Advances in Agricultural Technology & Plant Sciences
ISSN: 2640-6586

Academic Strive
Researcher's perception is our reality

Editorial *Volume 7 Issue 2*

Agroforestry for Mitigating Global Warming and Carbon Sequestration

Baruah N* and Kalita N

AICRP for Dryland Agriculture, Biswanath Chariali Centre, India

***Corresponding author:** Nikhilesh Baruah, AICRP for Dryland Agriculture, Biswanath Chariali Centre, AAU, Biswanath Chariali, Assam, India, Email: baruah.nikhilesh@gmail.com

Received Date: November 11, 2024; **Published Date:** November 20, 2024

Keywords: Mitigating Global Warming; Agroforestry

Abbreviations

NAPCC: National Action Plan on Climate Change; CDM: Clean Development Mechanism; SCS: Soil Carbon Sequestration.

Editorial

Carbon sequestration in agroforestry is an effective and sustainable approach to climate change mitigation. Carbon sequestration refers to the process of capturing and storing carbon dioxide (CO2) from the atmosphere through the integration of trees in agricultural systems. During the past three decades, Agroforestry has become recognized the world over as an integrated approach to sustainable land use because of its production and environmental benefits. Its recent recognition as a greenhouse gas–mitigation strategy under the Kyoto Protocol has earned it added attention as a strategy for biological carbon sequestration.

Carbon sequestration involves the net removal of CO_2 from atmosphere and storage in long-lived pools of Carbon. Such pools include the above ground plant biomass, belowground biomass such as roots, soil microorganisms and the relatively stable forms of organic and inorganic C in soils and deeper subsurface environments and the durable products derived from timber biomass. Forest absorb carbon dioxide from the atmosphere and store it in different repositories called carbon pools which include trees both living and dead, root systems, undergrowth, the forest floor and soils.

Global warming is the increase in average temperature of the earth's surrounding air and ocean, which is believed to be caused mainly by the increase in atmospheric concentrations of the greenhouse gases. According to the IPCC, the GHG emissions could rise by 25 – 90% by 2030 relative to 2000 and the earth could warm by 3 °C at the end of this century. Even with a temperature rise of 1– 2.5°C, the IPCC predict serious disastrous effects including reduction in crop yields in tropical and subtropical areas leading to increased risk of food shortage, spread of climate responsive diseases such as malaria, and an increased risk of extinction of 20 – 30% of all biodiversity present on earth.

Among all GHGs, CO_2 is a major GHG and between 2000 and 2011, atmospheric concentration of CO_2 has increased considerably. CO_2 emissions from industrial processes and fossil fuel combustion contributed about 78% of the total GHG emission.

Sequestering CO_2 from point sources or atmosphere through natural techniques afforestation, reforestation, natural regeneration of forests and the adaptive agriculture is economically sound in increasing the C storage capacity of the terrestrial ecosystems. On 30 June, 2008 the Government of India released India's first National Action Plan on Climate Change (NAPCC) to address the climate mitigation and adaptation through existing and future policies and programs. There are six national missions, which have direct influence on agriculture selected under the NAPCC due to various objectives in relation to agriculture including agroforestry. Agroforestry has the potential to mitigate the climate change effects through microclimate moderation

and conservation of natural resources in the short run and through sequestration of carbon in the long run, which is far greater than the crop and grass systems.

The actual aim of farmers and government institutions behind agroforestry was improving rural livelihood and meeting various needs *viz.* food, fuel, timber, fodder for the farmers. But in recent era of climate change, agroforestry became economically and ecologically very attractive tool for mitigating harmful effect of GHGs. Since, the Kyoto Protocol allowed industrialized countries with a GHG reduction commitment so as to invest in mitigation projects in the developing and least developed countries under the Clean Development Mechanism (CDM). IPCC also indicated in its special report that the conversion of wasteland and grassland to agroforestry has the best potential to soak up atmospheric CO_2 other than direct benefits. Since CO_2 is the major greenhouse gas, representing 77% of total anthropogenic GHG emissions, its reduction is very essential from the atmosphere. Carbon sequestration is the capturing atmospheric CO_2 and storing for long term through natural soils/vegetation and engineering techniques. Among all the natural techniques, agroforestry provides a win-win opportunity to achieve the objectives of carbon sequestration and climate change mitigation and adaptation. Although agroforestry systems are not primarily designed for carbon sequestration, there are many recent studies to substantiate the evidence that agroforestry systems can play a major role in storing carbon in aboveground biomass as well as in below ground biomass.

Majority of the agroforestry systems have the potential to sequester carbon, which may vary according to tree species Literature clearly indicates that Long rotation agroforestry systems such as windbreak, shelterbelts, woodlots, boundary plantation, agrihorticulture, silvipasture, home gardens, and multi-storeyed systems have large potential in carbon storage in biomass. The short rotation systems like agrisilviculture have high potential for soil carbon sequestration and fast growing hardwoods like Eucalyptus, Poplar, Melia, Casuarina, Leucaena etc. and tropical bamboos have large potential for biomass than slow growing species.

- **Carbon sequestration by crops:** In agroforestry systems, although trees sequester more carbon, but crops also fix and store carbon in considerable amounts. Crop improves the organic matter in soil, which is a significant component of the terrestrial C pool. An Kushwah, et al., conducted an experiment at ICAR-Indian Institute of Soil Science, Bhopal to assess the carbon sequestration potential of different crops and concluded that maize, sorghum and pearl millet had higher potential to carbon sequestration as compared to rice, finger millet and soybean.
- **Carbon sequestration in soil:** Carbon sequestration in soil is the process of transferring CO_2 from the atmosphere into the soil through crop residues, tree roots and other organic solids, and in a form that is not immediately reemitted. The sequestered carbon in soil helps in reducing CO_2 present in the atmosphere, while enhances soil quality and a sustained productivity. Soil carbon sequestration can be accomplished by management practices that add high amounts of biomass to the soil, cause minimal soil disturbance, conserve soil and water, improve soil structure, and enhance soil faunal activity. The studies on carbon sequestration in soils of India and rest of the world revealed a general trend of increasing soil carbon sequestration (SCS) in agroforestry as compared to other land-use practices. Agroforestry systems with better management have greater amounts of C sequestration potential in and out of the soil.

Conclusion

The agroforestry has slowly been gaining ground in India and as per data (Forest Survey of India, 2013) an area of 111,554 Km2 (3.39% of the total geographical area of the country) of the country, is now under agroforests, which have initiated bio-remediation of the socio-economic and ecoclimatic crisis for reverting rural livelihood sustainability.

The evidences are clear to suggest that agroforestry is desirable, both for its beneficial effects on climate change adaptation and mitigation, and for sustaining farm income. The combination of trees with crop gives not only timber, fuel, fodder and food but also reduces CO_2 from the atmosphere at acceptable level. The carbon sequestration potential of agroforestry system is higher than any other land use system except forest. Agriculture including agroforestry sector is an important component in overall goals set up by the Government of India in meeting the adaptation and mitigation targets. Globally, C trading is rapidly expanding, and the CDM of the Kyoto Protocol offers an attractive economic opportunity for subsistence farmers in developing countries, the major practitioners of agroforestry, for selling the C sequestered through agroforestry activities to industrialized countries. It will be an environmental benefit to the global community at large scale. The political environment is also favorable for enhancing smallholder involvement in GHG-mitigation projects. The success in the implementation of such projects will depend on the farmers' willingness to participate in the project.