Changing Trends in Fertilizer Use

For Prelims: Fertiliser, Fertilizer Subsidy, Urea, DAP, Nutrient Based Subsidy (NBS) Scheme

For Mains: Issues Related with Fertiliser Industry and Fertilizer Subsidy and the Way Forward.

Source: BS

Why in News?

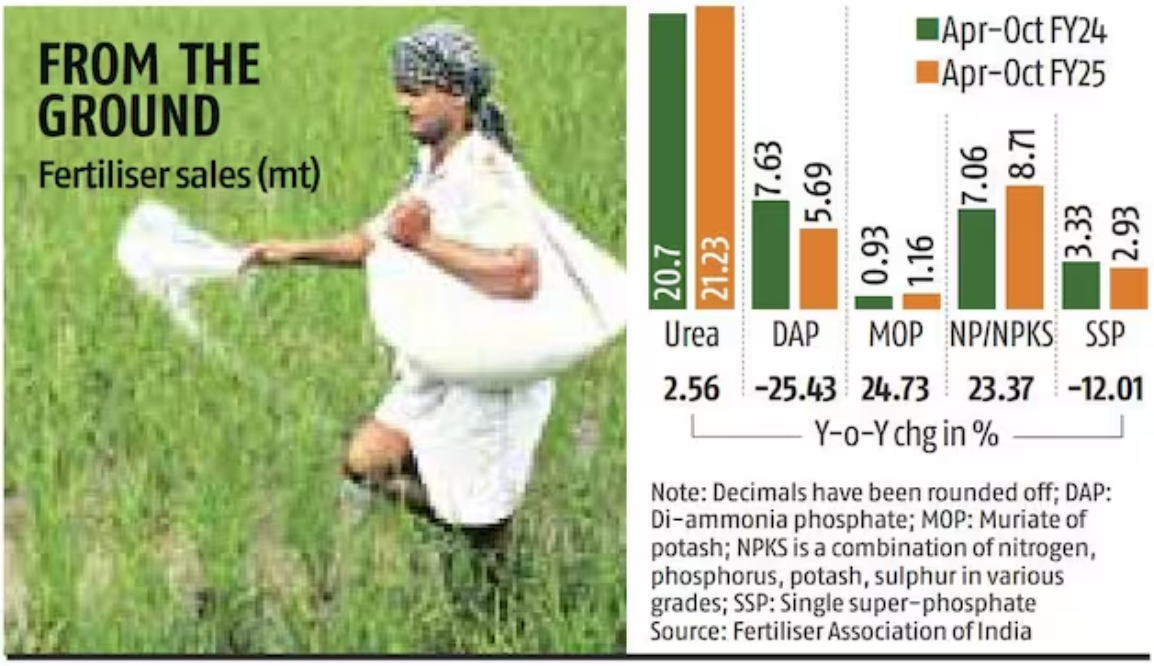
Recently, the sales of fertilisers **Di-Ammonium Phosphate (DAP),** a key fertiliser for rabi crops, have declined significantly by **25.4% during April to October FY25,** while that of NPKS **(Nitrogen, Phosphorus, Potassium, and Sulphur)** fertilizers **surged by 23.5%** in the same period.

- This shift is largely driven by reduced imports and higher costs of DAP, encouraging farmers to opt for alternatives like NPKS, which provide more balanced soil nutrition.

What are Factors Influencing the Shift in Fertilizer Usage Preferences?

- **Decline in DAP Usage:** The shift is largely driven by **rising costs and supply chain issues** associated with DAP, prompting farmers to seek alternatives.
  - Global challenges like the **Russia-Ukraine war** and **Belarus sanctions disrupted potash markets** leading to **rising Muriate of Potash(MOP) prices** in FY23. These countries are among **major producers of potash** in the world.
  - **DAP sales declined by 30%** to 2.78 million tonnes due to the **Persian Gulf crisis** which has led to **prolonged shipping delays,** extending transit times from the usual 20-25 days to nearly 45 days.
    - This led to prices for DAP rising to approximately USD 632 per tonne in September 2024.
- **Shift in Fertilizer Preferences:** Farmers are increasingly turning to NPKS fertilizers, which are considered **more beneficial than DAP** due to their **balanced nutrient composition.** The **20:20:0:13 NPKS grade,** offering balanced quantities of nitrogen, phosphorus, potash, and sulphur has seen significant sales growth.

//



Note: Improved fertilizer use enhanced the **NPK ratio in Indian soils to 9.8:3.7:1** in kharif 2024 from **10.9:4.9:1 in kharif 2023,** though still below the ideal **4:2:1 r**atio recommended by Fertiliser Association of India (FAI).

What are the Benefits of Using NPKS Fertilizer?

- **Balanced Nutrient Supply**: NPKS fertilizers provide a comprehensive supply of essential nutrients- **Nitrogen (N), Phosphorus (P), Potassium (K), and Sulfur (S)**- which are critical for plant growth, enhancing the overall health and productivity of crops.
    - This balance ensures that plants receive adequate nutrients for various growth stages, from vegetative to reproductive phases.
- **Improved Soil Health and Sustainable Agriculture**: : Sulfur, an essential nutrient often deficient in soils, improves root development, enzyme activation, and resistance to diseases.
    - By including sulfur, NPKS fertilizers enhance soil health and fertility, promoting **more efficient nutrient uptake by plants.**
- **Enhanced Crop Yield**: It helps in **boosting crop yield by improving photosynthesis,** strengthening plant immunity, and promoting better flowering, fruiting, and seed formation. This leads to higher productivity, which is particularly beneficial for food security.
- **Optimal Plant Growth**: It is designed to support overall plant growth, improving root and stem development, increasing **chlorophyll production,** and enhancing drought resistance, which helps crops thrive in varying environmental conditions.

What are the Different Types of Chemical Fertilisers Used in Agriculture?

- **Nitrogenous Fertilisers:** Nitrogenous fertilizers like **Urea (46% nitrogen)**, **Ammonium Sulfate (21% nitrogen, 24% sulfur)**, and **Calcium Ammonium Nitrate (26% nitrogen)** are essential for plant growth, enhancing protein synthesis, chlorophyll formation, and rapid development.
- **Phosphatic Fertilisers:** These are vital for root development, flowering, and seed formation, include **Single Super Phosphate (16-20% P_2O_5, calcium, and sulfur)** and **Diammonium Phosphate (46% phosphorus, 18% nitrogen)**, both enhancing soil fertility and plant growth
- **Potassic Fertilisers:** These are essential for water regulation, enzyme activation, and disease resistance, include **MOP (60% potassium)**, commonly used in India, and **Sulphate of Potash**

(50% potassium, 18% sulfur), recommended for chloride-sensitive crops like tobacco, fruits, and vegetables.
- **Complex Fertilisers:** Complex fertilizers, formulated with multiple primary nutrients, include **NPK fertilizers** (e.g., 10:26:26, 12:32:16) for balanced nutrition, **NPKS** (containing nitrogen, phosphorus, potassium, and sulfur), and **Ammonium Phosphate Sulfate (APS)**, which is rich in sulfur, phosphorus, and nitrogen, ideal for sulfur-deficient soils.

What are Government Initiatives Related to Fertilisers?

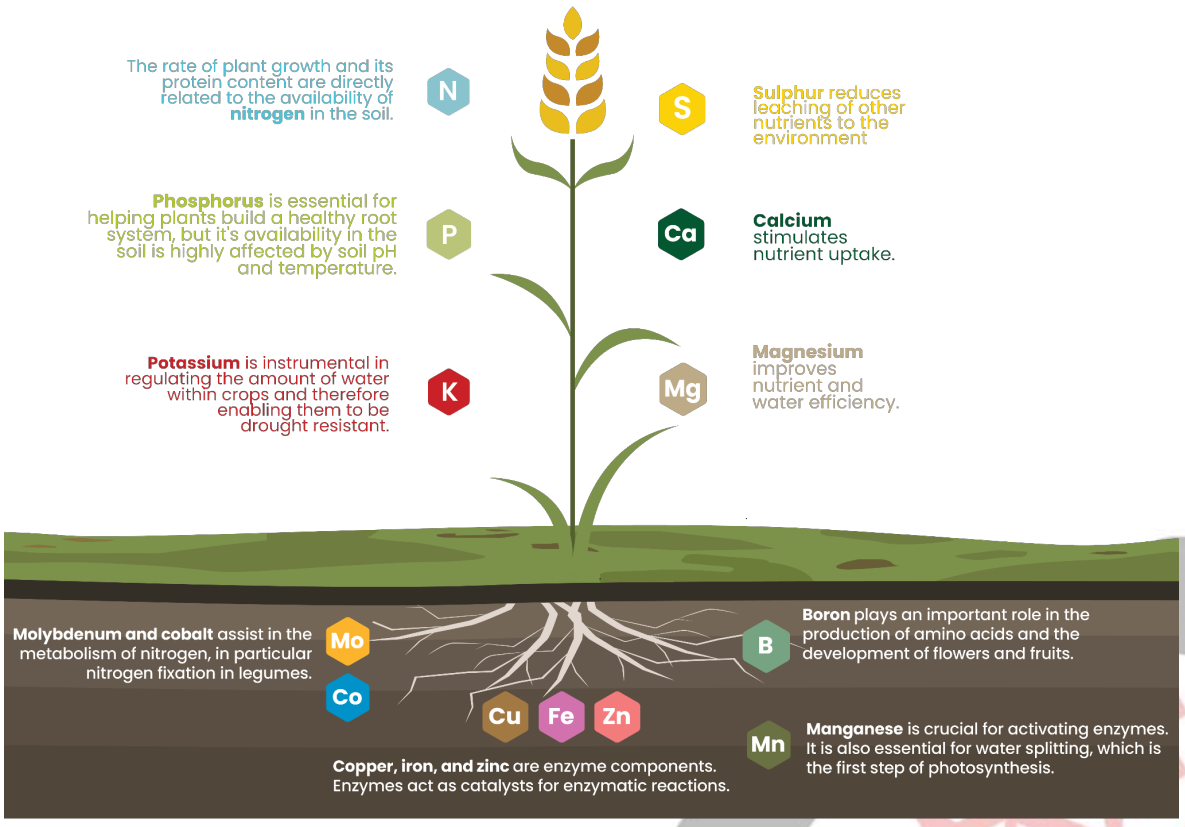
- **PM PRANAM Scheme**
- **One Nation One Fertilizer (ONOF)**
- **Direct Benefit Transfer (DBT)**
- **Nutrient Based Subsidy (NBS)**
- **Neem Coated Urea (NCU)**

What are the Challenges with Fertilizer Usage in India?

- **Imbalance in Fertilizer Use:** India's actual NPK ratio **(9.8:3.7:1 in Kharif 2024) deviates** significantly from the recommended **4:2:1 ratio,** leading to **nutrient deficiencies and soil degradation**.
    - This imbalance, with excessive nitrogen and insufficient phosphorus and potassium, leads to nutrient deficiencies, soil degradation, and reduced crop yields.
- **Excessive Use of Nitrogenous Fertilizers**: India is the **second-largest consumer** of urea in the world after China**,** but its overuse causes soil degradation, water pollution, and **greenhouse gas** emissions. Subsidies distort the fertilizer market and promote inefficiency.
- **Low Production and High Consumption:** Despite a slight increase in production in fertilizers from **385.39 LMT in 2014-15 to 503.35 LMT in 2023-24,** domestic fertilizer production **remains inadequate to fully meet the country's demand.**
    - In 2020-21, the total consumption of fertilizers was about **629.83 LMT**.
- **Dependence on Imports:** India imports around 20% of its urea, 50-60% of diammonium phosphate (DAP), and 100% of muriate of potash (MOP) fertilisers from nations such as **China, Russia, Saudi Arabia, UAE, Oman, Iran, and Egypt**.
    - This makes India **highly dependent on global supply chains** for key fertilizer nutrients and **exposed to global price fluctuations** and supply volatility.

Way Forward

- **Balanced Fertilizer Usage**: Promoting balanced fertilizer usage, with an emphasis on NPKS (nitrogen, phosphorus, potassium, and sulfur), can help address the **imbalance in the NPK ratio,** enhance soil health, and **decrease dependency** on nitrogen-dominant fertilizers such as urea.
- **Promotion of Organic and Bio-fertilizers**: Incentivizing **organic farming** and **bio-fertilizers** can reduce chemical fertilizer dependence, **enhance soil fertility, and minimize the environmental impact** of synthetic fertilizers.
- **Efficient Fertilizer Distribution**: Streamlining **fertilizer subsidies and distribution** through a **targeted approach** will **reduce inefficiencies and promote balanced,** cost-effective fertilizer use.
- **Domestic Production Capacity Expansion**: **Expanding domestic production** of phosphatic and potassic fertilizers, with **investments in technology and infrastructure,** will reduce India's dependence on imports and strengthen supply chain resilience
- **Sustainable Fertilizer Policies**: The government should design policies that **encourage the judicious use of fertilizers,** taking into account regional soil types and crop-specific nutrient needs.



Drishti Mains Question:

Discuss the challenges of fertilizer usage in India and suggest measures to promote balanced usage and enhance domestic production.

UPSC Civil Services Examination, Previous Year's Question (PYQs)

Q. With reference to chemical fertilizers in India, consider the following statements: (2020)

1. At present, the retail price of chemical fertilizers is market-driven and not administered by the Government.
2. Ammonia, which is an input of urea, is produced from natural gas.
3. Sulphur, which is a raw material for phosphoric acid fertilizer, is a by-product of oil refineries.

Which of the statements given above is/are correct?

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

Ans: (b)

Q. Why does the Government of India promote the use of 'Neem-coated Urea' in agriculture? (2016)

(a) Release of Neem oil in the soil increases nitrogen fixation by the soil microorganisms.

(b) Neem coating slows down the rate of dissolution of urea in the soil.

(c) Nitrous oxide, which is a greenhouse gas, is not at all released into atmosphere by crop fields.

(d) It is a combination of a weedicide and a fertilizer for particular crops.

Ans: (b)

SC Prioritising SLPs Disposal

Source: IE

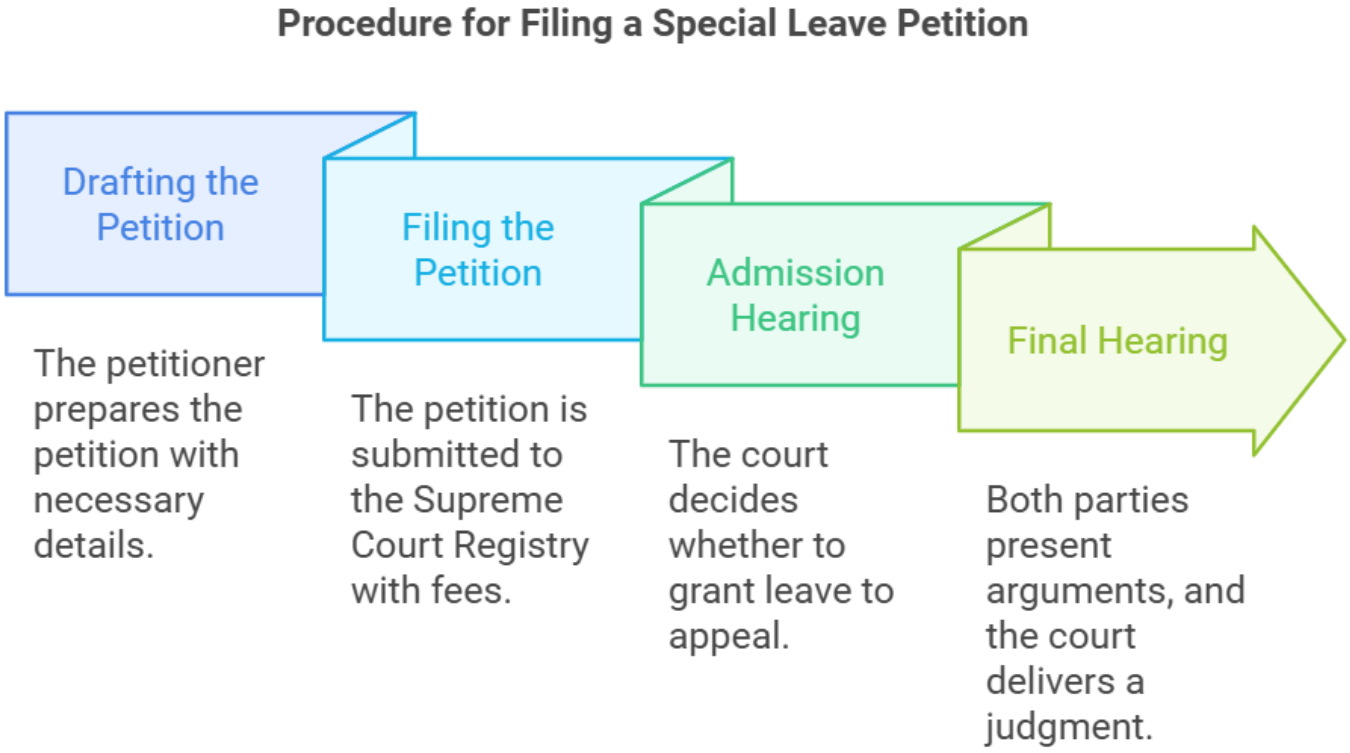
Why in News?

The **Supreme Court (SC)** has started prioritising hearing **special leave petitions (SLPs)** cases with the aim to **reduce the high burden of cases** filed each year, alongside a substantial backlog.

- As of December 2024, over **82,000 cases are pending in the SC,** which has prompted the **Chief Justice of India (CJI)**, to implement such strategies.

What is a Special Leave Petition (SLP)?

- **About:**
  - A **SLP** is a **discretionary appeal mechanism** (**Article 136** of the **Constitution of India**) allowing the **SC** to hear **appeals against judgments,** decrees, or orders of any court or tribunal.
    - It is **not applicable** for **Armed Forces Tribunals**.
- **Origin:**
  - The concept of **"special leave"** is derived from the **Government of India Act, 1935,** which had recognized the **prerogative to grant special leave for appeals**.
- **Key Features:**
  - This is an **extraordinary jurisdiction** of the SC, which enables it to address cases where **no direct right of appeal exists.**
  - It is granted **solely at the discretion of the SC**, which may deny leave without providing reasons.
    - It is **applicable to both civil and criminal matters.**
  - When the SC grants an SLP, it transitions into a **formal appeal,** allowing detailed examination of the case and enabling both parties to present their arguments before a final verdict is delivered.
    - It is typically invoked in cases i**nvolving substantial questions of law** or a **miscarriage of justice.**
- **Eligibility:**
  - Any aggrieved party can file an SLP against a judgment or order of a **High Court** or tribunal, especially where:
    - A **certificate of fitness** for appeal to the SC has been denied.
    - **Substantial questions of law** or injustice are involved.
- **Time Limit to File a SLP:**
  - An SLP can be filed within **90 days** from the date of a High Court's judgment.
  - If the High Court refuses to grant a **certificate of fitness** for appeal to the SC, the SLP must be filed **within 60 days** from the date of such refusal.
- **Procedure for Filing a SLP:**



What are the Supreme Court Cases Related SLPs?

- In ***Laxmi & Co. v. Anand R. Deshpande (1972),*** the SC held that during appeals under Article 136, the **Court may consider subsequent developments** to expedite proceedings, safeguard the rights of parties, and uphold the interests of justice.
- In ***Kerala State v. Kunhayammed (2000)*** SC ruled that **declining to grant an SLP does not invoke its appellate jurisdiction**.
    - This discretion ensures that the SC intervenes only in cases warranting judicial scrutiny.
- In ***Pritam Singh v. The State (1950)***, it was emphasized that the **SC should exercise its powers under Article 136 sparingly,** interfering with **High Court d**ecisions only in **exceptional cases**.
    - Once an appeal is admitted, the **appellant may challenge any erroneous legal findings** by the High Court.
- In ***N. Suriyakala v. A. Mohandoss & Ors. (2007)*** SC clarified that Article 136 does not establish an ordinary appellate forum but grants broad discretionary powers to the Supreme Court to intervene for ensuring justice, rather than providing a right of appeal to litigants.
    - **Filing SLPs indiscriminately goes against the purpose of Article 136.**

UPSC Civil Services Examination Previous Year Question (PYQ)

Prelims:

Q. With reference to the Indian judiciary, consider the following statements:

1. Any retired judge of the Supreme Court of India can be called back to sit and act as a Supreme Court judge by the Chief Justice of India with the prior permission of the President of India.
2. A High Court in India has the power to review its own judgement as the Supreme Court does.

Which of the statements given above is/are correct? (2021)

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither I nor 2

Ans: (c)

India-Australia CECA

Source: PIB

Why in News?

India and Australia have “outlined a path forward for the early conclusion” of the **Comprehensive Economic Cooperation Agreement (CECA)** between both nations.

- During a three-day stocktake meeting between the two nations, discussions covered several critical areas of the CECA, including trade in goods, services, mobility, agri-tech cooperation, and more.

What is the Australia-India Comprehensive Economic Cooperation Agreement (CECA)?

- **About:**
  - The CECA is a **free trade agreement (FTA)** aimed to **eliminate tariffs** on **goods traded and liberalise services sectors** to facilitate business opportunities and cooperation.
  - India-Australia CECA aims to address **five key areas**: **Goods, services, digital trade, government procurement, and Rules of Origin/Product Specific Rules**.
    - In the recent negotiations, both sides have shown interest in the inclusion of new areas in the comprehensive trade deals, such as **competition policy, MSMEs, gender, innovation, agri-tech, critical minerals, and sports.**
- **Background:**
  - Negotiations for CECA **began in May 2011**, were suspended in 2016, and re-launched in September 2021.
  - The India-Australia **Economic Cooperation and Trade Agreement (ECTA)**, a foundational agreement, was **signed** and **came into force in 2022**. It is a limited trade agreement and is less comprehensive than CECA.

- **Current Trade Statistics:**
  - Trade between Australia and India has grown significantly, with **India being Australia's fifth-largest trading partner**.
  - During 2023-24, in value terms, India's imports from Australia were $16.2 billion, while exports were almost $8 billion, (compared to $19 billion in imports and nearly $7 billion in exports in the previous fiscal).
- **Other Similar Initiatives between India and Australia:**
  - **Indo-Pacific Economic Framework for Prosperity (IPEF)**
  - **Trilateral Supply Chain Resilience Initiative (SCRI)** (India, Australia and Japan)
- **India's CECA with Other Countries:**
  - **India-Singapore CECA**
  - **India-Malaysia CECA**
  - **India-Thailand CECA**
  - **India -New Zealand CECA**

Read More: 2nd India-Australia Annual Summit

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims:

Q.1 Consider the following countries: (2018)

1. Australia
2. Canada
3. China
4. India
5. Japan
6. USA

Which of the above are among the 'free-trade partners' of ASEAN?

(a) 1, 2, 4 and 5

(b) 3, 4, 5 and 6

(c) 1, 3, 4 and 5

(d) 2, 3, 4 and 6

Ans: (c)

Gene Therapy Treatment for Haemophilia

Source: TH

Indian scientists have developed a novel **gene therapy for haemophilia A**, offering a **one-time treatment to replace frequent clotting factor injections**.

- In a trial at Christian Medical College, Vellore, five patients have been free of bleeding episodes for over a year.
- Haemophilia A is a **genetic disorder** caused by **insufficient Factor VIII,** preventing **proper blood clotting.** India, with 40,000 to 100,000 affected patients, has the second-largest haemophilia population globally.
    - Haemophilia A is inherited in an **X-linked recessive pattern.** Males with a **defective X chromosome have hemophilia,** while females **need two defective X chromosomes to be affected.**
    - Current treatments are lifelong and expensive, costing up to Rs 2.54 crore over ten years, making gene therapy a cost-effective alternative.
- **Gene therapy replaces defective genes in a patient's cells with healthy ones.**
- **Roctavian,** the only USFood and Drug Administration approved gene therapy, uses an **adenovirus vector to deliver a gene for Factor VIII production** in the liver but is **not approved for children.**
- The Vellore trial used a **lentivirus vector,** considered **safer and potentially suitable for children,** offering new possibilities for gene therapy in resource-constrained settings.

Read more: World Haemophilia Day

Climate Footprint of Space Exploration

For Prelims: Paris Agreement, Black carbon, Space Debris, Low Earth orbit (LEO), Outer Space Treaty, 1967, Indian National Space Promotion and Authorization Centre, Network for Space Objects Tracking and Analysis

For Mains: Environmental impact of space exploration, India's role in space sustainability, Intersection of technology and environmental policy

Source: TH

Why in News?

Space exploration is expanding rapidly, but its **environmental impact from rocket emissions** to satellite debris is largely ignored by global sustainability frameworks like the **Paris Agreement.** Urgent action is needed to address these growing concerns.

How are Space Activities Affecting the Environment?

- **Rocket Emissions:** Rocket launches emit **carbon dioxide (CO_2), black carbon**, and water vapor. Black carbon absorbs sunlight 500 times more effectively than CO_2, exacerbating **global warming.**
    - Additionally, **chlorine-based rocket propellants** deplete the **ozone layer,** increasing **ultraviolet (UV)** exposure and disrupting atmospheric circulation.
- **Space Debris:** As of September 2024, 19,590 satellites have been launched, with 13,230 still in orbit, of which 10,200 are operational.
    - The total mass of space objects exceeds 13,000 tonnes, contributing to pollution by **Space Debris** due to overcrowding in **low Earth orbit (LEO).**
        - Non-functional satellites and debris from collisions add to the growing problem of space junk and making **space increasingly inaccessible.**
    - This debris can disrupt radio waves and sensor accuracy, affecting critical systems for **disaster tracking, climate monitoring, and communication.**
- **Satellite Manufacturing:** The production of satellites involves energy-intensive processes that contribute significantly to their **carbon footprint,** particularly through the use of metals and composites.
    - Satellite propulsion systems also release additional emissions during orbital adjustments. Furthermore, satellites **burn up during re-entry,** releasing **metallic "satellite ash"** that could alter atmospheric dynamics and harm the climate.
- **Emerging Threats: Space mining,** although not yet operational, poses a potential **threat to both Earth and space environments**.
    - Increased industrial activity in orbit could intensify environmental impacts, compounding the challenges posed by current space operations.

What are the Barriers to Sustainable Space Exploration?

- **Lack of Regulations:** Space activities are not covered by agreements like the **Paris Accord,** leaving emissions and debris largely unregulated.
    - Without clear guidelines, the **rapid increase in satellites and debris led to overcrowded orbits,** making future missions more costly and riskier.
    - While the **Outer Space Treaty, 1967 emphasizes responsible use,** it lacks binding provisions for environmental sustainability.
    - In 2019, **the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS)** adopted 21 voluntary guidelines for the long-term sustainability of space activities.
        - However, the **lack of binding regulations** and **conflicting national and**

commercial priorities hinder the implementation of these guidelines, making it challenging to achieve a **unified approach to space sustainability.**

- **Commercial Exploitation of Space:** It involves generating revenue through space-related technologies and services, such as **space resource recovery from asteroids, developing commercial space stations**, and offering space tourism, driven by profit-focused companies, may undermine sustainability efforts.
- **High Costs:** Developing and implementing **sustainable technologies for space exploration is expensive.**
    - This includes **costs related to debris mitigation,** sustainable fuel alternatives, and long-term missions, all of which require significant investment.
    - Achieving sustainability in space requires advanced technologies for debris removal, efficient propulsion systems, and life support systems for long-duration missions.
        - **Many of these technologies are still in development** and demand substantial investment.
- **Data-Sharing Issues:** Security and commercial interests often **hinder real-time satellite and debris tracking,** which is essential for coordinated space traffic management.

Where Does India Stand on Space Sustainability?

- **Private Sector Engagement**: The formal establishment of the **Indian National Space Promotion and Authorization Centre (In-SPACe)** is expected to boost the role of private companies.
    - Startups like **Agnikul, Skyroot, and Dhruva Space** are developing sustainable satellite launch vehicles and technologies.
    - Manastu Space Technologies has delivered the **iBooster Green Propulsion System** to the **Defence Research and Development Organisation**.
        - The system uses a **hydrogen peroxide-based fuel for safer, cost-effective satellite** operations like orbit raising and deorbiting.
- **Space Debris Management**: **Indian Space Research Organisation (ISRO) Network for Space Objects Tracking and Analysis (NETRA) project** aims to track space debris, providing critical data to protect space assets and help manage risks.
    - This initiative helps manage risks and **prevent Kessler Syndrome,** where collisions create more debris.
    - India has also collaborated with the US on space object monitoring under a pact signed in 2022.
- **In-Orbit Servicing**: ISRO is developing the **SPADEX (Space Docking Experiment)** to dock satellites for refueling and other services, which will enhance satellite longevity and mission flexibility.

United Nations Committee on the Peaceful Uses of Outer Space

- COPUOS was established in 1958, following the launch of the **first artificial satellite, Sputnik I, in 1957**. Initially created as an ad hoc intergovernmental committee, it was later made a **permanent body by the UN General Assembly** in 1959. **India was one of the 18 founding members.**
- COPUOS oversees the exploration and use of space for humanity's benefit, focusing on peace, security, and development.
    - It reviews international cooperation, encourages space research, and addresses legal issues related to outer space.
- **India and COPUOS:**
    - **Dr. Vikram K. Sarabhai,** the **Father of Indian Space Program**, served as Vice-President and Scientific Chairman of the **United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE-I) in 1968.**
    - In 2021, India was elected as Chair of the new Working Group on the Long-term Sustainability of Outer Space Activities.

Way Forward

- **Technological Innovations: Reusable rockets,** like those developed by **Elon Musk's SpaceX**, reduce waste and costs. **Green hydrogen and biofuels** can lower emissions in launches.
    - Electric propulsion is efficient for low-thrust missions but not suitable for heavy-lift operations.
    - **Nuclear propulsion** presents a potential option, but it carries the risk of nuclear radiation pollution in the event of an accident within Earth's atmosphere.
- **Mitigating Orbital Debris:** Biodegradable satellites such as **Japan's LignoSat,** where components could disintegrate on re-entry, reducing space debris accumulation.
    - Investment in **Autonomous Debris Removal (ADR)** technologies such as **robotic arms and lasers** is essential for **cleaning up existing debris.**
    - Deorbiting satellites from LEO to **Geostationary Orbit (GEO)** or higher orbits can reduce the risk of re-entry into Earth's atmosphere and minimize debris accumulation in LEO.
- **Global Traffic Management:** A global system to monitor satellite movements in real-time would reduce collision risks and ensure safer orbital use.
    - Overcoming **data-sharing resistance and building trust** with security protocols are key for effective space traffic management.
- **Policy and Governance:** Aligning sustainability goals with the Outer Space Treaty and introducing binding agreements under COPUOS is essential for enforcing environmental responsibility in space.
    - Governments can **enforce emission caps, debris mitigation, and offer incentives for green technologies** through subsidies and penalties to promote a sustainable space industry.
- **Public-Private Partnerships:** Collaboration between governments and private entities is key to funding sustainable technologies. Shared accountability frameworks ensure mutual responsibility for sustainability in space.

Drishti Mains Question:

Examine the environmental impact of space exploration. Suggest sustainability measures.

UPSC Civil Services Examination, Previous Year Question (PYQ)

Mains

Q.1 What is India’s plan to have its own space station and how will it benefit our space programme? **(2019)**

Q.2 Discuss India’s achievements in the field of Space Science and Technology. How the application of this technology helped India in its socio-economic development? **(2016)**

Q.3 What is the main task of India’s third mood mission which could not be achieved in its earlier mission? List the countries that have achieved this task. Introduce the subsystems in the spacecraft launched and explain the role of the ‘Virtual Launch Control Centre’ at the Vikram Sarabhai Space Centre which contributed to the successful launch from Sriharikota. **(2023)**

Caspian Sea

Source: TH

Kazakhstan's state-owned energy company, KazMunayGas, has successfully decontaminated **significant oil waste along the Caspian Sea's shores**, which has been hit by pollution and the effects of global warming.

- **Location**: Lies between **Asia and Europe,** east of the Caucasus Mountains and west of the Central Asian steppe.
    - It is bordered by Russia (northwest), Azerbaijan (west), Iran (south), Turkmenistan (southeast) and Kazakhstan (northeast).
- **Formation and Characteristics:** The Caspian Sea was once part of a **prehistoric sea known as the Paratethys. Tectonic forces** uplifting the land and a drop in **sea level** left the **Caspian landlocked** more than 5 million years ago.
    - It is technically a lake, as it is landlocked without a direct outlet to the ocean. It is the **world's Largest Inland Water Body.**
- **Rivers:** Three major rivers **Volga, Ural, and Terek** empty into the Caspian.
- **Rich in Resources:** Contains significant oil and natural gas reserves in offshore and onshore fields. Caspian Sea Known for producing most of the **world's caviar (eggs of various large fish).**

Read more: Caspian Sea