



Biochar (right) is the carbon-rich solid produced by heating biomass (left) under low-oxygen conditions. Courtesy photo by Biomacon.

# Converting Biomass to Biochar Delivers a More Sustainable Future

Converting biomass to biochar offers exciting opportunities to support U.S. Department of Agriculture (USDA) Forest Service priorities such as mitigating climate change, improving forest and soil health, decreasing wildfire risk, bolstering water retention, and revitalizing rural economies. Biochar is fine-grained charcoal found naturally in soils around the world because of fires. Higher quality biochar can also be manufactured cleanly and efficiently in specially designed, low-oxygen furnaces that heat sustainably procured biomass, such as forestry and agricultural byproducts like logging slash, plant material, and manure.

Wood Innovations Success Story: Biomass to Biochar

Despite the growing number of studies increasing understanding about the material, technical, economic, and policy barriers have prevented biochar from realizing its full potential. To reduce these barriers, the Forest Service Wood Innovations Program, with support from Forest Service Research and Development, brought together 40 biochar producers, practitioners, scientists, and engineers in 2020. The group charted a roadmap for future development of the biochar industry in the Pacific Northwest and beyond. The result was a 184-page report: [Biomass to Biochar: Maximizing the Carbon Value](#).

“The work we did in 2020 is serving as a springboard for current efforts to support biochar nationally. We are seeing elements of the roadmap being used by a variety of players as they make proposals and implement projects to expand the impact of biochar,” says James Amonette, one of the lead authors of the report. Amonette is a researcher with Washington State University’s Center for Sustaining Agriculture and Natural Resources and the U.S. Department of Energy’s Pacific Northwest National Laboratory.





This biochar production unit and loader are an example of moderate-scale biochar production using an invasive woody plant called gorse. USDA Forest Service photo.

## MAXIMIZING THE CARBON VALUE OF BIOCHAR

When it comes to mitigating climate change, soils have significant capacity to store carbon; amending soils with biochar can greatly enhance this potential. Biochar is also an important tool to improve forest and soil health by increasing soil pH and water retention.

“Stimulating markets for biochar could also help mitigate wildfire risk by providing cost recovery for forest thinning operations and encouraging harvest of low-value wood that might otherwise be left as fuel on the landscape,” says Georgine Yorgey, associate director of the Washington State University Center for Sustaining Agriculture and Natural Resources and a lead author of the report. “There is also a secondary climate change benefit because without a market for biochar, low-value forest residues are often burned as a way to get rid of them.”

Biochar’s potential to revitalize rural economies is another huge plus. Consider that a typical wood gasifier facility could produce 49,600 tons of biochar and 660,000 MWh of energy annually. With steam generation, the facility could supply 19 MW of electricity to the local grid, enough to power 15,000 homes, and still have 57 MW of thermal energy available for other purposes such as space heating homes, businesses, and greenhouses. A plant this size could potentially provide 35 jobs and support 120 people in a rural community.

## NINE RECOMMENDATIONS FROM *BIOCHAR: MAXIMIZING THE CARBON VALUE*

1. Quantify biomass-to-biochar conversion efficiencies.
2. Quantify avoided emissions compared to open burning.
3. Compare different systems for accessing stranded biomass.
4. Evaluate carbon market potential.
5. Develop planning and cost tools for contractors.
6. Develop workforce training programs.
7. Ascribe monetary value to the social and ecosystem services provided by biochar.
8. Develop outreach and education networks.
9. Create an open access research and information clearinghouse.

### More Information

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## FAST FACTS

- Biochar is fine-grained charcoal, found naturally in soils, that can be manufactured cleanly and efficiently in specially designed, low-oxygen furnaces
- Biochar can mitigate climate change, improve forest health, and bolster water retention in soil
- Biochar helps mitigate wildfires by encouraging harvesting low-value wood
- Biochar can revitalize rural economies



Biochar can be composted with manure, soil, or other organic material to create a higher value product—in this case using an invasive woody plant called gorse. USDA Forest Service photo.