Week 1 Notes

From "Biochar Application" by T. Komang Ratebiso, Senior, and Caroline H. Orr.

- What is biochar?
  - Biochar is a carbon-rich solid that is produced when carbonizing biomass, known as S- usually burned & temps between 300°C - 1000°C (pyrolysis) under low oxygen conditions.

- Pyrolysis usually gives 3 products
  - Bio-oil (liquid)
  - Biochar (solid)
  - Syngas (gas)

- Many factors contribute to the final product: Feedstock, temp, pressure, time, heating, & rate.

- Charcoal & biochar differ by intended use. Biochar = soil treatment, carbon storage, or filtration of water.

Feedstock - This can determine final chemical composition.

- Temps & pyrolysis rate can determine surface area, pore size/volume/distribution, sorption of biochar
Biochar produced at temps (>550°C)
- Biochar has higher surface area
- Increased aromaticity and therefore high recalcitrance
- Good adsorption rates

Biochar produced at temps
- Higher yields
- Potentially more phytotoxic
- May improve soil fertility
- Increased functional groups which provide sites for nutrient exchange

Temp + pyrolysis time determine CEC.

Pg 6: Feedstock + pyrolysis temp can determine carbon retention.

- Adding biochar to soils can act as soil benefit +
  also sequester carbon.

Pg 6: Biochar can also help mitigate greenhouse gases such as N₂O + CH₄
  - Pg 6: Rondin et al. (2005)
  - N₂O reduced by 60% in rice field
  - CH₄ fully mitigated / application.
Biochar + Agriculture:
Biochar's potential:

1) Microbial stimulation in the rhizosphere
2) Less fertilizer application
3) Carbon sequestration
4) Improved soil moisture-holding capacity

*One biochar is not the solution for all ecosystems.

- Biochar pyrolyzed @ 400-700°C may be best for C sequestration.
  - Has higher recalcitrance which means it will stay in soil longer but also has reduced CEC.
- Production @ 250-400°C have more C=O + C-H bonds which allow for easier oxidation + therefore more exchange sites.

- Positives of Biochar

  - Improve soil pH
  - Improve CEC
  - Help P + S become usable
  - ↑ Water-holding capacity
  - ↑ Soil bulk density
  - Reduces # of pathogens
  - Promotes mycorrhizal relation.