

OPPORTUNITIES OF BIOCHAR APPLICATIONS FOR SOIL ENRICHMENT, ENVIRONMENTAL BENEFITS AND INCOME FROM BIOMASS AND CARBON CREDITS: EXPLORING POSSIBILITIES IN MEGHALAYA

Consultative Meeting to be held on 20th November, 2024

Concept Note

INTRODUCTION

Biochar is a carbon-rich material that is produced through the pyrolysis of organic matter, such as agricultural waste, wood, Bamboo and even manure, in an environment with limited oxygen. Biochar has been considered an innovative tool which shows multiple benefits such as improvement in water holding ability and fertility of soil, greenhouse gases mitigation, carbon sequestration, acidity and salinity suppression and the removal of pathogens with increase in agricultural output (Kapoor, et. al., 2024). The utilization of agricultural waste as biomass to synthesize biochar and biofuels, is the pertinent approach for attaining sustainable development goals. Biochar contributes in the improvement of soil properties, carbon sequestration, reducing greenhouse gases (GHG) emission, removal of organic and heavy metal pollutants, production of biofuels, synthesis of useful chemicals and building cementitious materials (Neogi, Sharma, et. al., 2022). Carbon stored in the form of biochar is durable and last for decades to millennia. Biomass-derived biochar production has been demonstrated as a potentially viable strategy for developing negative carbon emission technologies for climate change mitigation and as a material for effective amendment of relatively poor agricultural soils. Most interestingly, ongoing biochar research work has expanded broadly, stretching from its traditional core in the environmental and agricultural science to studies in the use of biochar for energy generation and as adsorbents for pollution treatment applications. Application of biochar as a material for soil amendment is closely linked with its potential for climate change mitigation by carbon sequestration. Specifically, the properties of biochar that include resistance to microbial degradation and chemical transformations, high surface areas, high water retention capacity, cation-exchange capacity, porosity, and its effectiveness as support and substrate for soil microbes, has endowed biochar with a greater potential to become a highly useful material for improving agricultural productivity through soil quality enhancement while simultaneously sequestering CO₂ from the atmosphere to mitigate climate change (Mulabagal, Baah, et. al., 2022). The production of biochar is one of few established CDR methods that can be deployed at a scale large enough to counteract effects of climate change within the next decade. Biochar has drawn renewed global attention because of its immense potential for CO₂ removal. Biochar is being encouraged as Carbon Dioxide Removal (CDR) strategy for large scale application as it offers a low cost solution for CDR. Carbon credits from biochar projects are considered as high quality credits and are traded at high price in the voluntary markets. The production of biochar can help manage agricultural and forestry waste by converting it into a valuable product rather than allowing it to decompose and release carbon dioxide and methane. Additionally, biochar can reduce nutrient leaching from soils, minimize soil erosion, and

improve water quality by filtering pollutants. By turning waste into a valuable resource, biochar also offers a sustainable solution for managing biomass from agricultural residues and forestry by-products.

For mainstreaming biochar and derive multiple benefits offered by it at scale, it is also important to educate and collaborate with farmers, researchers, and policymakers. Additionally, provisions such as training and resources to facilitate adoption among agricultural communities is crucial to leverage this initiative.

Relevance of biochar in Meghalaya

Biochar holds significant potential for addressing various environmental, agricultural, and social challenges in Meghalaya. Meghalaya is a biomass rich State. Excessive availability bamboo, agricultural residues, plantation residues and forest biomass create a highly favourable environment for introducing biochar units in the cluster model. Biochar has huge demand for various end use in agriculture, water purification, cosmetic and pharmaceutical sectors. Additionally, a biochar-CDR Project may generate significant revenues in the form of carbon credits. Bamboo (or other biomass) based biochar production can be suitably developed as income generating strategy for benefitting the communities in the State.

The multifaceted benefits offered by biochar application that align with the region's unique ecological and socio-economic needs are listed below:

- **Soil Improvement:** Meghalaya's agriculture is predominantly rain-fed and often faces challenges like soil erosion, low soil fertility, and nutrient depletion (Badavath et. al., 2024). Biochar can help improve soil health by functioning as a reservoir for nutrients to improve soil structure, by retaining moisture and by providing a habitat for beneficial soil microbes, which can further enhance soil health and fertility.
- **Waste Management:** Meghalaya faces challenges related to the management of organic waste, particularly from agriculture, forestry, biomass and other organic waste which can be addressed by converting them into a stable form of carbon that can be used for soil improvement and other applications.
- **Forest and Agriculture Synergy:** Meghalaya is rich in forests and has a thriving agriculture sector, with small-scale farmers engaging in shifting cultivation. Biochar could be an important tool to tackle land degradation due to shifting cultivation practices to help maintain soil fertility without the need for repeated burning.
- **Water Quality Improvement:** In Meghalaya, where there is a significant presence of rivers and streams, biochar could play a role in protecting water quality and ensuring clean water for local communities. It plays a vital role in help reduce water contamination from agricultural runoff by trapping heavy metals, organic pollutants, and nutrients.
- **Energy Generation:** In the process of producing biochar (through pyrolysis), valuable by-products such as bio-oil and syngas are produced. These can be used as renewable energy sources, helping

to reduce reliance on fossil fuels and providing sustainable energy solutions for rural communities in Meghalaya.

- **Livelihood Opportunities:** The production and use of biochar can open up new avenues for local entrepreneurship and income generation of rural households such as small-scale biochar production units to training farmers in biochar application. The carbon credits from biochar projects can further add to the income of the community members.
- **Achieving Carbon Neutrality Goal:** Biochar initiative may prove to be an effective green economy pathway for achieving carbon neutrality goal in the State.

Bamboo as potential resource for biochar production in the State

Bamboo is a valuable resource for Meghalaya, contributing to the State's ecological health, cultural identity, and economy. The resource provides a wide range of opportunities, from construction materials and handicrafts to potential industrial applications. Meghalaya is home to a rich and diverse array of bamboo species, which play a crucial role in the State's ecology, economy, and culture. Bamboo, due to its fast growth rate, high carbon content, and natural abundance in certain regions, is an ideal feedstock for producing biochar. Bamboo biochar shares many of the benefits of biochar made from other organic materials, but it also has unique properties that make it particularly valuable for specific applications, such as soil improvement, carbon sequestration, and environmental remediation

A detailed bamboo resource inventory of the State was carried out by the Centre of Excellence for NRM and Sustainable Livelihoods, MBDA (CoE, MBMA, 2024). The study has estimated the availability of nearly 21 million tonnes of bamboo in the State. This availability of huge biomass makes Meghalaya an attractive region for establishing bamboo-based biochar plants/ units that may be scaled up for large scale production in a phased manner.

OBJECTIVES

The objectives of the consultative meeting are as follows:

- Review on the potential applications of Biochar in Meghalaya
- Discuss ways and means for biochar application for soil enhancement in Meghalaya.
- Explore possibilities for bamboo-based biochar production in the State.
- Discuss possibilities for leveraging carbon credit benefits from biochar initiative
- Identify Key Stakeholders and Collaborative Opportunities.

EXPECTED OUTCOMES

The ultimate goal of a Biochar Initiative in Meghalaya is to create a unified vision and actionable roadmap for biochar application in the State and reap associated benefits of soil enhancement, carbon sequestration and income generation opportunities.