

Terrestrial-Aquatic Connections: Invasive *Ailanthus altissima* leaf decomposition in freshwater ecosystems and impacts on macroinvertebrate communities

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Terrestrial-Aquatic Connections

- Interactions between terrestrial and aquatic ecosystems
- Resources are exchanged between ecosystems
- Cross-ecosystems subsidies (*e.g.* nutrients, organic matter)



Riparian Zones

- Riparian (streamside) zones serves as a buffer between terrestrial and aquatic ecosystems
- Can reduce nutrient pollution into aquatic ecosystems
- Healthy riparian zones support increased biodiversity of aquatic biota



Invasive Species

- A non-native organism to an ecosystem whose introduction causes or is likely to cause economic or environmental harm or harm to human health



Water Hyacinth



American Bullfrog



Brown Trout

Ailanthus altissima

(Tree of Heaven)

- Native to China and North Vietnam
- First introduced in the US during the late 1700s
- Introduced to California in 1890s during the Gold Rush



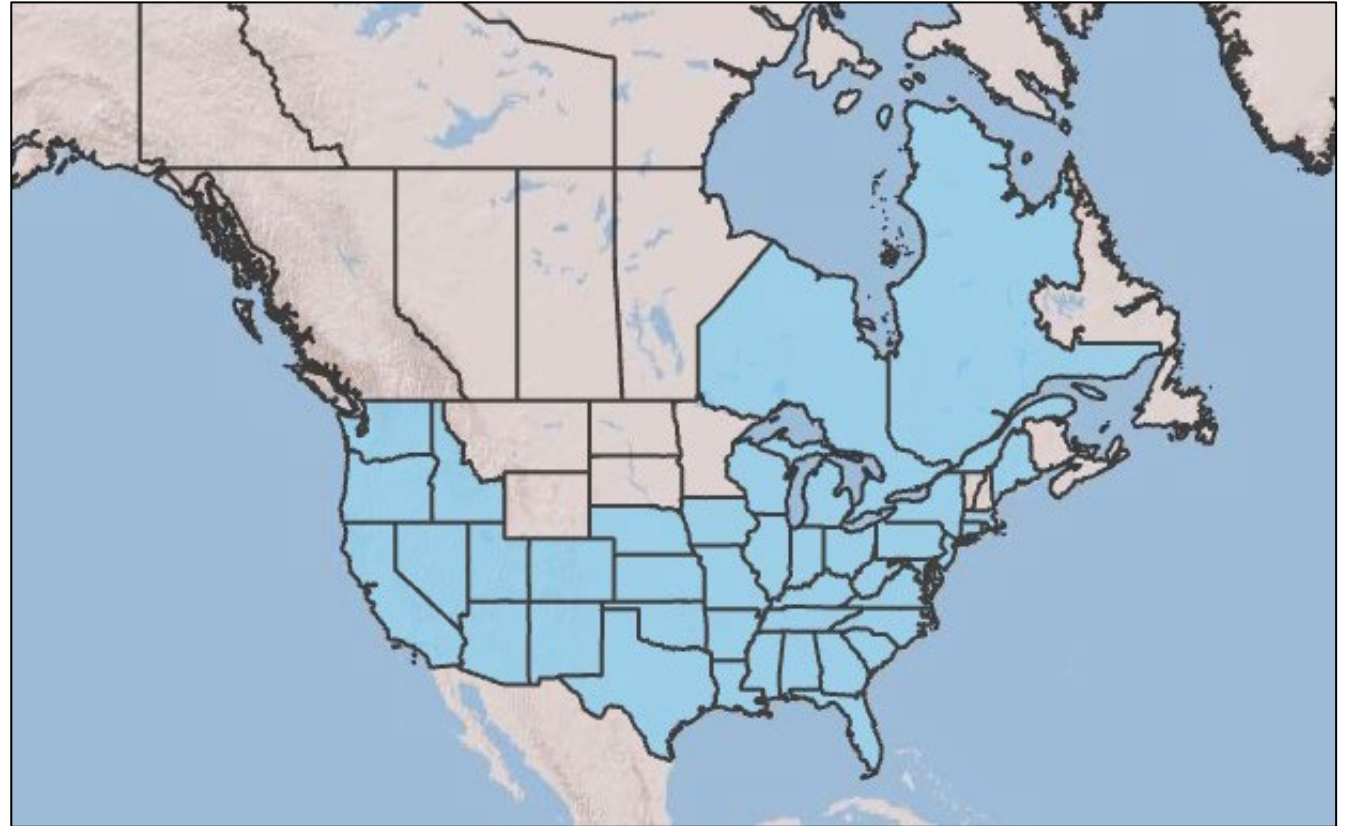
Ailanthus altissima

(Tree of Heaven)

- Difficult to remove (Kowarik 1995)
- Uses allelochemicals for a competitive advantage (Lawrence et.al 1991)



Photo Credit: J. Juarez



Credit: USDA

<https://plants.usda.gov/home/plantProfile?symbol=AIAL>

Aquatic Macroinvertebrates

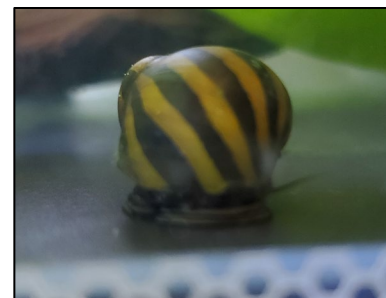
- Use leaf litter as both food and habitat
- Important to both aquatic and terrestrial food webs (Baxter et.al. 2005)
- Specialized to fill different niches (Functional Feeding Group)
(Anderson & Seddell 1979)
- Indicator species for stream pollution (Wallace & Webster 1996)



Predator



Shredder



Scraper-Grazer



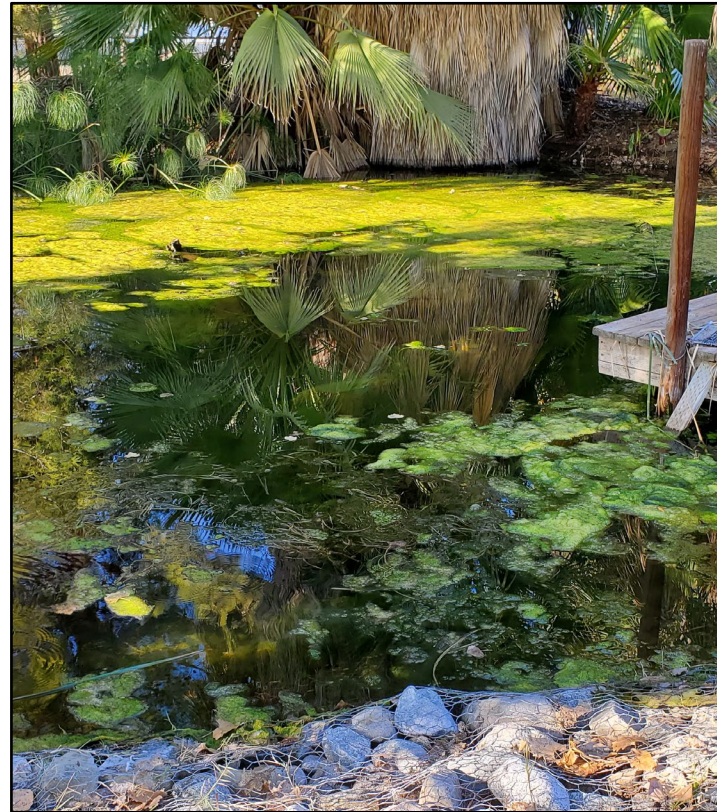
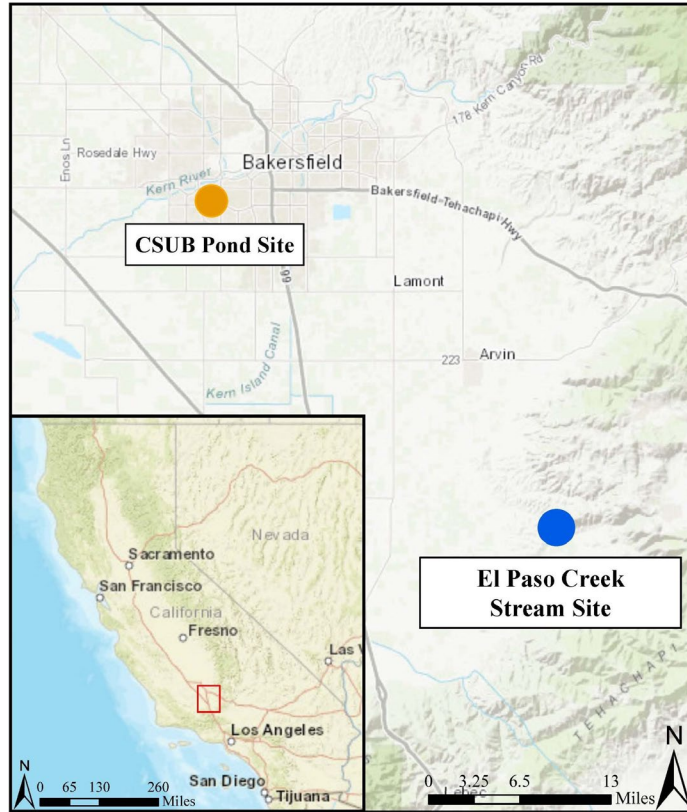
Collector-Gatherer

Research Questions

Does leaf litter from Tree of Heaven decompose at a different rate compared to leaves from two native California species, and are these decomposition patterns consistent across different freshwater ecosystems?

Does leaf litter from the invasive plant support unique aquatic macroinvertebrate communities compared to leaf litter from native plants, and is this pattern consistent across freshwater habitats?

Research Sites



CSUB Pond



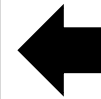
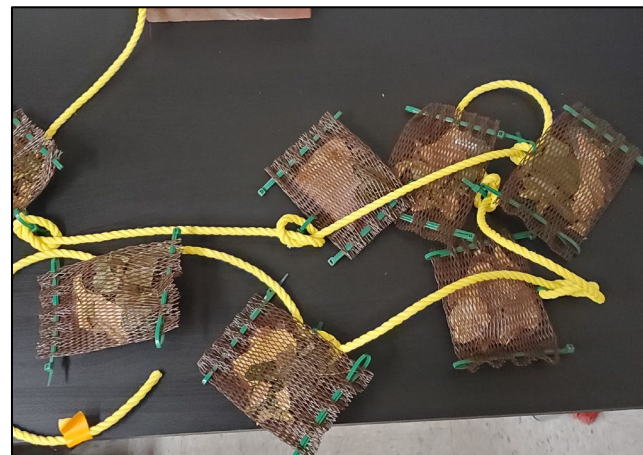
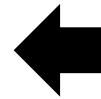
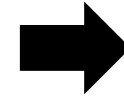
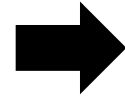
El Paso Creek

Native Species

- Fremont Cottonwood (*Populus fremontii*) and London Planetree (*Platanus acerifolia*)
- Leaves break down fast (cottonwood) or slow (planetree)



Methods



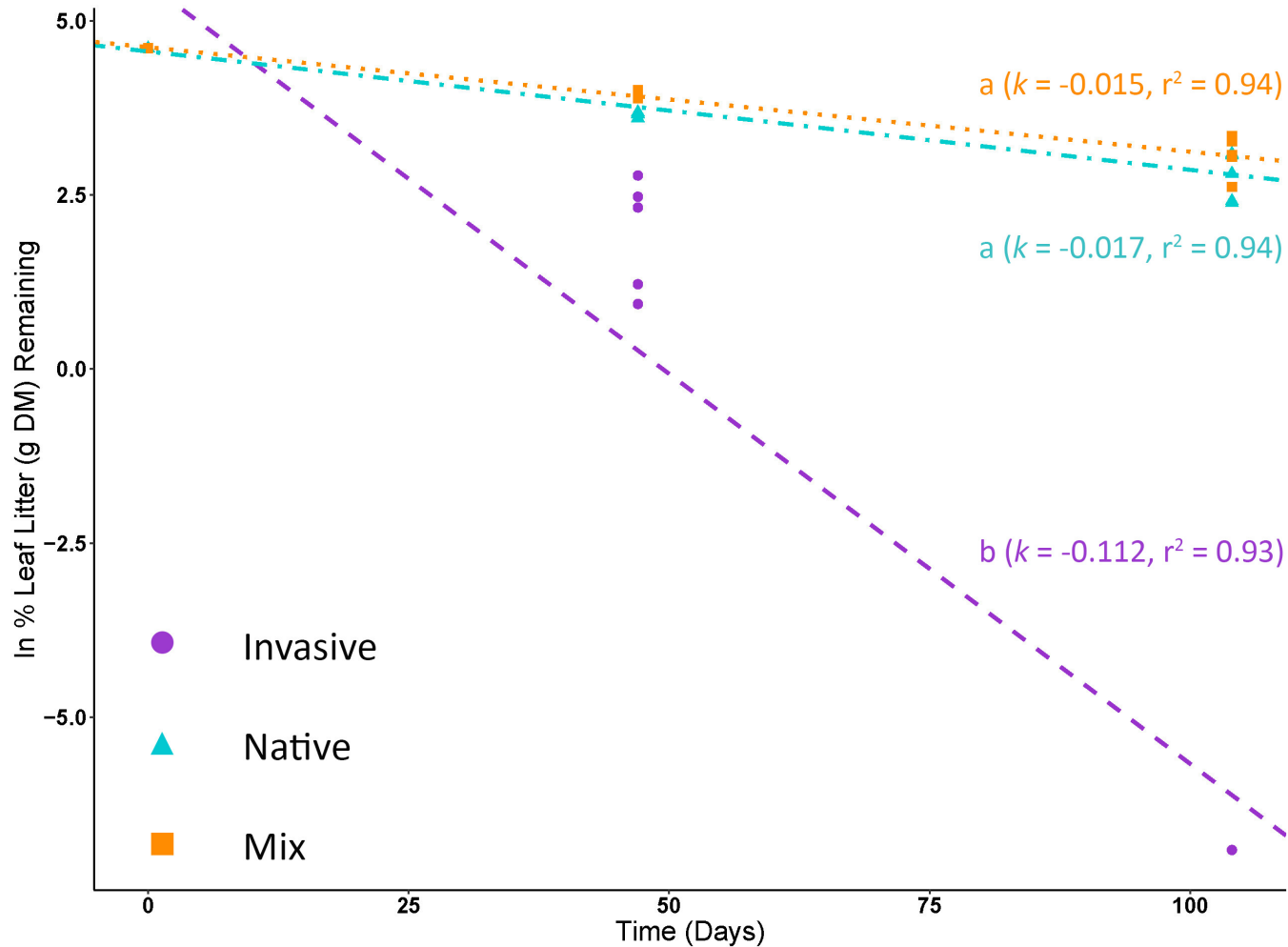
Pond Pilot Study

- Due to uncharacteristic rain in 2023, stream site was lost



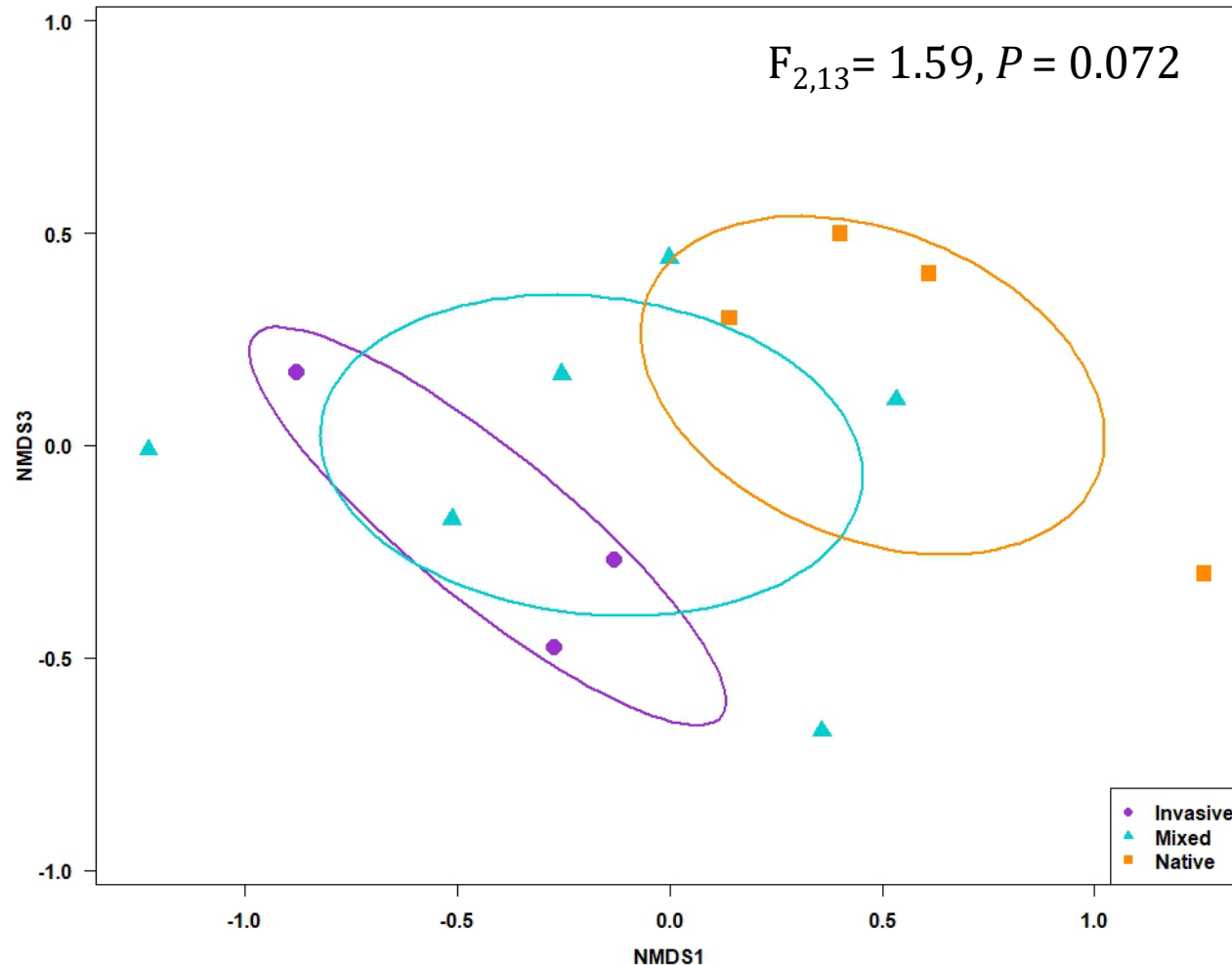
- Study redeployed in January and sampling ongoing

Leaf Decomposition

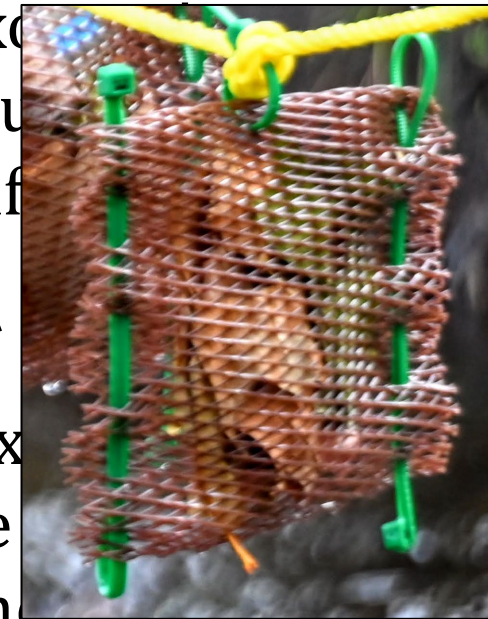


- Leaf litter decomposition was different among leaf pack treatments ($P < 0.0001$)
- Decomposition of Tree of Heaven leaf litter was:
 - $\sim 7.4\times$ faster than native leaf packs
 - $\sim 6.5\times$ faster than the mix leaf packs

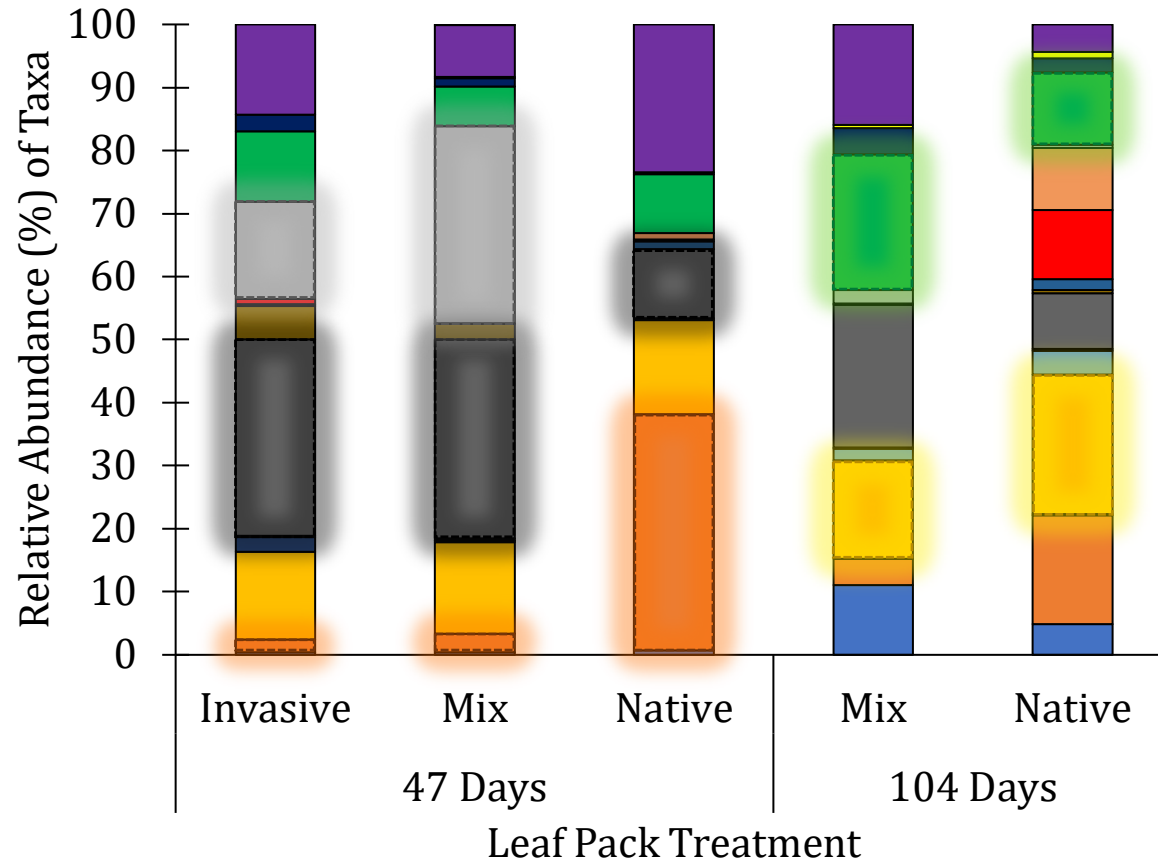
Macroinvertebrate Community Dynamics



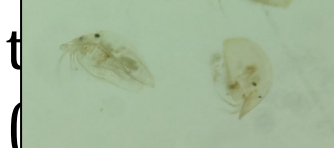
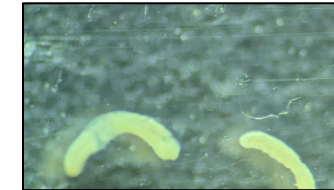
- Macroinvertebrate taxonomic community structure varied across leaf litter treatments
- Mixed litter treatment was not significantly different from the other treatments



Macroinvertebrate Taxa Dynamics

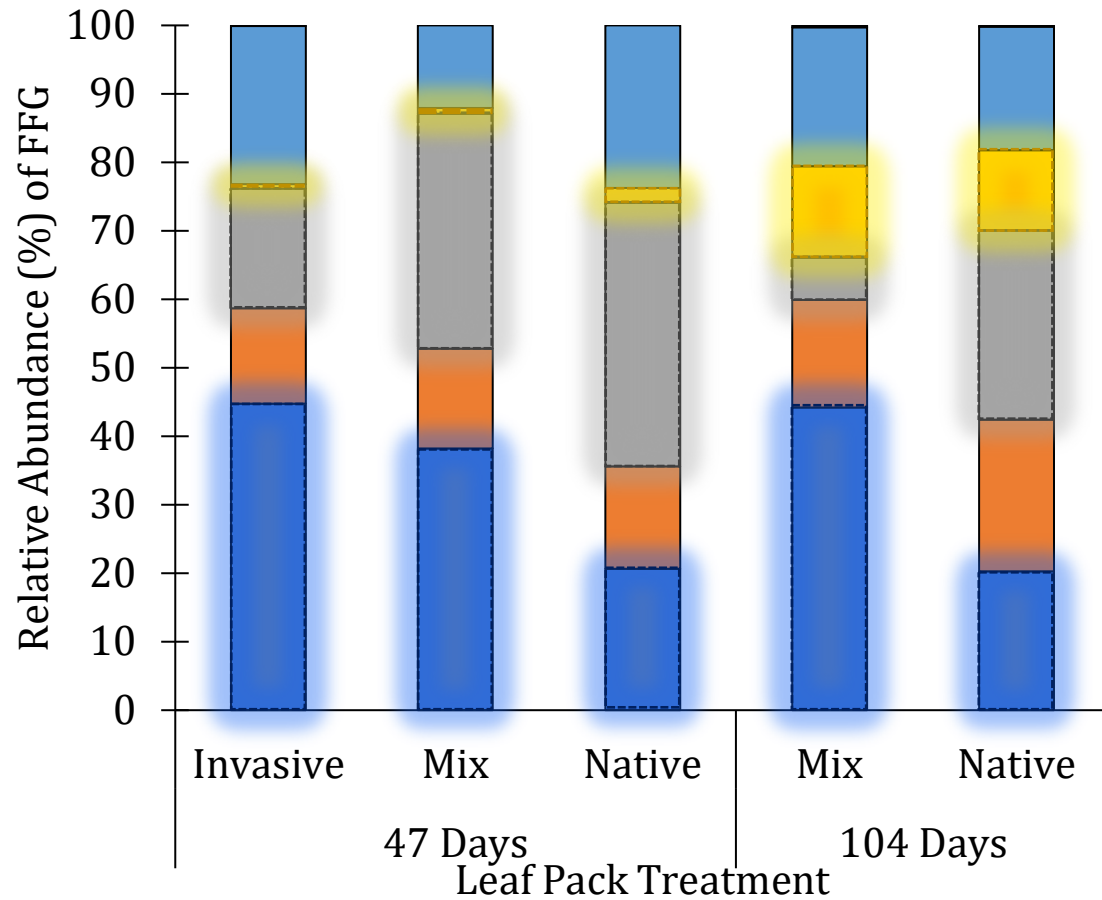


- Psychodidae
- Planorbidae
- Planariidae
- Physidae
- Ostracoda
- Oligochaeta
- Naididae
- Limpet
- Libellulidae
- Hirudinea
- Gastropoda
- Cladocera
- Curculionidae
- Copepoda
- Collembola
- Coenagrionidae
- Chironomidae
- Ceratopogonidae
- Amphipoda
- Acari

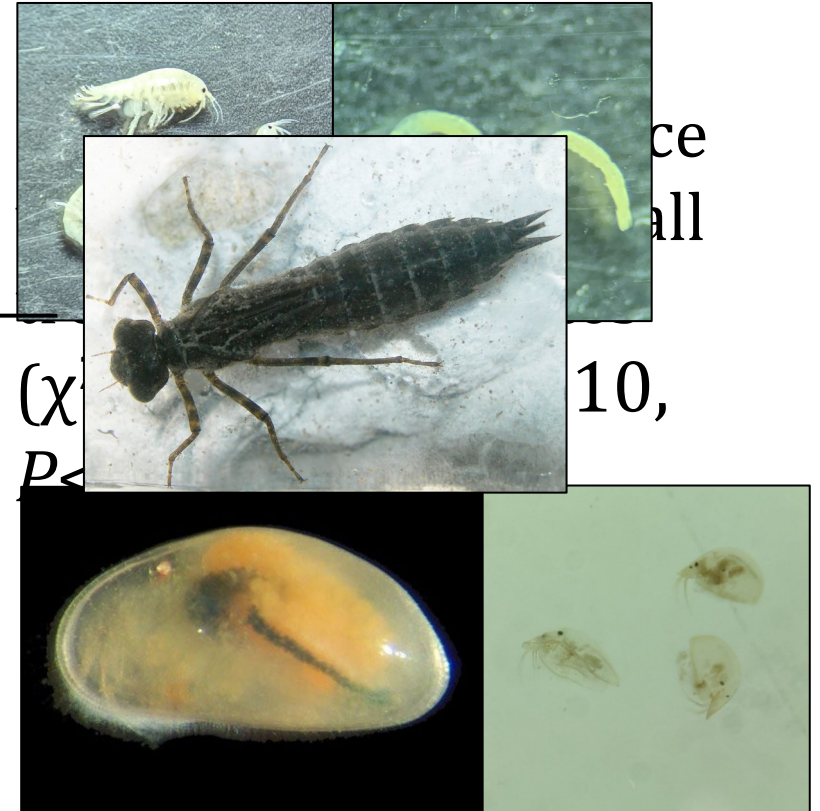


abundance
among all
and dates
df = 38,

Macroinvertebrate Functional Feeding Group Dynamics



- SH
- SG
- Predator
- Detritivore
- CG
- CF

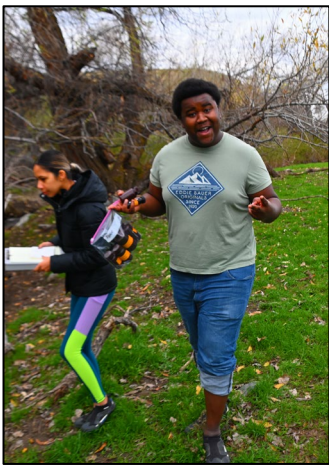


Potential Implications

- Tree of Heaven leaf litter may be an easy to access energy source for aquatic macroinvertebrates
- Replacement of riparian vegetation with Tree of Heaven may lead to changes in macroinvertebrate communities



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CSUB



SIGMA XI
THE SCIENTIFIC RESEARCH HONOR SOCIETY



Questions?