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Effects of Amur Honeysuckle on Soil CO₂ Emissions

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Introduction

- Amur honeysuckle (*Lonicera maackii*) is a highly invasive shrub found in the deciduous forests of the eastern United States.
- *Lonicera maackii*'s extended leaf phenology can impact soil nutrient availability as well as decrease air temperatures beneath its canopy.
- The high density of shallow roots in *L. maackii* may influence soil moisture levels in the upper soil layer.
- *Lonicera maackii*'s leaf senescence later in the year may alter rates of microbial nitrification in the soil across the season as the leaves undergo decomposition.
- *Lonicera maackii*'s localized environmental impacts have the potential to affect soil microbial communities.
- This in turn could change the amount of carbon dioxide released into the atmosphere from the soil surface due to microbial respiration or root activity, affecting the carbon flux of forests invaded by this shrub species.

Methods

- Plastic soil collars were inserted under the canopies of both the invasive shrub *Lonicera maackii* and the native shrub *Lindera benzoin* (spicebush) in the Kraus Nature Preserve (n = 12 for each shrub species). Open sites at least 1 meter away from any shrub were used as a control.
- The amount of CO₂ released from the soil was measured using an infrared gas analyzer (LI-COR LI-6400) placed on each collar for about 5 minutes.
- Soil samples were collected in the vicinity of each collar, dried, and weighed to measure soil moisture. Soil temperature was monitored during each measurement.
- The statistical program "R" was utilized for anova tests, t-tests, scatter plots, boxplots, and other statistical and visual testing.



Left: Aidan Shumaker configuring the LI-COR LI-6400

Right: *Lonicera maackii*



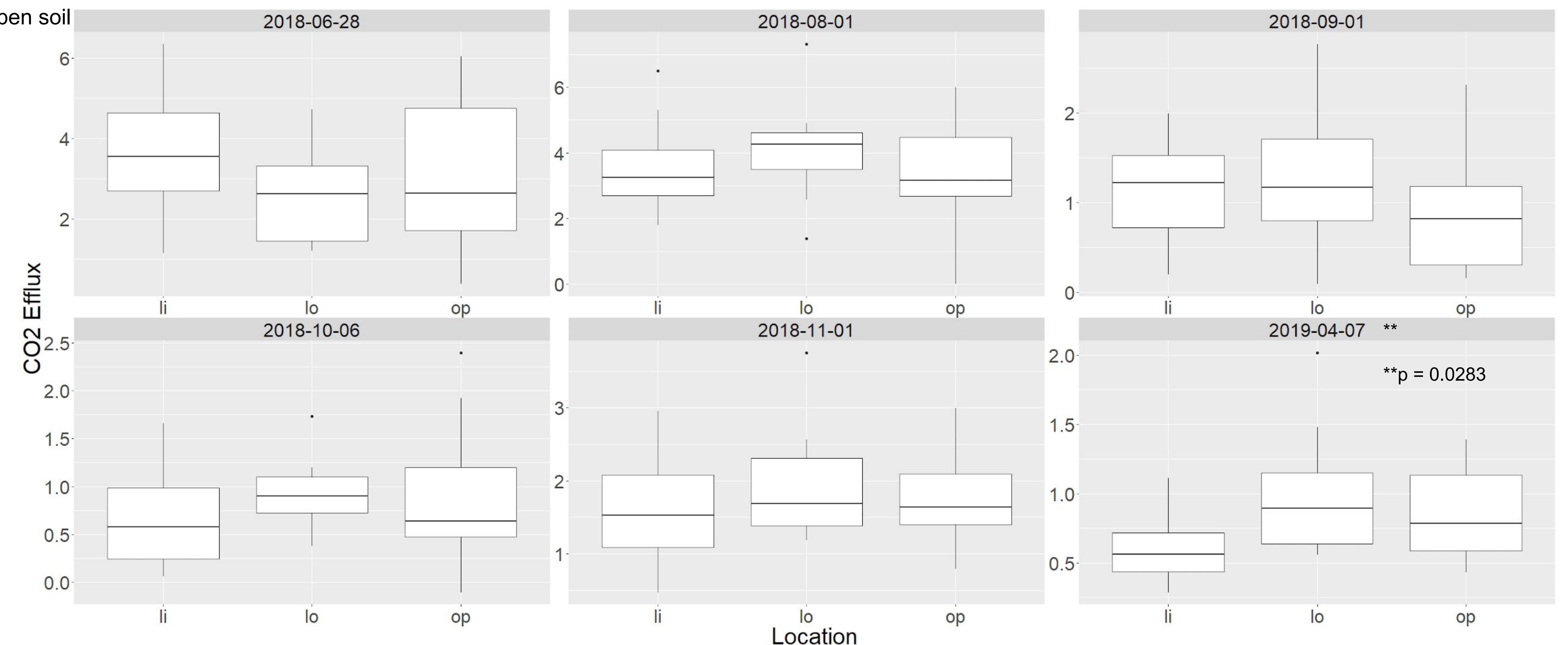
Key:

Li: underneath *Lindera benzoin*

Lo: underneath *Lonicera maackii*

Op: open soil

Figure 1: Soil CO₂ efflux across three locations, June 2018 to April 2019, n = 12 per location



- During leaf-out of *L. maackii* in April, soil respiration was significantly higher (ANOVA p < 0.05) under *L. maackii* as compared to *L. benzoin*. Soil respiration rates were slightly higher under *L. maackii* as compared to open sites, but the differences were not significant. Winter respiration readings were not collected due to frozen soils. Soil moisture did not differ significantly among the sites.

Conclusions

Results indicate that there is a significant difference in soil CO₂ efflux between *L. maackii* and *L. benzoin* in April. At this time, *L. maackii* is producing leaf buds that are beginning the leaf out process before native *L. benzoin*. This is consistent with literature that shows *L. maackii* being more photosynthetically active during the earliest spring months compared to *L. benzoin*, presumably allowing *L. maackii* to transfer more carbon to its root system to support root respiration. These results suggest that *L. maackii* is respiring more during this phenological stage. Since measurements during late fall were not significantly different between species, it seems that these two shrubs are not allocating carbon differently to their root systems in the fall, in spite of differences in aboveground leaf phenology.

Acknowledgments

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