

Black to the Future: Biochar and Forests

Developed in 2024

Biochar FAQ

What is biochar?

Biochar is a carbon-rich material created by burning woody residues (slash) in a low or no oxygen environment using either specially designed equipment, such as kilns or air-curtain burners, or in constructed hand or machine piles. Learn more here: [Biochar at a Glance](#).



What is biochar made of?

Biochar can be made from many types of organic material, such as wood, hay, or manure. The Forest Service uses the low- to no-value wood slash produced from forest management projects, such as forest thinning, to make biochar. This is a climate friendly method to alleviate issues with slash accumulation, that also provides a widely beneficial amendment for forest soils.

How is biochar made?

Biochar is made by heating woody biomass at relatively low temperatures (300° C to 700° C), then quenching the coals with water to stop combustion in a limited oxygen environment. The production of biochar can be achieved at a variety of scales, from small-scale on-site production in forests to large-scale industrial plants that require woody biomass to be transported from a given location.

How is biochar made in the forest?

Several methods exist for creating biochar from forest slash on-site. Hand and machine piles, kilns of various shapes and sizes, and air curtain burners are available. These tools can be used near a road, on a log landing, or at a centralized location near the timber harvest unit. Learn more on how to make biochar without specialized equipment [here](#).

Can existing slash piles be turned into biochar?

Yes, open burning of hand- or machine-built slash piles can be used to create biochar, but it requires some thought about pile construction or slash segregation to produce biochar. The key to creating biochar during open burning operations is to light the piles from the top and quench the coals after the flames go out so the material does not turn into ash.

You can read more on how to create biochar from hand piles [here](#).

Can I make biochar at home?

Yes, you can! Make biochar in your fire pit, a 50-gallon barrel, or any other metal container that can limit the oxygen reaching the feedstock. Individual homeowners can use biochar for gardening, slope stabilization, and revegetation.

What is biochar used for? What are some examples of projects and uses that biochar is being used for?

Biochar has a wide range of applications. They include but are not limited to:

- Storing carbon in the soil
- Pollutant remediation
- Stormwater management
- Soil amendment and soil health improvement
- Compost additive to form an enriched soil amendment
- Abandoned mine reclamation

Examples of projects include:

- Post-fire recovery
- Salvage logging dead trees
- Thinning to reduce stand density
- Invasive species reduction at log landings
- Compacted soils restoration
- Coal mine restoration/remediation
- Abandoned mine sites vegetation restoration
- Agricultural purposes
- Building soil properties to build pollinator habitat after logging



How does biochar store carbon or contribute to climate mitigation?

Biochar is ~85% carbon by weight and due to its recalcitrant structure and low nutrient content, it is very slow to decompose. Generally, the creation of biochar by careful burning in piles or equipment generates less smoke and particulates. Learn more in this [fact sheet](#) about biochar's climate change mitigation properties.

What are typical application rates of biochar?

Application rates of biochar depend on the end use. Biochar suited for assisting in plant establishment may need 1 to 10 tons/acre, whereas biochar meant to remediate a mine site could require 5 to 60 tons/acre.

Are higher applications better?

More is not always better. The range of application rates depends upon the management goals, soil type, biochar type, and climatic regimes. In general, biochar added up to 10 tons/acre is not detrimental to forest soil processes or tree growth.

Does biochar need to be mixed into the soil?

Biochar is not mixed into forest soils when the surface horizons are undisturbed. However, on highly disturbed sites such as log landings, biochar can be mixed into the mineral soil to reduce compaction and aid in revegetation with native species.

Do I need to reapply biochar regularly?

No. In forest soils that are not routinely mixed or disturbed, biochar does not require regular re-application. Applied biochar can last for hundreds of years. One exception is if the application for biochar is to remediate pollutants. Then you may need to apply more than once.

What is activated biochar? Do I need to use it?

Activated carbon is often used in filters or for specific purposes. It is activated using either chemicals or steam, which may increase its ability to adsorb heavy metals. It is often used for filtering wastewater. Because the biochar created in-woods is quenched after the fire goes out, some steam activation occurs. It is not necessary to use specifically made activated biochar unless your objectives focus on remediation of heavy metals.

How does soil type affect outcomes of biochar applications?

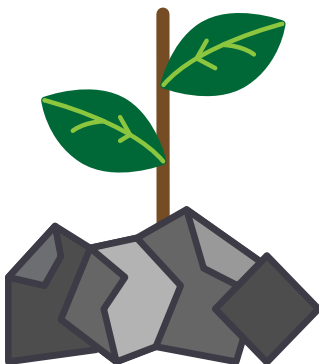
Soil texture, inherent organic matter amount, and rock-fragment content all influence how soil physical, chemical, and biological properties respond to biochar applications. In general, soils with low organic matter and that are coarse (sandy) textured, have the greatest responses in increased water holding capacity and carbon additions because overall soil fertility is low. This allows these soils to get more benefit from the increased plant available water and external introduction of carbon back into the system, promoting restoration of soil health.

What are the different types of biochar? Why and when should I use these different types?

Every biochar is different, just as every soil is different. Factors such as density, surface area, moisture content, percent nitrogen, and percent carbon also all play a role in the properties of biochar. Biochar created on-site will be different from biochar created at a fixed bioenergy or biochar production facility. If you purchase biochar from a company, ask for the biochar analyses.

Typically, biochar applied to forests can be taken from slash that is on-site or local to the site. Applications in this manner are generally aimed at revegetation, increasing soil health, and providing stability to the soil from erosion. Unless there is a need for remediating pollutants on-site, managers do not necessarily need specific types of biochar. However, conducting analyses to understand the qualities of the biochar can be helpful.

If you are applying biochar to soil for a high-value crop, then soil and biochar testing should be done, and rates should be adjusted for the soil type. See the USDA Climate Hubs' [website](#) on the Pacific Northwest Biochar Atlas for agricultural application information.



What are the different sources for biochar and how do these differ in application and results?

Biochar can be created from hardwood and softwood species. In general, biochar from conifers has consistent properties and biochar from hardwood species has variable properties. Woody invasive species can also be used to create biochar, and these species may produce biochar with different properties than trees. Factors such as density, surface area, moisture content, percent nitrogen, and percent carbon also all play a role in the properties of biochar. If in doubt about biochar properties, send a sample to a local lab for analyses.

Does the source wood determine the appropriate end use application?

In forests, biochar created on-site can usually be applied on-site. However, specific uses, such as contaminated mine site restoration, may require specific biochar types. Lab testing of the soil and biochar will help determine the appropriate combinations.



Where can I find more information on biochar producers and suppliers in my area?

The Rocky Mountain Research Station has a [webpage](#) dedicated to biochar, highlighting events, communications products, and publications. For additional information, including case studies on biochar use, check out the [Pacific Northwest Biochar Atlas](#), a tool developed with support from the Northwest Climate Hub and partners.

The United States Biochar Initiative (USBI) has a database of information on many of the U.S. biochar producers and suppliers in the country. You can visit their [website](#) to learn more.



USDA Forest Service photo
by Rick Fletcher

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