

# Carbon Sequestration Potential of Different Agroforestry Systems in India

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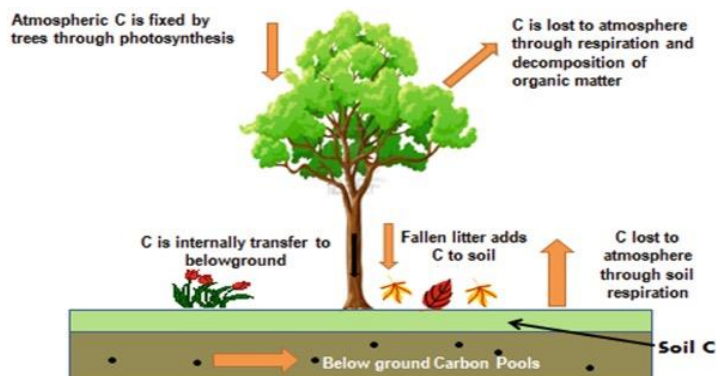
The greenhouse gases cause global warming, in which carbon dioxide (CO<sub>2</sub>) alone account for 60% share. Plant act as a sink for carbon dioxide (CO<sub>2</sub>) by absorbing it through photosynthesis process and naturally storing it as biomass. Continuous growth of plant also increased the carbon stock and different plant species have different capacity of carbon sequestration. The deforestation contributes about 5.9 Gt carbon dioxide (CO<sub>2</sub>) in the world. Since the late nineteenth century, global surface temperatures have risen by 0.8 °C, and 11 of the 12 warmest years on record have happened since 1995. In India, the temperature has risen by 0.4 to 0.6 °C over the past 100 years. By increasing carbon storage in soil and trees, carbon sequestration operations can contribute to the prevention of global climate change. Activities related to plantations and reforestation are crucial in the fight against global warming. Compared to short rotation species, long rotation species have a longer carbon locking period.

## Carbon sequestration

The Concept of Carbon Sequestration emerged in 1980s due to consequences of steadily increasing level of Carbon dioxide in the atmosphere. Carbon sequestration is one of the major tool for reducing anthropogenic carbon emission. Carbon sequestration is the process through which agriculture and forestry practices remove carbon dioxide (CO<sub>2</sub>) from the atmosphere.

## Definitions

Carbon sequestration is the process of capture and long term storage of atmospheric carbon dioxide (CO<sub>2</sub>) to mitigate global warming and to avoid dangerous impact of climate change. Carbon sequestration is the process of extraction of the atmospheric carbon dioxide (CO<sub>2</sub>) and storing in a terrestrial or aquatic body for a long period of time.



## Type of carbon sequestration

Carbon sequestration in an ecosystem are mainly through three forms:

- Terrestrial Carbon sequestration.
- Geological Carbon sequestration.
- Ocean Carbon sequestration.

Table 1: Different Carbon Pool in Forest:

	Pools	Description
Living biomass	Above Ground biomass (ABG)	All living biomass above the soil including stem, stump, bark, branches, seeds and foliage.
	Bellow Ground biomass (BGB)	Roots of all plants and living organisms
Dead organic matter	Dead wood	Including all non-living woody biomass such as, dead woods, dead roots and stumps larger than or equal to 10 cm in diameter are also includes.
	Litter	Includes all non-living biomass with a diameter less than a minimum diameter chosen by the country (for FSI 5 cm).
Soil	Soil Organic Matter (SOM)	Includes organic carbon in mineral and organic soil (including peat) for specific depth chosen by country (for FSI 30cm).

**Carbon Pool**

Carbon pool are major components of an ecosystem that can either accumulate or release carbon, i.e. a reservoir where sequestered carbon is stored.

**Forest and Carbon sequestration**

Forest vegetation and soils constitute a major terrestrial carbon pool with the potential to absorb and store carbon dioxide (CO<sub>2</sub>) from the atmosphere. The world's forests store more than 650 billion tonnes of carbon, 44% in the biomass, 11% in dead wood & litter and 45% in the soil. Deforestation and forest degradation are still very much challenging the living beings on earth due to the increased production of greenhouse gases.

**Forestry practices to increase carbon sequestration**

- i. Reforestation.
- ii. Afforestation.
- iii. Preservation of forest land.
- iv. Adoption of agroforestry practices.
- v. Establishment woody biomass plantations.

**Agroforestry- an old practice, but a new science:**

A multifunctional land use system. A specialized way of farming crops and trees in various combinations on the landscape. It enhances livelihoods and contribute to resolving climate change effects.

**Agroforestry can be practiced at-**

- i. On farm
- ii. Road side
- iii. Canal embankments
- iv. On degraded land
- v. Homeland
- vi. Sliding terraces
- vii. Common property

**Advantage of agroforestry**

- i. Carbon sequestration
- ii. Reduce pressure on natural forest
- iii. Soil conservation
- iv. Reclamation of degraded land
- v. Employment opportunity

- vi. Aesthetic value

**Agroforestry as an option for carbon stock**

A significant portion of the resources found in forests are the tree plantations that have been built both inside and outside the forest region. The sequestration of carbon may be facilitated by improved land management. A young plantation can operate as a reservoir, whereas a mature plantation can sequester substantially higher amounts of carbon. Additionally, production from plantation forests might reduce pressure on timber extraction from natural forests, aiding in the preservation of forests.

**Agroforestry for carbon sequestration:**

- i. Potential to limit carbon emissions and sequester carbon
- ii. Microclimate amelioration
- iii. Protection and stabilization of ecosystem
- iv. Soil and water conservation
- v. Sustainable diversification of agricultural systems
- vi. Improvement in rain water efficiency
- vii. Interventions for drought mitigation

**Role of agroforestry in Carbon sequestration**

Agroforestry system recognized as a carbon sequestration strategy because of its applicability in agricultural lands as well as in reforestation programs. Agroforestry offers the highest potential for carbon sequestration

Direct role: Carbon sequestration rates ranging from 1.5 to 3.5 Mg C per ha per yr in agroforestry systems

Indirect role: Agroforestry has also some indirect effects on C sequestration since it helps to reduce pressure on natural forests

**Potential area of agroforestry in India**

India has a 328.2 million hectare (ha) total geographical area, of which 141 million hectares (ha) are agricultural. Agroforestry techniques have the ability to store a significant quantity of carbon. According to India's land capability categorization, 96.40 mha of its land is considered to be degraded. By the year 2030, this combination of forestry alternatives and land capacity might increase the sequestration

potential by an extra 78 million tons of carbon annually.

### **Factor determining carbon sequestration in agroforestry**

- i. Site quality.
- ii. Protection against fire, disease and pest infestation.
- iii. Silvicultural Management practices.
- iv. Species adaptability.
- v. Rate of growth.
- vi. Spacing.

### **Conclusion**

One of the key strategies for reducing anthropogenic carbon emissions is carbon

sequestration. One significant terrestrial carbon sink is the carbon reserves in the currently existent forests and crops. Agroforestry techniques have the potential to store large amounts of carbon while simultaneously supplying fruit, fiber, and organic fertilizers as well as fuel and fodder. Carbon Sequestration Potential of agroforestry at districts and state levels helps to support India's position in climate change scenario. By the year 2030, the use of agroforestry on land might increase the sequestration capacity by an additional 78 million tons of carbon annually. The most significant function of agroforestry is its ability to sequester carbon. Agroforestry systems are thought to yearly offset 109.34 million tons of CO<sub>2</sub> on a nationwide level.

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