Ecological effects of biochar on stream communities

Will Clements
Dept. of Fish, Wildlife & Conservation Biology
Colorado State University

Motivation for the study

Beneficial effects of biochar and activated carbon (AC) are well established in the literature; however:

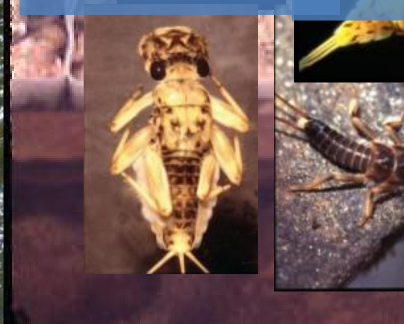
- ~20% of studies have reported negative effects
  → growth, behavior and survival (Janssen et al. 2013)

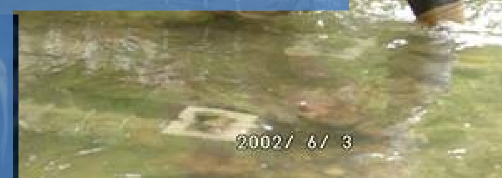
- Contaminant release (e.g., PAHs), loss of interstitial space, alterations in food resources, clogging of respiratory surfaces

- Most research conducted in terrestrial ecosystems; little focused on community responses

Previous Findings (2014)

Mayflies	Stoneflies	Caddisflies	Dipterans	Other Taxa
BAETIS	CAPNIA	BRAAME	CHIRON	HETCOR
DIPHET	ZAPADA	MICRAS	TANYTA	HYDRAC
DRUDOD	TAENIO	GLOSSO	ORTHOC	NEMATO
DRUGRA	SWELTSA	ARCGRA	TANYPO	OLIGOC
SERRAT	HESPAC	LEPIDO	BEZZIA	POLYCEL
CINYGM	ISOPERLA	RHYACOP	EMPIDI	
RHIHAG	MEGSIG	ALLOYM	CHELIF	
PARALEP	SKWALA		PERICO	
AMELET	PTEBAD		SIMULI	
			ANTOCH	





Environmental Science & Technology
Article
pubs.acs.org/est

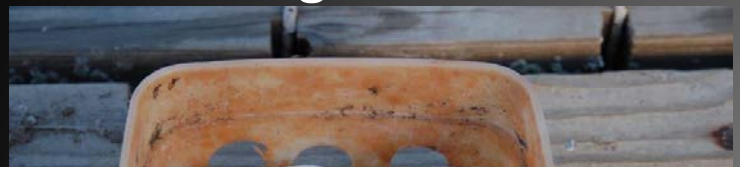
Ecological Effects of Biochar on the Structure and Function of Stream Benthic Communities

William H. Clements,[*,†] Ralph G. Stahl, Jr.,[‡] and Richard C. Landis[§]

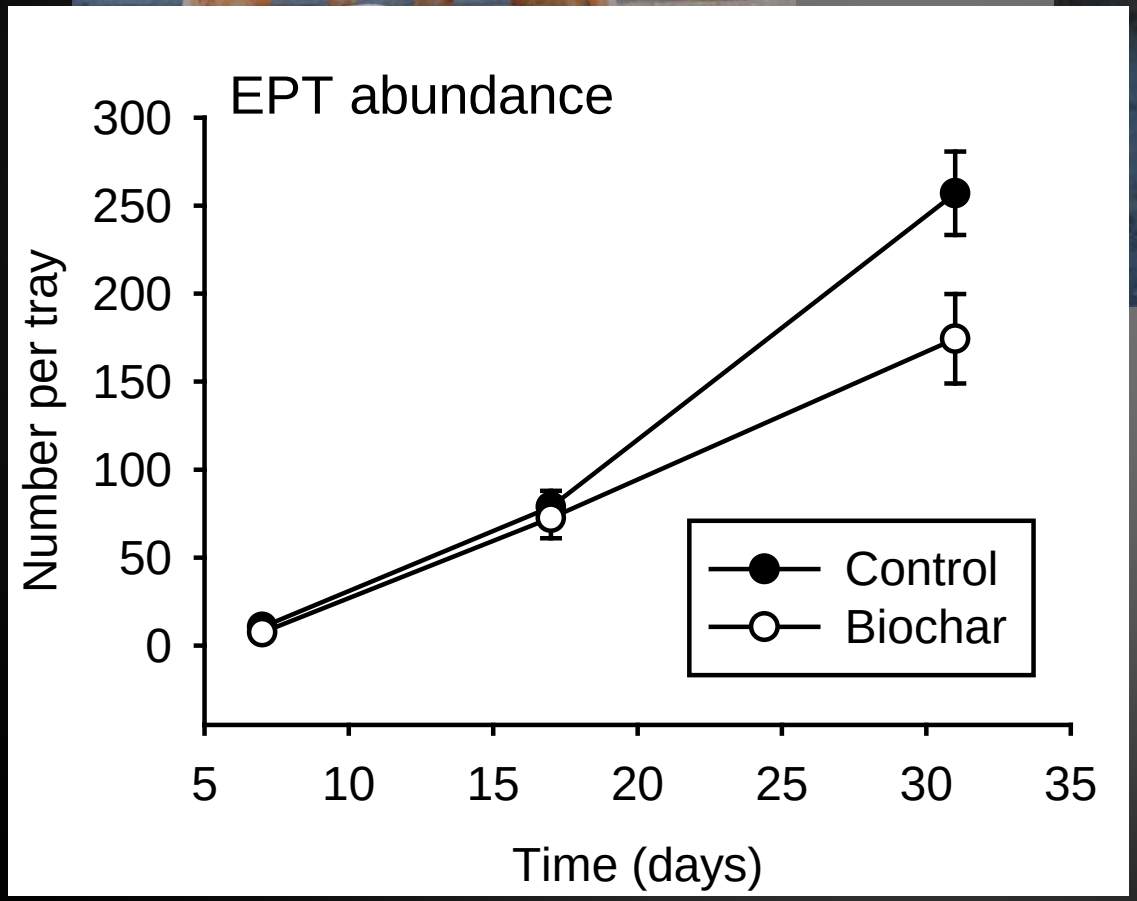

Communities on trays similar to those in natural substrate

“Pilot” Colonization Study

Mesh bags filled with either Biochar or small gravel substrate

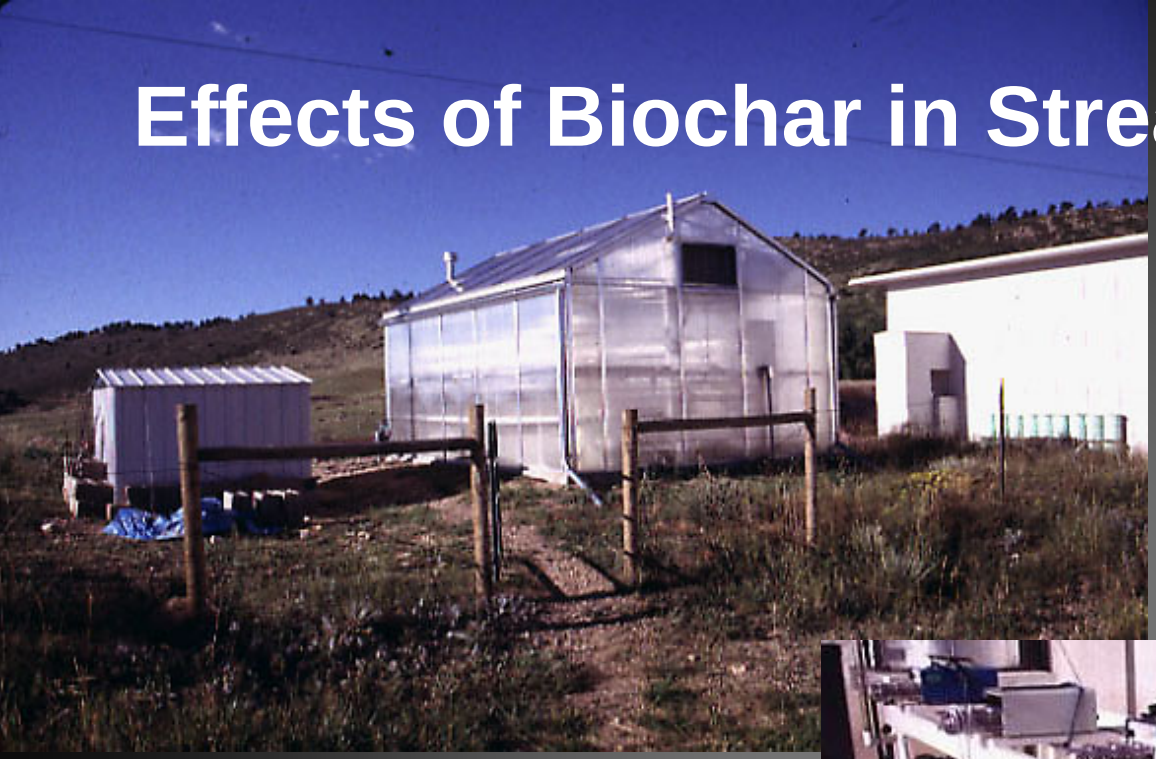


Covered with small cobble substrate



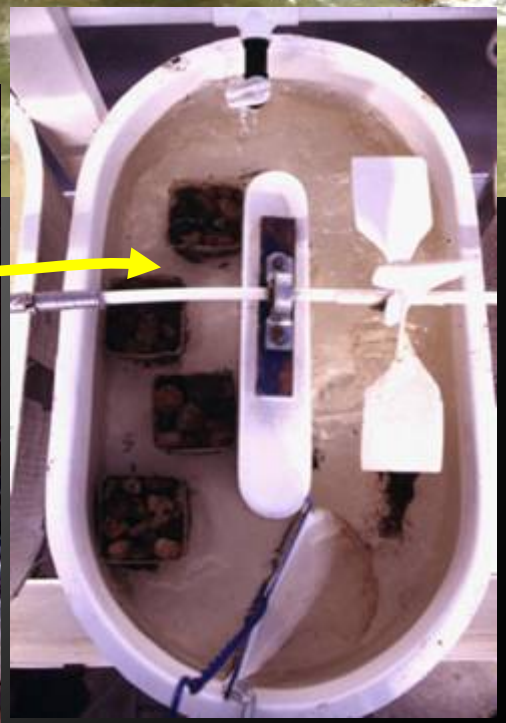
Abundance of mayflies, stoneflies & caddisflies 26% lower on trays with Biochar ($p = 0.0234$)

Effects of Biochar in Stream Microcosms



CSU Stream Research Laboratory

Natural water source
(oligotrophic reservoir)
Natural sunlight
18 20-L microcosms
Flow through systems



10 d exposure

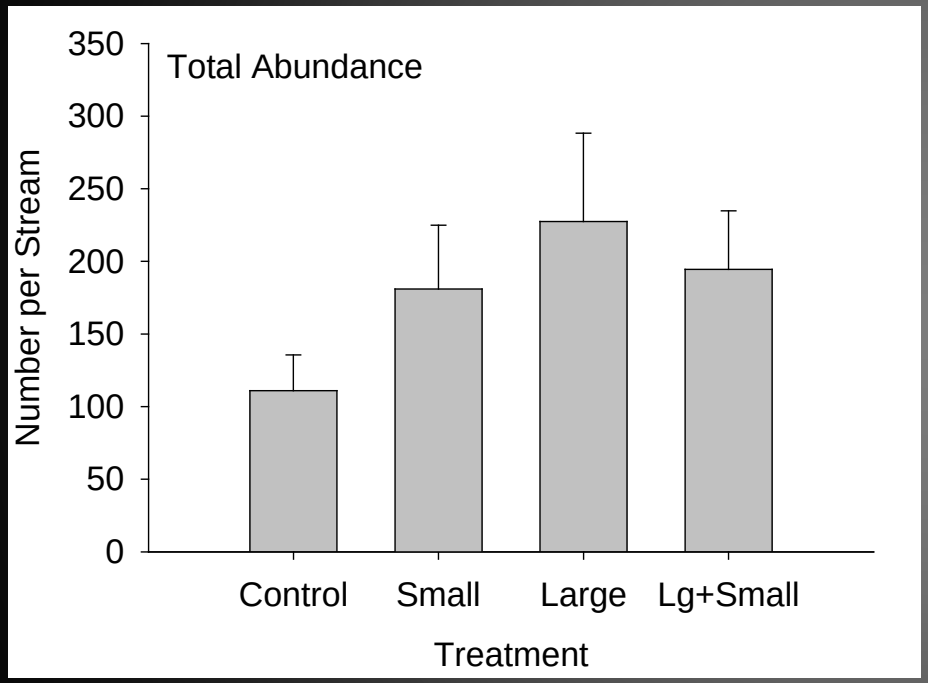
1.0 L container
350 µm mesh

2 Mesocosm Experiments:

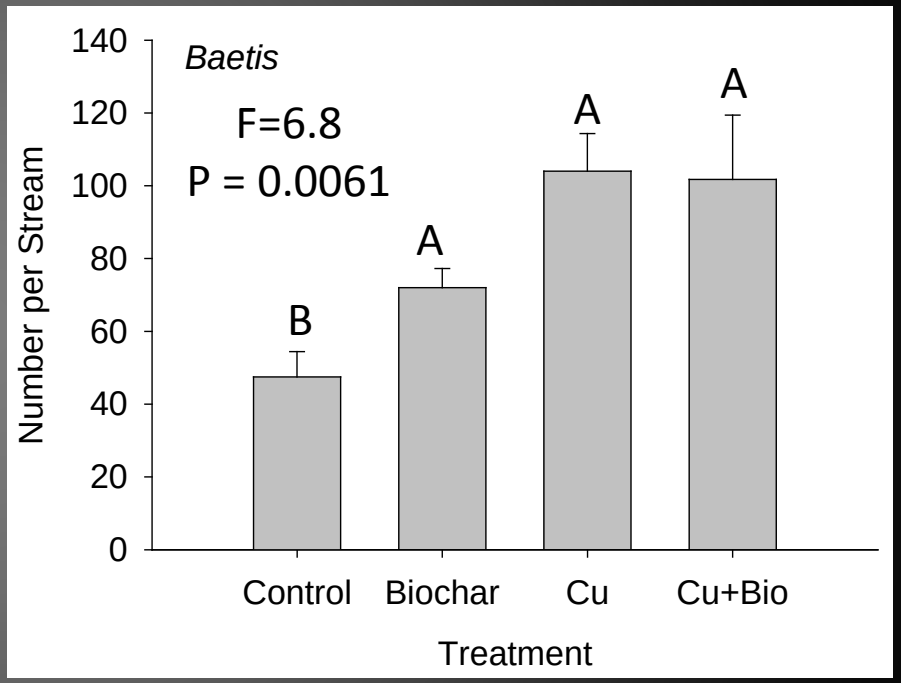
- Large vs. small biochar
- Biochar & metals

Drift of aquatic insects in stream mesocosms

Large vs. small biochar

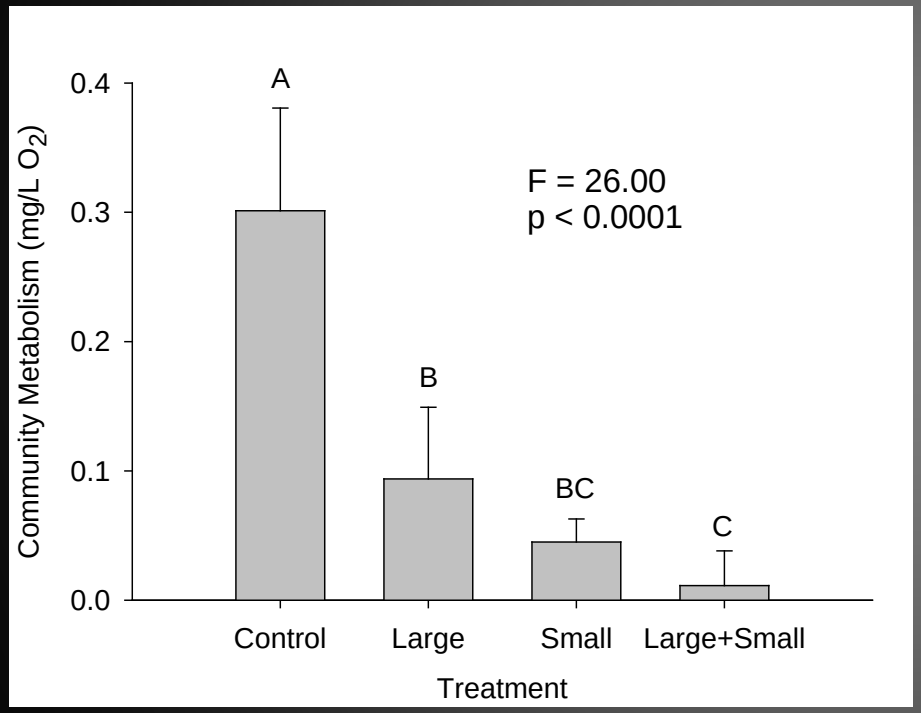


Biochar and Cu

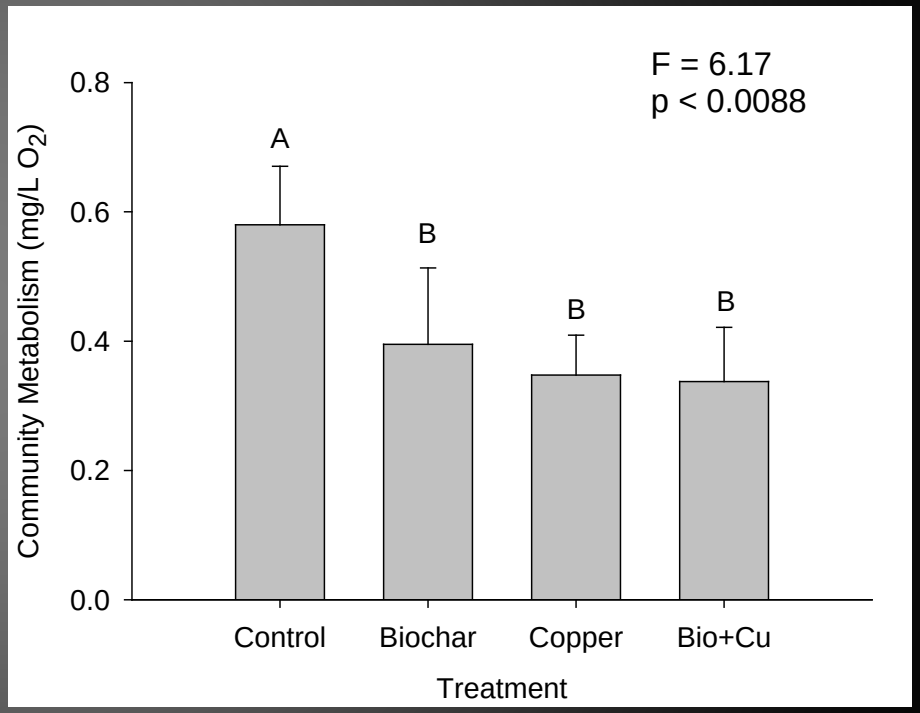


Community metabolism

Large vs. small biochar

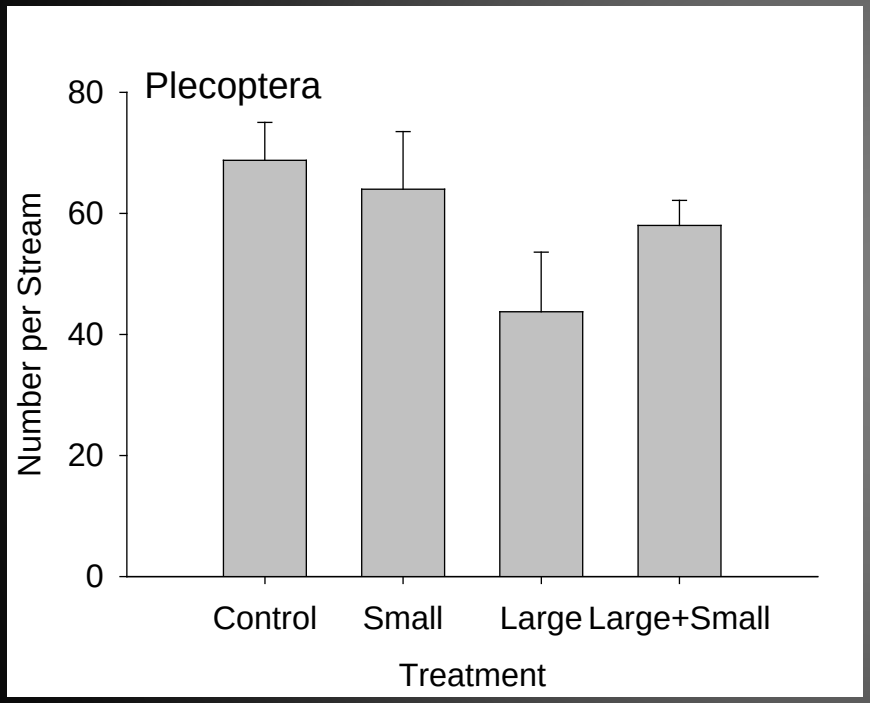


Biochar and Cu

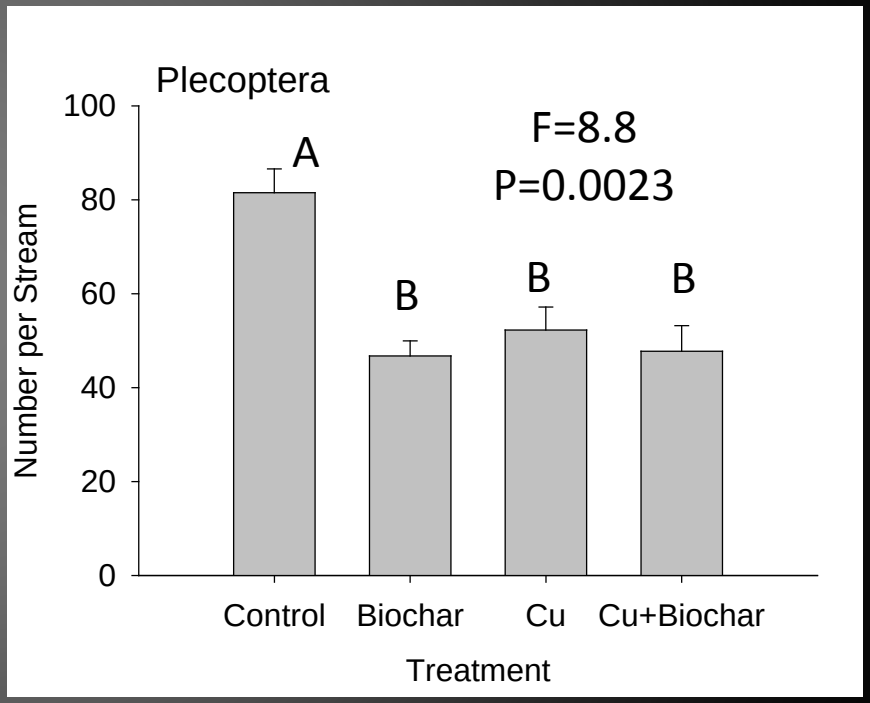


Community composition

Large vs. small biochar



Biochar and Cu



Summary of previous results

- Biochar reduced community metabolism
- Colonization of EPT taxa in the field was significantly lower in trays containing Biochar
- Biochar increased macroinvertebrate drift
- Hypothesize this was an avoidance response

Objectives of the 2016 Study

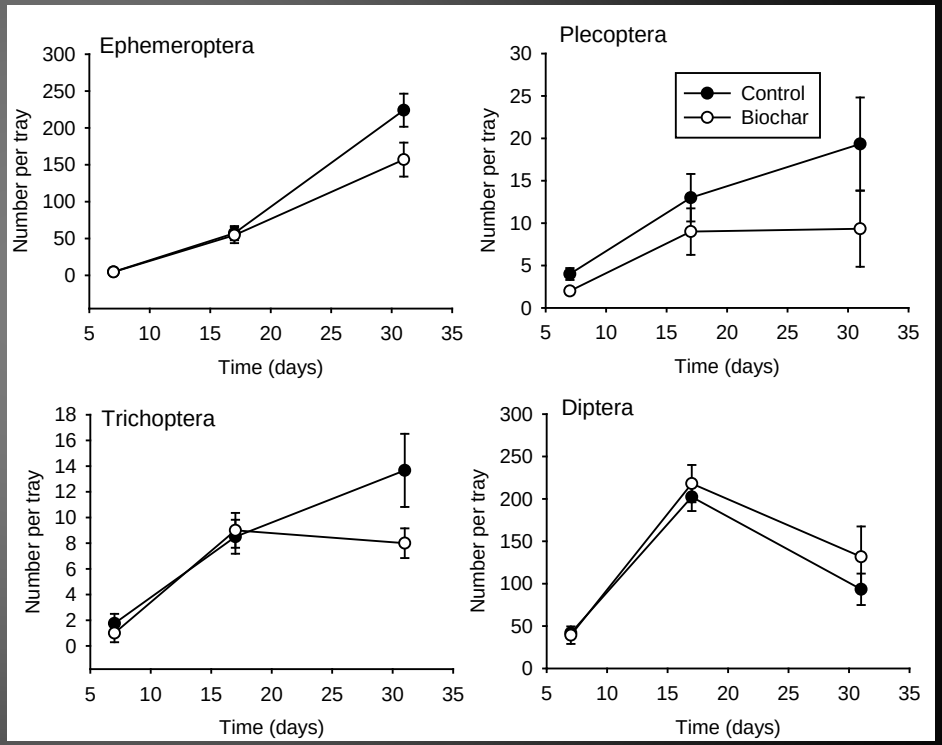
- Assess effects of Biochar on survival and community composition in the field
- Quantify potential effects of leachates from biochar materials

Experimental Approach

40 d field colonization study

3 Treatments:

- Control
- Biochar
- Washed biochar



→ Increase replication

→ Greater statistical power


Questions and Suggestions?