Potential effects of the invasive *Amynthas* earthworm on vegetation in hardwood forests

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Non-native earthworms can negatively affect forest vegetation

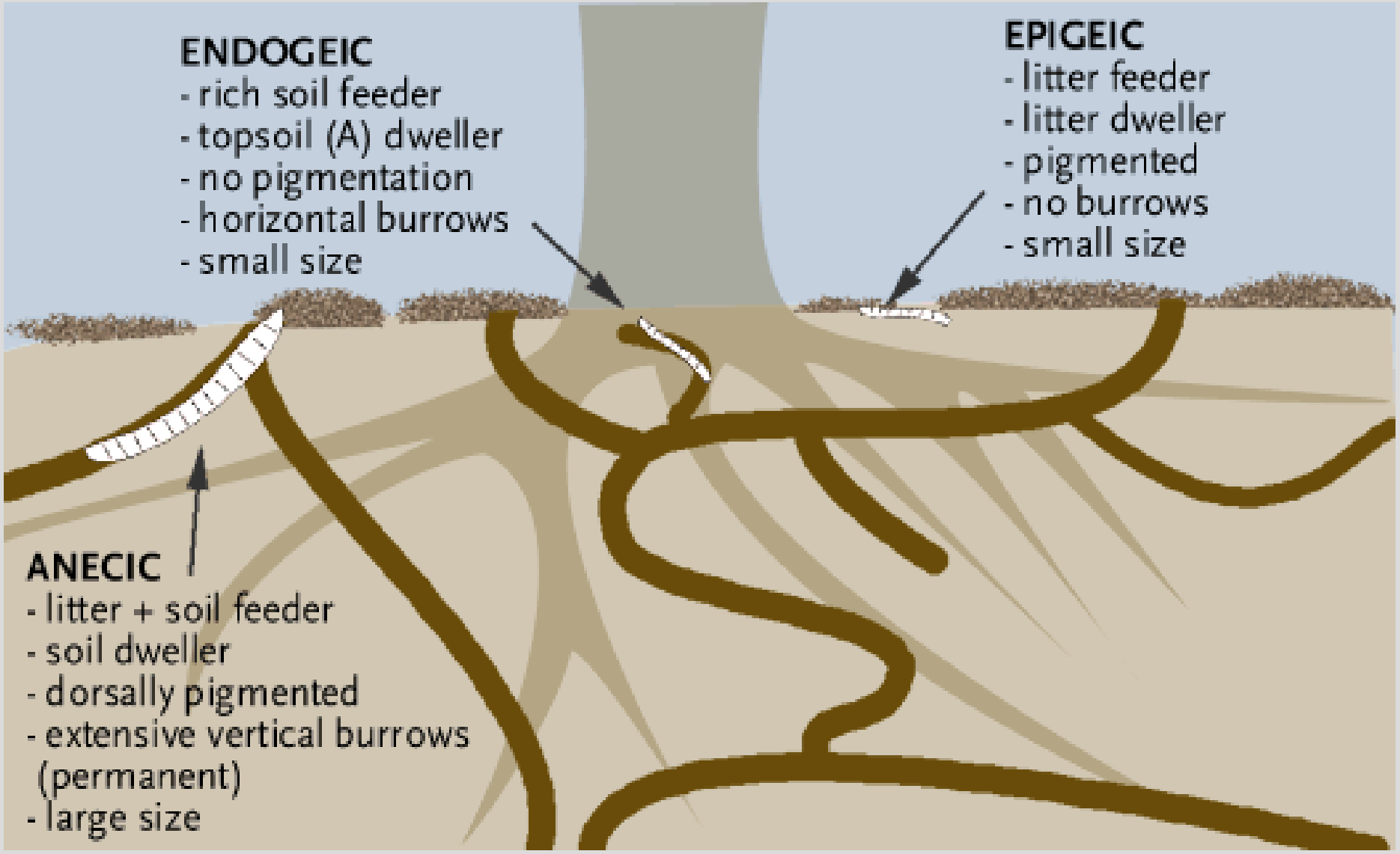
Reduce:

- Leaf litter
- Seedling establishment
- Plant species richness
- Mycorrhizal relationships

(Asshoff et al. 2010, Szlavecz et al. 2011, Hale et al. 2006)

Amynthas agrestis and *tokiensis* – ‘Jumping Worms’

Amynthas is typically an epi-endogeic worm

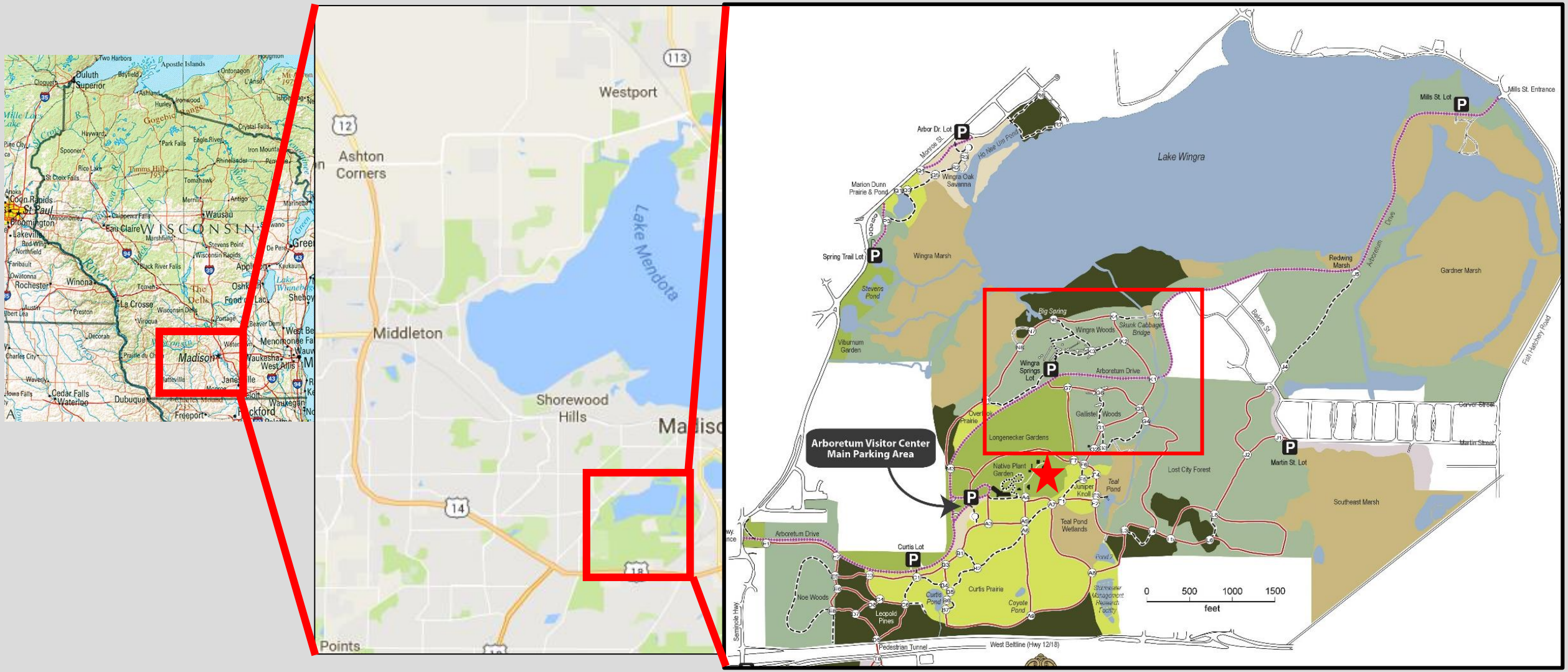


Amynthas can have significant effects on forest soils

Research Questions

- **What are the current distributions of *Amynthas* and European earthworms in the Arboretum forests?**
- **How does vegetation compare in parts of the Arboretum forest with and without *Amynthas*?**
- **Are vegetation and forest characteristics different in areas where certain earthworms are more abundant than others?**

Data Collection

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Data Collection: 1-m^2 vegetation plots surveyed in May and August of 2015 and August 2016

Data Collection: 0.36-m^2 plots surveyed in August of 2015 and 2016 for earthworm abundance

Data Collection: Site characteristics

Measurements taken
at each vegetation plot:

- Ground cover
- Soil moisture
- Soil pH
- Leaf litter depth
- Leaf litter mass

2015
Amynthas
Distribution

Epi-endogeic

Max. = 37 per 0.36 m^2

2016
Amynthas
distribution

Epi-endogeic

Max. = 49 per 0.36 m^2

2015
Lumbricus terrestris
distribution

European

Anecic

Max. = 8 per 0.36 m^2

2016

Lumbricus terrestris

Distribution

European

Anecic

Max. = 7 per 0.36 m^2

2015
Lumbricus rubellus
distribution

European

Epi-endogeic

Max. = 43 per 0.36 m^2

2016
Lumbricus rubellus
distribution

European

Epi-endogeic

Max. = 23 per 0.36 m^2

2015

Aporrectodea sp.

Distribution

European

Endogeic

Max. = 43 per 0.36 m^2

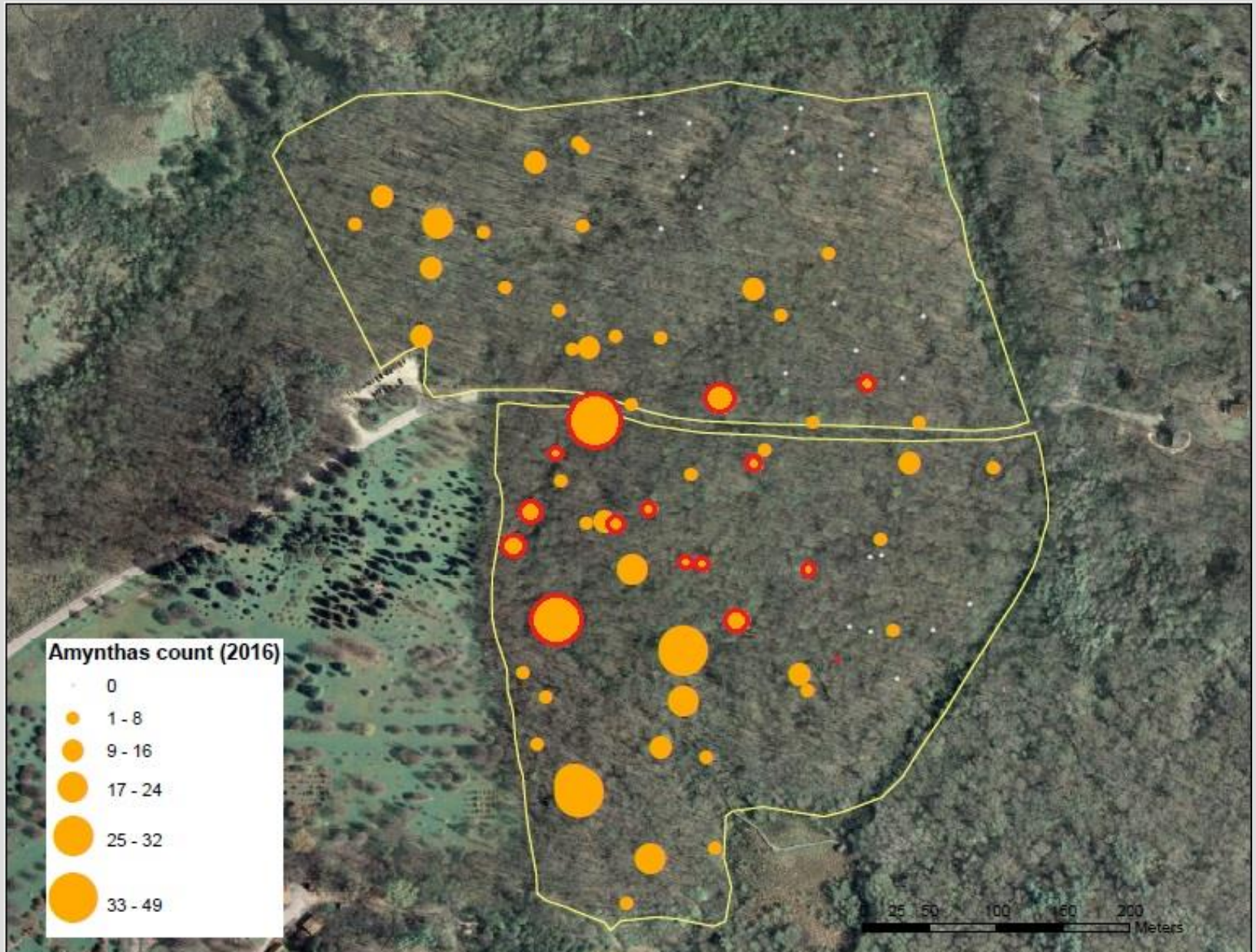
2016
Aporrectodea sp. distribution

European

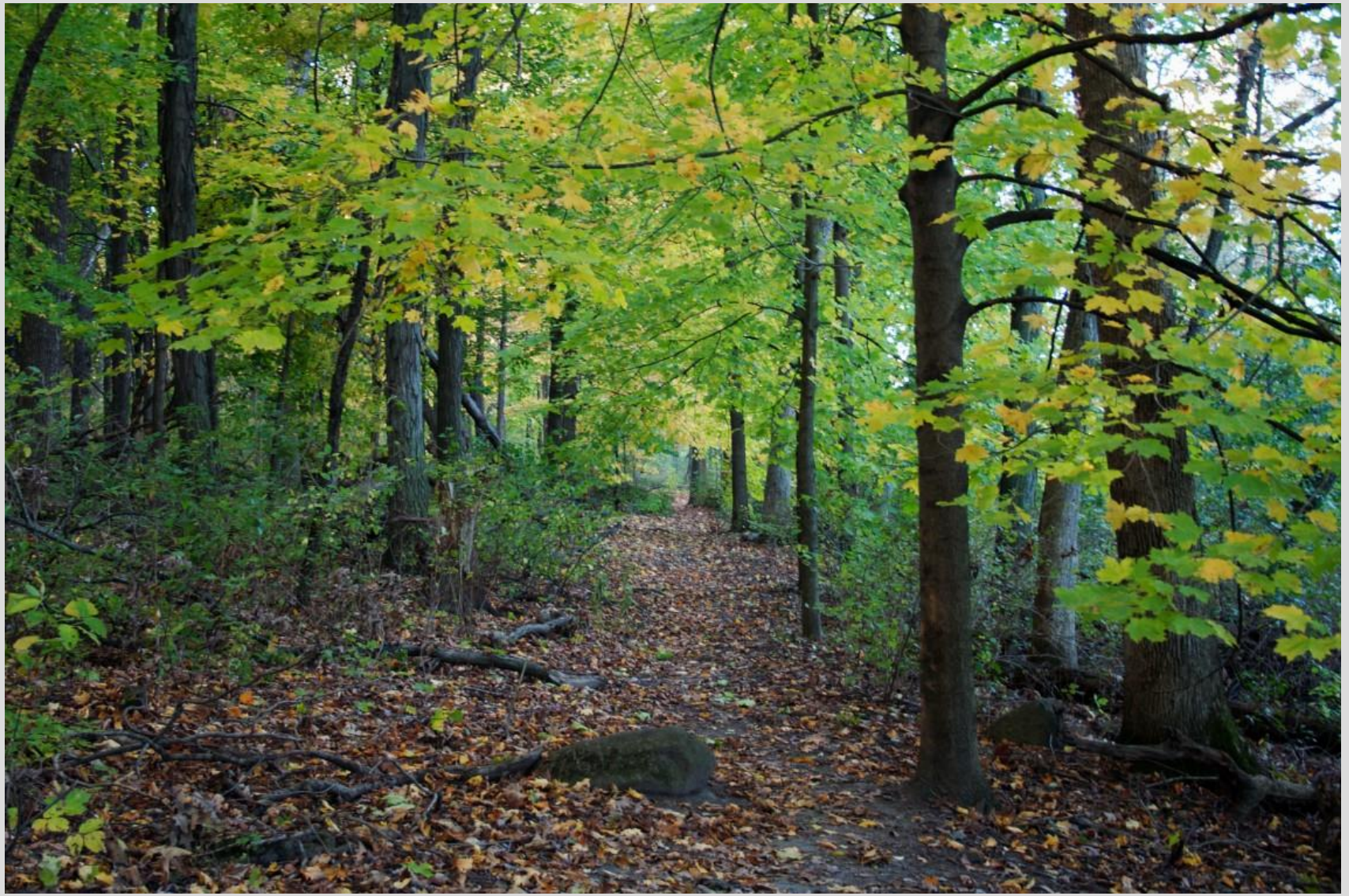
Endogeic

Max. = 35 per 0.36 m^2

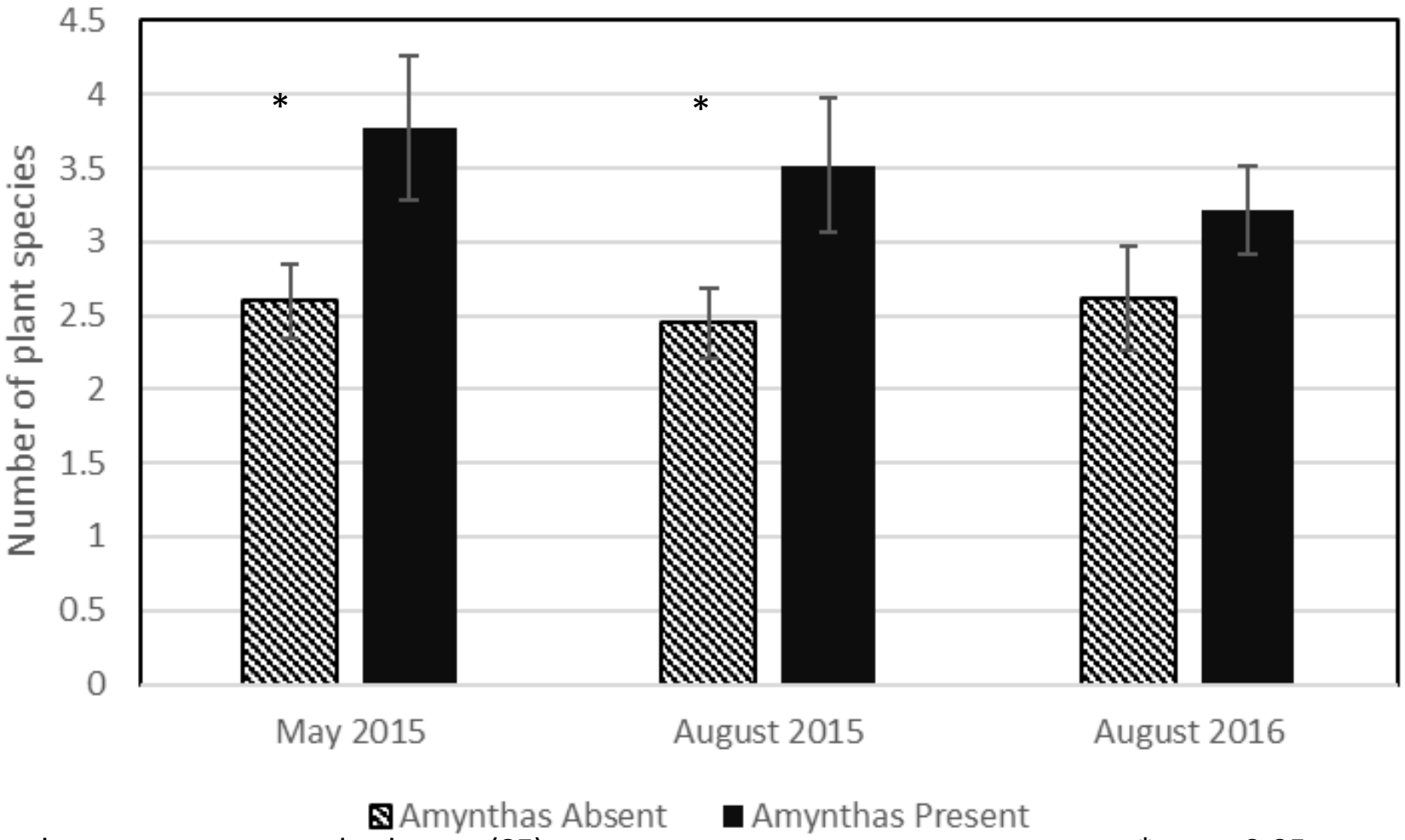
15 new plots added in 2016 help show *Amynthas* distribution in finer detail



How does the vegetation compare?



Results: Plant species richness

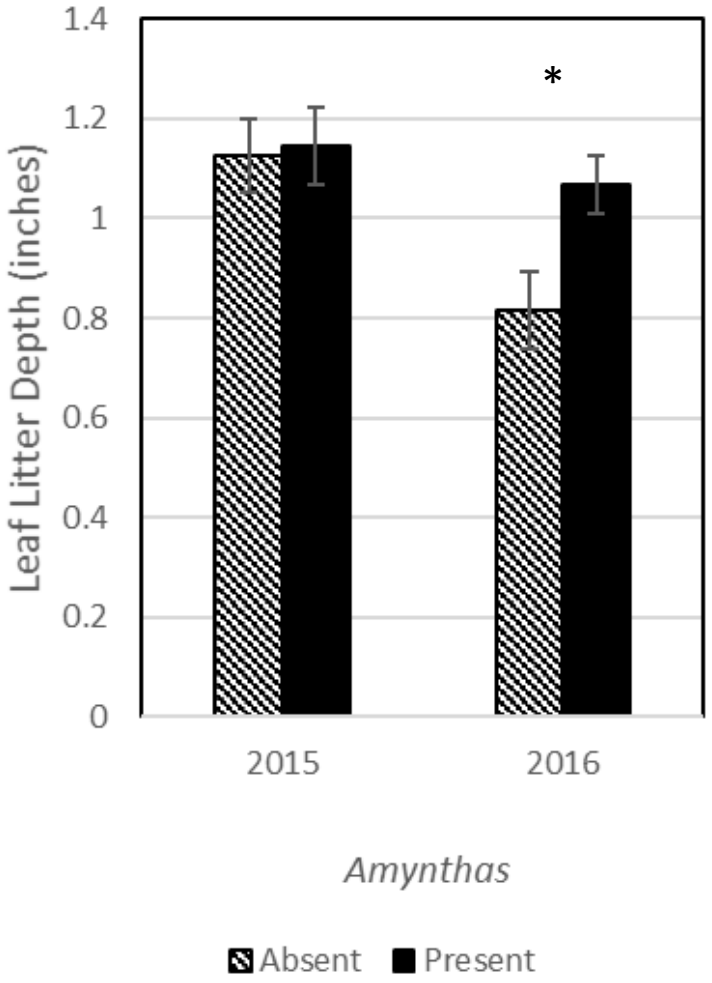


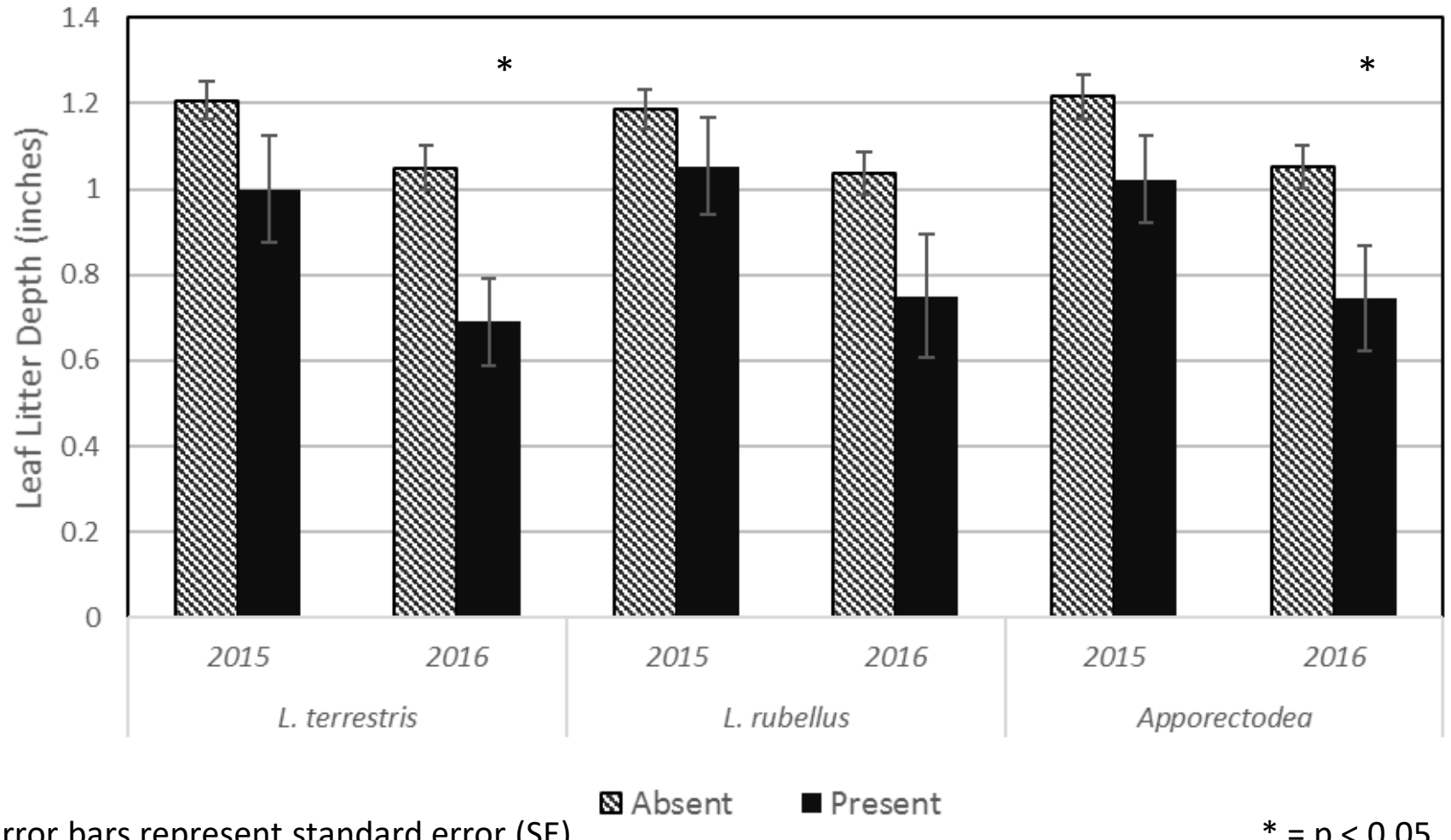
Error bars represent standard error (SE).

* = $p < 0.05$

- Species richness was significantly higher in plots with *Amynthas* present in 2015
- Species richness did not change significantly based on presence of European earthworms
- Sugar maple abundance did not change significantly based on any earthworm presence
- Herbaceous species abundance is currently being analyzed.

Results: Leaf Litter Depth





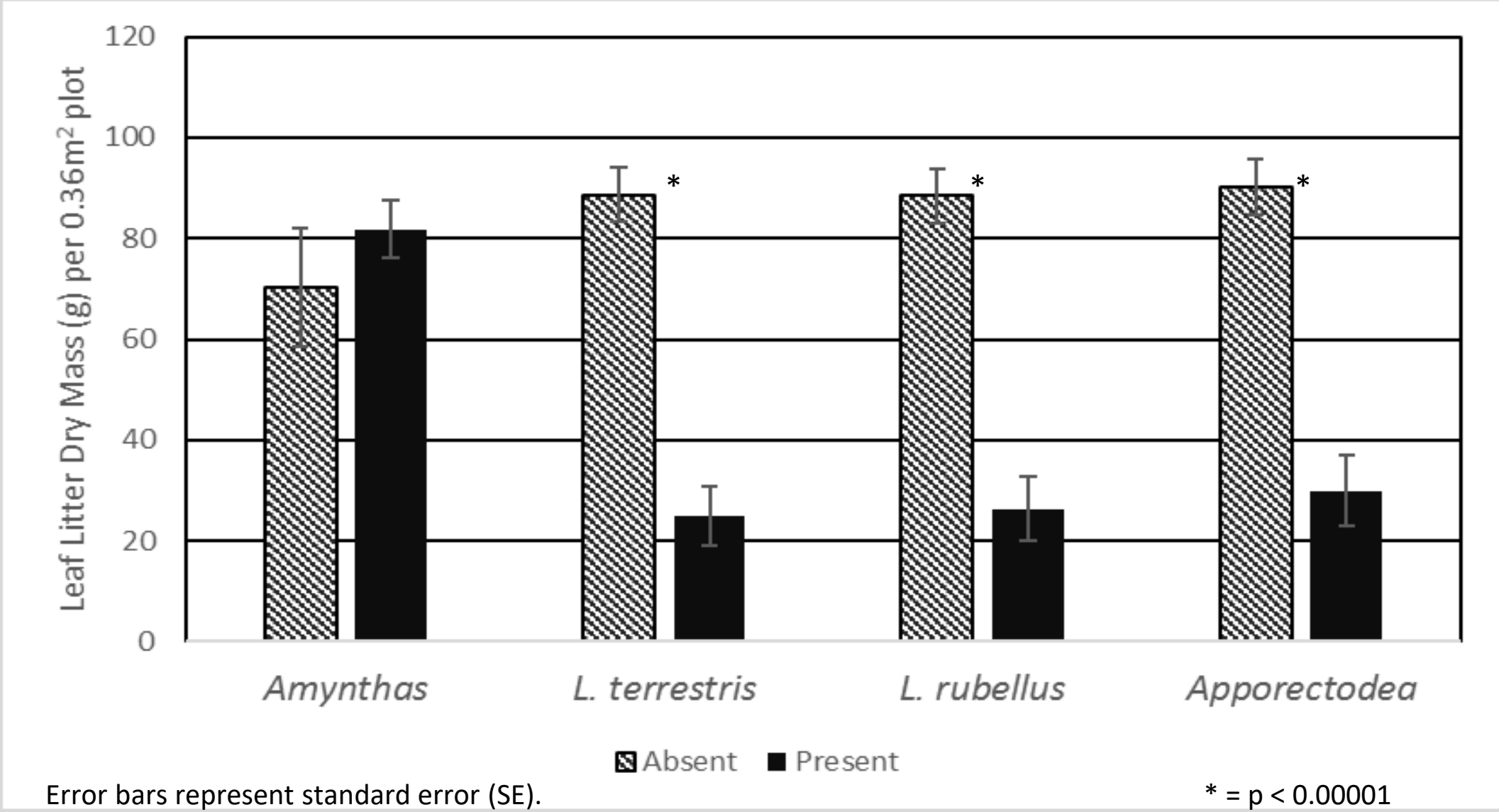
Error bars represent standard error (SE).

* = $p < 0.05$

Plots with *Amynthas* present had deeper leaf litter

Plots with European earthworms present had shallower leaf litter

Results: Leaf Litter Mass (2016)

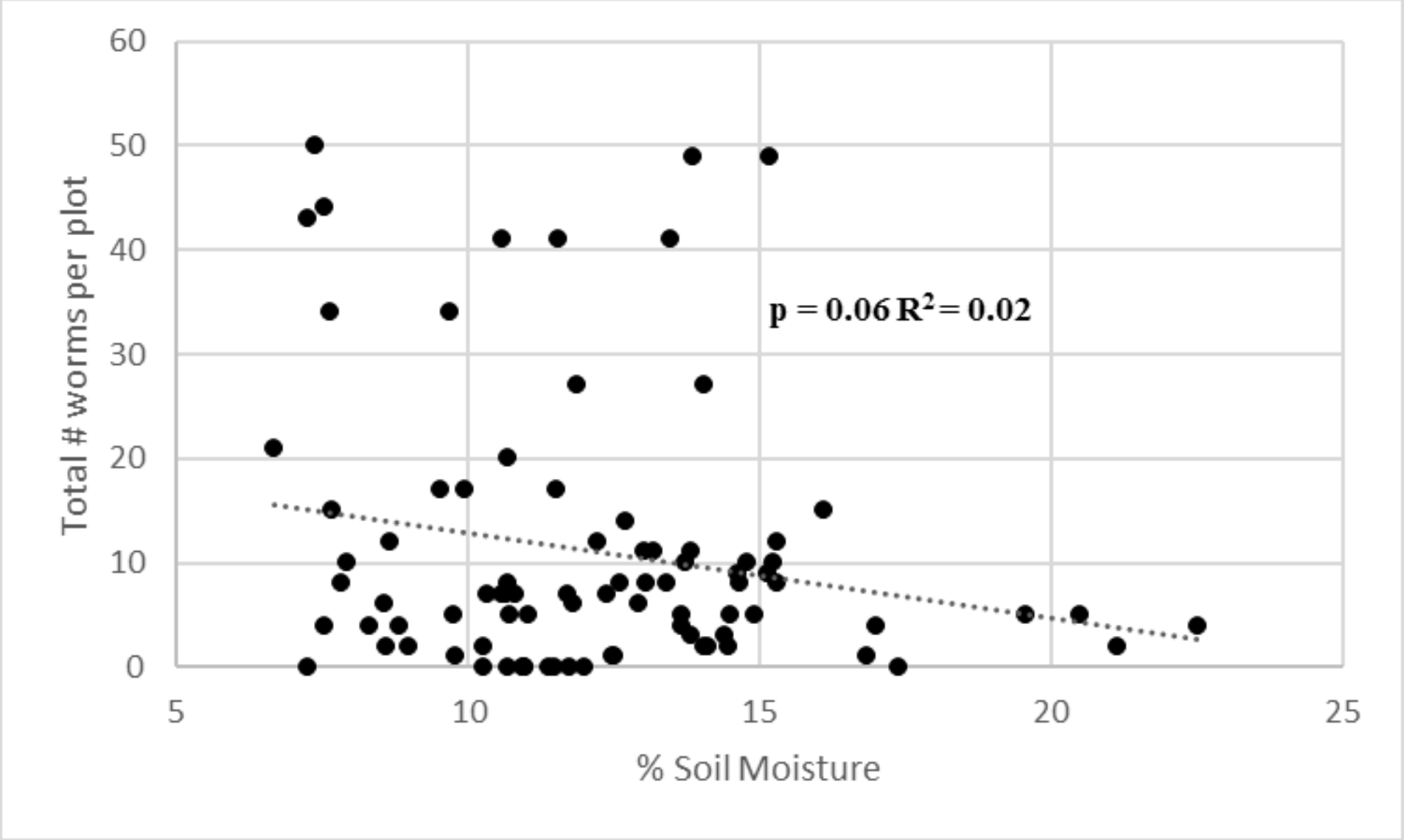


Error bars represent standard error (SE).

* = $p < 0.00001$

Litter mass was significantly lower in plots with European earthworms present

Results: Soil moisture (2016)



Total earthworm abundance was negatively correlated with soil moisture

So what's happening?

Potential explanations for preliminary findings

- *Amynthas* isn't having negative effects on vegetation
- *Amynthas*' invasion is too recent to have noticeable effects
- Areas with *Amynthas* largely lack European earthworms, reducing the negative effects of being previously occupied by European earthworms
- Earthworms' distributions and relations to vegetation are dependent on habitat preferences
- Earthworms' distributions and relations to vegetation are dependent on competition and relationships among earthworm groups

Ongoing analyses

- Changes in herbaceous species cover based on earthworm abundance
- Comparisons of pH based on earthworm abundance
- Non-metric multidimensional scaling of environmental factors
- Comparisons of 2015 and 2016 data to observe any temporal changes

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Questions?

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