BioThink, Vol 2, Issue 2
ISSN: 30487943

Agroforestry and Carbon Sequestration: A Sustainable Climate Solution

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Introduction

Climate change is a global challenge driven by rising greenhouse gas (GHG) emissions, particularly carbon dioxide (CO_2). Agroforestry, the integration of trees, crops, and livestock, has emerged as a promising strategy for carbon sequestration. This article discusses how agroforestry enhances carbon storage, its impact on soil health, and its potential in climate resilience.

Agroforestry and Carbon Sequestration

Agroforestry contributes to carbon sequestration through:

Aboveground Biomass Storage: Trees and shrubs absorb atmospheric CO_2 and store it as biomass.

Soil Carbon Sequestration: Tree roots enhance soil organic matter, improving longterm carbon storage.

Microclimate Regulation: Agroforestry reduces land degradation and enhances carbon retention.

Types of Agroforestry Systems for Carbon Sequestration

1. **Agrisilviculture:** Crops and trees together improve carbon storage in vegetation and soil.
2. **Silvopastoral Systems:** Trees with livestock enhance carbon sequestration while improving pasture quality.
3. **Agrisilvopastoral Systems:** A combination of trees, crops, and livestock maximizes carbon retention.

Case Study: Agroforestry and Carbon Sequestration in India

Poplarbased Agroforestry in Punjab: Poplar *(Populus deltoides)* plantations significantly sequester carbon while providing timber and economic benefits to farmers.

Teak Agroforestry in Karnataka: Farmers practicing teakbased agroforestry (*Tectona grandis*) store large amounts of carbon while generating longterm income.

Challenges and Future Prospects

Despite its advantages, agroforestry faces challenges such as:

Lack of Awareness and Training: Farmers need knowledge of suitable tree species and management techniques.

Policy and Financial Barriers: Agroforestry adoption requires stronger policy support and incentives.

Future Research: Advancing research on high carbon sequestering species and agroforestry models is crucial for improving climate resilience.

Conclusion

Agroforestry is a vital tool for carbon sequestration, helping mitigate climate change while enhancing agricultural sustainability. With proper policy support, research, and farmer participation, agroforestry can play a significant role in global carbon reduction strategies.

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