Carbon Farming

Introduction

- **Carbon:**
    - It is recognized as a **key energy currency of biological systems**, including agriculture.
    - Agricultural production depends on plant photosynthesis to move CO_2 out of the atmosphere and into the plant, where it is transformed into agricultural products: food, flora, fuel or fiber.
- **Agriculture and Carbon Emissions:**
    - Agriculture covers more than half of Earth's terrestrial surface and **contributes roughly one-third of** global GHG emissions.
    - **Agricultural emissions in India** are primarily from the livestock sector (54.6%) and the use of **nitrogenous fertilisers** (19%).
- **Carbon Farming:**
    - Carbon farming (also known as **carbon sequestration**) is a system of agricultural management that **helps the land store more carbon** and **reduce the amount of GHG** that it releases into the atmosphere.
    - It involves practices that are known to improve the rate at which CO_2 is removed from the atmosphere and converted to plant material and soil organic matter.
    - Carbon farming is successful when **carbon gains** resulting from enhanced land management or conservation practices **exceed carbon losses.**

Methods for Carbon Farming

- **Forest Management**: Healthy forests absorb and hold CO_2 emissions produced from other sources. Carbon offsets can be created by:
    - Avoiding deforestation
    - Permanent land conservation
    - Reforestation and replanting activities
    - Improved forest management
- **Grasslands Conservation**: It includes maintaining native plant life through permanent land conservation and **avoiding** conversion of grasslands **for commercial development** or intensive agriculture.
- **Mixed Farming**: A climate-friendly strategy of raising livestock and crops together.
    - Rotating cows among pastures allows grasses to **recover from grazing** and the **animals' manure** and the impacts of their grazing **regenerate carbon in soils**.
- **Using Cover Crops**: These crops are **planted to cover the soil** rather than for the purpose of being harvested. They are planted after the harvest of the main crop.
    - They return more carbon to the soil and **sustain soil microbes** that play key roles in carbon storage.
- **Reduction of Soil Tillage**: **Tillage** is normally used to loosen and aerate the soil and to remove

initial weeds.

    - However, **tillage increases carbon mineralization** (decomposition of chemical compounds in organic matter) leading to CO_2 emissions from the soil.
    - Reducing the soil disturbance is a useful tool to protect soil organic matter.
- **Wetland Restoration**: **Wetland** soil is an important natural carbon pool or sink as the wetlands **conserve about 14.5% of the soil carbon** found in the world.

Significance of Carbon Farming

- **Multidimensional Benefits**: Increasing Soil Organic Carbon (SOC) through various methods can **improve soil health, agricultural yield, food security, water quality**, and reduce the need for chemicals.

    - It would not just address carbon mitigation but also **improve other planetary boundaries in peril** such as fresh water, biodiversity, land use and nitrogen use.
- **Offsets Carbon Emissions**: An international initiative called "**4 per 1000,**" showed that increasing soil carbon worldwide by just 0.4% yearly could offset that year's new growth in CO_2 emissions from fossil fuel emissions.

    - The **'4 per 1,000' initiative** was launched by the France government at the COP21 **Paris climate summit** in 2015.
    - The aim of the initiative is to demonstrate that agriculture, and in particular agricultural soils, can play a **crucial role where food security and climate change** are concerned.
- **Acts as an Intermediate Mitigation Strategy**: Increasing soil carbon offers a range of co-benefits along with buying the time before other technologies can help the world transition to a **zero-carbon** lifestyle.
- **Helps Restoring Carbon Cycle:** Worldwide, soils are estimated to contain about 10 times the amount of carbon in the atmosphere; far more than what is found in normal vegetation.

    - Carbon farming is seen as a way to help **restore balance within the carbon cycle.**
    - It also helps soil build a **resilience to drought** and increases agricultural productivity in a natural way

Challenge Associated

- **Requires Participation at a Larger Level**: For the overall framework of carbon farming to be successful, it would have to **include sound policies**, **public-private partnerships**, accurate quantification methodologies and **supportive financing** to efficiently implement the idea.

    - It requires to be done at a scale where measurable carbon capture can be achieved along with maintaining healthy soils that absorb and store carbon.
- **Limited Benefit**: The areas with long growing seasons, sufficient rainfall and substantial irrigation make viable opportunities for carbon farming.

    - However, carbon farming, likely, is more of **a challenge for farmers in hot and dry areas** of the country.
    - Moreover, many farmers may not be able to **afford the cost of implementing environmentally beneficial measures** without some sort of financial assistance.

Way Forward

- **Direct Incentives for Farmers:** The land sector is key for reaching a climate-neutral economy, because it can capture CO_2 from the atmosphere.

    - However, to encourage the **agriculture and forestry sectors**, it is necessary to **create direct incentives for the adoption of climate-friendly practices**, as currently there is no targeted policy tool to significantly incentivise the increase and protection of carbon

sinks.

- **Carbon Credits and Carbon Banks**: The farmers can be rewarded through globally tradable **carbon credits** and '**carbon banks**' can also be created that would **buy and sell carbon credits from farmers.**
    - These credits could then be sold to corporations needing to offset their emissions.
    - Paying farmers to restore carbon-depleted soils offers a **great opportunity for a natural climate solution** and to stabilize global warming below 2°C.
- **Organic-Carbon Rich Fertilisers:** Fertilisers such as compost and **solid manure with wide C:N (carbon:nitrogen) ratios** will have a **slow carbon turnover** compared to other materials. They should be part of the farming system.
- **Biofuel over Fossil Fuels:** Nearly all biofuel systems (mainly biodiesel and bioethanol) produce fewer GHG emissions than fossil fuels.
    - Using biofuel as a replacement for fossil fuels is an **opportunity for farmers to diversify income, reduce costs**, and **assist in reducing global GHG emissions** – mainly **carbon dioxide (CO_2), methane (CH_4)** and **nitrous oxide (N_2O).**