

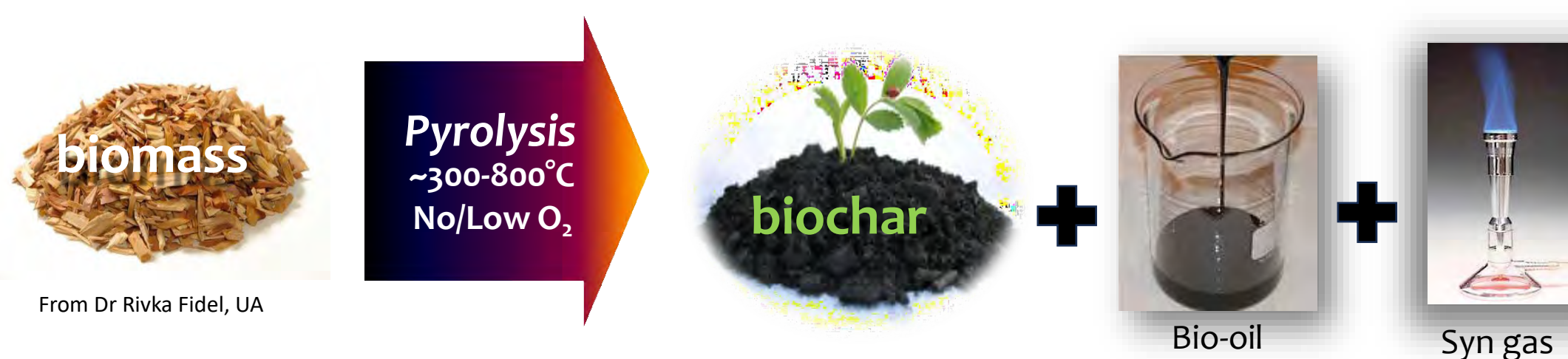
Biochar Demonstration Kiln: A PILOT EXTENSION PROGRAM

What Is Biochar?

Biochar is charcoal used for land and water applications. Unlike typical charcoal which is used as a fuel, biochar is valued for its various sorptive properties and its ability to reduce emissions from biomass that would otherwise naturally degrade into greenhouse gases (<https://biochar-international.org/faqs/>). It's potential as a forest product made from small diameter biomass is promising.

How is Biochar Made?

- Biochar is produced by thermal decomposition of organic material (such as wood, manure or agriculture residue) under limited oxygen conditions and at relatively low temperatures (<700°C).



- Production is scalable from a backyard KonTiki grill to industrial gasifiers to Air Curtain Burner, Inc.'s CharBoss.



- Flame-cap kilns are a practical tool for small-scale biochar production, and Extension outreach.



What Is Biochar Good For?

Biochar can turn sources of carbon and woody waste into products with valuable properties. It is a direct and effective method of carbon sequestration. Many researchers and entrepreneurs are seeking ways to increase the demand and benefits of biochar.

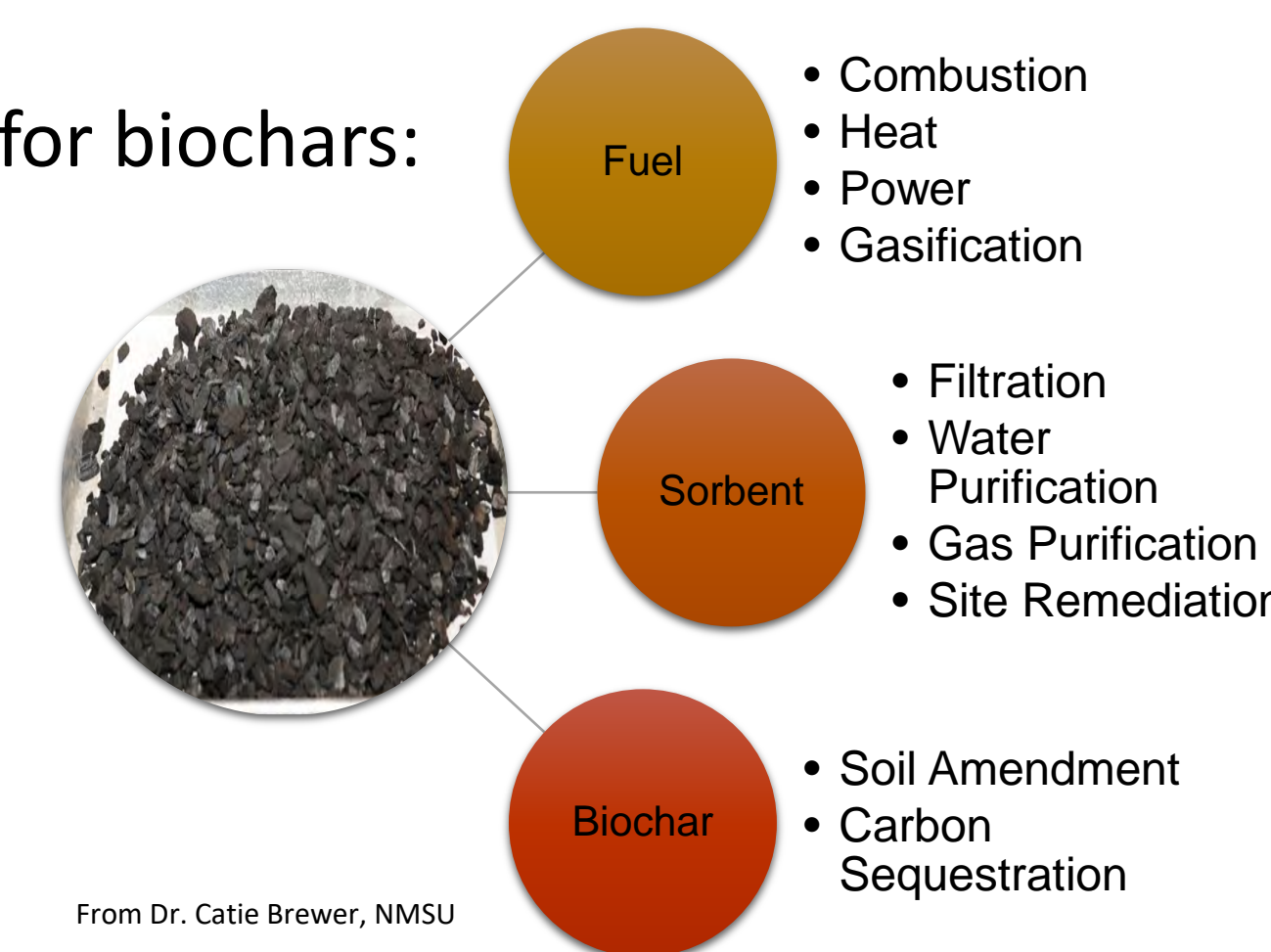
Supply and Demand



Supply sources for biochar are limitless. Hazardous fuels in forests and wildland urban interface communities, woody urban and yard waste, and agriculture residues can be used to make biochar.

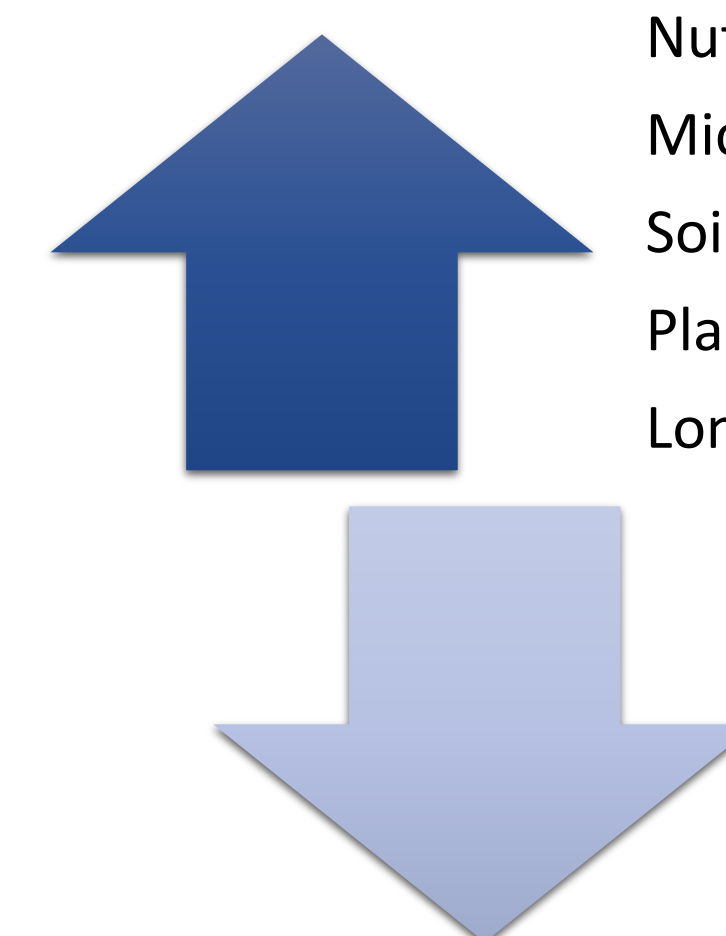
Uses for Char

There are many market opportunities for biochars:



Organic Soil Amendment

Works like a sponge to hold moisture and nutrients in the root zone:



Nutrient Use Efficiency
Microbial Activity
Soil Organic Matter
Plant-Available Water
Long-Term Crop Yields

Fertilizer/Irrigation Needs
Greenhouse Gas Emissions
Nutrient Leaching
Soil Bulk Density

From Dr. Catie Brewer, NMSU

Water Quality

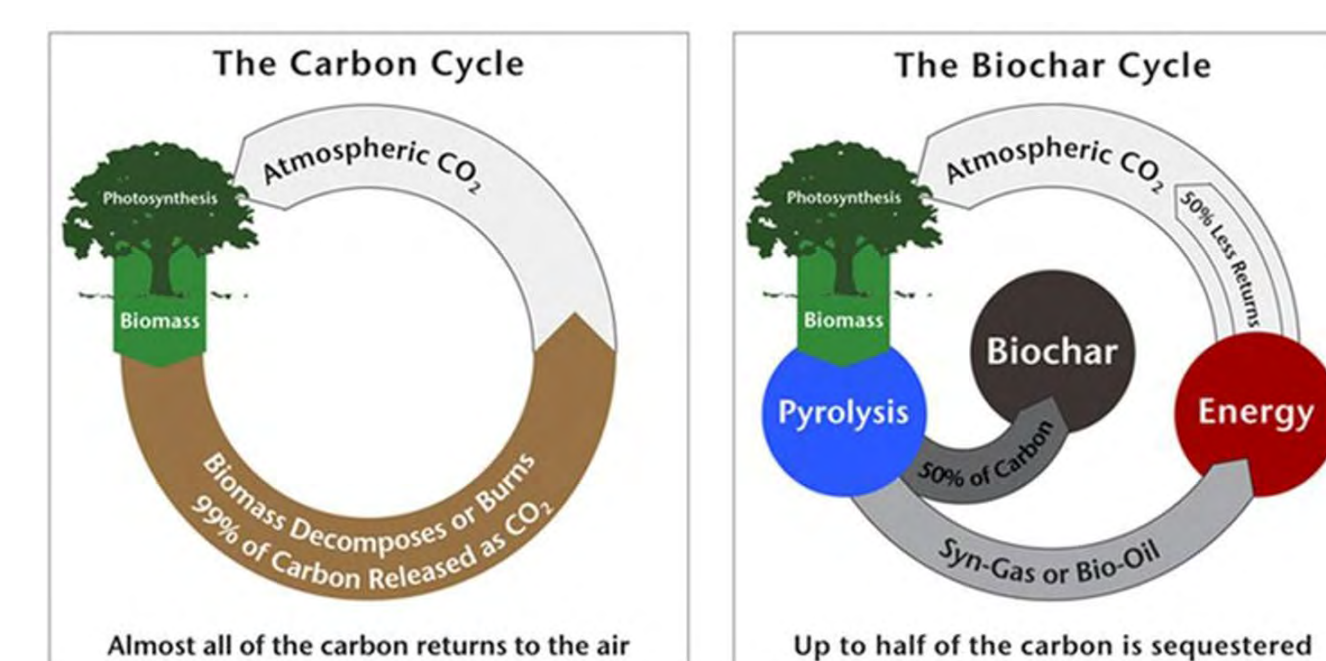


Biochar has a highly sorbent surface. It can capture and filter pollutants out of water, including metals. Biochar has been successfully used in the wastewater treatment process. Its sorptive properties can benefit stormwater systems, dairies, landfills and mining reclamation sites.

From <https://extension.psu.edu/using-biochar-for-water-quality>

Carbon Sequestration

Biochar retains roughly 50% of the original carbon source. When applied to soil, it sequesters that carbon for centuries, reducing atmospheric CO2 by removing it from the active cycle. Biochar also enhances plant growth which, in turn, absorbs more CO2. When produced sustainably, the biochar process is carbon negative.

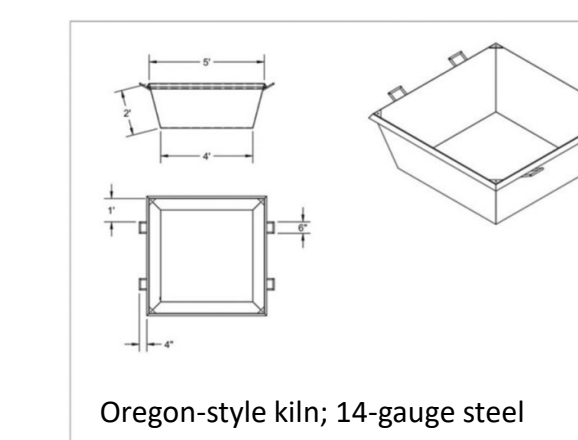


Biochar Extension Program

After collaborating with USU Wood Products Extension Specialist Darren McAvoy, UA Extension Agent Chris Jones initiated a pilot Extension program in 2021 to raise awareness about biochar and encourage adoption. Demonstration participants learn about building a portable flame cap kiln to make biochar. Details such as burn permits, fire safety, a water source, and lighting and quenching the fire are discussed. Biochar is popular with early adopters.

Program Inputs and Outputs

- Contracted local construction of two 4'x4'x2' metal kilns for demonstration.
- Invited Darren McAvoy to conduct initial workshop in Globe, AZ in March 2022.
- Cultivated partnerships with state and local fire leadership to provide fire safety support at demonstrations.
- Live demonstrations to date: 9
- Classes, webinars and presentations: 7
- Total participants to date: 370



Clockwise from top left corner: Design diagram for biochar kiln; Darren McAvoy in Globe, AZ for first biochar kiln demo; Chris Jones and participants at kiln demo at the brush pit in Pine, AZ; Participant loading biochar for his garden, Pine, AZ. Image credits: Chris Jones

Program Evaluation

50 surveys from live kiln demonstrations showed the following outcomes:



Biochar Challenges in Arizona

All biochars are not created equal (McLaughlin *et al*, 2009):

- The carbon source or woodstock, temperature, time and oxygen levels at which is it made, will affect the variable attributes of a biochar, including cation exchange properties and sorption capacity.
- While turning forest biomass into biochar may increase value, production and transportation costs are still high.
- Carbon markets are voluntary and do not cover the cost from production to application.
- Matching specific biochar properties to specific problems may help create greater value and market demand.

McLaughlin, H., Anderson, P.S., Shields, F., & Reed, T. (2009). All Biochars are Not Created Equal, and How to Tell Them Apart. N. Am. Biochar V. 2.

