

Black to the Future: Biochar and Forests

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Making Biochar with Hand-Built Piles

Woody biomass waste material is generated as a byproduct of forest management activities, defensible space clearing, tree trimming, or removing hazard trees. These activities take place on public and private lands and are designed to reduce hazardous fuels and improve ecosystem resilience to wildfire. However,

the material often has little value, or transportation distances to bioenergy plants are too far for making use of the wood. Open burning of slash piles near the site of biomass generation is the usual method used to dispose of slash piles. Another method that land managers can use is the construction of hand-built piles

to create biochar, which also provides a host of soil benefits such as water storage, soil health, and carbon sequestration. Hand-built piles are a place-based solution to disposing of woody residues that range in size from 1 to 10 inches size. The piles are constructed and then burned when conditions are favorable (i.e., soil moisture, wind, temperature). Rather than piles being allowed to smolder for long periods turning the wood to ash, piles burned to create biochar are quenched as soon as the flames go out. Quenching can be done with water or by raking out the coals.


One concern with burning slash piles is soil heating, which can kill microbes, change nutrient availability, and destroy soil organic matter. Soil heating after pile burning may also result in loss of a seed bank or increases in invasive plant cover. Hand-built piles created for biochar production are generally simple to construct, are not costly to implement, and do not result in detrimental soil impacts, but may require land managers to adjust from traditional pile construction and burning methods to biochar-generating piles. The focus of the guide below is on hand-built pile construction.



Hand-built piles on the Umatilla National Forest. USDA Forest Service photo by Debbie Page-Dumroese.

Pile Construction for Creating Biochar

Hand-built piles tailored to biochar production do not look like regular slash piles. Here are some pile building tips to maximize biochar production:

- Make a loose stack of wood by placing one piece of wood at a time. Piles should not be compacted so they get adequate airflow.
- No care is needed to elevate the pile above the ground. Piles typically rest on a few supporting branches or logs.
- Piles can be square- or triangle-shaped. 
- If piles will be burned in the winter, it will help to cover them until the day they are lit.
- Light the pile from the top.
- Quench (or rake out coals) before coals turn to ash.
- Larger material at the bottom of the pile will help to protect the soil, while lighting the top of the piles develops a "flame cap." This technique contains the combustion, which helps the wood burn more efficiently and creates less smoke.
- Once the flames go out, the coals should be either raked out across the soil or quenched with water to conserve as much charcoal as possible.



Advantages and disadvantages of using hand piles to create biochar

Advantages:

- No specialized equipment is required.
- Soil heating is reduced.
- Top-lighting creates a more efficient burn.
- The process sequesters carbon as biochar.
- The method provides an opportunity to engage conservation groups or the local community in forest restoration activities (if they are constructing piles).
- Biochar can be used where it is made and provides both soil benefits and a method to sequester carbon.

Disadvantages:

- Biochar production in slash piles is less efficient (length of time) compared to kiln-based or mobile equipment methods.
- Biochar quality can be variable (depending on feedstock, moisture conditions, burn temperature, etc.).
- Quenching the coals requires water, and raking takes practitioner effort.
- The method requires contractors and staff to adjust to a different method that they may not be used to.

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