



 **Biochar affects the spatial distribution of eutectic soil microorganisms in petroleum hydrocarbon contaminated soil**



100:9:1

$C_{TPH} : N : P$

Chang et al., 2010.

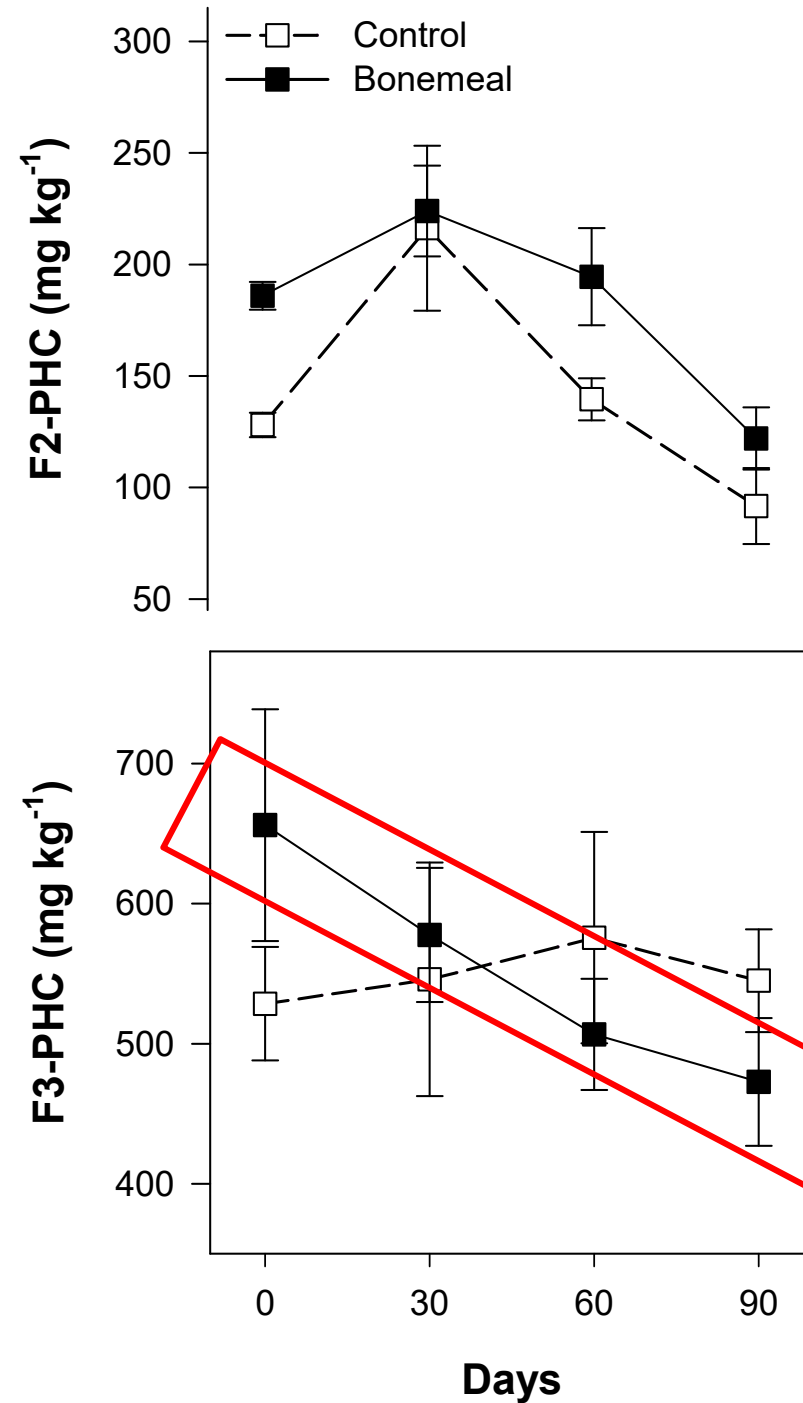
Biochar

- Organic biomass that is pyrolyzed to produce a carbon-rich char
 - Source of nutrients
 - Habitat for microorganisms
 - Alter abiotic factors (texture, pH, WHC, CEC, etc.)



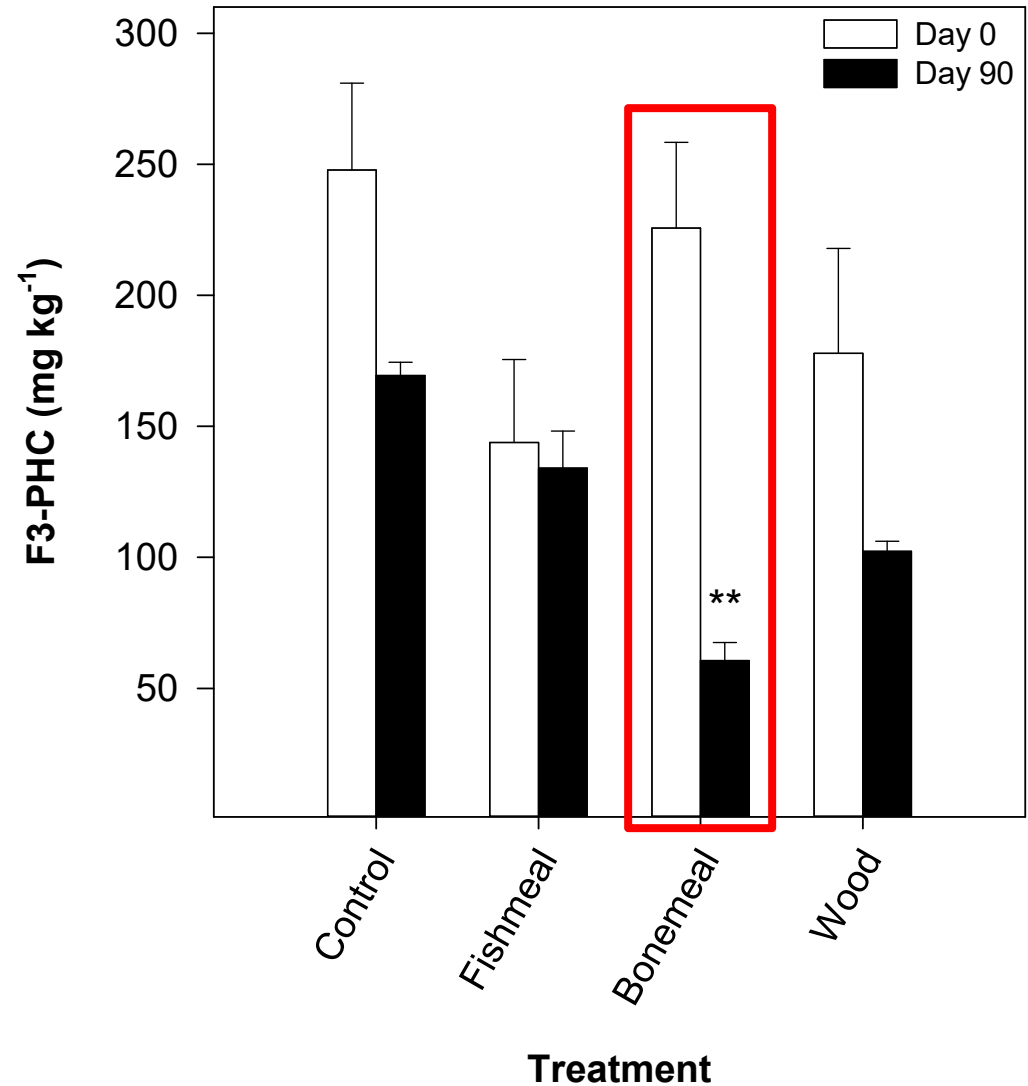
Laboratory Study #1

- Incubated at -5°C for 90 days
- Bonemeal biochar increased F3-PHC degradation



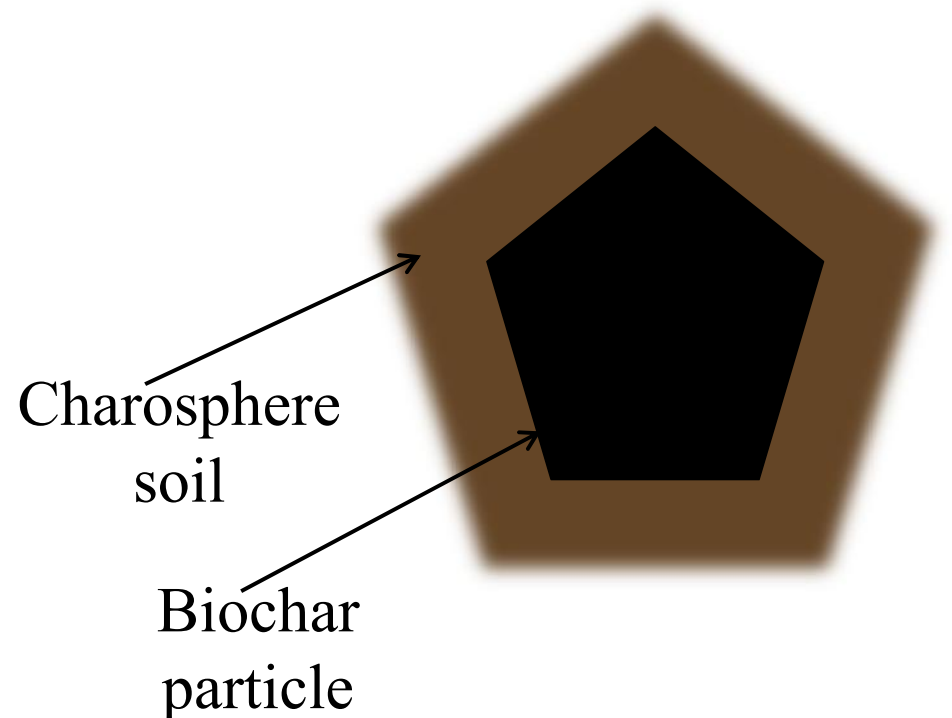
Laboratory Study #2

- Incubated at -5°C for 90 days
- Only bonemeal biochar increased F3-PHC degradation



Hypothesis

- Bonemeal biochar has ideal properties for PHC remediation in northern landfarms.
- In short-term studies, biochar influences the physical, chemical and biological properties of the charosphere.

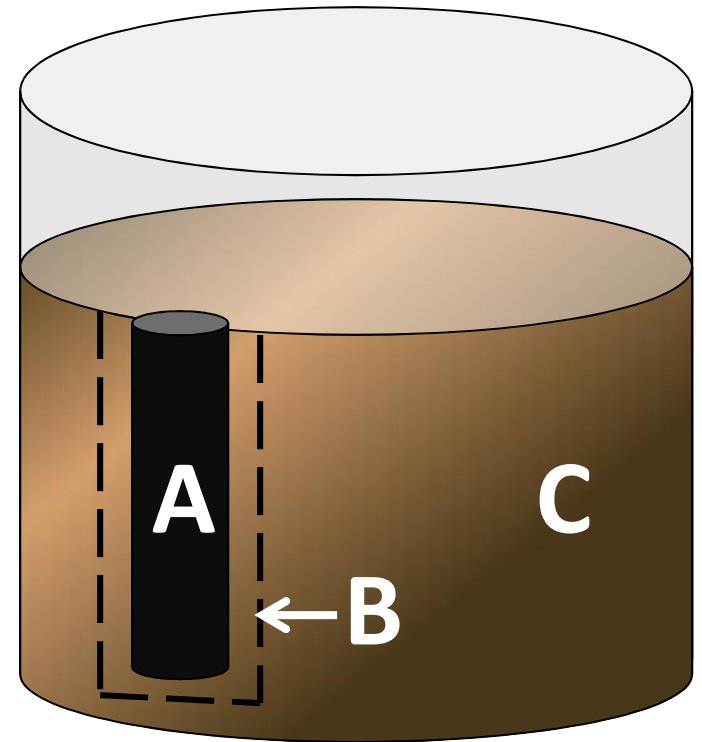


Experimental Design

A) Biochar (6%)

B) Charosphere soil (0.7%)

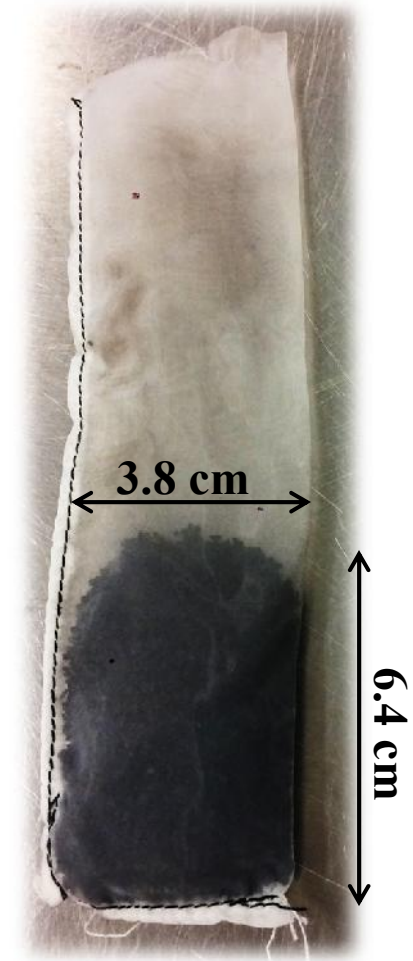
C) Bulk soil (93.3%)



Treatments

- i) Control
- ii) Fishmeal biochar
- iii) Bonemeal biochar
- iv) Wood biochar

Replicated 5x and incubated
at -5°C for 90 days



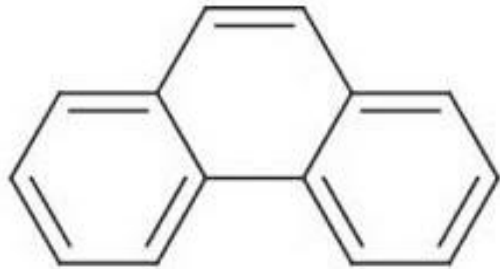
Biochar Properties

Amendment Property	Amendments		
	Fishmeal	Bonemeal	Wood
pH	9.0	8.5	8.9
Surface area (m ² g ⁻¹)	7.1	147	78
Pore volume (cm ³ g ⁻¹)	0.025	0.382	0.006
Pore size (nm)	13	9.8	2.2
CEC [†] (cmol _c kg ⁻¹)	54	57	7

†CEC = cation exchange capacity

^{13}C -Phenanthrene Mineralization

Unlabelled

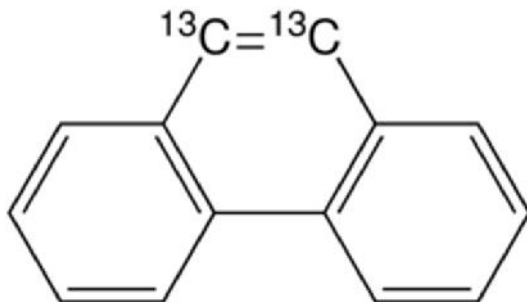


Microbial decomposition of
PHE

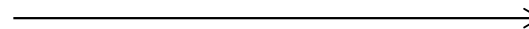


$$\frac{^{13}\text{C}}{^{12}\text{C}} = -24$$

Labelled



Microbial decomposition of
enriched PHE



$$\frac{^{13}\text{C}}{^{12}\text{C}} = 670$$

**^{13}C -phenanthrene mineralization (%)
normalized to bulk soil**

3
2
1
Bulk Soil
Biochar
Charosphere

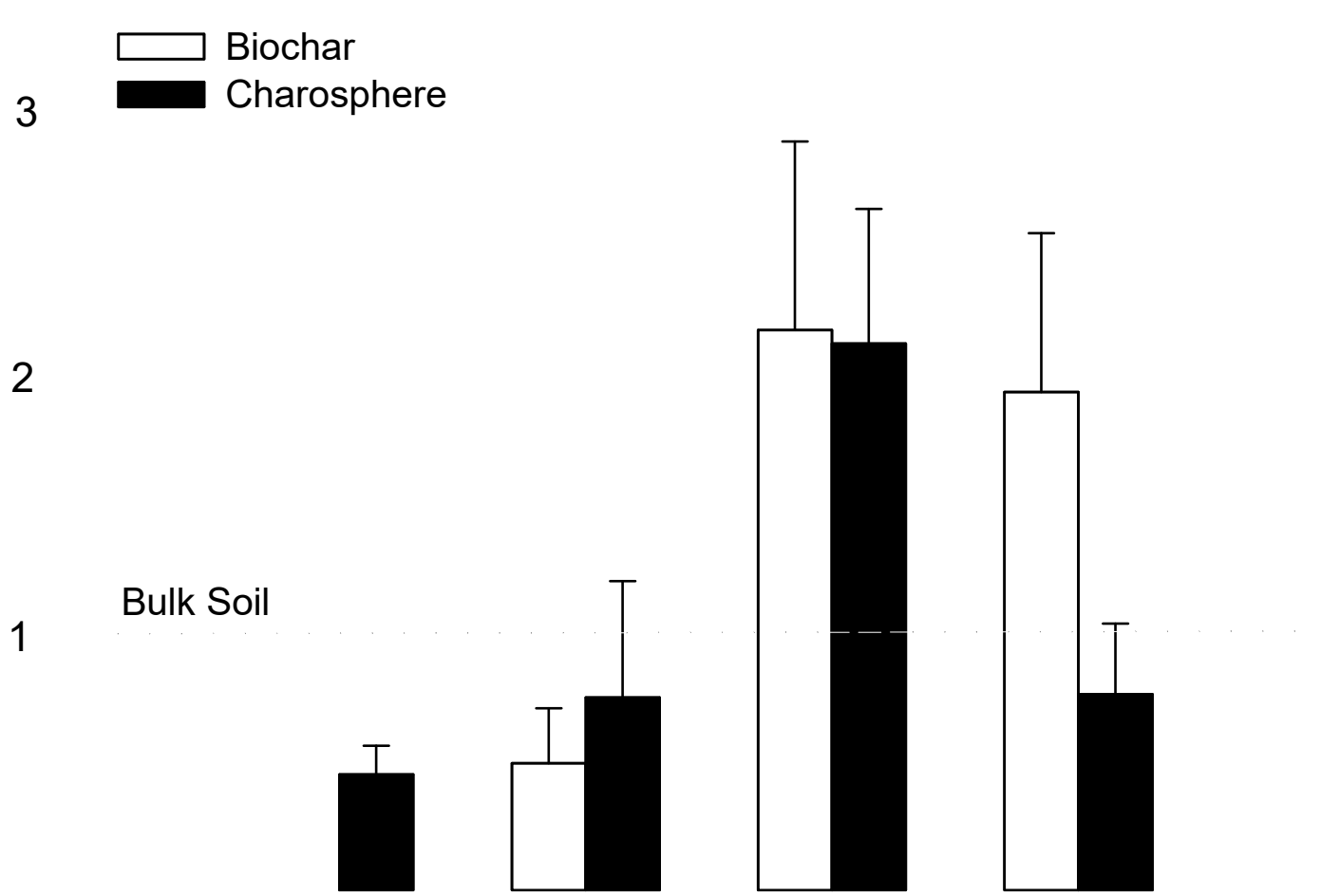
Control

Fishmeal

Bonemeal

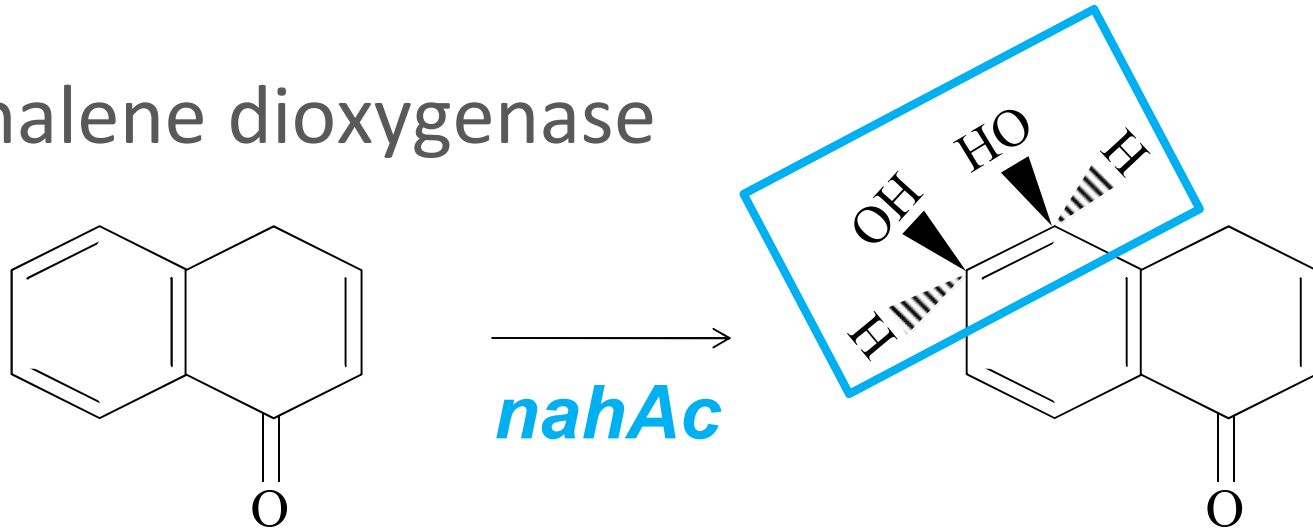
Wood

Treatment

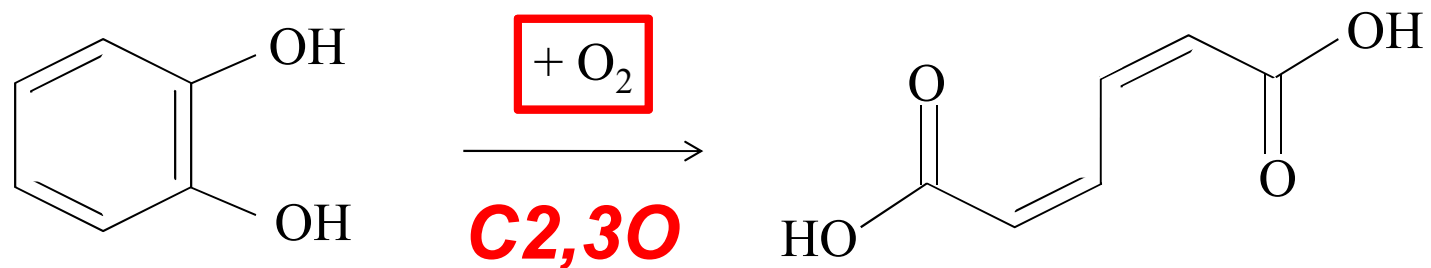


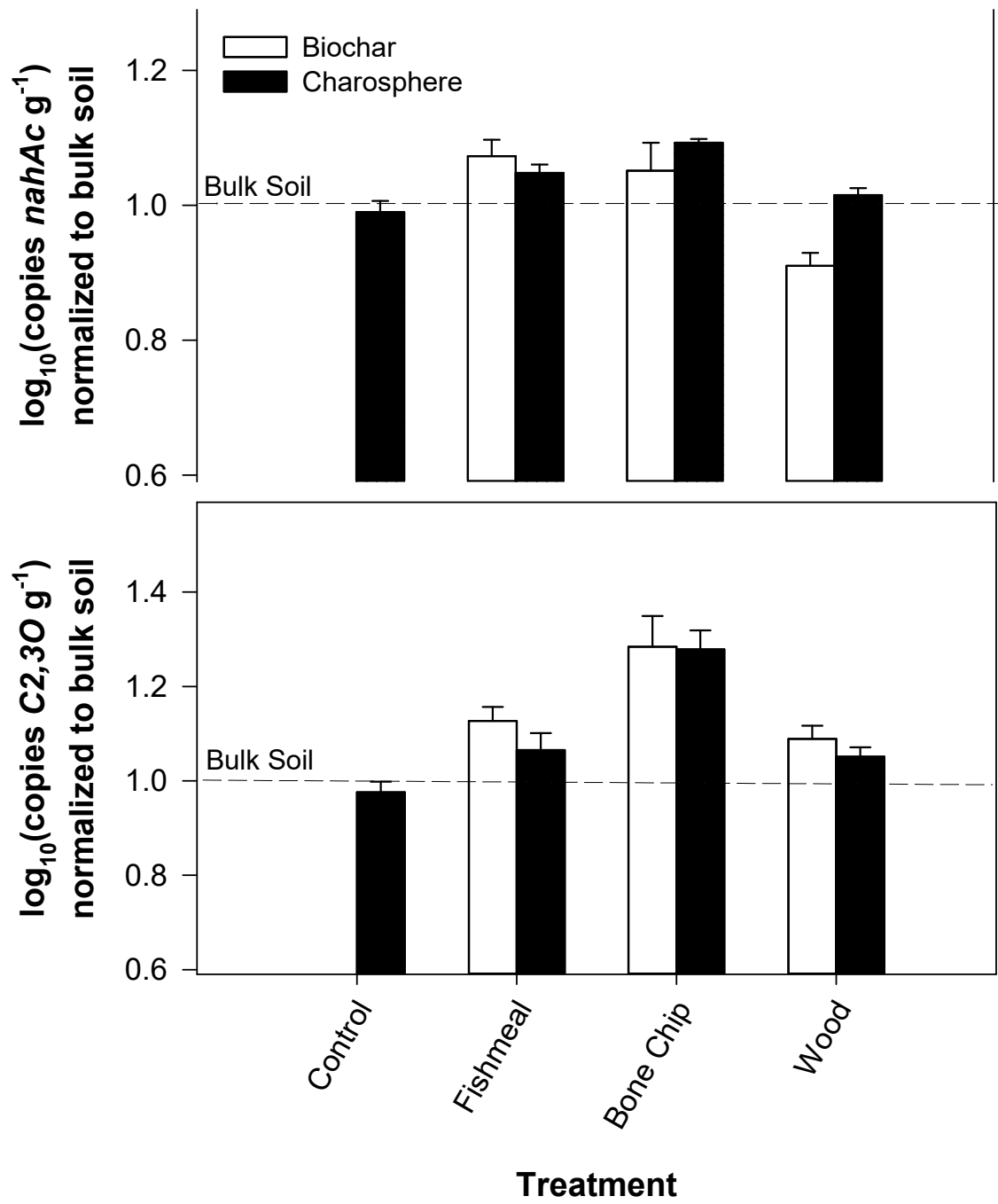
Functional Gene Abundance

Napthalene dioxygenase

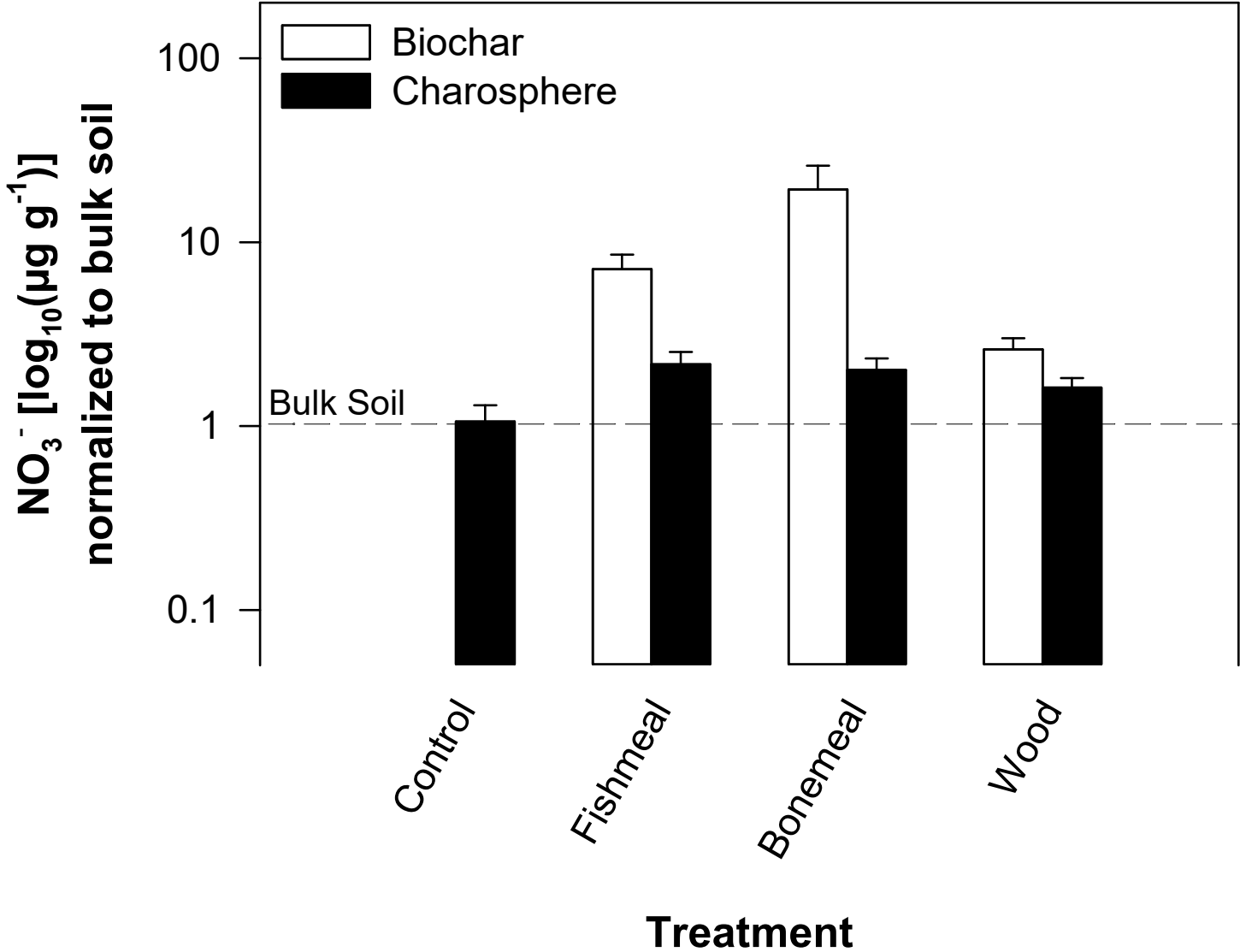


Catechol 2,3 dioxygenase





Extractable Nitrate



Summary

- Bonemeal biochar particles directly influence mineralization and functional gene abundance in the charosphere.
- Surface area and pore volume are important for microbial activity and PHC-degradation.
- Bone-derived biochars supply nitrate, but diffusion into the charosphere was not evident.

Further analysis

- Microbial community structure
 - Next-gen sequencing

- Total PHC-degrading population
 - MPN

- pH and extractable PO_4^{3-}

Questions?

