Soil- The living skin of the earth
Is the key to any successful eco-restoration effort

http://geosci.uchicago.edu/solids/images/earth_interior.jpg
Natural soil formation

• Thousands and thousands of years
• Five factors of soil formation-
  - Parent material
  - Topography
  - Climate
  - Organisms
  - Time
• Natural soil formation results in soil horizons
You mostly care about that top horizon ‘A’

1. Zone of greatest biological activity
   - Highest organic matter
   - Highest concentration of plant roots

This soil was built in a couple of weeks
You care about:

- Soil fertility (N, P, K, S, Ca, Mg, Fe, Mn, Cu, Zn, Mo, B, Co, Se)
You care about:

- Soil physical properties
  - Texture
You care about:

- Soil physical properties
  - Bulk density

0.6 g cm\(^3\)

2.65 g cm\(^3\)
You care about:

- Soil pH
You care about:

• Soil electrical conductivity

Measured in units dS m
Values of concern are > 2decisiemens
Soil Carbon

• Is the pretty much easy answer for many of these things
• Start with physical properties
  – Reason so important is for root penetration, water infiltration, water holding capacity, and air flow
How fast water goes into the soil
How well soil holds onto water

Early grown of corn on control (left) and compost amended (right) Plots on Woodstown silt loam soil (Epstein and Chaney, 1974).
Strongly wilted corn on control plot in experiment with biosolids
Compost application to Woodstown silt loam (Epstein and Chaney)
Corn on biosolids compost treated soil on same day as control plot corn was strongly wilted (Epstein and Chaney).
Look at soil bulk density

- Kate’s Soil
  - Borrow pit for a landfill
  - Restored with a range of composts made from municipal residuals
Carbon and plant nutrients

- Organic matter will have all essential nutrients
- C:N ratio key factor
Adding carbon also increases plant growth
Which in turn provides more food
You can build soil quickly—generally by adding organic matter.
Surface application of biosolids and wood ash

Biosolids and lime, incorporated

Biosolids sugar beet lime, CaO

Surface application of compost and wood ash

Lime stabilized biosolids + Fe
Joplin- 12 years+1 drought in
When you build a soil
Realize that we make soil building basics every day
Compost is available up and down the state

And that the people that manage these resources are not used to being sought after
What are biosolids?

(Compost is about the same - less water, less N and P)

**Water** - 60-80%

**Carbon** 4-10% (20-50%)

K, Ca, Mg, Mn, Cu, Fe, Zn < 1%

N 0.4 - 1.4% (2-7%)

P 1-3%
Biosolids are available where there are people.

http://www.casaweb.org/biosolids
When you built a soil

- Realize that there are guidelines but not precise formulas
- Want to add enough amendment to keep it self sufficient in organic matter cycling
- Don’t go make hay- let the site reestablish
- Don’t give up if you need to re-apply- remember we make more every day
Also realize that a healthy soil is a building block for a native ecosystem—other ingredients are required.