Carbon Sequestration

Why in News

There has been **increasing investments to develop technology** in the field of **Carbon Sequestration** and fight the menace of **climate change.**

Key Points

- **Need:**
  - As Global Warming accelerates and society continues to emit greenhouse gases, the idea is gaining of investing in **artificial techniques of Carbon Sequestration.**
  - According to the **Intergovernmental Panel on Climate Change**, nations may need to remove between **100 billion and 1 trillion tonnes of carbon dioxide** from the atmosphere this century to **avert the worst effects of climate change,** far more than can be absorbed by simply planting more trees.
- **About:**
  - Carbon sequestration is the **long-term storage of carbon in plants, soils, geologic formations, and the ocean.**
  - Carbon sequestration **occurs both naturally and as a result of anthropogenic activities** and typically refers to the storage of carbon.

- **Types:**
  - **Terrestrial Carbon Sequestration:**

    Terrestrial carbon sequestration is the process through which CO_2 from the atmosphere is **absorbed by trees and plants through photosynthesis and stored as carbon** in soils and biomass (tree trunks, branches, foliage, and roots)
  - **Geologic Carbon Sequestration:**

    CO_2 can be stored, including **oil reservoirs, gas reservoirs, unmineable coal seams,** saline formations and shale formations with high organic content.
  - **Ocean Carbon Sequestration:**
    - Oceans absorb, release and store large amounts of CO_2 from the atmosphere. This can be done in two ways- **enhancing productivity** of ocean biological systems through **Iron fertilization,** and **injecting CO_2** into the deep ocean.
    - The dumping of iron stimulates phytoplankton production, which in turn leads to enhanced photosynthesis from these microorganisms, helping in CO_2 absorption.

- **Methods:**
  - **Natural Carbon Sequestration:**
    - It is the process by which nature has achieved a **balance of carbon dioxide in our atmosphere suitable** for sustaining life. Animals expel carbon dioxide, as do plants during the night.
    - Nature provided **trees, the oceans, earth and the animals themselves as carbon sinks, or sponges.** All organic life on this planet is carbon based and when plants and animals die, much of the carbon goes back into the ground where it has little impact on contributing to global warming.
  - **Artificial Carbon Sequestration:**
    - Artificial carbon sequestration refers to a **number of processes** whereby **carbon emissions** are **captured at the point of production (e.g. Factory Chimneys) and then buried.**
    - One proposed method is ocean sequestration whereby carbon dioxide is **injected deep into the ocean,** forming **lakes of CO_2.** In theory, the CO_2 will stay down deep due to the pressure and temperature of the surrounding water, gradually dissolving into that water over time.
    - Another example is **geological sequestration** where the carbon dioxide is **pumped into underground chambers such as old oil reservoirs, aquifers and coal seams that are unable to be mined.**
  - **Challenges of Artificial Carbon Sequestration:**
    - **Lack of technology:**
      - A growing number of corporations are pouring money into so-called engineered carbon removal techniques.
      - However, these technologies are at a **nascent stage** and need an **overhaul to be exploited.**
    - **High Cost:**
      - Carbon removal technologies remain **too expensive for widespread use.**
      - Artificial carbon sequestration is **costly, energy intensive, relatively untested** and has **no other side benefits.**
    - **Environmental Concerns:**

      Carbon dioxide may be stored deep underground. Reservoir design faults, rock fissures, and tectonic processes may act to release the gas stored into the ocean or atmosphere leading to unintended consequences such as **ocean acidification** etc.

- **Potential of Artificial Carbon Sequestration:**
  - **Faster Sequestration:**
    Natural sequestration is a slow process compared to artificial sequestration. Thus it can complement natural sequestering to achieve goals which are necessary to fight climate change.
  - **Increase in Productivity:**
    Enhanced agricultural yield and better oil recovery as a result of stored carbon in underground chambers such as old oil reservoirs, aquifers and coal seams.
  - **Employment Generation:**
    This new and emerging field is attracting private players and venture capitalists, which in turn can help in employment generation.