

Soil Health & Carbon Farming

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Charlie McIntosh, Pacific Biochar



What is Biochar?



Biochar: biomass charcoal when used or found in soils

Biochar + Soil Health

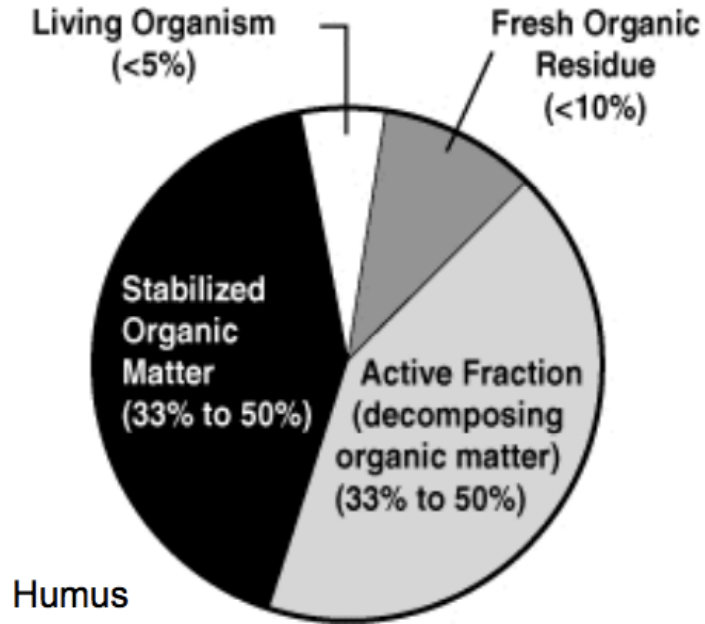
SOIL ORGANIC MATTER

- Biochar is a natural component of soil organic matter
- Seasonal fires deposit biochar in soils where it accumulates over time
- People have used biochar to improve soils for millenia (ex. Terra Preta soils of the Amazon Basin)
- Fertile soils around the world often contain high levels of biochar ~30-50% of SOM



Photo courtesy of Julie Major and Bruno Glaser

Organic Matter



Biochar forms a portion of the “Stabilized Organic Matter” pool in soils

Biochar + Soil Health

SOIL BIOLOGY

- Biochar provides an ideal micro-habitat for soil organisms
- Porous surfaces retain air, water and nutrients available for microorganisms and root hairs
- Studies consistently demonstrate enhanced biological activity in soils & composting using biochar



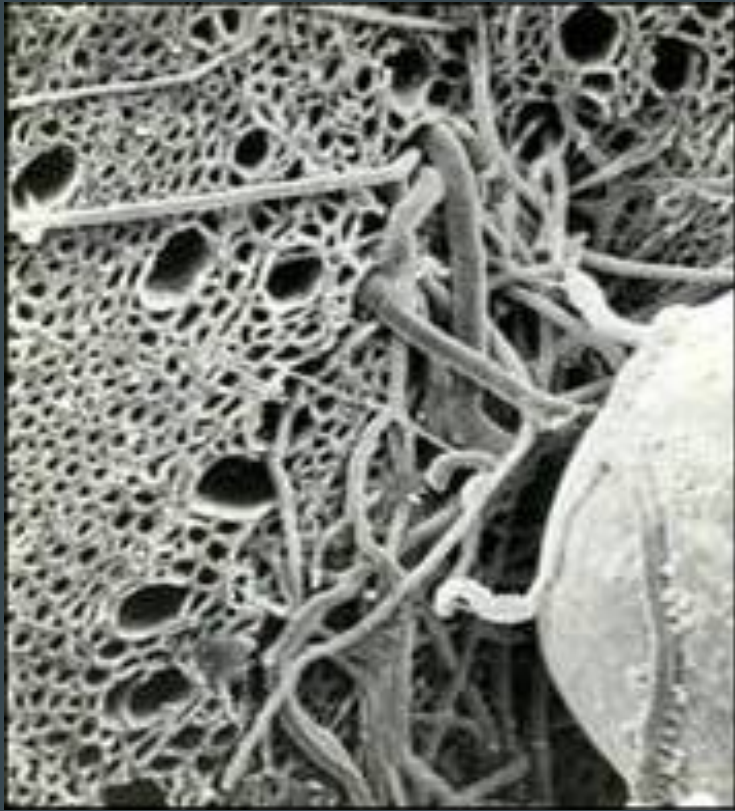


Photo showing microstructure of biochar particle and fungal hyphae extending from spore, courtesy of Ogawa

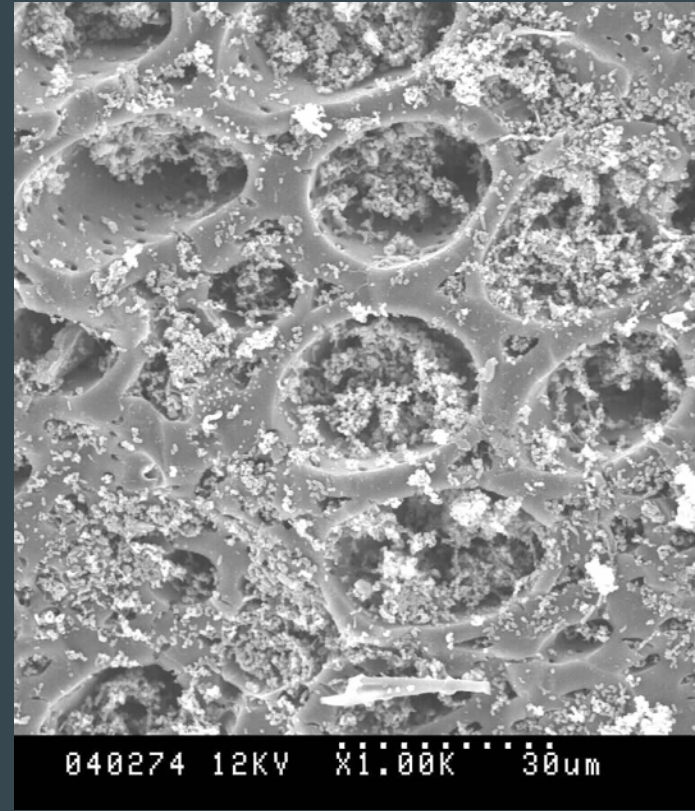


Photo showing the organic coating formed on biochar surfaces and pores, courtesy of Yoshizawa

Biochar + Soil Health

WATER & NUTRIENT CONSERVATION

- Biochar acts like a sponge
- Micropores retain moisture while macropores allow drainage
- Improves plant available water in sandy and heavy clay soils
- Biochar acts like a filter
- Reduces leaching & volatilization of nutrients, especially nitrogen





Biochar + Compost

COMPOST QUALITY

- Biochar-amended compost improves compost quality and maturity while the biochar is improved by microbe colonization and surface complexing
- Faster maturation due to increased microbial activity
- Increased measures of maturity (i.e. HA : FA, respiration rate, aggregate stability)



Biochar + Compost

BIOCHAR-AMENDED COMPOSTING

- Composting is a powerful tool for soil health & carbon farming made more effective with biochar
- Emissions from composting represent a loss of nutrients
- Incorporating biochar during active composting can dramatically reduce NO_x and NH_3 emissions, odors, bulk density, and nitrogen losses





Biochar Production: Small-Scale

CONSERVATION BURNS

- On-farm biochar production transforms agricultural residues into tools for building soil health
- Top-lit piles combust volatile gases released from heated biomass below
- ~50% of biomass carbon remains as biochar after quenching
- Quenching ensures biochar does not smolder to ash



Photo courtesy of Wines and Vines

Biochar Production: Large-Scale

CALIFORNIA BIOMASS MANAGEMENT

- California woody biomass resources ~40 million BDT/yr
- Forestry & Agricultural residues can be utilized to produce biochar
- Alternative fate considerations
- Biochar produced from woody biomass and pyrolyzed at $>500^{\circ}\text{C}$ for sufficient time can persist in soil for over 1000 years



Biochar Field Day @ Shone Farm - SRJC

BIOCHAR TOPICS:

- How biochar is produced on-farm and at large-scale
- How biochar is used on farms, vineyards, and rangelands
- How biochar is used in composting
- Impacts on climate change, biomass management, and soil health

Join us for a hands-on biochar workshop at Shone Farm in Fall 2019!

BIOCHAR DEMONSTRATIONS:

- Conservation Burn + On-Farm Biochar Production
- On-Farm Biochar Applications using common agricultural equipment
- Biochar in Composting



PACIFIC
BIOCHAR