

Biochar

Biochar is a carbon-rich, charcoal-like substance produced by heating organic plant material, known as biomass, that can be used in carbon storage. When applied to soils, biochar can sequester carbon at a cost of \$10 to \$350 per metric ton. Biochar has the potential to remove 0.5 to 2 gigatons of CO₂ equivalents per year globally.

Biochar is created from burning biomass feedstocks like wood or crop residues in temperature- and oxygen-controlled pyrolysis units. Biochar may be created in small units, on-site at individual farms, or at large centralized facilities. It is then scattered over the soil surface, tilled under the soil, or mixed with seeds during sowing.

Co-benefits, risks, and impact on climate

Biochar extends the durability of carbon removed by plants from years to centuries. It also protects crops from drought by holding water in the soil. In certain soils, applying exact amounts of biochar can improve soil pH and fertility.

Biochar production fuels itself without any energy inputs, but it has the potential to create ash and air pollution. Production and utilization, including transport, must be held to strict air quality standards to ensure the well-being of communities. Biochar also must be tested for heavy metals and hazardous chemicals.

Biochar may also reduce emissions of other greenhouse gases such as methane or nitrous oxide. However, spreading biochar over a soil surface darkens it, which means more energy absorption and increased warming (much like asphalt on a sunny day).

KEY TERMS

Life cycle assessment

Analysis that accounts for the total greenhouse gas impact of a product or process, starting at production and ending with use or disposal.

Soil amendment

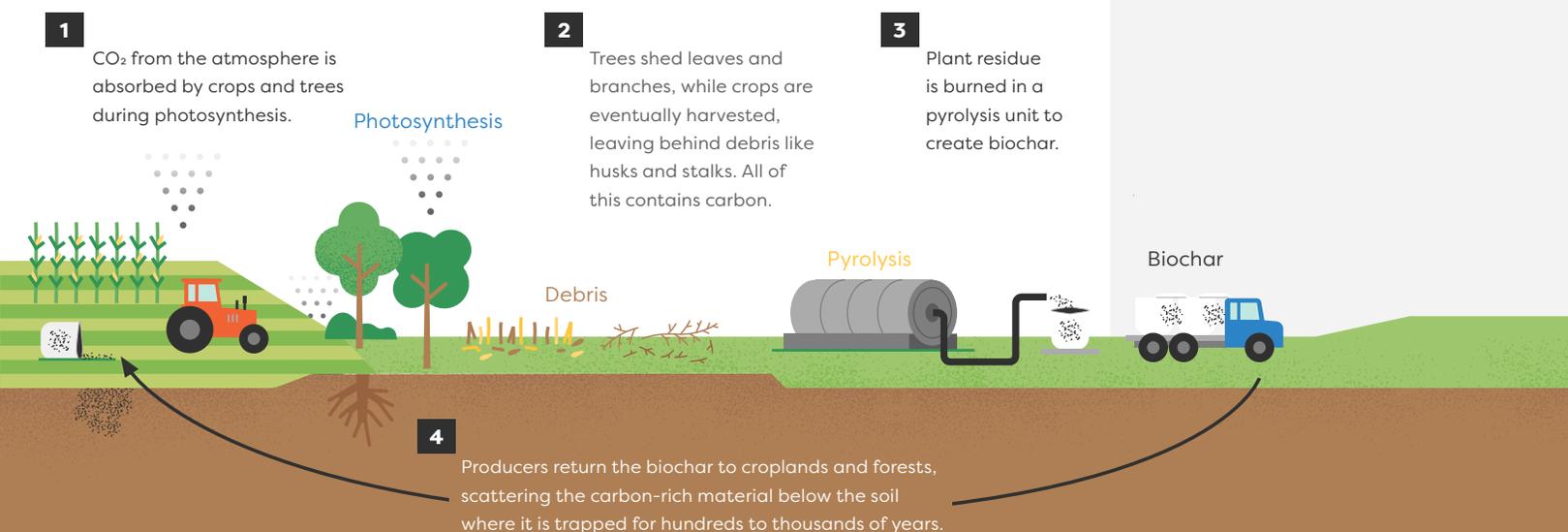
Material added to soil to improve properties such as water retention, nutrient content, and ability to sequester carbon.

Biomass feedstocks

Raw organic material that can be used to produce energy or fuel on an industrial scale.

Pyrolysis

A process that breaks down organic materials through the application of heat in the absence of oxygen.



HOW LONG DOES BIOCHAR LAST?

With careful planning, biochar application projects have the potential to trap carbon for hundreds to thousands of years. The projects that store carbon the most durably produce biochar from woody feedstocks, use coarse chunks that can withstand wind and soil erosion, and integrate biochar into the soil (at the cost of some soil disturbance).

REFERENCES

[The 3R principles for applying biochar to improve soil health](#), Mingxin Guo

[Potentials, Limitations, Co-Benefits, and Trade-Offs of Biochar Applications to Soils for Climate Change Mitigation](#), Alexandre Tisserant and Francesco Cherubini

[Biochar in climate change mitigation](#), Johannes Lehmann et al.

[Current Research Information System](#), National Institute of Food and Agriculture

Explore today's federal support for biochar with the [Carbon Removal Policy Tracker](#).

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Current policy support

The US Department of Agriculture (USDA) funds biochar as a conservation practice or co-product of bioenergy production, mostly through programs focused on research and development. Currently, there is no standalone biochar program at USDA.

USDA supports new research on biochar applications through their national labs and externally funded research. The National Institute of Food and Agriculture, for example, currently funds 351 active research, extension, and education projects focused on biochar.

The Conservation Stewardship Program (CSP) has included the application of biomass made from woody debris as a Conservation Enhancement Activity since 2019. More recently, the Infrastructure Investment and Jobs Act of 2021 (H.R. 3684) and Inflation Reduction Act (IRA) of 2022 (H.R. 5376/S. 1961) provided investments for forest products, including biochar. In January 2023, the Natural Resource Conservation Service updated the Environmental Quality Incentives Program (EQIP) Soil Carbon Amendment Practice Standard to incentivize biochar application.

Leading up to the 2023 Farm Bill, legislators have introduced proposals in support of biochar. The bipartisan Biochar Research Network Act of 2022 (S. 4895) would improve our understanding of biochar's benefits for climate mitigation and crop production, its potential for soil carbon sequestration, and the technical support farmers need to successfully apply biochar. In addition, the Agriculture Resilience Act of 2023 (S. 1016) amends the crop insurance risk reduction discount to include rewards for biochar use.

Monitoring, reporting, and verification (MRV)

Biochar carbon removal projects must prioritize rigorous certifications and MRV. Biochar durability and safety is currently verified by international standards. However, additional criteria are needed to ensure high-quality carbon removal and protections for disadvantaged communities.

For each biochar project, the purchaser should require certification of the type of biochar and its permanence and application as well as conduct a detailed life cycle assessment. Standards should be expanded to include highly site-specific impacts on soil carbon, methane, and nitrous oxide emissions, as well as air quality monitoring, to fully assess a project's impact.

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