UPSC Daily Current Affairs | Prelim Bits 21-11-2024

Solar Activity

Recently, 3 tiny Australian satellites from Curtin University's Binar Space Program burned up in Earth's atmosphere due to high solar activity.

- **Solar activity** – The sun is a ***magnetic variable star*** that fluctuates on times scales ranging from a fraction of a second to billions of years.
- It includes phenomena such as sunspots, solar flares and solar wind, the stream of charged particles that flows toward Earth.
- This activity is a product of the Sun's ever-changing magnetic field, and approximately ***every 11 years***, it completely flips.
- At the midpoint of this cycle, solar activity is at its highest.
- **High solar activity -** It means more solar flares and stronger solar wind, resulting in a ***higher flux of charged particles*** that can damage or disrupt electrical components on satellites.
- The most obvious is the presence of auroras which are far more intensely and closer to the equator than in the last two decades.
- It is a direct result of the increased solar activity.
- It also increase in ionising radiation, resulting in a higher dose for astronauts and pilots, and potential disruptions to long-distance radio communications.
- **Impact on Satellites –** The satellite orbiting in Lower Earth Orbit at an altitudes up to 2,000 km, experiences orbital decay, eventually re-entering and burning up in the atmosphere.
- The increase in solar activity accelerate this process, particularly affecting smaller satellites that lack altitude control systems.

Binar Space Program

- It is a satellite research program operating out of Curtin University.
- Binar (BIN-ah) is the Noongar word for "fireball".
- **Aim** - To advance our understanding of the Solar System and lower the barrier for operating in space.
- **Program Missions - Binar-1 -** First satellite mission, launched to the International Space Station (ISS) on August 29, 2021.
- It was deployed into its own orbit and operated in orbit for almost a year in space.
- It was intact and powered up, included beacon messages and some data about the spacecraft's systems.
- **Follow-Up Mission -** Binar-2, 3, & 4, launched on August 4, 2024.
- They comprised 3 1U CubeSats hosting scientific experiments, in-house developed technology validation and industry payloads.
- They were deployed into a naturally decaying orbit below the ISS at an altitude of

400km above sea-level, and circled Earth every 90 minutes for just 2 months.
- They were expected to last approximately 6 months but managed only 2 months due to unexpected high solar activity.

References

1. The Hindu| Solar Activity
2. Binar| Solar Activity

Bhu-Neer portal

Recently, the Minister of Jal Shakti launched a newly developed Bhu-Neer portal during the concluding ceremony of India Water Week 2024.

- **Bhu-Neer –** It is a ***centralized platform for managing groundwater withdrawal permits.***
- **Developed by** - Central Ground Water Authority (CGWA) in collaboration with the National Informatics Centre (NIC).
- **Ministry** - Ministry of Jal Shakti.
- It is designed to provide comprehensive details regarding the legal framework governing groundwater extraction, regulations at the state and national levels.
- It is to enhance transparency, efficiency and sustainability in groundwater usage across the country.
- It replaces the older NOCAP system with advanced features designed to simplify the permit process and ensure seamless compliance with groundwater regulations.

No Objection Certificate (NOC) to Abstract Ground Water (NOCAP) is required to abstract groundwater from an existing or proposed bore well at a project site for drinking, domestic, and factory operations by residential, commercial, and industrial units.

- **Key Innovations** – Making the process entirely digital and faceless it includes a
    - PAN-based single ID system, a user-friendly interface and
    - QR-coded No Objection Certificates (NOCs)
- It provides comprehensive details on groundwater policies, legal frameworks and sustainable practices, serving as a vital resource for project proponents and stakeholders.
- It aligns with the Prime Minister vision of ***Ease of Doing Business*** by making ground water regulation a seamless and faceless exercise.

Central Ground Water Authority (CGWA)
• It has been constituted under *Section 3 (3) of the Environment (Protection) Act, 1986.* • To regulate and control, management and development of ground water in the country and to issue necessary regulatory directions for the purpose.

References

1. The Hindu| Bhu-Neer portal
2. PIB| Bhu-Neer portal

AroTrack

The scientists at the Indian Institute of Technology Bombay (IIT Bombay) have introduced a water-pollutant detecting device AroTrack.

- **AroTrack –** It is a portable device ***accurately detect harmful pollutants such as phenol, benzene and xylenols in water.***
- **Developed by -** Indian Institute of Technology Bombay (IIT Bombay).
- It is a user-friendly, low-cost bio sensing device.
- It uses a ***protein-based biosensor*** which typically found in bacteria living in heavily polluted environments to effectively identify multiple aromatic pollutants in water.
- The protein undergoes a highly selective ATP hydrolysis chemical reaction if an aromatic compound is present in the sample.
- This reaction is expressed with a change in the colour of the protein solution, which it can detect.
- **MopR** – It is a ***biosensing module and a sensitive sensor*** for detecting phenol.
- MopR is both selective and stable and it can *detect pollutants even in complex environments* with a high degree of precision.
- It detect other pollutants from the benzene and xylenol groups by engineering mutations in the bacterial protein.
- The reaction is measured using a light-emitting diode (LED), phototransistor assembly within the device.
- **Features -** It can detect several aromatic contaminants, including phenol, benzene, and 2, 3 dimethyl phenol even when these pollutants are present in low concentrations usually in the 10-200 parts per billion range.
- AroTrack can operates efficiently in water temperatures up to 50°C and it completes analyses within 30 minutes.
- It is highly reliable, offering a degree of accuracy and efficiency on par with modern spectrophotometers, which are currently used for detection.
- It promises to revolutionise water quality monitoring, particularly in rural and resource-limited areas.

References

1. The Hindu| AroTrack
2. The Free Press Journal| AroTrack

Soil Degradation and retrogression

The Minister of Agriculture and Farmers' Welfare raised a concern over soil degradation,

which affects 30% of the India's land.

> *India produces over 330 million tonnes of foodgrains annually and exports agricultural products worth $50 billion.*

Soil Degradation

- It is the physical, chemical and biological decline in soil quality.
- It is caused by its improper use or poor management, usually for agricultural, industrial or urban purposes.
    - Soil degradation can involve
    - Water erosion, including sheet, rill and gully erosion
    - Wind erosion
    - Salinity, including dryland, irrigation and urban salinity
    - Loss of organic matter
    - Fertility decline
    - Soil acidity or alkalinity
    - Structure decline, including soil compaction and surface sealing
    - Mass movement
    - Soil contamination, including the effects of toxic chemicals and pollutants.
- **Influencing Factors** - Excessive fertiliser use, imbalance in nutrient application, unsustainable exploitation of natural resources, and poor soil management practices.

- **Relevant UN convention / multilateral treaty**
    - Land Degradation Assessment in Dryland (LADA) (FAO, 2020b),
    - Global Assessment of Human-Induced Soil Degradation (GLASOD) 1991 (ISRIC, 1991),
    - United Nations Convention to Combat Desertification (UNCCD) (UNCDD, 1994).

> *12 million hectares of agricultural soils are lost globally through soil degradation every year.*

- **Soil degradation in India -** 30% of the soil in India is degraded.
- Of this, around 29% is lost to the sea, 61% is transferred from one place to another, and 10% is deposited in reservoirs.
- The worst affected states are Punjab, Haryana, Gujarat, Maharashtra, Andhra Pradesh and Telangana.

Soil Retrogression

- Retrogression is primarily due to soil erosion and corresponds to a phenomenon where succession reverts the land to its natural physical state.
- It is a form of evolution that is distinct from normal evolution and is influenced by the local climate and vegetation.
- It results in reduction in ecosystem productivity band standing plant biomass, declines

in the availability of nutrients and shifts in both aboveground and belowground communities.
- It gets dominant by nutrient-stress-tolerant, slow-growing species that are adapted to nutrient poor conditions.

References

Business Standard | Soil degradation

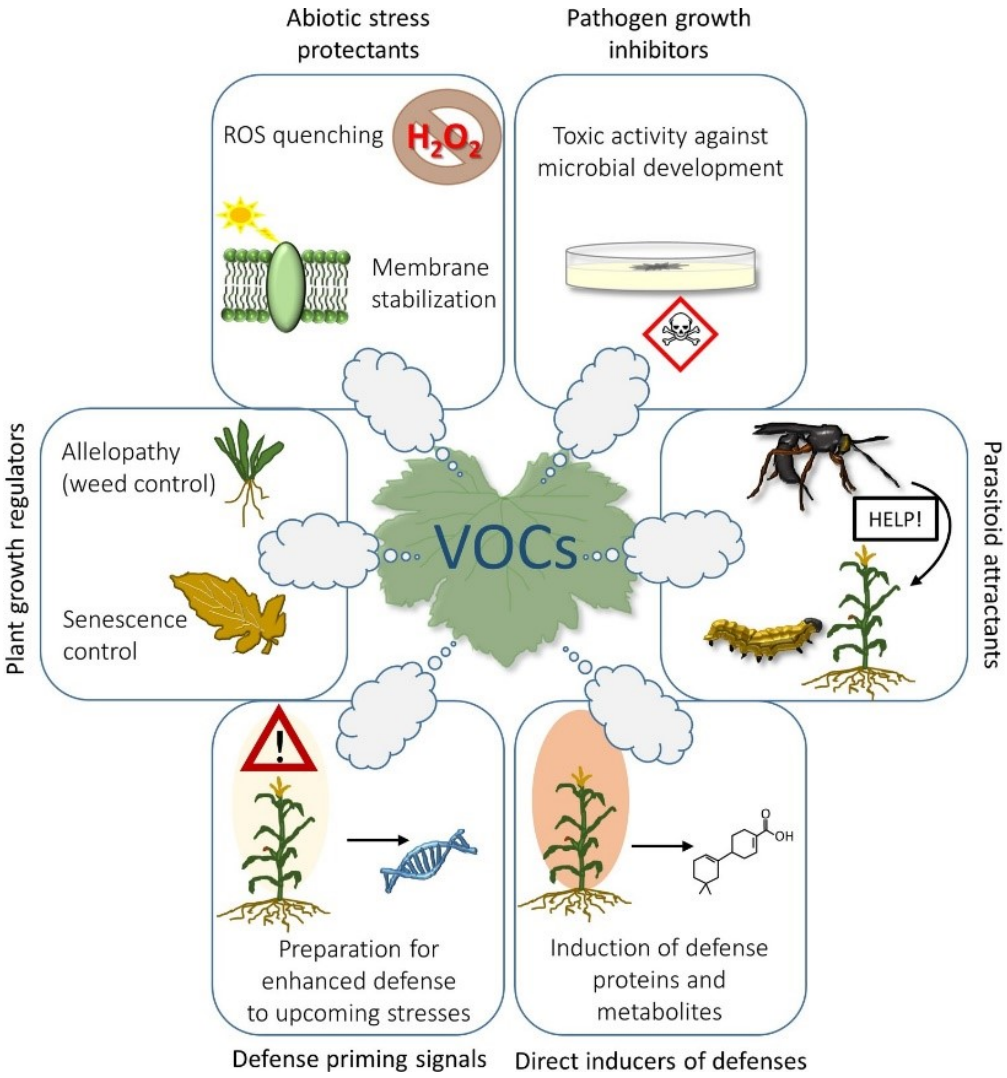
Science of Plant Communication

The Biologists and scientists discovered that plants understand the significance of communication which is better than any other organisms.

- **Plants –** It appear to be the quiet, silent and solitary type of organisms but they have a complex way of communicating.
- They communicate using volatile organic compounds (VOCs), electrical signaling, and common mycorrhizal networks between plants and a host of other organisms.

Volatile organic compounds (VOCs) are a group of chemicals that can vaporize into air.

- **Ways of Communication - Chemical signals -** It release chemicals into the air when in danger, known as VOCs.
- VOCs alerting the neighbouring plants to start producing defensive compounds or toxic substances to keep the herbivores away.
- It release the signals through soil also by when it experience stress by pest attacks or droughts immediately sends out signals to others through their roots.



Biologists and scientists discovered that plants form a symbiotic bond with mycorrhizal fungi that connects roots of different plants and thus named this fungal network 'wood wide web'.

- **Underground Networking** – It friendly attached with fungi to the roots that helps in extending the plant's root system with fungi's web of filament.
- This wide network helps the plants to share the nutrients received from fungi to other plants in time of distress.
- **Cooperative Behaviour** – When a growing plant know about their struggling neighbour, they share nutrients to support their neighbour's growth.
- It is widely noticeable in densely populated forests where there is an intense need for light, water and nutrients.
- **Significance –** It shows their understanding of the surrounding and their prompt response to potential threat or dangers.
- It prioritise their resources to support close and far plants in distress which helps in the overall forest health.
- It shows the resilient and reliable ecosystem by working together.

Reference

[The Hindu| Science of Plant Communication]