



## Carbon Sequestration: Importance & Its Role in Sustainable Agriculture

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### INTRODUCTION

Climate change is one of the most critical issues facing the world today. Global warming, drought, pollution, irregular rainfall and weather extremes are some of the factors that affect climate change. Global warming is the main reason for the rapid rise of carbon dioxide in the atmosphere, which is the main result of human activities such as fossil fuel combustion, deforestation, pollution and land use. To reduce the risk associated with a changing climate, scientists and experts are looking for alternatives, which are environmentally friendly methods to remove excess carbon dioxide from the atmosphere. Carbon sequestration is considered a viable approach to resolving this dilemma. Instead of allowing excess carbon to gather in the atmosphere, it is sequestered or stored in the environment, which acts like a natural sink.

Agriculture has a dual role to play in the global carbon cycle. On the one hand, if agriculture is practiced in an unsustainable manner, it can lead to a high amount of carbon emissions into the atmosphere. On the other hand, agriculture can help to reduce climate change through a powerful carbon sink, thereby improving soil fertility and crop yields while reducing greenhouse emissions.

### Understanding Carbon Sequestration:

Carbon sequestration is a mechanism of capturing carbon dioxide (CO<sub>2</sub>) from the atmosphere and storing it in natural and artificial reservoirs for a long time. The natural reservoirs include soils, forests, and oceans, among others. Carbon sequestration helps to control climate change by storing carbon in natural sinks, which in turn reduces the level of greenhouse gases in the atmosphere. Photosynthesis is one of the most natural methods of carbon sequestration. This method involves plants using carbon dioxide from the atmosphere to produce food for their development.

The carbon absorbed by plants is stored in plant tissues such as roots, leaves and stems. When plants die and decay, carbon is stored in the soil in those plant parts. Soils are the major carbon reservoirs. The carbon stored in soils is obtained from plant residues, plant roots, & microorganisms. This carbon is stored in the soil for a very long time. Carbon sequestration is not limited to natural methods; there are also artificial methods of carbon sequestration. This method involves using modern technologies to capture carbon from industrial emissions and storing it in underground reservoirs. This helps to maintain a balance in the carbon cycle.

### Carbon Sequestration Types:

#### 1. Biological Carbon Sequestration:

Biological sequestration happens in various ecosystems like grasslands, forests, agricultural soils and wetlands. Plants absorb CO<sub>2</sub> from the atmosphere through photosynthesis and store carbon in the plants and soil reservoirs. Forests play a crucial role in capturing more carbon when trees store more carbon in their trunks, branches and roots. Conservation tillage, crop rotation,

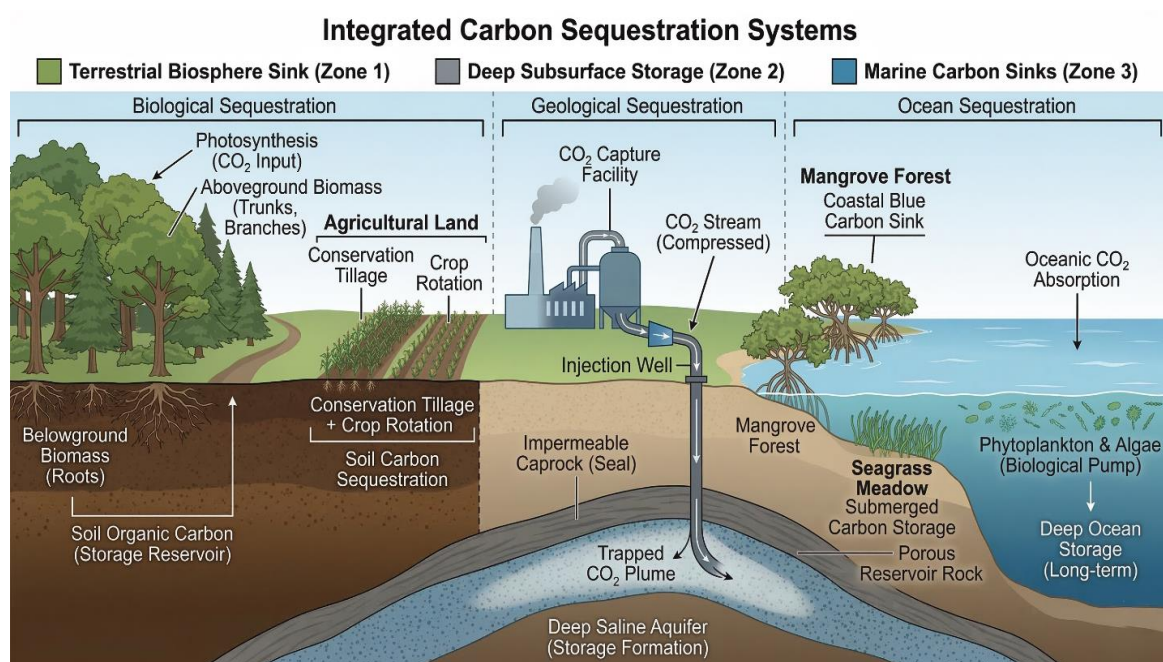
cover crops and agroforestry are farming techniques that help to increase soil organic matter and mitigate emissions of carbon into the atmosphere.

#### 2. Geological Carbon Sequestration:

Geological sequestration is a technique of capturing carbon dioxide emissions from various sources, like factories, and storing them in underground rocks and empty oil and gas reservoirs or saline aquifers. Once captured, it is compressed and then injected into these structures to remain there for thousands of years. This technique will reduce massive carbon emissions from various sources.

#### 3. Ocean Carbon Sequestration:

In Oceans occurs, natural processes of absorption of carbon dioxide from the atmosphere. This is mainly because of the photosynthetic activities of the algae, plants and phytoplankton present in the ocean. In this way, carbon dioxide is stored in the deeper parts of the ocean. Coastal ecosystems such as mangroves, seagrasses, and salt marshes are also carbon sinks.



### Importance of Carbon Sequestration:

- Climate Change Mitigation:

The most important advantage of carbon sequestration is that it mitigates climate change. When plants and soil sequester carbon dioxide and hold it in plant tissues and in soil, they help to reduce global warming and make the Earth's climate conditions stable.

- Improves Soil Health:

Soils that have rich organic carbon are productive and fertile. When organic carbon is present in large amounts in a given area, it makes that area healthy and productive.

- Better Water Retention:

Soils that are rich in carbon are also able to hold water in large amounts. When a soil is rich in carbon, it makes it easier to hold water, and this makes it easier to address drought in areas that are rain-fed and dryland.

- Biodiversity Conservation:

Plants and ecosystems are rich in carbon, and forests & wetlands act as natural carbon sinks that makes solution for biodiversity conservation and mitigate climate change.

- Economic Opportunities:

Carbon sequestration is also important in creating economic opportunities. When a large amount of carbon is sequestered in a given area, it makes it easier to create carbon credit markets.

### Role of Agriculture in Carbon Sequestration:

Agriculture has huge potential in improving carbon sequestration with the help of

sustainable agriculture practices. Agricultural soils are acts like a carbon sinks with increased organic matter and minimum disturbance.

- Conservation Agriculture:

Conservation agriculture has mainly three principles: minimum tillage, permanent cover on the soil, and diversification of crops. Tillage is also minimized to prevent the destruction of organic matter and the loss of carbon from the soils.

- Crop Residue Management:

Allowing crop residue to stay on the agricultural fields and not to burn helps to increase organic matter in the soil. Crop residues help to increase organic matter and soil fertility.

- Cover Cropping:

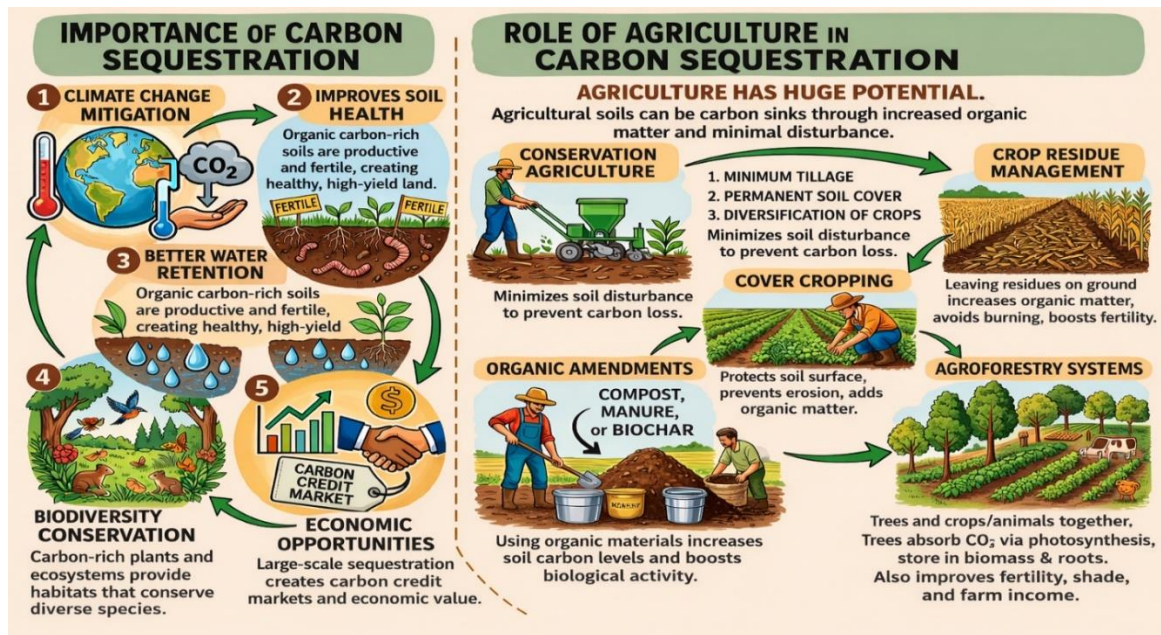
Cover crops help to protect the soil and prevent erosion. In addition, they increase organic matter in the soil.

- Organic Amendments:

The use of organic materials like compost, farm yard manure, and biochar helps in increasing levels of carbon in the soil and boosts soil biological activity.

- Agroforestry Systems:

Agroforestry is defined as trees/crops & animals under the same land management unit. Trees and crops absorb CO<sub>2</sub> from the atmosphere through photosynthesis and store it in plant biomass and roots. Agroforestry systems act as carbon sinks, which helps in improving soil fertility, provides shade and boosts farm income.



### Future Prospects:

In the context of rising global concern over climate change, carbon sequestration is slowly becoming an integrated part of all sustainable land management practices. Climate-smart agriculture is slowly taking hold, supported by scientific and governmental advocacy for its use in farming activities. Soil science and carbon monitoring technologies have improved over the years. These technologies will help scientists come up with more effective farming methods that promote soil carbon and high productivity.

### CONCLUSION

Carbon sequestration systematically provides solutions to climate change and contributes to sustainable agriculture. The capture and

storage of carbon in plants, soils and ecosystems are reducing the amount of greenhouse gas emissions in the atmosphere. Conservation tillage, agroforestry, cover cropping and the application of organic amendments are agricultural management strategies that improve carbon storage in the soil. In addition to reducing greenhouse gas emissions, these strategies promote improved fertility, water retention and biodiversity in the soil. With ongoing global environmental challenges, there will be an increasing need to incorporate carbon sequestration into farming systems. Therefore, promoting climate-smart agricultural practices will lead to environmentally sustainable, healthy soils and long-term agricultural productivity for future generations.