Science & Technology

Cloud Seeding

Syllabus: GS3/Science & Technology

In News
Recently, the United Arab Emirates's (UAE) National Center of Meteorology opted to go for cloud seeding to beat the extreme weather conditions.

About
● UAE has employed the technology of using drones to generate rainfall.
● In India as well, Cloud seeding has earlier been attempted in Karnataka, Andhra Pradesh and Maharashtra to address drought.
● Similar experiments of cloud seeding had earlier been tried in Australia, America, Spain and France.
● In the United Arab Emirates, the cloud seeding technique led to the creation of 52 storms in Abu Dhabi.

Cloud Seeding (Weather Modification)
● Cloud seeding is a kind of weather modification technology to create artificial rainfall. It works only when there are enough pre-existing clouds in the atmosphere.
● Drones are charged into the clouds and cause an electric shock due to which they clump together and cause rainfall.
Otherwise, in this process either **silver iodide, potassium iodide or dry ice (solid carbon dioxide)** is dumped onto the clouds causing rainfall. The seeds of chemicals can be delivered by plane or simply by spraying from the ground.

**Cloud-seeding chemicals** can be dispersed in clouds either by **fly-through aircraft or by ground-based dispersion devices** that use rockets or guns to fire canisters into the sky.

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**Applications of Cloud Seeding**

- **Creation of Rain:** Cloud seeding is the best way to consider **improving rainfall quantity in case of inadequate rainfall**. Arid areas usually have conditions that may be **harsh in terms of food security** and a conducive environment for living.
  - Cloud seeding **can bring rain**, which makes the natural environment flourish and becomes more habitable.

- **Boosting of the Economy:** Agricultural production is important to the local economies of many regions around the world. **Rain is important in achieving a proper harvest.**

- **Weather Regulation:** Cloud seeding provides an **avenue for controlling prevailing weather conditions** in different areas.
- Geographically oriented: Cloud seeding is primarily done to create certain conditions in specific areas, also termed as microclimates. Places like airports, for instance, often use cloud seeding to create a stable condition for their runway. This is to ensure that planes are not restricted from taking off or landing.

**Concerns**

- Requires the use of Potentially Harmful Chemicals: Some chemicals are potentially harmful to the natural environment. Mostly, this applies to the plants which depend on the contaminated rain to produce food.
- It is expensive: Cloud seeding is a very expensive process. Planes are used to get the chemicals into the air and this is a big obstacle as some of the areas in need of this technology do not have enough financial backing to facilitate the process.
- Poses Weather Problems: Cloud seeding could have many dire consequences to the environment if not well regulated.
  - Dry areas are not usually well-positioned to handle certain weather conditions, and thus, may become easily flooded and cause more harm to the already struggling environment.
- Dependence on atmospheric conditions: For cloud seeding to be successful, certain uncontrollable conditions have to be met. for example
  - Clouds have to be present, not just any cloud but clouds capable of producing rain.
  - The atmospheric conditions must also suit the process as certain conditions could lead to an unwarranted result like the rain falling in a different location or not falling at all.

Source: CBS News

### Polity and Governance

#### Surveillance Laws in India

**Syllabus:** GS 2, Government Policies & Interventions, Issues Arising out of their Design & Implementation, GS 3, Cyber Crime & Security

**In News**

In a recent response to the incident of individuals being targeted by Pegasus, the Government of India has claimed that all interception took place lawfully.

**Background**

- Over 300 mobile phone numbers in India were targeted by Pegasus spyware.
- The Indian list of “verified” numbers includes those used by ministers, opposition leaders, journalists, the legal community, businessmen, government officials, scientists, rights activists and others.
○ However, the presence of a phone number in the database was not a confirmation of whether the corresponding device was infected with Pegasus or was subject to an attempted hack.

- Pegasus was developed by the NSO Group of Israel, which describes its customers as 60 intelligence, military and law-enforcement agencies in 40 countries.
  ○ It has refrained from confirming the identities of any of them, citing client confidentiality obligations.

**Government’s Stand**

- The government holds that the allegations regarding government surveillance on specific people has no concrete basis or truth associated with it whatsoever.
  ○ In the past, similar claims were made regarding the use of Pegasus on WhatsApp by Indian state. Those reports also had no factual basis and were categorically denied by all parties, including WhatsApp in the Indian Supreme Court.
  ○ However, WhatsApp confirmed use of Pegasus to target journalists and human right activists in India in a lawsuit it had filed in a US court in San Francisco.

- It highlighted that the latest news also appears to be a similar fishing expedition, based on conjectures and exaggerations to malign the Indian democracy and its institutions.

- Although Indian Government has not clearly admitted to or denied buying or using Pegasus to conduct surveillance, the NSO Group has clarified that Pegasus is used by sovereign governments in foreign countries.

- Government held that all interception took place lawfully.
  ○ Communication surveillance in India takes place primarily under two laws, the Telegraph Act, 1885, which deals with interception of calls and the Information Technology (IT) Act, 2000, which deals with surveillance of all electronic communication.
  ○ However, a comprehensive data protection law to address the gaps in existing frameworks for surveillance is yet to be enacted.

**Telegraph Act, 1885**

- **Section 5(2)** of the Telegraph Act empowers the Central/State government(s) to stop transmitting, intercept or detain or disclose calls and messages by a person or a group of people.

- Under this law, the government can intercept calls only in certain situations, namely the interests of the sovereignty and integrity of India, the security of the state, friendly relations with foreign states or public order, or for preventing incitement to the commission of an offence.
  ○ These are the same restrictions imposed on free speech under Article 19(2) of the Constitution.

- Significantly, even these restrictions can be imposed only when there is a condition precedent, the occurrence of any public emergency or in the interest of public safety.

- A provision in **Section 5(2)** states that even this lawful interception cannot take place against journalists.
It reads that “Provided that press messages intended to be published in India of correspondents accredited to the Central Government or a State Government shall not be intercepted or detained, unless their transmission has been prohibited under this subsection.”

**Genesis**

- In **Public Union for Civil Liberties versus Union of India** (1996), the SC pointed out lack of procedural safeguards in the provisions of the Telegraph Act and laid down certain guidelines for interceptions.
  - A public interest litigation (PIL) was filed in the wake of the report on “Tapping of politicians phones” by the Central Bureau of Investigation (CBI).
- The SC held that tapping is a serious invasion of an individual’s privacy.
  - Every Government, howsoever democratic, exercises some degree of subrosa operation as a part of its intelligence outfit but at the same time citizen’s right to privacy has to be protected from being abused by the authorities of the day,
  - It also noted that authorities engaging in interception were not even maintaining adequate records and logs on interception.
- The Supreme Court’s guidelines formed the basis of introducing **Rule 419A in the Telegraph Rules in 2007** and later in the rules prescribed under the **IT Act in 2009**.
  - Among the guidelines issued by the court were setting up a review committee that can look into authorisations made under Section 5(2) of the Telegraph Act.
  - **Rule 419A** states that a Secretary to the Government of India in the Ministry of Home Affairs can pass orders of interception in the case of Centre, and a secretary-level officer who is in-charge of the Home Department can issue such directives in the case of a state government.
  - In unavoidable circumstances, Rule 419A adds, such orders may be made by an officer, not below the rank of a Joint Secretary to the Government of India, who has been duly authorised by the Union Home Secretary or the state Home Secretary.

**Information Technology Act, 2000**

- **Section 69** of the IT Act and the **Information Technology (Procedure for Safeguards for Interception, Monitoring and Decryption of Information) Rules, 2009** were enacted to further the legal framework for electronic surveillance.
  - Section 69 empowers the Central/State government(s) to intercept, monitor or decrypt any information generated, transmitted, received or stored in any computer resource in the interest of the sovereignty or integrity of India, security of the State, friendly relations with foreign States or public order or for
preventing incitement to the commission of any cognizable offence relating to above or for investigation of any offence.

- Apart from the restrictions provided in Section 5(2) of the Telegraph Act and Article 19(2) of the Constitution, Section 69 the IT Act adds another aspect “for the investigation of an offence” that makes it broader.
- Significantly, it dispenses with the condition precedent set under the Telegraph Act that requires “the occurrence of public emergency of the interest of public safety” which widens the ambit of powers under the law.
- Under the IT Act, all electronic transmission of data can be intercepted.
  - For a Pegasus-like spyware to be used lawfully, the government would have to invoke both the IT Act and the Telegraph Act.
- The Central government has authorised 10 agencies to intercept communications.
  - These are Intelligence Bureau (IB), Narcotics Control Bureau (NCB), Enforcement Directorate (ED), Central Board of Direct Taxes (CBDT), Directorate of Revenue Intelligence (DRI), Central Bureau of Investigation (CBI), National Investigation Agency (NIA), Cabinet Secretariat (RAW), Directorate of Signal Intelligence (For service areas of Jammu and Kashmir, North East and Assam only) and Commissioner of Police, Delhi.

Way Forward
- In 2012, the Planning Commission and the Group of Experts on Privacy Issues were tasked with identifying the gaps in laws affecting privacy.
  - On surveillance, the committee pointed out divergence in laws on permitted grounds, “type of interception”, “granularity of information that can be intercepted”, the degree of assistance from service providers and the “destruction and retention” of intercepted material.
- Although the grounds of selecting a person for surveillance and extent of information gathering has to be recorded in writing, the wide reach of these laws has not been tested in court against the cornerstone of Fundamental Rights.
- There is a need for more debates on the issue in order to secure individuals’ right to privacy and to keep a check on the authoritative traits of governments trying to silence the people who raise their voices.

Pegasus
- Pegasus is spyware that can be installed on devices running some versions of iOS (Apple’s mobile operating system) and on devices running on Android.
- It was developed by the Israeli cyberarms firm NSO Group.
  - NSO is a highly-regulated enterprise that provides government agencies an essential tool to monitor terrorists and criminals.
- Functioning
It mainly uses **Exploit Links** for its working. **Clicking** on such links **automatically installs Pegasus** on the user’s phone. The method of **Social Engineering** is used.

- In the context of information security, social engineering is the **psychological manipulation** of people into performing actions or divulging confidential information.
- This differs from social engineering within the social sciences, which does not concern the divulging of confidential information.

Once the spyware is installed, Pegasus can **potentially harvest most of the data** on the device including SMS, emails, WhatsApp chats, call logs, GPS data, contact lists and transmit it back to the attacker.

It can also activate functionalities such as camera, microphone, call recording, etc. to provide **surveillance capabilities** to the client.

- **An online database** about the use of the spyware Pegasus was launched.
  - It was launched by **Forensic Architecture, Amnesty International** and the **Citizen Lab** to document attacks against human rights defenders.
  - It showed the connections between ‘digital violence’ of Pegasus and the threats faced by the lawyers, activists and other civil society figures.

- **Israel** has established a **commission to review allegations** that the NSO Group’s Pegasus phone surveillance software was **misused** to assess whether the nation needs to make corrections.

Source: [IE](https://www.indiatoday.in)

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**Geography**

**Potential of Geospatial Technologies for the Water Sector in India**

**Syllabus:** GS1/ Water Resources

**In News**
Recently, a report on opportunities from the use of Geospatial Technologies in the Water Sector was released by the Director General, National Mission for Clean Ganga.

**About**
- This Report was prepared by the **Association of Geospatial Industries** – a geospatial technology industry body.
- The report provides an overview of how each of these programmes is currently using geospatial technologies, and how to improve technology adoption in the future.
  - Various programmes like Jal Jeevan Mission, Atal Bhujal Yojana, have been set up using these technologies.

**Major Highlights from the Report**
As a fast developing and second most populous country in the world, India is facing a severe water crisis that is becoming a critical issue.

Home to about 17% of the world population, and around 20% of world’s livestock population, India has access to only about 4% of the world’s freshwater reserves.

**Key Concerns or Indian Water Sector**

- **Rain water and Glaciers:**
  - India receives 3,000 billion cubic metres of water every year through rainfall or other sources such as glaciers; of this, only 8% is collected.

- **Ground Water:**
  - Rate of extraction of Groundwater in India is higher than Rate of filling the aquifers.
  - 89% of India’s water resources are used for agriculture, out of which 65% is withdrawn from under the ground.
  - Industry too obtains around 80% of their water requirements from underground sources. Thus, one of India’s biggest challenges is to conserve groundwater.

- **Water Storage Capacities:**
  - India also has insufficient water storage capacities.
  - While some countries have capacities up to 5000 mt cube per person storage infrastructure, India only has about 200 mtr cube per person.
  - This results in droughts even in years that experience good monsoons.

- **Water Quality:**
  - Even the water that is available is not fit for direct consumption. Groundwater in one-third of India’s 600 districts is contaminated mainly through fluoride and arsenic.
  - India’s economic burden through water borne diseases is approximately USD 600 million a year.
  - Less than 50 percent of India’s population has access to safe managed drinking water, and that too is inequitable.

- **Water Resources Management:**
  - The science in water resources management is very complex and dynamic.
  - The implication of an applied strategy is not known in the short run.
  - The gestation period for any quantifiable change is upwards of a decade, hence adoption of appropriate technology tools and analytics to assess the situation and simulate various possibilities is critical for sustainable development in the water sector.

**GeoSpatial Technologies in India**

- **Geospatial Technologies** are tools that enable us to present the spatial context of phenomena and provide a platform for developing an understanding of ‘what-if’ scenarios by integrating various other datasets.
- The term ‘geospatial’ refers not to one single technology, but a sleuth of technologies that help to collect, analyse, store, manage, distribute, integrate, and present geographic information.
- It consists of the following technologies:
  - **Remote Sensing:**
- This technology allows us to remotely **capture features of Earth’s surface** by using various sensors that are typically mounted on satellites or airborne vehicles.

- Remote Sensing sensors **record earth’s reflectance in different wavelengths**, and these received reflectance values are processed to create a separate image for each wavelength.

- The reflectance value is stored for different wavelengths in different layers, which are also called **bands** present in that satellite image.

- A sensor can record several wavelengths simultaneously. In general, there are **three wavelengths from visible** i.e. blue wavelength, green wavelength and red wavelength, whereas **infrared** can be further defined as near infrared, mid infrared, far infrared and thermal infrared.

- Multispectral satellite data for the **water sector** is extremely useful as it helps extract detailed information and facilitates more accurate interpretation and classified thematic maps.

- It helps in:
  - assessing depth,
  - water turbidity,
  - understanding aquaculture,
  - assessing water levels,
  - river movement,
  - understanding water-related disaster scenarios,
  - overview of population spread etc.

  - **Surveying:**
    - This technology is used to make **relatively large-scale**, accurate measurements of the **Earth’s surface**.
    - Surveying has two similar but opposite functions:
      - The determination of existing relative horizontal and vertical position, such as that used for the process of mapping, and
      - The establishment of marks to control construction or to indicate land/water boundaries.
    - Survey equipment include theodolite, total station, 3D scanners, LiDAR etc.

  - **Global Navigation Satellite System (GNSS):**
    - Global Navigation Satellite System (GNSS) provides precise position or geographic location of people, equipment or things that are attached to a device that includes a GNSS chip.
    - Data about the location is gathered from a constellation of navigation satellites that cover the entire globe.
    - Common applications include navigation, and routing.
    - GNSS is also used in high precision construction.

  - **Geographic Information System (GIS):**
    - A Geographic Information System (GIS) is a conceptualized framework that provides the ability to capture and analyse spatial and geographic data.
GIS helps integrate different data layers for enabling spatial based decision making for a variety of users from local governments, transport/logistics, insurance, environment monitoring, telecommunications etc.

Geospatial Technologies in Relation to Digital Technologies

- The fourth industrial revolution is marked by the advent of new-age technologies that are revolutionizing the way we live, work, and relate to each other.
- These technologies include:
  - **Artificial Intelligence:**
    - Artificial intelligence (AI) is the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings.
    - AI simulates human intelligence in machines that are programmed to think like humans and mimic their actions.
    - GeoAI can help professionals in the water sector to automatically detect terrain features, densely distributed building footprints, extract
information from scanned historical maps, cleanse data in subterranean utility networks, interpretation of utility drawings and asset recognition in images.

- GIS combined with AI is also useful for developing and maintaining decision-making processes like smart water grids, smart sewage systems, and smart waste management systems.

- **Big Data Analytics:**
  - Geospatial data has always been characterised as big data.
  - Geospatial data is being captured from a variety of sources, right from satellites, UAV mounted sensors, other sensors measuring and monitoring water/air quality, traffic patterns, cell phone data etc.
  - For the water sector, big data analytics can address issues of data scarcity by consolidating data available from different sources, both traditional and unconventional.
  - Big data analytics can transform data into usable information that can support groundwater management, especially at a local scale.
  - Big data analytics techniques and methods provide benefits beyond traditional analytics, when dealing with large heterogeneous datasets and are particularly useful when performing data-driven modelling.
  - For the water sector, big geospatial data analytics can help develop algorithms for predictive scenarios used for dam construction, water resource management, river linking projects etc.

- **Internet of Things:**
  - The network of physical objects embedded with sensors/software, exchanging data with other devices is called the Internet of Things.
  - These sensors measure with high precision the state of the physical world such as temperature, humidity, radiation, electromagnetism, noise, chemicals, etc.
  - Data collected through IoT when combined with geospatial data provides rich knowledge and analytics about the real world and helps deliver better outcomes.
  - IoT sensors when combined with GIS technology can be an effective tool for:
    - Generating flooding models,
    - Calculating the expected excess rainwater,
    - Identifying groundwater potential zones in hard rock terrain,
    - monitoring the seasonal variation of physicochemical parameters of an urban water stream,
    - Generating high-risk flood plain maps,
    - Delineating groundwater potential zones in hard rock terrain,
    - assessing the spatial variation of groundwater quality
    - Producing salinity hazard maps.

- **Robotics:**
  - Robotic mapping has significantly contributed to the field of localization and mapping, by increasingly becoming independent and automated.
Low-cost robots for remote surface data collection support water balance computations and hydrologic understanding where water availability data is sparse

**Digital Twin:**
- A Digital Twin is a virtual replica of the physical world, its dynamics, and processes, which allow us to simulate real life situations and analyse its impact.
- Digital twins are composed of three parts -
  - the physical entities in the physical world,
  - the virtual models in the virtual world, and
  - the connected data that tie the two worlds.
- Digital Twins not only integrate the digital representation of physical assets, like physical systems of pipes, pumps, valves, and tanks, but also include historical data sets such as weather records and realtime dynamic interactions, which allow them to be used for multiple analyses.

**5G:**
- The 5G or fifth generation technology standard for broadband cellular networks is set to be about 100 times faster than the currently available 4G networks.
- 5G enabled IoT devices will provide precise location about water supply, sanitation, incidents related to leaks or emergencies on a real-time basis.
- As 5G will enable faster machine-to-machine communications, these incoming data from various sensors can be integrated in a GIS based control centre that will process location information in real time and AI systems will analyse and trigger actions, thereby enhancing the ability of decision makers to better monitor and manage water related assets and resources.

**Ongoing Water Projects in India**
- Recognising the water crisis in India, the government of India formed a single ministry i.e Ministry of Jal Shakti.
- Previously, water was a subject which was dealt with by almost nine Ministries.
- Projects are:
  - Jal Jeevan Mission
  - Dam Rehabilitation and Improvement Project (DRIP)
  - Namami Gange
  - National River Linking Project (NRLP)
  - Atal Mission for Rejuvenation and Urban Transformation (AMRUT)
  - National Hydrology Programme
  - Pradhan Mantri Krishi Sinchayi Yojana (PMKSY)
  - National Aquifer Mapping and Management Programme (NAQUIM)
  - River Basin Management
  - Atal Bhujal Yojana (ABHY)
  - National Water Mission

**Suggestions**
- **Long-term Geospatial Vision:** In order to derive maximum benefit from geospatial technology implementation in various programmes, user departments need to build a long-term vision of the outcomes of geospatial implementation. This will ensure a
sustainable infrastructure and human resource investments, as well as better programme outcomes.

- **Integrated geospatial platform:** Even when a lot of data and technology is used by various agencies at central and state level, they are still functioning in silos. An integrated collaborative platform to connect the data and technology used by various organizations need to be developed for seamless access to information both locally and nationally and enable decision making.

- **Data and system integration:** various datasets including demography, socio-cultural, economic, and other parameters need to be integrated with spatial and non-spatial data related to water, like soil moisture, annual rainfall, rivers, aquifer, groundwater levels, water quality etc.

- **Improving water use efficiency:** Agriculture sector is the largest user of water resources in our country. They use 80-85% of water resources, while have only about 30-35% efficiency of water use. Geospatial technologies can be used for increasing water use efficiency, so that this can be increased to at least 50%.

- **Sharing of best practices:** A lot of knowledge exists that can help stakeholders to leverage from and not reinvent the wheel. A central repository of such knowledge base, in the form of a Knowledge Portal can be created and maintained by the Ministry of Jal Shakti that includes case studies, best practices, tools, information on data sources etc. that can be used by

**Conclusion**
- It is critical to use the latest and best digital and spatial technologies to make data-based informed decisions.
- There is a need for collaborating with stakeholders in the entire ecosystem such as Geospatial organizations, academics, Policy makers, funding agencies.

Source: **PIB**

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**Biodiversity & Environment**

**Increasing Microplastics Concentration in River Ganga**

**Syllabus:** GS3/ Environmental Pollution and Degradation

**In News**
According to the recent study, various stretches of Ganga have been polluted with Microplastics.

**Key Findings**
- The Ganga is heavily polluted with microplastics at **Varanasi, Haridwar** and **Kanpur**.
- **Varanasi** showed the maximum load of microplastics in the water of the Ganga, as compared to the other two cities.
  - This might be due to cumulative downstream pollution as well as industrial and human activities.
- Major reason for Microplastic pollution is:
  - Municipal discharge like sewage
  - Industrial discharges like that from tanneries and other industries like textiles, etc.
- The study analysed the types of microplastics present in the Ganga.
- Ethylene Vinyl is particularly suited for food, drugs and cosmetic packaging.
- Polyacetylene is used as a doping agent in the electronics industry.
- Polypropylene is also used in packaging, plastic sheets, fibre, fabrics, rope, etc.
- PIP is mainly used in footwear and baby bottle nipples.
- Polyamide, commonly known as nylon, is used as a natural fibre and as metal wires in clothing and industry.
- All these and 36 other types were found in the samples with variations in presence from site to site.

**Microplastics**
- They are plastics that are less than 5 millimetres in size but are a major source of marine pollution.
- It is non-degradable plastics that often entered the Ganga through industrial waste or packaging of religious offerings.
- They are insoluble in water.

**Impacts**
- **Polluting water channels:**
  - Rivers, water pipelines are being toxicated by the presence of microplastics in them. This water is used for cooking, drinking, washing etc.
- **Agriculture:**
  - Same river water is used for irrigation allowing these particles to enter crops and food.
  - Microplastics in river water can **cause toxicity through various means**.
  - Not only are these microplastics toxic themselves, they also have a tendency to absorb various toxins present in water, including harmful chemicals.
- **Through rivers to sea:**
  - Once these substances reach the sea, they’re ingested by fauna (especially plankton, invertebrates, fish, seagulls, sharks, whales and dolphins) and can alter the food chain.
  - According to the environmental research institution ISPRA, 15 to 20 per cent of marine species that end up on our tables contain microplastics.
  - According to researchers from the National University of Ireland, who fished mesopelagic species that live from 200 to 1000 metres deep in the North Sea, this concentration reaches 73 per cent.
- **Genetic modification diseases in humans:**
  - The pollutants released by microplastics can be ingested and absorbed by humans.
  - These can interfere with the human **endocrine system** and produce genetic modifications.

**Sources of Microplastics**
- **Global plastic production:**
  - It went from 1.5 million tonnes to more than 280 million tonnes from the 1930s to the first decade of the 2000s (with a 38 per cent growth in the last ten years).
  - The consequences are obvious: as **more plastic is used, more is thrown into the sea**, directly or indirectly.
- **Marine Environment:**
  - Various shapes and forms of plastic are present in marine environments: bags, microbeads, packaging, construction coating, polystyrene containers, tape and fishing equipment.
- **Oxidation tank and sewage sludge:**
  - Water depuration systems can trap plastic and fragments of various sizes through oxidation tanks or sewage sludge.
  - Nevertheless, a large portion of microplastics manage to pass through this filtration system and reach seas and oceans after being thrown into rivers.

- **Cosmetics and make-up:**
  - During the 1990s, cosmetics and make-up manufacturers started to use “microbeads” in skin detergents, toothpastes and shaving foams.
  - In the second half of the 2000s, investigations have found these plastic microspheres in public water systems and in nature, ultimately ending up in the water that runs from our taps.

- **Clothes and synthetic materials:**
  - The fibres in synthetic materials contain large amounts of microplastics that then end up in wastewater and aquatic environments.

- **Mobility and tyres:**
  - The external part of a tyre is made from synthetic polymers mixed with rubber and other additives.
  - According to research carried out by the IUCN, a large number of microplastics are created by the friction of tyres on asphalt.
  - The plastic fibres released are then carried into marine environments by wind or rain.
  - The research also explains that road signs (made with thermoplastic) release small particles under certain weather conditions.

- **Navigation and fishing**
  - Ships still cause very large amounts of marine waste:
    - Even though an international agreement that forbids fishing boats from abandoning fishing nets and plastic entered into force in 1988, the amount of plastic left at sea was around 6.5 million tonnes at the start of the 1990s.

**Challenges**

- **Lack of proper definition:** The lack of a solid definition of what can be considered as microplastic makes it difficult to compare the results obtained in different investigations.
- **Lack of Technology:** Lack of technology that effectively retains this kind of material at wastewater facilities is need of the hour.
- **Lacking exhaustive data:** With greater research and data, water-management experts can set thresholds for microplastics in water, beyond which it would be considered unsafe for drinking or use in agriculture.

**Indian Initiative on Microplastics Pollution**

- India and Norway have pledged to work together to address the issue of marine plastic litter and microplastics.
- More than 20 States and Union Territories have joined the fight to beat the plastic pollution, announcing a ban on single-use plastics such as carry bags etc.
- Global efforts like “Beat Plastic Pollution” to address plastic pollution.

**Way Ahead**

- **Development of standard methods:** Standard methods for measuring microplastic particles, including nanoplastics in water should be developed to improve the quality of studies and enable researchers to compare and reproduce results.
• **Improved understanding of sources of microplastics into fresh water:** Although surface run-off and wastewater effluent are considered the main sources of microplastics into fresh water, better data are required to quantify their contributions relative to other inputs and identify the original sources of contamination through these pathways. This may require establishing reliable methods to track origins and identify major sources of microplastics in freshwater.

• **Better understanding of overall microplastic exposures in the environment:** A better understanding of occurrence in these environmental compartments, including quality of these studies, will be useful in articulating relative exposure through drinking-water compared to other sources.

• **Segregation of the wastes at source:** More focus on single use plastics into usable recycled products using low cost technology.

• **Responsibility of manufacturers:** There should be a way for the manufacturer/seller responsibility to recycle the used plastic products from the consumers through incentives/caution money deposit schemes through public participatory approach.

• **National Marine Litter policy:** A policy needs to be framed to control and manage the litter at the land boundary as it is impossible to remove the litter once it enters the marine environment.

Source: TH+DTE

**Internal Security**

**Bilateral Pacts to Fight Drug Trafficking**

**Syllabus:** GS3/ Security challenges and their management in border areas

**In News**
India is party to 26 bilateral pacts to fight drug trafficking.

**About**
- India has signed 26 bilateral pacts, 15 memoranda of understanding and 2 agreements with different countries and international organisations to share information and security cooperation.
- These are signed for combating illicit trafficking of narcotic, drugs and psychotropic substances, besides chemical precursors.

**Latest Developments**
- **Seizure Information Management System (SIMS):**
  - For digitisation of pan-India drug seizure data, the MHA has launched an e-portal called ‘SIMS’ in 2019 for all the drug law enforcement agencies under the mandate of Narcotics Drugs and Psychotropic Substances Act (NDPS)
- **Border Strengthening for surveillance:**
  - Various other organizations have also been empowered under the NDPS Act for making drug seizures, like:
    - Directorate of Revenue Intelligence,
    - the Border Security Force,
    - Sashastra Seema Bal,
    - Indian Coast Guard,
Railway Protection Force

the National Investigation Agency.

- It has been done for preventing cross-border drug smuggling
- The forces are using the latest gadgets and equipment

**Significance**
- Gradual increase is seen in the registration of a number of drug trafficking cases in the country. This has happened due to:
  - Sharp vigilance,
  - effective surveillance,
  - public cooperation,
  - source-based intelligence,
  - sensitisation of field officials
- Better coordinated results are being promoted by deploying various mechanisms, like:
  - The Narco Coordination Centre (NCORD) mechanism was set up by the MHA in 2016
  - It was set up for effective drug law enforcement and cooperation between centre and state agencies.
  - This NCORD system has been restructured into a four-tier scheme up to district level on July 29, 2019, for better coordination.

**Way Ahead**
- **International cooperation:** Foster international cooperation for fighting the enduring problem of drug trafficking. The development of international accountability mechanisms and best practices would greatly increase interception capacity.
- **Global monitoring:** Enhance expert access to the dark web in order to take down online markets and platforms. Implement real-time data monitoring systems for promptly detecting and addressing drug market changes.
- **People-centred Approach:** Implement an integrated, people-centred and human-rights based approach to empowering African societies to develop sustainable solutions to drug use.
- **Public-private partnerships:** Improve government response to drug trafficking on the internet by forging public/private partnerships with internet service providers, tech companies, shipping and mailing companies.
- **Awareness-raising and communication:** Use fact-based information to raise awareness of the potential harm from non-medical use of cannabis. Need to close the gap between perception and reality by educating young people and safeguarding public health.

**Narcotics Control Bureau (NCB)**
- It was set up as an apex drug law enforcement agency with a view to coordinate actions of various central/state agencies in the matters related with drug law in the country.
- **Administrative Control:** Ministry of Home Affairs
  - The Narcotics Control Bureau was established in March 1986 in terms of Section 4 (3) of the Narcotic Drugs and Psychotropic Substances Act, 1985.
  - **Charter for the Bureau:**
    - **Coordination of actions** by various officers, State Governments and other authorities under the principal Act, the Customs Act, 1962, the Drugs and Cosmetics Act, 1940 and any other law for the time being in force in connection with the enforcement of the principal Act.
○ **Implementation of the obligations** in respect of counter-measures against illicit traffic under various international conventions.
○ **Assistance to the concerned authorities** in foreign countries and concerned international organizations with a view to facilitating coordination and universal action for prevention and suppression of illicit traffic in narcotic drugs and psychotropic substances.
○ **Coordination of actions** taken by the Ministry of Health and Family Welfare, the Ministry of Welfare and other concerned Ministries, Departments or Organisations in respect of matters relating to drug abuse.

- In accordance with its charter, the Bureau discharges the following functions:
  ○ Coordination among various Central and State Agencies engaged in drug law enforcement;
  ○ Assisting States in enhancing their drug law enforcement effort;
  ○ Collection and dissemination of intelligence;
  ○ Analysis of seizure data, study of trends and modus operandi;
  ○ Preparation of National Drug Enforcement Statistics;
  ○ Liaison with International agencies such as UNDCP, INCB, INTERPOL, Customs Cooperation Council, RILO etc;
  ○ National contact point for intelligence and investigations

Sources: [TH](#)

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**International Relations**

**Nord Stream 2 Pipeline Project**

**Syllabus:** GS 2/India & Foreign Relations

**In News**

Recently, the US has approved the completion of the Nord Stream 2 pipeline project between Russia and Germany.

**About**

- In December 2019, work on the project was suspended due to the threat of US sanctions.
  - In January 2021, the US imposed sanctions on a Russian ship tasked with laying pipes for the project.
- The US and Germany reached a deal on the Nord Stream 2 pipeline.
  - The US-Germany deal lays out that if Russia attempts to “use energy as a weapon or commit further aggressive acts against Ukraine.
    - Germany will take steps on its own and push for actions at the EU, including sanctions to limit Russian export capabilities to Europe in the energy sector.

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About the Nord Stream 2 pipeline

- In 2015, the Russian energy major Gazprom and five other European firms decided to build **Nord Stream 2** which is valued at around $11 billion.
- The Approx 1,200-km pipeline will run from Ust-Luga in Russia to Greifswald in Germany through the Baltic Sea and will carry **55 billion cubic metres** of gas per year.
- The under-construction pipeline will run along with the already completed Nord Stream 1 system, and the two together will supply an **aggregate of 110 billion cubic metres** of gas to Germany per year.
  - The pipeline falls in the territory of **EU members Germany and Denmark** and is about 98% complete.

Controversies

- Since it was first planned, Nord Stream 2 has drawn criticism from the US as it believed that the project would increase Europe’s dependence on Russia for natural gas, thus emboldening its leader **Vladimir Putin**.
  - Currently, EU countries already rely on Russia for **40 per cent of their gas needs**.
- The project also has opponents in **eastern Europe, especially Ukraine**, whose ties with Russia have **seriously deteriorated** in the aftermath of the **Crimean conflict in 2014**.
- There is an existing land pipeline between Russia and Europe that runs through Ukraine.
  - Ukraine feels that once Nord Storm 2 is completed, Russia could bypass the Ukrainian pipeline, and deprive it of **lucrative transit fees of around $3 billion** per year.
  - Ukraine also fears another invasion by Russia once the new pipeline is operational.
Russia has dismissed these fears and Germany also has solidly stood behind the Nord Stream 2, despite opposition from allies.

Source: IE
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<th>SMILE (Support for Marginalized Individuals for Livelihood and Enterprise) Scheme</th>
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**Facts in News**

- It is formulated by the **Ministry of Social Justice and Empowerment** which includes a subscheme - **‘Central Sector Scheme for Comprehensive Rehabilitation of persons engaged in the act of Begging’**.

**Key Points**

- The scheme covers several comprehensive measures including **welfare measures for persons** who are **engaged in the act of begging**.
- The focus of the scheme is extensively on rehabilitation, provision of medical facilities, counselling, basic documentation, education, skill development, economic linkages and so on.
- The scheme would be **implemented** with the support of State/UT Governments/Local Urban Bodies, Voluntary Organizations, Community Based Organizations (CBOs), institutions and others.
Recently, the **Inland Vessels Bill** has been introduced in Lok Sabha.

**About**
- The Bill seeks to bring in **transparency and accountability of administration** of inland water transportation.
- It will strengthen procedures governing inland vessels, their construction, survey, registration, manning and navigation.

**Key Features**
- **Unified law** for the country, instead of separate rules framed by the States.
- The **certificate of registration** granted under the proposed law will be deemed to be valid in all States and Union territories, and there will be **no need to seek separate permissions** from States.
- **Central database** for recording the details of the vessels and their crew on an electronic portal.
- It requires all **mechanically propelled vessels to be mandatorily registered**. All non-mechanically propelled vessels will also have to be enrolled at district, taluk or panchayat or village level.

**Inland Water Transport (IWT) in India**
- India has about **14,500 km of navigable waterways** which consist of rivers, canals, backwaters, creeks, etc.
- They are found to be cost effective as well as an environmentally friendly means of transporting freight. In India, **Inland Water Transport (IWT)** has the potential to supplement the over-burdened railways and congested roadways.
- As per the National Waterways Act 2016, 111 waterways have been declared as National Waterways (NWs).
- The **Inland Waterways Authority of India (IWAI)** is implementing the Jal Marg Vikas Project (JMVP) for capacity augmentation of navigation on the **Haldia-Varanasi stretch of Ganga** (part of NW-1) with the technical and financial assistance of the World Bank.

**Inland Waterways Authority of India (IWAI)**
- It came into existence on **27th October 1986** for **development and regulation of inland waterways** for shipping and navigation.
• The Authority primarily undertakes projects for development and maintenance of IWT infrastructure on national waterways through grants received from the Ministry of Shipping.
• The head office of the Authority is at Noida.
Recently, the **Border Roads Organisation** (BRO) has conducted the last blast for the **under-construction Sela Tunnel**.

- The Prime Minister of India laid the **foundation stone** of the Tunnel in **February 2019**.
- It aims to provide **all weather connectivity** to Tawang, Arunachal Pradesh through the Balipara-Chariduar-Tawang Road.
- The **breakthrough facilitates faster completion** of Sela Tunnel by undertaking simultaneous activities in two tubes.
  - A **two-way tube** of 1,555 meters and an **escape tube** of 980 meters, besides 8.8 kms of approach roads.
- On completion, it will be the **longest bi-lane road tunnel in the world at an altitude above 13,000 feet**.
- The tunnel is constructed using the latest **New Austrian Tunneling Method** (NATM).
  - NATM is a method of modern tunnel design and construction employing **sophisticated monitoring to optimize various wall reinforcement techniques** based on the type of rock encountered as tunneling progresses.
  - The name NATM was intended to distinguish it from earlier methods, with its **economic advantage of employing inherent geological strength available** in the surrounding rock mass to stabilize the tunnel wherever possible **rather than reinforcing** the entire tunnel.
  - It is also known as the **Sequential Excavation Method** (SEM) or **Sprayed Concrete Lining** (SCL) method.
- **Significance**
  - It is **much below the snow line** allowing all **weather travel** without the challenges of snow clearance.
  - It will **reduce travel time** and ensure **speedier movement** across the Sela Pass.
  - It will play a crucial role in the **development** of not just Arunachal Pradesh, but the **entire North-East**.
  - In case of **natural calamities and adverse weather**, it can prove to be a **vital link for evacuation** of
personnel.

(Image Courtesy: TP)
China-led South Asian Initiative

Recently, the Foreign Minister of Bangladesh has clarified that India can join the China-led South Asian initiative.

- The China-South Asian Countries Emergency Supplies Reserve and a Poverty Alleviation and Cooperative Development Centre were set up in China on 8th July 2021.
- The China-South Asia centre is being established in the Southern Chinese city of Chongqing.

Genesis

○ When Bangladesh requested China for vaccines, China suggested setting up an e-commerce economic cooperation forum and an emergency storage facility for vaccines, which would also work as a poverty alleviation centre to deal with economic issues arising in South Asia due to Covid-19.
  ○ So Foreign Ministers of China, Afghanistan, Bangladesh, Nepal, Pakistan and Sri Lanka held a meeting in April and set it up.
  ○ At that time, it appeared to leave out only India, Bhutan and the Maldives.

- India has not given any official response on being left out or plans to join the group.
  ○ However, given the border tensions in Ladakh and India’s firm stand that bilateral relations cannot move ahead without a resolution of the issue.
  ○ It is understood that India would be unlikely to consider a new grouping involving China, especially one that could be seen to dilute its role in the SAARC region.
  ○ Some experts suggest that this group was meant to be a “Minus India” initiative seeing the exclusion of India from the grouping and consultations on Covid-19 relief different combinations of all SAARC member countries.
  ○ India is the only country of all eight SAARC nations that has not requested or accepted Chinese Covid-19 vaccines.

- However, the membership has been kept open for India as the issues involved in the forum are common to all South
Asian countries battling Covid-19 and its impact on the Gross Domestic Product (GDP) in the region.
Recently, **Gwalior** and **Orchha** (Madhya Pradesh) have been selected by **UNESCO** under the **Historic Urban Landscape Project**.

- The project was started for the inclusive and well-planned development of fast-growing historical cities while preserving the culture and heritage.
- On **10th November 2011** UNESCO’s General Conference adopted the new **Recommendation on the Historic Urban Landscape** by acclamation, the first such instrument on the historic environment issued by UNESCO in 35 years.
  - The project marks its **10th anniversary** in 2021.
  - The anniversary is a platform to share lessons learned from Covid-19 and to resume discussions on the future of urban management, including topics such as public space, renovations, tourism, infrastructure and livelihoods.
- **Varanasi** and **Ajmer** are the other two Indian cities recognised under the project.
- **UNESCO will prepare the development and management plan** of these cities, which will be jointly developed by UNESCO, Government of India and Madhya Pradesh.
  - Under the plan, **full care** of the culture, history, nature, traditions and heritage of the cities will be taken in the **sustainable development** of the cities.
  - It will help MP tourism get a new dimension and additional **employment opportunities** will also be created along with the **development of tourism**.
- Both Gwalior and Orchha are located in the **Northern part of Madhya Pradesh** and both are **nationally** and **internationally** famous tourist destinations.
  - Gwalior hosts the historic Gwalior Fort, Scindia Royal Palace called Jai Vilas Palace and other monuments of tourist interest.
  - Orchha town is situated on banks of the Betwa river and has bountiful scenic places and historical monuments.
ORCHHA

Founded in the 16th century by the Bundela Rajput chief, Rudra Pratap, Orchha is nestled on the banks of river Betwa. Legend says the Betwa splits into 7 channels to honour the 7 erstwhile chiefs of Orchha. This place is known to bridge the gap between heritage and society.

(Image Courtesy: GHR)