



# CARBON FARMING: A SUSTAINABLE AGRICULTURAL APPROACH TO CLIMATE CHANGE MITIGATION

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## Introduction

Climate change has emerged as one of the most critical challenges confronting global agriculture. Rising temperatures, erratic rainfall patterns and increasing frequency of extreme weather events are threatening crop productivity, soil health and farmers' livelihoods. Agriculture is both a contributor to climate change through greenhouse gas emissions and a sector highly vulnerable to its impacts. At the same time, agriculture possesses immense potential to act as a solution by adopting sustainable practices that reduce emissions and enhance carbon sequestration. In this context, carbon farming has gained recognition as a promising approach for climate change mitigation while supporting sustainable agricultural development.

## Concept of Carbon Farming

Carbon farming refers to a set of agricultural practices aimed at capturing atmospheric carbon dioxide and storing it in soils and vegetation. The central idea of carbon farming is to increase soil organic carbon through improved land management while reducing emissions associated with conventional farming practices. Unlike extractive agricultural systems that degrade soil resources, carbon farming emphasizes regenerative practices that enhance ecosystem services and long-term farm productivity.

## Agriculture and Climate Change

Agriculture contributes significantly to global greenhouse gas emissions through land-use changes, excessive fertilizer use, methane emissions from livestock and residue burning. However, agricultural soils also represent one of the largest potential carbon sinks. By adopting carbon farming practices, farmers can convert their fields into effective carbon reservoirs, thereby reducing the net carbon footprint of agricultural production. This dual role makes agriculture a key sector in climate change mitigation strategies.

## Key Carbon Farming Practices

Carbon Farming Practice	Description	Climate & Agricultural Benefits
Conservation Tillage	Reduces soil disturbance by minimizing ploughing operations	Enhances soil carbon storage, reduces carbon loss and improves soil structure
Cover Cropping	Growing cover crops during fallow periods	Increases soil organic matter, prevents erosion and improves soil moisture retention

Crop Diversification and Rotation	Cultivation of diverse crops in sequence	Improves soil fertility, enhances carbon sequestration and reduces pest incidence
Agroforestry Systems	Integration of trees with crops and/or livestock	Stores carbon in biomass and soil, improves biodiversity and microclimate
Residue Management	Retention and incorporation of crop residues in the field	Adds organic carbon to soil, reduces residue burning and improves nutrient cycling
Organic Amendments	Application of compost, farmyard manure and green manures	Enhances soil organic carbon, microbial activity and nutrient availability
Improved Nutrient Management	Balanced and efficient use of fertilizers	Reduces greenhouse gas emissions and improves nutrient use efficiency
Integrated Farming Systems	Combining crops, livestock and allied activities	Enhances carbon recycling, improves farm resilience and income stability

**Soil Carbon Sequestration and Soil Health**

Soil is a vital component of the global carbon cycle. Increasing soil organic carbon through carbon farming improves soil structure, water-holding capacity and nutrient availability. Healthy soils support beneficial microorganisms and enhance plant growth, making farming systems more resilient to droughts and floods. Thus, soil carbon sequestration not only contributes to climate change mitigation but also strengthens the foundation of sustainable agriculture.

**Environmental Benefits of Carbon Farming**

Beyond carbon storage, carbon farming offers multiple environmental benefits. It reduces soil erosion, improves water infiltration and enhances biodiversity both above and below the ground. Reduced reliance on chemical fertilizers lowers the risk of water pollution and decreases emissions associated with fertilizer production. These environmental co-benefits make carbon farming an effective approach for ecosystem conservation.

**Economic and Social Benefits for Farmers**

Carbon farming can improve farm economics by reducing input costs and stabilizing yields through improved soil fertility. An emerging benefit is farmers’ participation in carbon credit markets, where they are financially rewarded for sequestering carbon. These additional income opportunities enhance livelihood security and encourage wider adoption of sustainable practices, particularly among small and marginal farmers.

**Carbon Credits and Recent Developments**

Recent developments highlight the growing importance of carbon farming in global and Indian agriculture. In 2026, Indian farmers achieved a significant milestone when verified soil carbon credits were issued for the first time under an internationally recognized standard.

Through initiatives such as the Aadi Project, farmers adopting regenerative practices like reduced tillage and improved soil management generated verified carbon credits, with a substantial share of revenue directly benefiting farmers. At the global level, corporate demand for agricultural carbon credits has increased rapidly. Major companies have entered large-scale agreements to purchase soil carbon credits as part of their climate commitments. These developments demonstrate that carbon farming is no longer a theoretical concept but an emerging economic opportunity linking agriculture with climate finance.

### **Challenges in Adoption of Carbon Farming**

Despite its potential, several challenges limit the widespread adoption of carbon farming. Limited awareness among farmers, high initial transition costs and lack of technical support are major constraints. Measuring and verifying soil carbon changes is complex and requires scientific monitoring systems. Access to carbon markets and benefit-sharing mechanisms also remains limited, especially for smallholders in developing countries.

### **Policy Support and Institutional Role**

Effective policy and institutional support are crucial for scaling up carbon farming. Governments can promote adoption through incentives, training programs and integration of carbon farming into climate-smart agriculture policies.

Strengthening extension services and facilitating farmer participation in carbon credit mechanisms can accelerate the transition toward low-carbon agriculture. Collaboration among policymakers, researchers, private sector and farmer organizations is essential for long-term success.

### **Future Prospects**

Carbon farming holds strong potential as a sustainable pathway for climate change mitigation. Advances in soil carbon measurement technologies, digital agriculture and climate finance are expected to improve feasibility and transparency. With appropriate policy support and farmer engagement, carbon farming can contribute significantly to climate goals while enhancing agricultural sustainability and resilience.

### **Conclusion**

Carbon farming represents a win-win approach that enables agriculture to contribute to climate change mitigation while improving soil health, farm productivity and farmer incomes. By transforming agricultural lands into carbon sinks, carbon farming aligns environmental sustainability with economic benefits. Promoting this approach is essential for building climate-resilient agricultural systems and ensuring a sustainable future for farming communities.