

# Finally, a Market for Slash

By Deborah Page-Dumroese

**H**arvest operations frequently result in an excess of woody material that has traditionally been burned in slash piles. Finding a way to turn this no- or low-value woody material into a value-added product has been the holy grail of researchers and forest managers. Since 2009, a research team at the USDA Forest Service Rocky Mountain Research Station (RMRS) has explored the logistical and economic feasibility of turning this excess woody material into biochar. We now have the data to demonstrate the benefits of biochar and the methods to have biochar provide an economic return to landowners or entrepreneurs.



## Biochar basics and benefits

Biochar is produced by the burning of woody debris under low oxygen conditions. It is essentially charcoal, but because it's used as a soil amendment instead of burning for fuel, it's called biochar.

Because of its porous structure, applying biochar to soil results in a number of benefits. It's useful for retaining water on-site and can improve infiltration and decrease soil bulk density. In addition, many soils also have increased water available for plants. Because of the high cation exchange capacity of biochar, it is also useful for retaining nutrients on-site and reducing leaching losses. Crop yields have been shown to increase 10-42 percent with biochar additions, with the greatest increases on low-nutrient soils. (One note of caution: All soils are not the same and all biochar is not the same. Using woody biomass to create biochar results in a product that has a pH of approximately 7.0-8.0. However, some tree species or woody shrubs converted to biochar result in biochar with very high or very low pH—it's important to know your biochar and your soil before application.)

Biochar has demonstrated value in



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**A kiln one type of in-woods processing method for turning woody biomass into biochar. Many types of woody biomass can be used, such as this pinyon juniper that is being loaded into a big box kiln.**

rehabilitating log landings and skid trails post-harvest or obliterate illegal or decommissioned roadbeds. It can reduce invasive species colonization, and keeps the compacted soil layer from re-compacting. Sites with biochar additions often experience improved native vegetation success and increases in pollinator plants and insects due to the enhanced soil health.

Another benefit of using biochar as a soil amendment is as a solution to mitigating climate change. Biochar has variable effects on greenhouse gases, such as carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O) flux, when measured in agricultural soil that had biochar mixed into the soil profile. My colleagues and I conducted a study in Idaho, Montana, and Oregon on managed forest sites whose soils were amended with biochar; we measured greenhouse gas emissions, soil carbon content, and tree growth. We found that forest soils amended with biochar had a 41 percent increase in soil carbon content with no negative impacts to the surrounding forest.

When looking at the economic benefits of biochar, research conducted by Dan McCollum, an economist with the RMRS, and colleagues determined that biochar does have tangible benefits, such as job creation and rural economic development. Jobs needed to support a biochar industry include harvesting the woody biomass, making the biochar, delivery drivers, and biochar applicators.

Biochar production facilities can be more economically feasible to construct than other wood product operations, because they can operate at a range of scales and complexities. Facilities can also be distributed across multiple rural communities, spreading economic activity and benefits where there are sources of woody biomass. Biochar demand will likely increase with successful policy development that support implementation of CO<sub>2</sub> drawdown methods to sequester carbon and improve soil health.

## Making biochar

There are numerous in-woods processing methods currently available. These range from creating biochar in specially built slash piles, kilns, or transportable air curtain burners.

- **Slash piles**

To maximize the creation of charcoal, burn piles are elevated above the soil surface on large logs, with smaller material piled perpendicularly on top. Grapplers are used to build a pile on the base logs. If the piles are built so they can be burned from the top, a 'flame cap' develops that reduces particulate and smoke emissions. Even if slash piles are not elevated, quenching the coals when the flames go out will reduce soil impacts from pile burning and produce biochar.

- **Kilns**

Kilns are widely used for small-scale projects where open burning is restricted. When the woody debris is burned,

a 'flame cap' develops that emits fewer emissions than pile burns and wildfire. Kilns vary in size from small (3' diameter circular kiln) to large (12' long x 5' wide x 5' deep). Wood should be dried about 6-12 months after harvest before burning in piles or kilns.

• Mobile Biochar Processing & the CharBoss

Air curtain burners, also called air curtain incinerators or fire boxes, are another method for on-site biochar production. A team of researchers, which included myself, Forest Service managers, and the U.S. Biochar Initiative, worked with Air Burner Inc. to innovate ways to create a new air

curtain burner. We were recently awarded a patent for our mobile biochar production system designed for their air curtain burner, and the new system is called the CharBoss.

The CharBoss has fewer size and moisture content limitations than existing mobile biochar production machines,

and it can consume material from most burn piles with minimal to no preparation. The new technology immediately quenches the coals to reduce the risk of fire and increase the rate of application or transport to another site. The system can burn at a rate of 1 to 2 tons of feedstock per hour. This new equipment will be available to order from Air Curtain Burner, Inc. in fall 2022.

Although creating biochar does not result in the particulate and smoke emissions as a traditional slash burning, some are released. In our field trials, we still secured burn permits. If forest managers are considering creating biochar, we advise for them to work with the agency that issues the burn permits to work through the regulatory approvals.

### Getting biochar to the market

With the biochar market still in its infancy, the good news is there a demand for this product, particularly once forest managers see the data supporting its ecological benefits. The six primary markets for biochar are large-scale agriculture and livestock facilities; forest management; mine reclamation or restoration; urban trees, brownfield remediation, and golf courses; horticulture, native plant nurseries, community gardens; and industrial applications such as activated carbon for filtration. More recent advances in using biochar include mixing it into asphalt, concrete,

and other building materials and using it for wastewater treatment facilities. With a robust biochar market needing sources of woody debris, forest restoration projects can become more affordable and efforts to reduce wildfire risk more cost-effective.

The question we frequently receive is how can forest managers connect their biochar to buyers. Since one focus of biochar production is to make it in-woods, we suggest working within a watershed to find the most appropriate locations for biochar application. As demand grows it may become more economically feasible to sell biochar to the other markets.

And I'll close with what one early biochar tester, Jessie Salix, a forest botanist on the Beaverhead-Deerlodge National Forest, shared with my team, "If you make it, they will come." *WF*

This article was adapted from *Biochar Basics: An A-to-Z Guide to Biochar Production, Use, and Benefits*, a Science You Can Use Bulletin by the RMRS (pending publication) produced by the US Forest Service Rocky Mountain Research Station.

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PHOTO COURTESY OF USDA FOREST SERVICE

**One type of air curtain burner is the new CharBoss; this CharBoss is a demonstration-sized model that is ready for testing in Oregon. It's estimated that its throughput to be close to one ton a day depending on factors that include moisture content of the woody debris and equipment operation.**



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