Biochar, fertilization, and mastication: Surface and belowground decomposition rate changes on the Bitterroot National Forest

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A shout out to:

- Marty Jurgensen – Michigan Technological University
- Joanne Tirocke – Rocky Mountain Research Station
- Cole Mayn – Bitterroot National Forest
- Mark Coleman – University of Idaho
- Mark Kimsey – University of Idaho

Overview

- Using wood stakes as an index of biological activity
- Treatments
- What we found
- What it means

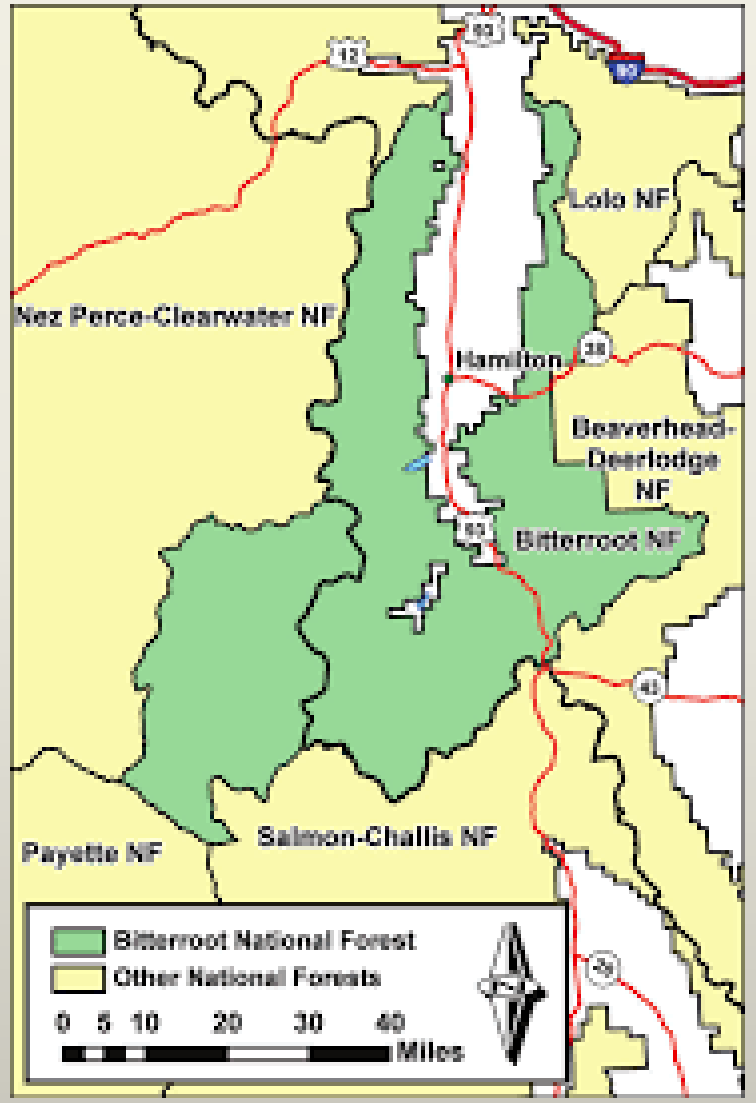
Why use wood stakes to measure soil processes?

- Wood stakes are an index that incorporate biotic and abiotic soil conditions
- Consistent organic matter (wood)
- Range of lignin and cellulose (aspen and pine) favor different types of fungi (white rot v. brown rot)
- Long-term (5 year) assessment

Wood stakes

- Pine (*Pinus taeda*) and aspen (*Populous tremuloides)*
- Inserted vertically into the mineral soil to a depth of 20 cm
- Placed on the soil surface and at the forest floor-mineral soil interface

Where is the study site?



Stand history

- Ponderosa pine (*Pinus ponderosa)* stand clearcut in 1965, thinned in 2009
- Thinned material was masticated and left on-site
- Single tree plots

Treatments (replicated 3 times)

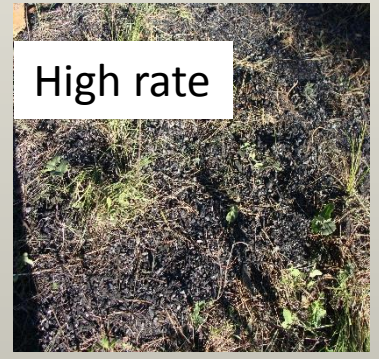
CONTROL

MASTICATED
38 Mg/ha woody biomass

FERTILIZED
224 kg/ha N

BIOCHAR
3 Mg/ha

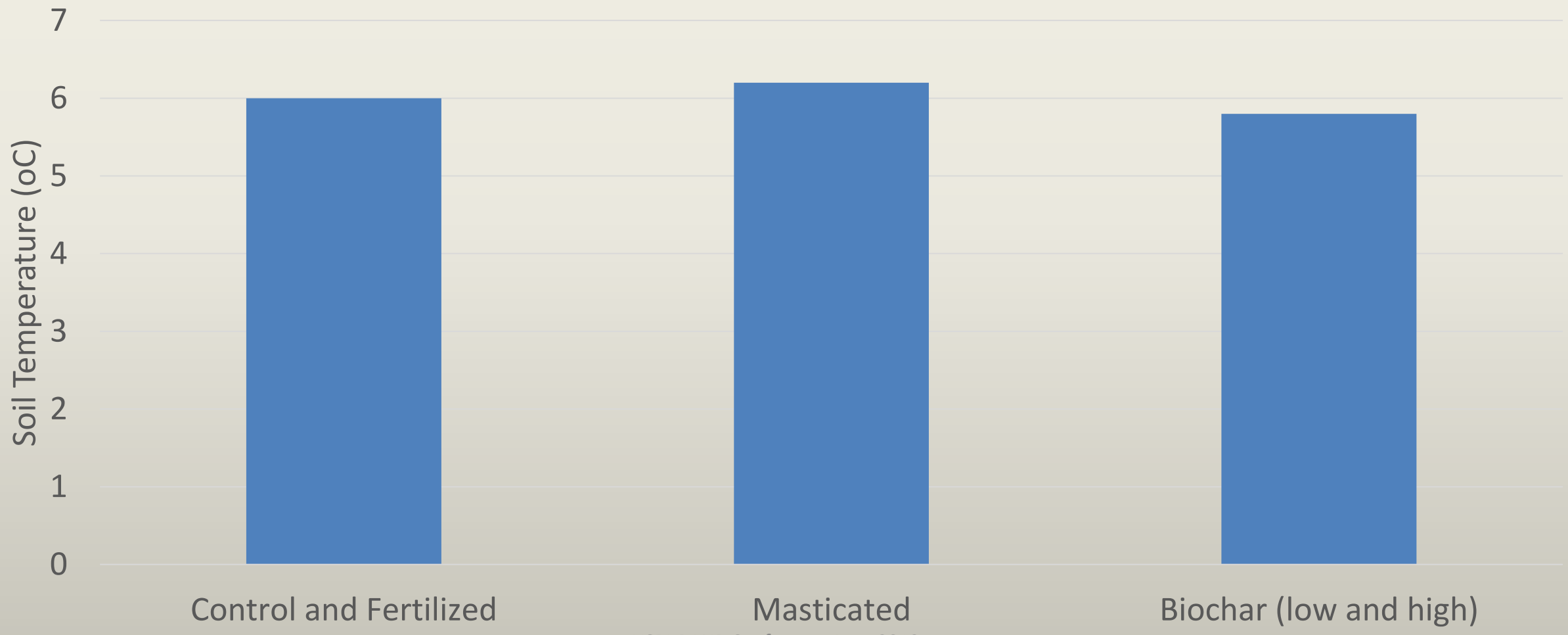
BIOCHAR
20 Mg/ha



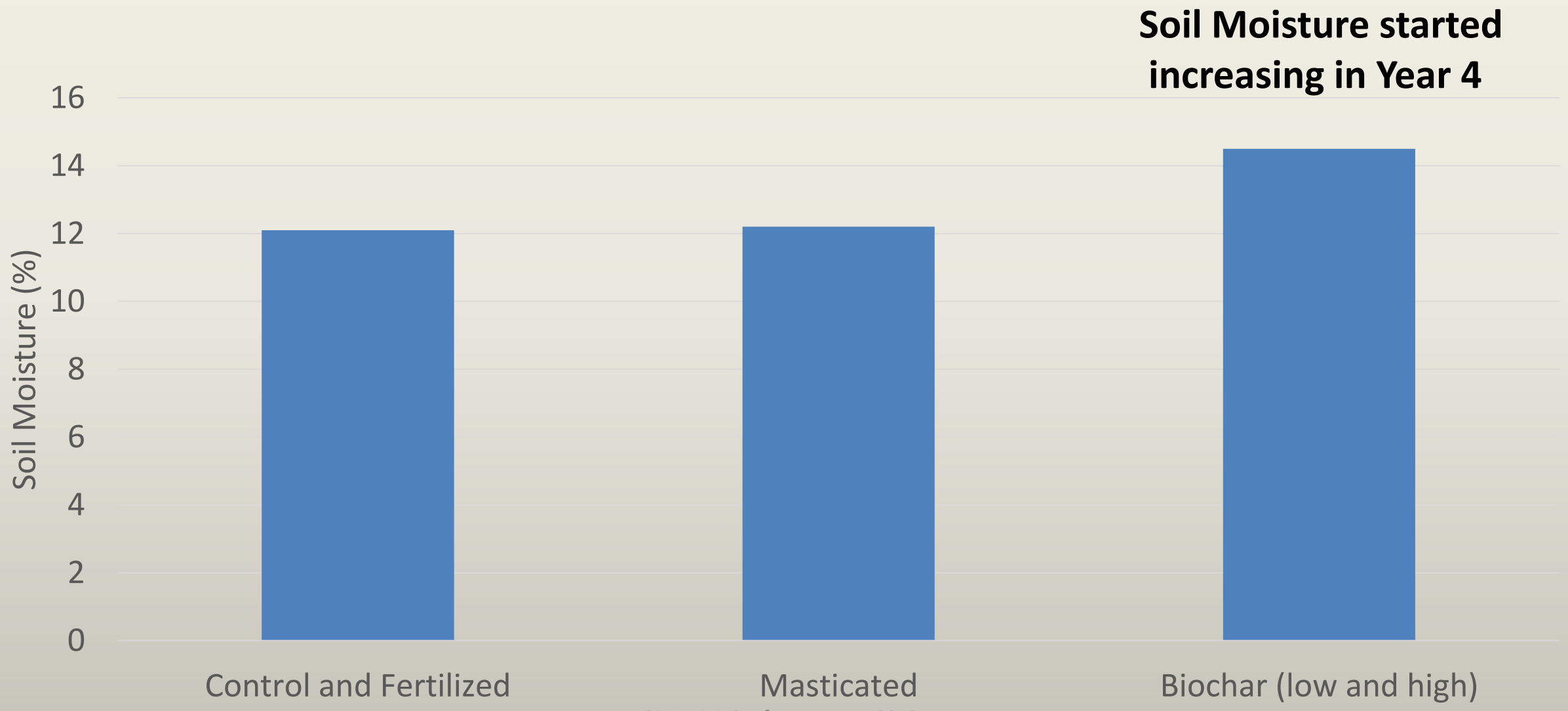
Results

Do amendments change soil temperature and moisture?

Soil temperature after 5 years (0-10 cm depth)

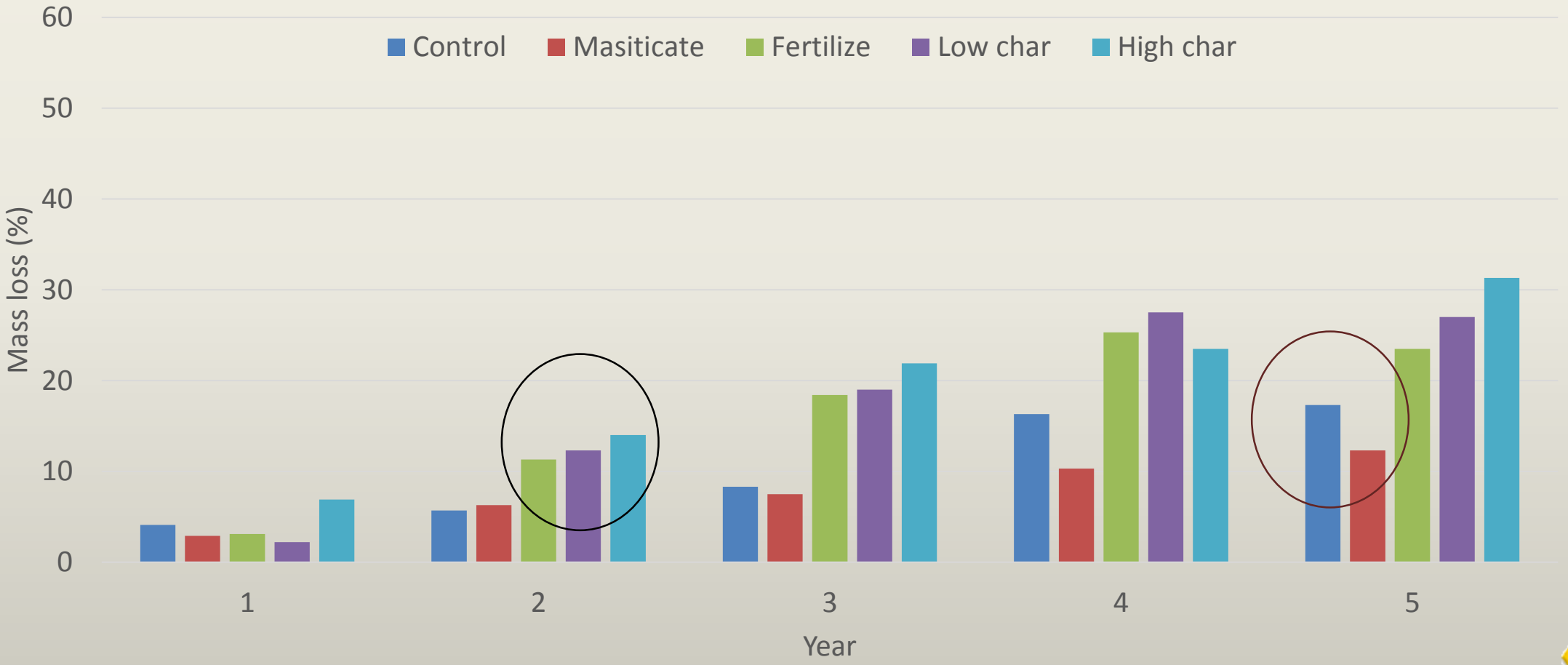


Soil moisture after 5 years (0-10 cm depth)

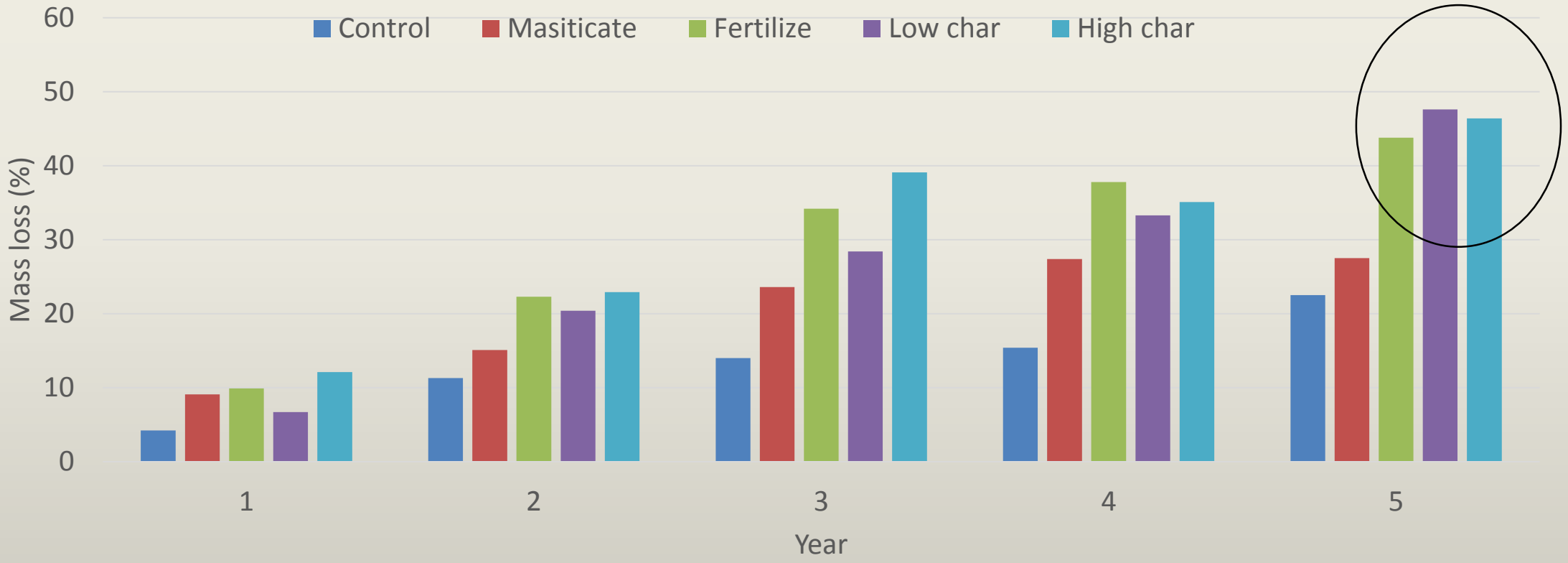


What happened to the wood stakes?

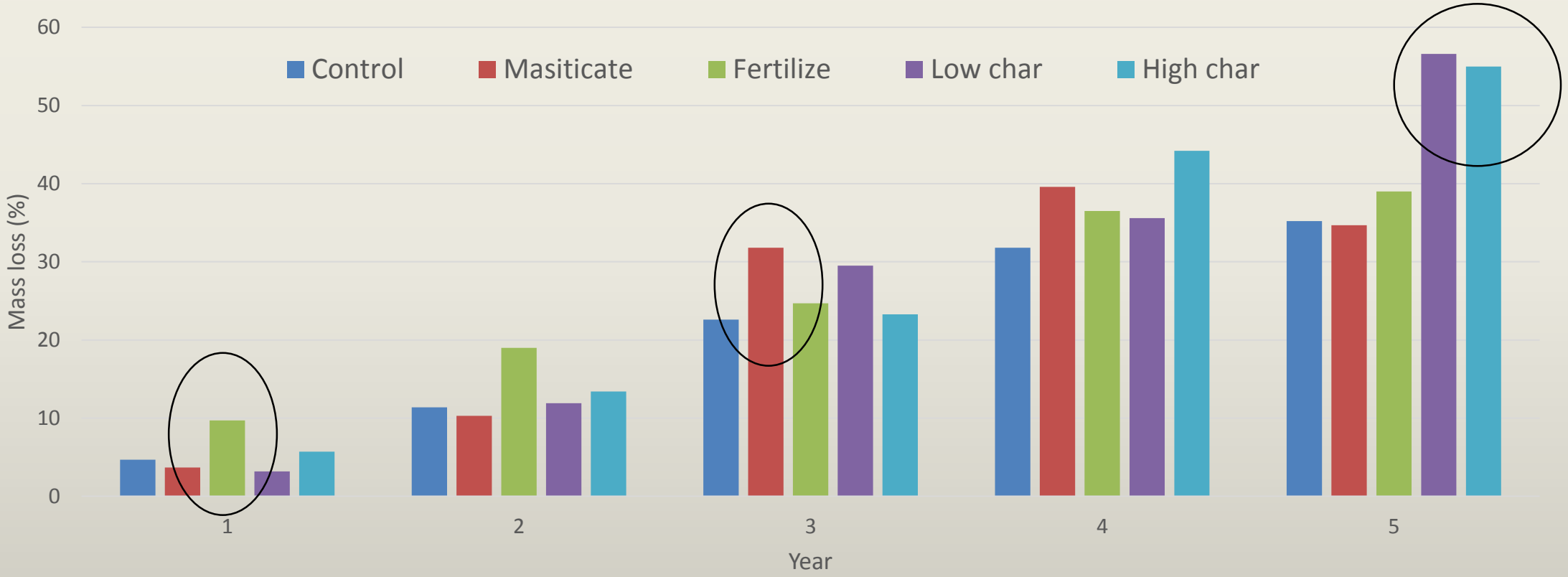
Surface stake mass loss for each year and treatment



Forest floor-mineral soil interface stake mass loss for each year and treatment



Mineral stake mass loss for each year and treatment



Summary

- Biochar added to forest sites is a long-term proposition
- Surface, interface, and mineral soil stakes initially responded differently at different sample dates
- After 5 years, biochar increased wood decomposition at all stake locations

Short- and long-term benefits of forest amendments

- **SHORT-TERM:** Mastication and fertilization
  - Mulch
  - Nutrients
  - Some carbon
- **LONG-TERM:** Biochar
  - Carbon sequestration
  - Available water
  - Soil health
  - Forest health

Questions?

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