Deborah "Deb" Neher, Soil ecologist, 10 July 2025, Rich Earth Institute Field Day
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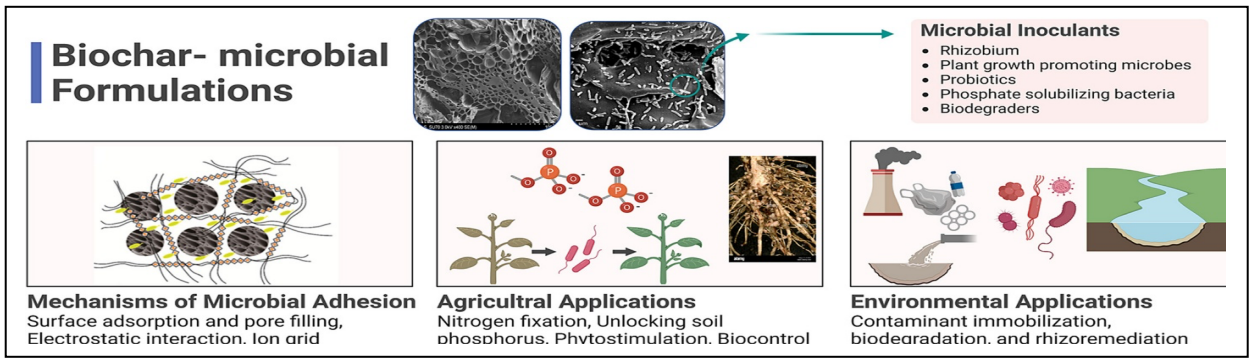

Characteristics of a healthy soil are those that promote healthy plant growth:

- efficiency and efficacy of nutrient cycling
- capacity to hold and release plant-available water
- an environment conducive to root growth, supportive of beneficial soil organisms and improved resilience of plants to stress from pests, diseases, drought and/or heat

Biochar vs. compost

- Biochar affects physio-chemical more than biology; compost adds organic matter and microbes
- Both reduce bulk density; increase porosity, water holding capacity, and soil aggregate capacity
- Compost & biochar together are more effective in stabilizing and sequestering C than biochar alone

Factors that affect microbial community diversity & function

- Generalizing the impacts of biochar on soil microbiomes is a difficult task
- Pyrolysis temperature: lower has more available C
- Low pH sorbs pharmaceuticals: higher pH increases nutrient recovery
- Pyrolysis temperatures are proportional to pH increases
- Pore sizes: Majority of pores < 50 nm (smaller than bacteria; so mostly surface colonization)
- Application rate: too much suppresses microbial activity
- Soil type: biochar most effective on fine and coarse soils

Potential risks of human urine & biochar made from biosolids in terms of soil health

- Introduction of external microbes can disrupt native microbial community
- Biochar can sorb pesticides and herbicides reducing their efficacy
- Biochar can contain potentially toxic elements from biosolids and manure containing Cd, As, and Pb
- There can be other microbial inhibitors such as phenols, carboxylic acids, ketones, PAHS etc.
- Low molecular weight, oxygenated volatile organic carbons (VOCs) in fresh biochar can be toxic to microbes generally
- Persistent free radicals produced during pyrolysis can be toxic to bacteria by damaging DNA
- High salinity of mixed urine & fecal biochars should be considered before application