — *Made in short period of time*
  - Made from Biomass (plant or animal waste)
  - Examples: ethanol, biodiesel, biogas
  - Renewable (Plants get energy from sun)
- NUCLEAR FUELS
- FOSSIL FUELS — *Made in long period of time*
  - Made from fossilized remains of ancient plants and animals
  - Examples: Coal, oil, natural gas
  - Non-renewable (Limited stocks)

Less polluting:
- ❑ less harmful pollutants,
- ❑ better combustion due to presence of oxygen

- **1st gen**
  - made from: Food Crops like wheat, sugarcane, soybean
  - problem: food vs fuel debate

- **2nd gen**
  - made from: non-food crops like Jatropha, organic waste, crop residue

- **3rd gen**
  - made from: algae
  - pros: does not need agricultural land
  - cons: technologically challenging

- **4th gen**
  - made from: genetically modified algae etc
  - pros: carbon sequestration
  - cons: high initial investment

Algaculture:
→ algae farming
Oilgae:
→ oil of algae

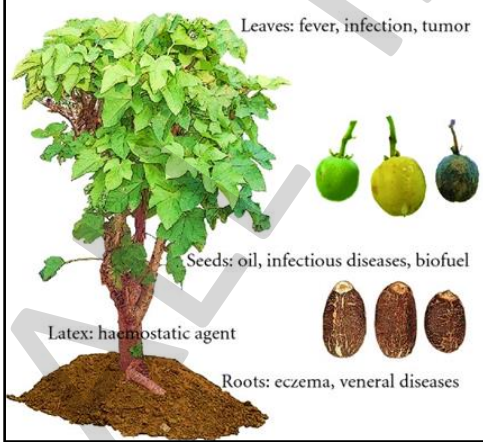
Prelims 2017:

It is possible to produce algae based biofuels, but what are the likely limitations of developing countries in promoting this industry?

1. Production of algae based biofuels is possible in seas only and not on continents.
2. Setting up and engineering the algae based biofuel production requires high level of expertise/technology until the construction is completed.
3. Economically viable production necessitates the setting up of large scale facilities which may raise ecological and social concerns.

Select the correct answer:

(a) 1 and 2 only
(b) 2 and 3 only
(c) 3 only
(d) 1, 2 and 3



Prelims 2010:

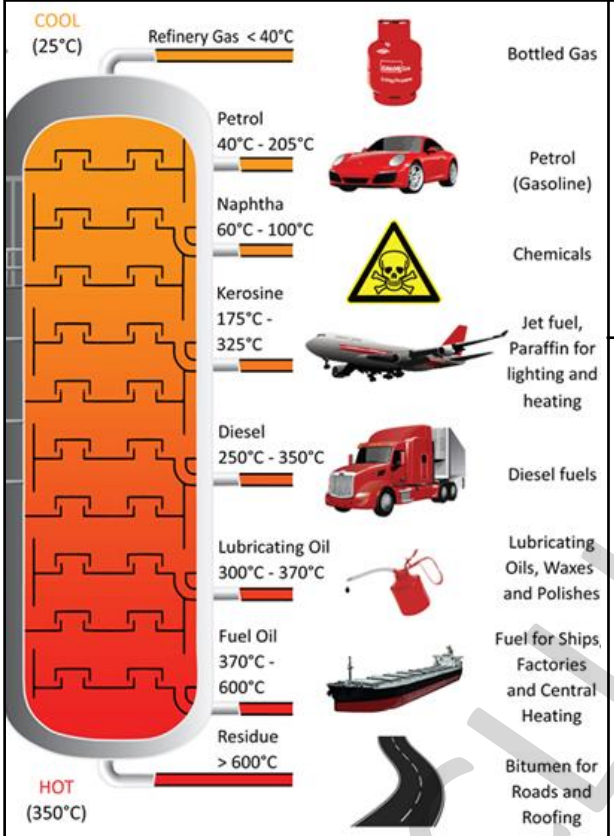
Given below are the names of four energy crops. Which one of them can be cultivated for ethanol?

(a) Jatropha
(b) Maize
(c) Pongamia
(d) Sunflower

Jatropha:

- ❑ native of ~~India~~ Americas
- ❑ drought-resistant
- ❑ used in medicines, insecticides, fertilizers, etc.
- ❑ seeds have up to 35% non-edible oil.
- ❑ used for making ~~ethanol~~ biodiesel

Crude oil → Petrol ≠ Diesel ≈ Ethanol ≠ Biodiesel ← Biomass



Prelims 2014:

Consider the following statements:

1. **Maize can be used for the production of starch.**
2. **Oil extracted from maize can be a feedstock for biodiesel.**
3. **Alcoholic beverages can be produced by using maize.**

Which of the above statements are correct?

(a) 1 only (b) 1 and 2 only

(c) 2 and 3 only (d) 1, 2 and 3

Blending target by 2030:

- **Ethanol: (E20) 20% (currently 8.5%) by 2025**
- **Biodiesel: 5% (currently 0.1%)**
- **Price that OMCs pay is set by CCEA**
- **Problem: performance, mileage, etc.**

Drop-in fuel:

- **functionally same to conventional fuel**
- **don't require engine modification**

Bi-fuel vehicle: **Fuels stored in separate tanks**

Flex-fuel vehicle: **Fuels store in same tank**

(May become mandatory, can run even E85)

Stardust 1.0: **in ~~India~~ USA**

- **First commercial space launch vehicle powered by biofuel;**

National Biofuel Policy

1st in 2009; new in 2018

Basic vs Advanced:

1G is Basic;

2G & 3G are Advanced

For using used cooking oil?

RUCO by FSSAI

NBCC under ministry?

X Ministry of Agriculture

✓ Ministry of P&NG

Scheme for 2G ethanol?

PM Ji-VAN Yojana

Coal Gasification

India's first coal gasification based fertiliser plant is being built at Talcher (Odisha).
India's first indigenously designed coal gasification based methanol plant was inaugurated at BHEL, Hyderabad.

Coal Gasification:

- Coal is partially oxidized by steam, under controlled conditions, to produce syngas
- Syngas is a mixture of hydrogen, carbon monoxide, carbon dioxide

Benefits of coal gasification:

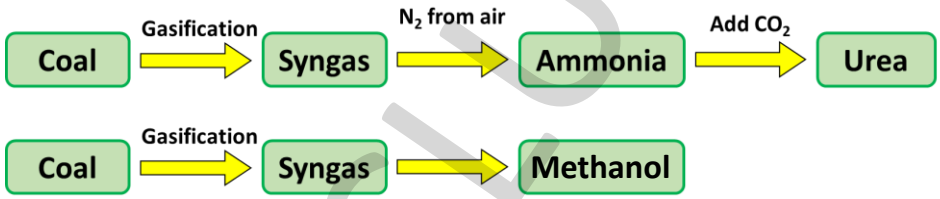
- Eco-friendly/cleaner way of using coal, compared to direct burning.
- Underground coal gasification can help exploit non-mineable coal reserves.
- Syngas can be used to produce methanol, dimethyl ether (DME), ammonia, urea, fertilizers, etc.

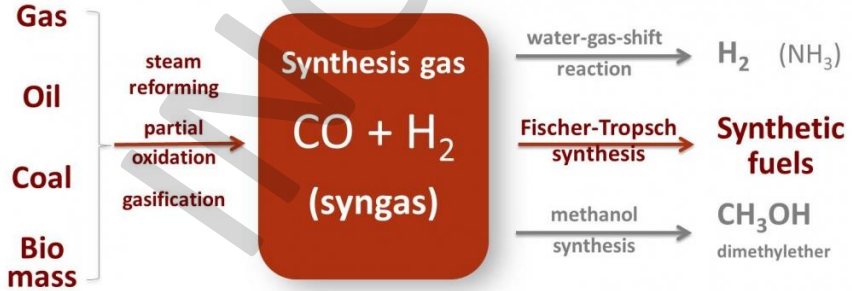
Challenges:

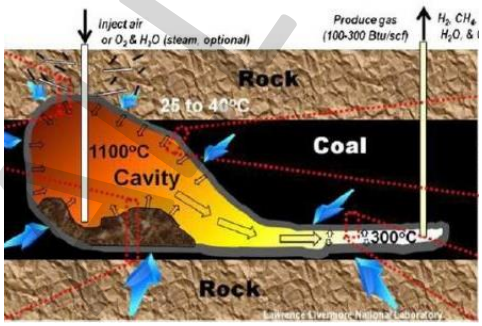
- Coal gasification plants are costly to build.
- Inadequate expertise in India for coal gasification.
- It is a water-intensive process (needs water, creates polluted water)
- High ash content in Indian coal makes gasification process challenging.

What can be done?

- ❑ Increase financial viability:
  - Tax holiday for coal gasification projects
  - Viability Gap Funding can be provided
- ❑ Technology:
  - Joint R&D projects with international universities







Underground coal gasification:

- It is an in-situ process which converts coal into product gas.
- It is carried out in non-mined coal seams.
- Steam and Oxidants are injected into coal seam.
- Gases are brought to surface through production wells.
- Product gases: CH_4, H_2, CO, CO_2 (Methane and Syngas)

Methanol Economy

India's first indigenously designed coal gasification based methanol plant was inaugurated at BHEL, Hyderabad.

Methanol: aka methyl alcohol
- It is an organic chemical and simplest alcohol CH_3OH.
- Its chemical and physical properties are similar to ethanol.
- It is a colourless & flammable liquid with alcoholic odour similar to ethanol

Uses:
- It can be used as clean fuel in vehicles and ships
- It is also used to generate di-methyl ether (DME), a liquid fuel that is very similar to diesel
- Its chemical derivatives are used in production of plastic, paint, foam, polyester, resin, etc.

Production:
- Mostly produced from natural gas
  - But India does not have much natural gas reserves
  - Using imported natural gas would make it uneconomical
- Coal can also be used
  - India has abundant coal, but it is high in ash content
  - BHEL has developed method to use coal gasification tech to produce methanol from high ash coal

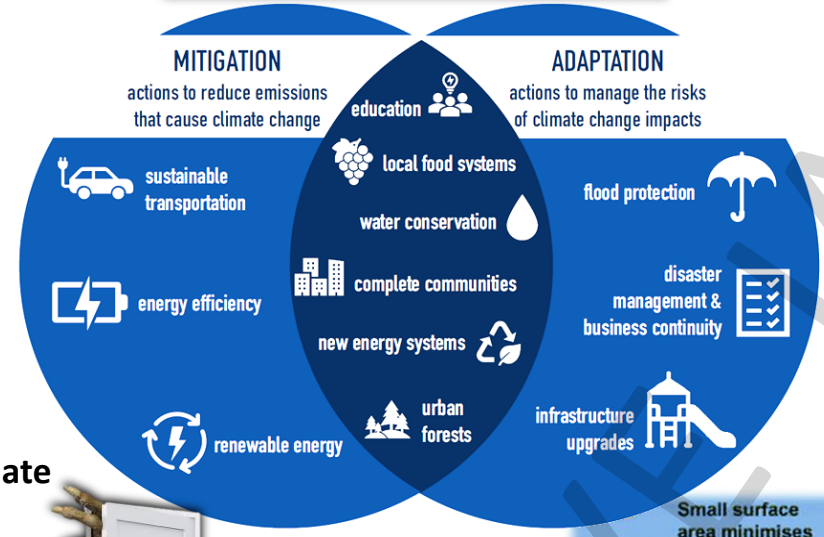
Benefits:
- Blending:
  - Blending 15% methanol in petrol can reduce emissions by 33%
- Near Zero pollution:
  - Produces negligible particulate matter, soot, SOx and Nox
- Misc: Cheaper fuel; Reduce inflation; Reduce CAD/import bill; can export to other countries to help them reduce emissions

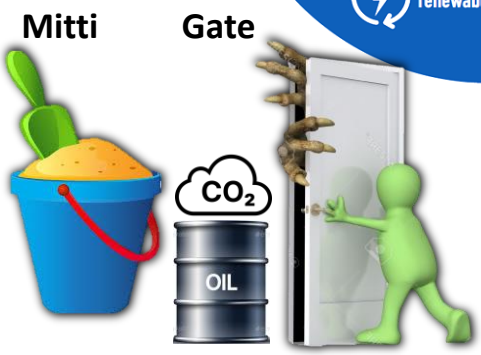
Challenges:
- Production issues:
  - Not much gas reserves, and Indian coal has high ash content
  - Technology to use high ash coal for methanol is not well developed for commercial use
- Compatible infra: (copied from pag-01)
  - Modification of supporting infra like storage tanks, dispensing nozzles, etc.
- Technical issues in vehicles: (copied from pag-01)
  - Ethanol can cause corrosion of engine parts
  - Engines need modification & fine-tuning to run on highly blended fuels

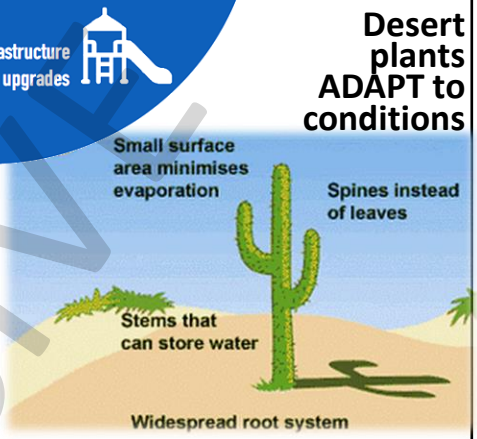
NITI Aayog's road map for Methanol Economy:
- Use indigenous technology to make methanol from high ash coal
- Use municipal solid waste, biomass to produce methanol
- Increase use of methanol and DME in road, rail, ships, gensets, etc.
- Substitute 10% of Crude imports by 2030 by using methanol

China:
- China uses coal to produce Methanol
- China produces 65% of world's Methanol
- Currently Methanol accounts for 10% of transport fuel in China

Mitigation vs Adaptation







WPA 1972

Wildlife (Protection) Amendment Bill, 2021

Passed by Lok Sabha in 1972. The Bill seeks to:

- **increase species protected under law**
- **implement CITES**

Provisions of the Bill:

- **It rationalises schedules:**
  - **Removes schedule for vermin species**
  - **Reduces number of schedules from 6 to 4**
- **Conservation Reserves:**
  - **Empowers both Centre and State to notify conservation reserve**
- **It fulfils obligations under CITES:**
  - **Central Govt to designate a management authority to grant export/import permits for trade of specimens**
- **Invasive alien species:**
  - **Empowers Central govt to regulate invasive alien species (import, trade, possession)**
- **Surrender of captive animals:**
  - **Any person can surrender a captive animal. It will become property of state govt.**

Note: features of the amendment bill can be used to explain need for amending WPA 1972

CITES 1973 (Convention on International Trade in Endangered species of Wild flora and fauna)

- **aka Washington Convention**
- **To control or prevent international commercial trade in Endangered species or products derived from them.**
- **Aim is to reduce economic incentive to poaching by closing international trade.**

WPA 1972

- For wild animals, birds, plants, environmental security of India
- Central govt can declare any area as NP or WS
- State govt can declare any area as NP or WS or Conservation reserve or Community reserve (see page-24)
- Chief Wildlife Warden (by State govt) can permit hunting/killing of any wild animal if it has become dangerous or is suffering beyond recovery (particular animal only)

Six schedules of WPA, 1972:

- *Schedule 1 & 2:*
  - protected, highest penalty
  - e.g. Tiger, flying squirrel, cobra, mongoose
- *Schedule 3 & 4:*
  - protected, lower penalty
  - e.g. Nilgai, Sambhar, wild pigs
- *Schedule 5:*
  - vermins, can be hunted
  - Central govt. notifies (but can't notify animals of Schedule-1 or Part-2 of Schedule-2)
  - Currently only mice, rat, common crow, flying fox (fruit eating bats)
- *Schedule 6:*
  - prohibited plants
  - Pitcher plant, Ladies slipper orchids, Red Vanda, Blue Vanda, Beddomes' cycad, Kuth

WPA establishes: (also see page-35)
National Board for Wildlife: Chair PM
State Board for Wildlife: Chair CM
Central Zoo Authority: Chair MoEFCC
National Tiger Conservation Authority: Chair MoEFCC
Wildlife Crime Control Bureau: HQ Delhi

Prevention of Cruelty to Animals Act, 1960

- "animal" means any living creature other than a human being
- Penalty:
  - 1st offence ₹ 10-50
  - Repeat offence ₹ 25-100
- #NoMore50 was in news
- Animal Welfare Board of India est in 1962; HQ Ballabhgarh in Haryana (earlier Chennai)

91. In India, if a species of tortoise is declared protected under Schedule I of the Wildlife (Protection) Act, 1972, what does it imply ?

(a) It enjoys the same level of protection as the tiger.

(b) It no longer exists in the wild, a few individuals are under captive protection; and now it is impossible to prevent its extinction.

(c) It is endemic to a particular region of India.

(d) Both (b) and (c) stated above are correct in this context.

Prelims 2017

35. According to the Wildlife (Protection) Act, 1972, which of the following animals ***cannot*** be hunted by any person except under some provisions provided by law ?

1. Gharial
2. Indian wild ass
3. Wild buffalo

Select the correct answer using the code given below :

(a) 1 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Prelims 2017

Urban Rivers

Sustainable river management:

- Making best use of river resources
  - without compromising on needs of future generations
- Historically, Human civilizations developed along river banks
  - This shows the importance of rivers for human settlements

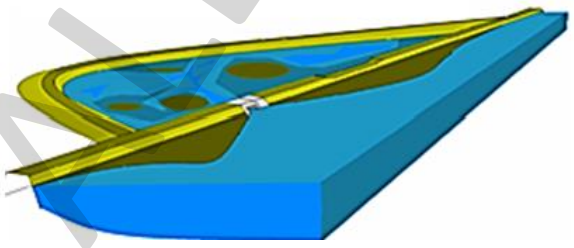
Challenges in ensuring sustainable river management:

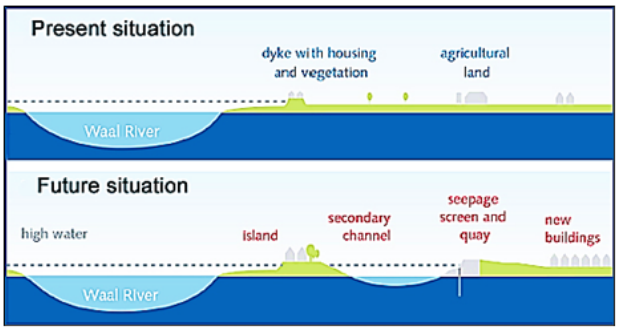
- Withdrawing excessive water:
  - It dries up the river and affects ecological flow (class-39, pg-11)
- Sewage water is discharged without treatment
  - It increases pollution, reduces biodiversity, converts river into drain
  - It impacts health of those who use river for religious activity (Chhath pooja, idol immersion)
- Houses are built on river floodplain
  - It damages river ecosystem, and makes infra vulnerable to flooding
- Irresponsible recreational use:
  - As per NGT, Art of Living festival damaged Yamuna floodplains in 2017
- Building of dams and barrages
  - It impacts free flow of fishes, accumulates silt, and creates problem in navigation

What can be done?

- Frame points from challenges
- Get more points from class-15 pg-05
- Reduce use of water, Reuse grey water for plants, Recycle black water
- Eco-friendly idol immersion:
  - Lucknow and many cities build artificial ponds for idol immersion
- Room for the river project of Netherlands:
  - Area around river is planned for flood protection, landscaping, etc.
- Singapore makes drain water drinkable
  - 40% of Singapore's water needs are met through wastewater
- River Cities Alliance: (Ministry of Jal Shakti)
  - Platform for river cities to discuss management of urban rivers
  - Focus is on river-sensitive planning and development
  - It is open to all river cities of India

Room of the river project, Netherlands





Lifestyle & Environment

LiFE: Lifestyle For Environment

- **At CoP-26, India launched LiFE initiative for environment-conscious lifestyle**
- **Main idea: it is people's responsibility to follow a lifestyle which protects environment**
- **Points for exam: No need to rattafy, just think about your daily activities.**

Some more points:

- **Bring Right to repair on lines of EU**
- **Replace use & throw culture with circular economy**
- **Make EPR mandatory (class-37 pg-07)**
- **For electronic products, implement urban mining to recover valuable metals (class-37 pg-06)**
- **Spread education for peaceful co-existence with nature**

All-Inclusive GS-2 & GS-3 MAINS 2022

Class-77

Man-Animal conflict

Reason for man-animal conflicts:

- **Deforestation and Habitat loss:**
  - encroachment on forest land for agriculture, resorts, adventure camping, timber production, etc.
- **Construction of road and railways:**
  - 35,000 animals were killed due to rail accidents during 2015-19
- **Lack of food & water in forest**
  - It forces animals to search for food in human settlements

Consequences: (People, animal, govt)

- **Loss of life and property**
  - Attack on human settlements by tiger, elephant, etc.
  - Crops in fields destroyed by trampling elephants
- **People attack animals:**
  - Locals set up traps to prevent wild animals from entering human settlements/fields
  - e.g. June 2020 Kerala: firecracker filled pineapple, placed for wild boar, killed an elephant
- **People oppose wildlife conservation efforts:**
  - People oppose forest officials who try to preserve wildlife, and may even support poachers

What can be done?

- **Create buffer to protect protected areas**
  - Prevent people from undertaking farming activities in NP and WS
  - Create Eco-sensitive zones around protected area
- **Construct Wildlife crossings**
  - Wildlife underpass and bridges will allow safe passage to animals, and reduce accidents
  - e.g. underpass on NH-7 in Kanha-Pench corridor
- **Augment fodder & water sources within forest**
  - This will reduce chances of animals wandering out of forest
- **Compensate farmers for crop loss**
  - Schemes like PM Fasal Bima Yojana can be used to reduce resentment in locals
- **Innovative methods like 'Plan Bee'**
  - Northeast Frontier Railway uses instruments that create buzzing sound of bees, to prevent animals from coming near rail tracks

Cheetah

African is bigger than Asian:
Lion, Elephant, Cheetah, etc.

Asiatic Cheetah is **CR**
African Cheetah is **Vulnerable**

Action Plan for Introduction of Cheetah in India:
- 50 to be reintroduced in NPs over 5 years
- From Southern Africa
- First release site will be Kuno NP

Why Kuno NP?
- Suitable habitat
- Adequate prey base
- No human settlements (complete relocation of villages)

Why from Southern Africa?
- Asiatic (Iran) are CR
  (so sourcing will be problem)
- African cheetahs are ancestral to all other lineages

Kuno National Park (in northern MP)
- 1981 WS, 2018 NP; 748 sq. km.
- part of Sheopur-Shivpuri deciduous open forest

Some animals: (don't learn the following names)
- Leopard, sloth bear, dhole, jackal, hyena, Bengal fox
- Chital, Sambar, Chinkara, Blackbuck, wild boar
- Mugger crocodile, Gharial, Bengal monitor

Cheetah:
- Independent India's only extinct large mammal
- Lives in grasslands, scrubs, semi-arid environments
- Usually does not attack humans and large livestock
- Keystone species (high impact in its ecosystem)

Other recommended sites:
- ❑ Nauradehi WS → MP
- ❑ Gandhi Sagar WS (Bhainsrorgarh WS) → MP
- ❑ Shahgarh bulge → Jaisalmer, Rajasthan
- ❑ Mukundara TR → Rajasthan

Expected benefits:
- ❑ Enhance grassland ecosystem
  - Cheetah being flagship species will help in reviving grasslands and boost biodiversity
- ❑ Boost Tourism & local economy
  - Tourists will get a new attraction, and locals will gain financially (Taxi, eateries, crafts)
- ❑ Help in Cheetah conservation:
  - By extending the range of cheetahs, their conservation efforts will get a boost

Concerns:
- ❑ Disturb grassland ecosystem
  - Cheetahs were absent for long time, ecosystem has adapted. It may now get disturbed.
  - Competition from other predators, like leopards
    (Forest officials are finding it difficult to remove them)
- ❑ Increase man-animal conflict
  - When more Cheetahs are introduced, they may venture into human settlements
- ❑ Quality of Cheetahs being imported:
  - Captive bred Cheetahs, who don't know hunting, could be delivered to India

Negative effects of Habitat Fragmentation:
- Less movement of animals in search of food.
- Less movement of animals during natural disaster (like drought).
- More man animals conflict, more road accidents.
- More pollution in habitats.
- Division of large population into small unviable unit, due to less genetic diversity.
- Less ability to cope with increased competition or threat.

4 major causes of biodiversity loss:
- Habitat loss and fragmentation
- Over-exploitation
- Alien species invasion
- Co-extinction

Eco-Sensitive Zones

In June 2022, SC ordered creation of minimum 1 km ESZ around protected areas

Eco-Sensitive Zones:

- ❑ They are ecologically fragile areas around National Parks and Wildlife sanctuaries
- ❑ They are notified by MoEFCC under EPA 1986

Importance:

- ❑ They act as Shock absorber for protected areas:
  - They reduce pollution and adverse impact from nearby economic activities
  - They reduce chances of man animal conflict
- ❑ They act as Transition zone:
  - between areas with higher protection to lower protection
- ❑ They use graded approach to regulation:
  - While mining is banned, activities like resorts and roads are regulated.
  - They regulate human activities instead of imposing prohibition.
- ❑ They become habitat for biodiversity:
  - Many species find shelter in vegetation of eco-sensitive zones
- ❑ They promote eco-tourism:
  - They allow hotels to host tourists for National park. (hotels can't run 'inside' NP)

Issues:

- ❑ ESZ not defined:
  - Govt hesitates in notifying ESZ as it might hamper economic activities.
- ❑ Urban area:
  - Some PAs are in urban areas, e.g. Guindy NP Chennai, making it difficult to create ESZ
- ❑ ESZ is very narrow:
  - Sometimes ESZ is only of few metres, making it irrelevant.
- ❑ Opposition from locals:
  - Locals depend on forests for livelihood, hence they perform economic activities close to PA

NP/WS notified by → State → WPA 1972
ESZ notified by → Centre → EPA 1986

Eco-Sensitive Zones

- Acts 'shock absorbers' to Protected Areas.
- Only up to 10 km around PA? No
- 'Corridors' to prevent biodiversity fragmentation
- Notified by MoEFCC under EPA, 1986
- EPA 1986 does not mention the word "Eco-Sensitive Zones".
- "Wildlife Conservation Strategy 2002" envisaged 10 km EFZ around protected areas. (F = Fragile)

❑ Prohibited: Commercial mining
❑ Regulated: hotels and resorts
❑ Permitted: Ongoing agricultural practices

Prelims 2014:

With reference to 'Eco-Sensitive Zones', which of the following statements is/are correct?

1. Eco-Sensitive Zones are the areas that are declared under Wildlife (Protection) Act, 1972.
2. The purpose of the declaration of Eco-Sensitive Zones is to prohibit all kinds of human activities in those zones except agriculture.

Select the correct answer using code given below.

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Prelims 2016:

'Gadgil Committee Report' and 'Kasturirangan Committee Report', sometimes seen in news, are related to

(a) constitutional reforms
(b) Ganga Action Plan
(c) linking of rivers
(d) protection of Western Ghats

2010 64% Gadgil
2012 37% Kasturi

Protected Areas

WPA 1972

India has a network of 982 Protected Areas including
106 National Parks,
566 Wildlife Sanctuaries,
97 Conservation Reserves,
214 Community Reserves
covering a total of 1,71,921 km² of geographical area of the country which is approximately 5.03%

	National Park	Wildlife Sanctuary
Purpose	To protect ecologically important area	To protect wildlife or its environment
Human activity	Not permitted	Restricted activities allowed
Notified by	State govt	State govt
Boundary change	NBWL recommendation	NBWL recommendation
Oldest	1936 Hailey/Corbett	1936 Vedanthangal Lake Bird Sanct. (TN)
Maximum in	MP (11)	A&N Islands (96)

Marine Protected Areas:

❑ Not specifically mentioned in WPA
❑ Est. as NP or WS or Cons. Reserve
❑ 129 = 25 South; 100 A&N; 4 Laksh.

Critical Wildlife Habitat:

❑ Within NP and WS
❑ No human settlement & usage
❑ Notified by MoEFCC under FRA 2006

	Conservation Reserve	Community Reserve
Purpose	Buffer zone / migration corridor	Buffer zone / migration corridor
Land ownership	Only government	Private also
Human activity	Can be used for subsistence by communities	Can be used for subsistence by communities
Notified by	State govt	State govt
Since	2005 (WPA amended in 2002)	2007 (WPA amended in 2002)
Maximum in	J&K (32)	Nagaland (114)

Environmental Impact Assessment

What is EIA?

- EIA is a process of evaluating the likely environmental impact of a proposed project.
- It aims to suitably modify the proposed project, to reduce adverse impact.

Precautionary principle:

- It is used to deal with actions that:
  - are weakly understood, e.g. impact of open pit mining on groundwater level & toxicity
  - have irreversible implications, e.g. forest submerged by dam cannot be retrieved.
- It is the main reason for conducting EIA
  - as environmental harm is weakly understood and irreparable
- In case of environmental decision making, it has four main components:
  - take preventive action (if there is uncertainty)
  - burden of proof is on promoter of project (that the project does not harm environment)
  - explore alternatives (change of site, or change of technology, or modify project size)
  - increase public participation in decision making (public opinion must be considered)

Existing problems with EIA in India:

- Funding:
  - EIA is funded by project promoter, hence there is clear conflict of interest.
- Assessment:
  - Team conducting EIA lacks in expertise in environmental science.
- Reports:
  - Most reports in English and not in the local language.
  - Reports are too technical for common people to understand.

Draft EIA notification 2020:

- Toxic industries
  - can be set up as close as 0-5 km from protected areas.
- Public consultation:
  - Public to submit response in 20 days, instead of 30 days.
  - Public hearing not needed for strategic sectors, widening highways, or projects up to 1.5 lakh m^2
- Reporting of violation:
  - Violation of environmental law can be reported only by the violator or the government.
- Does not cover all seasons:
  - EIA need not cover all seasons of the year. This will hide many possible impacts of the project.
- Monitoring frequency reduced:
  - from 6 months to annual. So, environmental damage will go unnoticed for longer time.
- Provision for Post-facto clearance:
  - Projects started without environmental clearance can be given clearance later.
  - It defeats the purpose of conducting EIA

Conclusion:

- Draft EIA will help in improving ease of doing business.
- But, its adverse impact on environment can have catastrophic effect in future.
- Wider consultations must be held, and objections addressed, before finalising the notification.

Mains 2020:

How does the draft Environment Impact Assessment (EIA) Notification, 2020 differ from the existing EIA Notification, 2006? (Answer in 150 words)

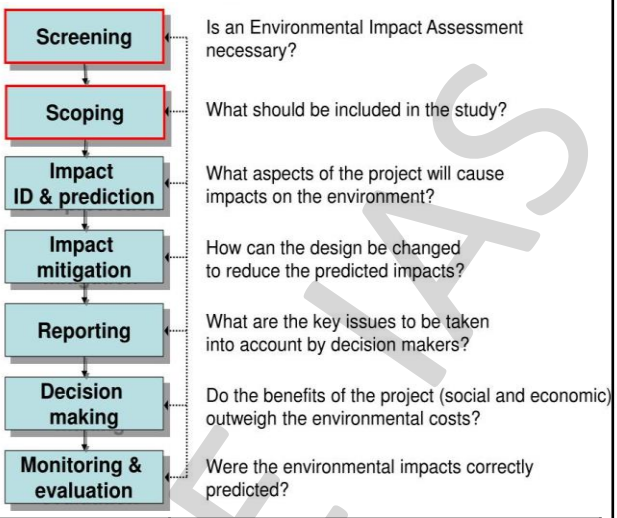
EIA

Environment Impact Assessment (EIA):

- ❖ evaluating the likely environmental impacts of a proposed project.
- ❖ EIA notification is made by MoEF&CC under EPA, 1986. Current notification is of 2006.

Categories of projects:

- ❑ Category A : EIA mandatory, so no screening.
- ❑ Category B : screening classifies projects as:
  - Category B1 projects: EIA required
  - Category B2 projects: EIA not required



Who gives Environmental clearance?	Category A projects: Expert Appraisal Committee → MoEFCC	Category B projects: State EAC → State EIA Authority

NGT

Prelims 2018:

How is NGT different from CPCB

1. NGT has been established by an Act whereas CPCB has been created by an executive order of the Government.
2. NGT provides environmental justice and helps reduce the burden of litigation in the higher courts whereas CPCB promotes cleanliness of streams and wells, and aims to improve the quality of air in the country.

Which of the above statements is/are correct:

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Prelims 2012:

The National Green Tribunal Act, 2010 was enacted in consonance with which of the following provisions of the Constitution of India?

1. Right to healthy environment, construed as a part of Right to life under Article 21
2. Provision of grants for raising level of administration in Scheduled Areas for welfare of Scheduled Tribes u/a 275(1)
3. Powers and functions of Gram Sabha as mentioned under Article 243 (A)

Select correct answer using codes given below:

(a) 1 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

- ❑ Statutory body; NGT Act 2010
- ❑ India 1st to set up env tribunal? No Aus/NZ
- ❑ Civil cases? Yes; Criminal cases? No
- ❑ Natural justice;
  Not bound by Code of Civil Procedure 1908
- ❑ Delhi (Principal)
  Pune, Kolkata, Bhopal, Chennai
- ❑ Decision can be challenged 'only' in SC? No

- ❑ Chairperson:
  serving/retd. SC Judge or HC CJ
- ❑ 10-20 Judicial members:
  serving/retd. SC Judge / HC CJ / HC Judge
- ❑ 10-20 Expert members
- ❑ 5 year term; no reappointment

Laws under NGT

WPA 1972? No

✓Water Act 1974; ✓Water Cess Act 1977; ✓Air Act 1981;
✓Forest (Conservation) Act 1980; ✓Environment (Protection) Act 1986;
✓Public Liability Insurance Act 1991; ✓Biological Diversity Act 2002

Indian Antarctic Act 2022

Also see:
class-44 pages 2-5

Aim of the Act:

- To have India's own national measures for protecting the Antarctic environment.
- To ensure de-militarization of the region, and end mining or illegal activities.
- To ensure that there should not be any nuclear test / explosion in the region.

Significance of the Act:

- It will help in efficient operation of Indian Antarctic Programme.
- It will increase India's involvement in tourism and fisheries in Antarctica.
- It will increase India's credibility in Polar governance
- It will increase India's cooperation in scientific and logistics field.

Key Features:

- **Permit:**
  - Indian expedition to Antarctic will need permit from govt
- **Jurisdiction of courts:**
  - It extends jurisdiction of Indian courts to Indian expeditions to Antarctica
  - It will be applicable to Indians and foreigners who are part of Indian expeditions.
- **Antarctic fund:**
  - It will be created for protecting Antarctic environment.
- **Environmental protection:**
  - It prohibits nuclear explosion, mining, garbage disposal etc that threaten Antarctic environment
- **Indian Antarctic Authority:**
  - Ministry: Ministry of Earth Sciences; Chairperson: Secretary, MoES
  - Provide transparent process for expeditions
  - Ensure compliance by Indian citizens in expeditions
  - Ensure protection of Antarctic environment

Antarctic Treaty 1961

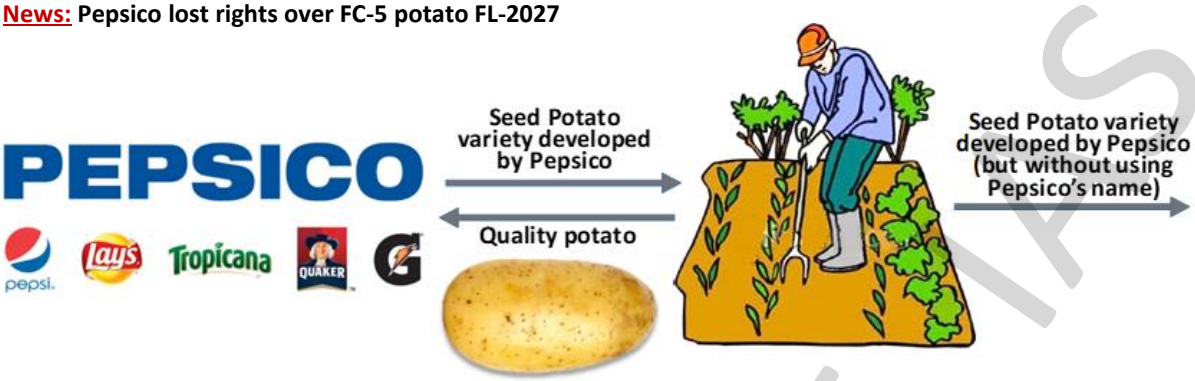
- India joined it in 1983
- Promote international scientific cooperation
- Only peaceful use of Antarctica:
  - Demilitarize Antarctica
  - Establish nuclear free zone

India's research stations in Antarctica:

- 1983 DG → 1989 Maitri → 2012 Bharti
- Maitri and Bharti are still operational
- India has successfully launched 40 scientific expeditions to Antarctica till date

PPVFR Act 2001

News: Pepsico lost rights over FC-5 potato FL-2027



Protection of Plant Varieties and Farmers' Rights (PPV&FR) Act, 2001:

Enacted to give effect to TRIPS agreement. Rights under the Act:

- **Breeder's rights:**
  - Right to produce, sell, import, export the protected variety.
- **Researcher's rights:**
  - Can use any registered variety for research (even to develop a new variety)
- **Farmer's rights:**
  - Farmer who develops new variety can get it registered as a breeder
  - Allows farmer to save, use, sow, resow, exchange, share or sell farm-saved seeds except the brand name.
  - Farmers can claim compensation if registered variety fails to perform
  - Farmers need not pay fees at any tribunal or court (money from National Gene Fund)

December 2021: PepsiCo's IPR on FL-2027 (FC-5) potato variety was revoked by PPVFR Authority.

Implications of the current verdict

- It sets a precedent for protecting farmer's rights.
- It may discourage innovation by companies due to weak IPR protection.
- It may boost local food processing units (by using same potato as PepsiCo)

Functions of PPVFR Authority:

- Registration of new plant varieties
- Facilitate commercialisation of new plant varieties
- Maintenance of National Gene Bank to store seed material