



# Soil Health

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## What is soil health?

- ▶ 42 attributes identified (e.g., carbon, pH, water holding, nitrogen, infiltration, fungi, etc.)
- ▶ Chemical, physical, and biological, and environmental flux properties
- ▶ Organic matter content is key across all health measures

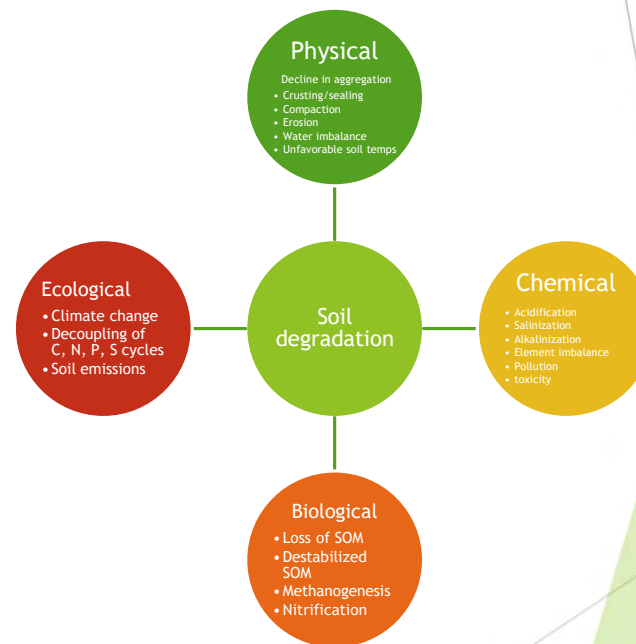


## Why healthy soils?

- ▶ Clean water
- ▶ Crop production
- ▶ Reduced erosion
- ▶ Resilience to climate change
- ▶ Sustainable forest/range production
- ▶ Greenhouse gas emissions
- ▶ Jobs

# Soil Organic Matter - what do I need?

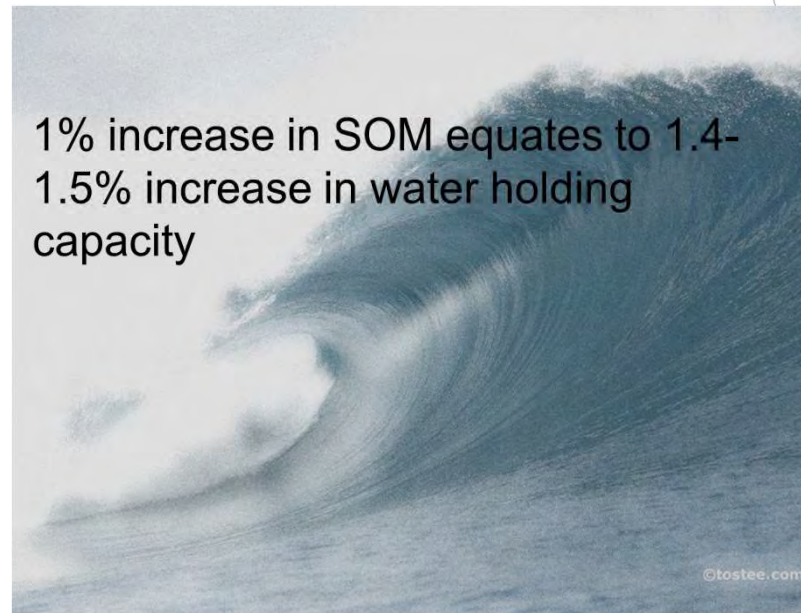
- Critical threshold of soil organic matter is ~2% in the temperate zone
- Agricultural crop yield is positively correlated with SOM
- Inputs of N fertilizer and irrigation water can be saved by increasing SOM content
- Nearly 2/3 of soils are lacking sufficient SOM





## Building healthy soils

- ❖ crop residues
- ❖ cover crops
- ❖ wood chips
- ❖ biosolids
- ❖ biochar



Libhova et al. 2018. Reevaluating the effects of soil organic matter and other properties on available water-holding capacity using the National Cooperative Soil Survey Database. JSWC. doi:10.2489/jswc.73.4.411



## Using biochar to improve soil health

- ▶ Biochar can be used for:
  - ▶ Mine site restoration
  - ▶ Range
  - ▶ Forests
  - ▶ Agriculture
- ▶ Improve
  - ▶ Pollinator species
  - ▶ Water movement/quality
  - ▶ Soil cover

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# Biochar logistics

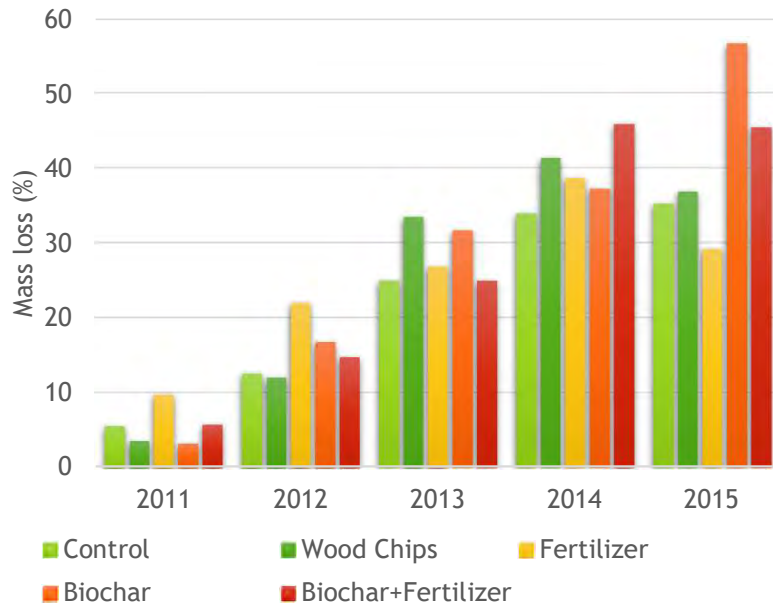


- Biochar spreader
  - Works on slopes up to 35%
  - Adjustable spread width and rate
- Tune application rates
  - Soil texture and other properties
  - Inherent OM content
  - Biochar properties
- Application sites
  - Skid trails
  - Log landings
  - Mine sites with no vegetation

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# Long-term biochar results -

Aspen wood mass loss  
Mineral soil 0-30 cm



- ▶ Soil moisture increases continue
- ▶ Understory stays green longer
- ▶ Tree growth is not impacted
- ▶ Forest soil responses can be slow
- ▶ More work:
  - ▶ Insects
  - ▶ Diseases
  - ▶ Tree health

Wood chips: 50 tons/acre; Biochar: 10 tons/acre; Fertilizer: 200# N using NKSB formulation





## ‘Waste’ wood to biochar

- ▶ Wood normally burned in slash piles
  - ▶ Creates smoke/particulates
- ▶ 10 tons/acre of biochar
  - ▶ Desired soil changes
  - ▶ Desired biochar properties
- ▶ Add to forest, range, agricultural, or mine soils
- ▶ Improve ecosystem services

# Thank you

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