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
Data Collection: 1-m$^2$ vegetation plots surveyed in May and August of 2015 and August 2016
Data Collection: 0.36-m² 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 m²
Amynthas distribution

Epi-endogeic

Max. = 49 per 0.36 m²
2015
*Lumbricus terrestris*
distribution

European

Anecic

Max. = 8 per 0.36 m²
2016
*Lumbricus terrestris*
Distribution

European

Anecic

Max. = 7 per 0.36 m²
2015
*Lumbricus rubellus*
distribution

European

Epi-endogeic

Max. = 43 per 0.36 m²
2016
*Lumbricus rubellus*
distribution

European

Epi-endogeic

Max. = 23 per 0.36 m²
2015
*Aporrectodea* sp.
Distribution

*European*

*Endogeic*

Max. = 43 per 0.36 m$^2$
2016
Aporrectodea sp.
distribution

European

Endogeic

Max. = 35 per 0.36 m²
15 new plots added in 2016 help show *Amynthas* distribution in finer detail.
How does the vegetation compare?
Results: Plant species richness

- 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

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.
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?
References


• Blakemore, R. J. 2010. Saga of Herr Hilgendorf’s worms... (Oligochaeta, Megascolecidae). Zoology in the Middle East 7140:7–22.


• Qiu, J., and M.G. Turner. 2016. Effects of Asian earthworm (Amynthas agrestis) invasion on temperate forest and prairie soils in the Midwestern US. Ecosystems (in revision).