MANGROVES AND CARBON SEQUESTRATION - GS III MAINS

Q. Mangroves act as effective carbon stores along with its effective ecological services. Discuss the significance of Mangrove forests and also bring out the challenges faced by it. (15 marks, 250 words)

News: *How mothers built a forest in world's largest delta*

What's in the news?

- As the annual COP-28 summit kicks off in Dubai, on a remote, cyclone-battered island in the Sunderbans, a school teacher has rallied climate crisis's most vulnerable community -mothers - to secure a mangrove forest and consequently, their lives.

Mangroves:

- Mangroves are salt-tolerant plant communities found in tropical and subtropical intertidal regions of the world.
- Such areas are characterized by high rainfall (between 1,000 to 3,000 mm) and temperature (ranging between 26°C-35°C).

Characteristics of Mangroves:

- Mangroves exhibit Viviparity mode of reproduction, where seeds germinate within the tree before falling to the ground. This is an adaptive mechanism to overcome the challenge of germination in saline water.
- Some mangrove species secrete excess salt through their leaves, while others block the absorption of salt at their roots.
- Mangrove plants have special roots like prop roots and pneumatophores, which help impede water flow and provide support in the challenging tidal environment.

Significance:

- Mangrove forests consisting of trees and shrubs that live in intertidal water in coastal areas that host diverse marine life.
- Mangroves provide a number of benefits, including acting as a natural barrier against storms, erosion and flooding, sources of food and timber, improved water quality, protecting coastal habitats, providing a nursery for marine life and carbon sequestration.
- They are unique because they grow in salt water and their pneumatophores (air roots) allow them to breathe even when the water is high.
- They also support a rich food web, with molluscs and algae-filled substrate acting as a breeding ground for small fish, mud crabs and shrimps, thus providing a livelihood to local artisanal fishers.

- Mangrove forests also provide natural habitat for over 1,533 different species, including nursery habitats for many commercially important fish, and are beneficial to the health of adjacent ecosystems such as coral reefs and seagrass meadows.

Mangroves and Carbon Sequestration:

- Mangroves act as effective carbon stores, holding up to four times the amount of carbon as other forested ecosystems - State of World Mangroves 2022.
    - The report warns that even a 1% loss of remaining mangroves could result in a loss of 0.23 gigatons of CO_2 equivalent, equivalent to over 520 million barrels of oil.
- Mangrove forests capture vast amounts of carbon dioxide from the atmosphere and their preservation can both aid in removal of carbon from the atmosphere and prevent the release of the same upon their destruction.
- Mangroves make up less than 2% of marine ecosystems, however they are responsible for 10-15% of carbon sequestration. As the leaves and older trees die, they fall to the seabed, taking the carbon with them to be buried in the soil.
    - This carbon is described as “blue carbon” because it is stored in coastal ecosystems such as mangrove forests, seagrass beds, and salt marshes.

Mangrove Forest Cover Worldwide:

- As per Global Forest Resource Assessment, 2020 (FRA 2020), world over, 113 countries have Mangrove forests covering an estimated 14.79 million hectares.
- The total mangrove cover in the globe is 1,500,000 sq.km.
- Asia contains the greatest amount of mangroves in the world.
- South Asia accounts for 8% of the global mangrove cover.
- India contributes 8% of South Asia’s total mangrove cover.

Mangrove Cover in India:

- According to the Champion and Seth Classification, mangrove forest in India is classified as Type Group-4 Littoral & Swamp Forest.
- Mangrove cover in India is 4992 sq. km which is 0.15% of the country's total geographical area - ISFR 2021.
- Sundarbans in West Bengal are the largest mangrove forest regions in the world. It is listed as a UNESCO World Heritage Site.
- The mangroves have been afforded protection under Category I of the CRZ (Coastal Zone Regulation 1991).

Government Initiatives:

1. Mangrove Initiative for Shoreline Habitats & Tangible Incomes (MISHTI):

- MISHTI is a new initiative aimed at promoting mangrove plantations along India’s coastline and saltpan lands.

- The program will focus on the intensive afforestation of coastal mangrove forests.
- The implementation of MISHTI will be achieved through collaboration between MGNREGS (Mahatma Gandhi National Rural Employment Guarantee Scheme), CAMPA Fund (Compensatory Afforestation Fund Management and Planning Authority Fund), and other sources.

2. Sustainable Aquaculture In Mangrove Ecosystem (SAIME):

- SAIME is a community-based pilot project in West Bengal under which farmers are planting mangrove trees around shrimp ponds.
- The initiative is started in 2019 — has established a collaborative ecosystem integrating several key stakeholders from government departments, academia and research institutes for co-creation and comprehensive advancement of this project.
- It is conceived by NEWS and Global Nature Fund (GNF), Naturland Bangladesh Environment and Development Society (BEDS).

Ramsar Convention:

- The Ramsar convention on wetlands is a relevant policy framework for conserving and managing coastal wetlands, including mangroves and other coastal ecosystems.

UN Decade on Ecosystem Restoration:

- Mangrove protection and restoration is central to the UN Decade on Ecosystem Restoration (2021-2030) which seeks to galvanize efforts to restore degraded and destroyed ecosystems to enhance food security, clean our air, secure freshwater supplies, address the climate crisis and protect habitats that support life on Earth.

Threat to Mangrove forests:

1. Biotic pressure and natural disasters have a significant negative impact on Mangrove ecosystems.

2. Growing land reclamation for agriculture and industry along coasts, as well as the discharge of untreated home sewage and industrial effluents, are threatening these trees.

3. Rising sea levels due to climate change pose a significant threat to mangroves.

4. The Commercialisation of Coastal Areas - Aquaculture, coastal expansion, rice and palm oil cultivation, and industrial activities are quickly displacing these salt-tolerant trees and the ecosystems they sustain.

5. Shrimp Farms - Shrimp farms are responsible for at least 35% of the entire loss of mangrove ecosystems.

Many studies have highlighted these issues, and extensive conservation efforts are required to assure the survival of these vulnerable ecosystems.

WAY FORWARD:

1. Mangrove Adoption Program:

- Launch a public-driven initiative where individuals, corporates, and institutions can "adopt" a patch of mangroves.

2. Engaging Local Community in Conservation:

- Involving and enabling local communities is critical for long-term success.

3. Afforestation:

- Encourage the planting of new mangrove trees to increase the forest's size and improve its health. Reducing mangrove deforestation rates would elevate the carbon benefit from climate change by 55–61%.