LANDMARC has received funding from the European Unions' Horizon2020 Grant Agreement No 869367

BIOCHAR for carbon sequestration

Deployment, innovation and upscaling in Sweden

Overview

Biochar offers a stable and persistent form of carbon, produced from pyrolysis (thermochemical treatment at high temperature and anaerobic conditions). It is a key land-based mitigation technology (LMT) because of its wide applicability and high global potential for both carbon sequestration and emission reductions. By offering a wealth of applications that contribute to numerous ecological functions and multiple sustainable development goals, low and high-income countries alike are considering biochar as part of their strategies. Biochar is among the most cross-cutting and cross-sectoral of all negative emission technologies (NETs), as it can include multiple components and application options across a wide variety of deployment and implementation schemes.

During the past decade or so, biochar has been intensively researched and a variety of pilot tests have been undertaken across many applications. The record suggests that in addition to its direct climate benefit as a carbon sink, biochar can be used in agriculture in other profitable and beneficial ways. Biochar can help to increase yields, promote humus formation, increase the water storage capacity of soils (thus raising their resistance to drought) and reduce GHG emissions from methane and nitrous oxide as well as reducing nitrate leaching. Figure 1 provides a schematic for the main impacts.

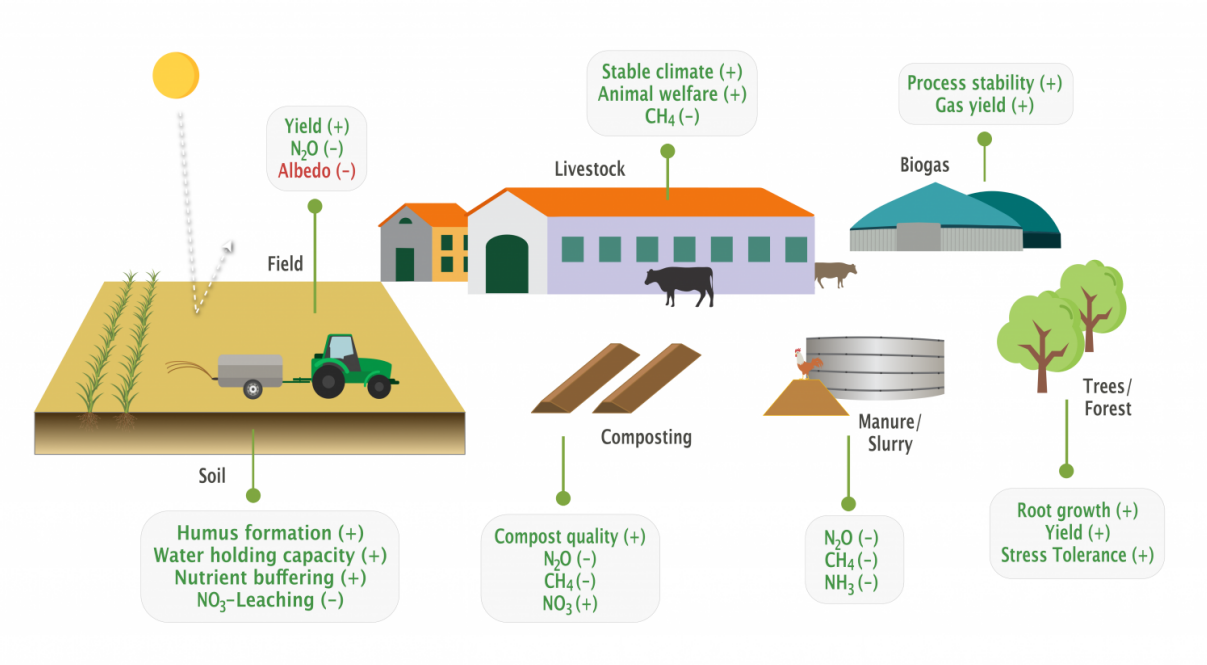

Figure 1: Biochar impacts in agricultural systems generally fall across seven categories: Soil/Field, Livestock, Energy (Biogas), Composting, Fertiliser (Slurry) and Forests (trees). Ecological and climate impacts are shown as decreasing or increasing; only one impact (albedo) is likely to be negative (in red). ***Source: EBI, 2020 [1].***

Stockholm Biochar Project

An innovative project in Stockholm (Sweden) exhibits the cross-cutting and cross-sectoral nature of biochar application [2]. Farm and garden wastes are gathered to provide biomass for conversion into gas and biochar through pyrolysis. The gas is used within the city's district heating system while the

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biochar is used to sequester carbon, enhance tree-planting, and provide soil benefits for farmers. In addition to the climate and ecological benefits [3], the project has also suggested innovative and complementary partnerships between urban and rural areas. There is considerable interest in the approach for cities elsewhere in the EU and a replication manual was developed for this purpose. There is a voluntary European Biochar Certification system for quality assurance to promote best practice.

The LANDMARC platform

This case study complements other case studies conducted within LANDMARC by looking at upscaling of biochar from the perspectives of trans-national replication and cross-regional learning. Replication of biochar applications can occur from one metropolitan region or one sub-national region to another and may also occur from the process of *outscaling*, in which innovation systems evolve through improvements in deployment, implementation and governance. Unlike economies-of-scale that depend on a greater volume, biochar as a multi-sector measure also requires experimentation across different logistical, biophysical, and economic conditions.

Stakeholder engagement is critical in ensuring the success of biochar upscaling and outscaling. The case study will operate especially at the regional level in Europe through engagement with stakeholders across the biochar value chain. Representatives from a variety of European, and international stakeholders will be consulted, such as the International Biochar Initiative, Africa Biochar Partnership, Stockholm Exergi, the World Agro-forestry Centre, and the European Biochar Industry Consortium. Cross-regional learning on biochar has been emphasised by the recently completed GEF/UNEP project conducted in six countries across Africa, Asia, and Latin America [4].

Regional Potential

The regional potential in Europe will be investigated through the use of a qualitative meta-analysis and expert consultation that will facilitate consideration of deployment and implementation constraints based on the heterogeneity of biochar applications. The results will then be used in conjunction with the E3ME modelling platform in order to compare biochar measures to other LMTs in a regional context and will also provide input to global scenario analyses.

References and Links

[1] EBI, 2020. European Biochar Industry, White Paper. https://www.biochar-industry.com/.
[2] https://www.stockholmvattenochavfall.se/en/current-projects/development/biochar/.
[3] Azzi, E. S., Karltun, E., Sundberg, C. (2019). Prospective life cycle assessment of large-scale biochar production and use for negative emissions in Stockholm. ES&T, 53(14), 8466-8476.
[4] B4SS project: https://biochar.international/.

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