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Addressing the current and potential impact of the invasive Jumping Worm (*Amynthas* spp.) in Wisconsin

Upper Midwest Invasive Species Conference
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WI DNR

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Outline

- Basic earthworm biology and ecology
- The effect of earthworms on the environment
- Asian jumping worms
  - Background
  - Why should we be concerned?
  - How were they introduced and where are they now?
  - What can we do?
  - Research at the UW-Arboretum

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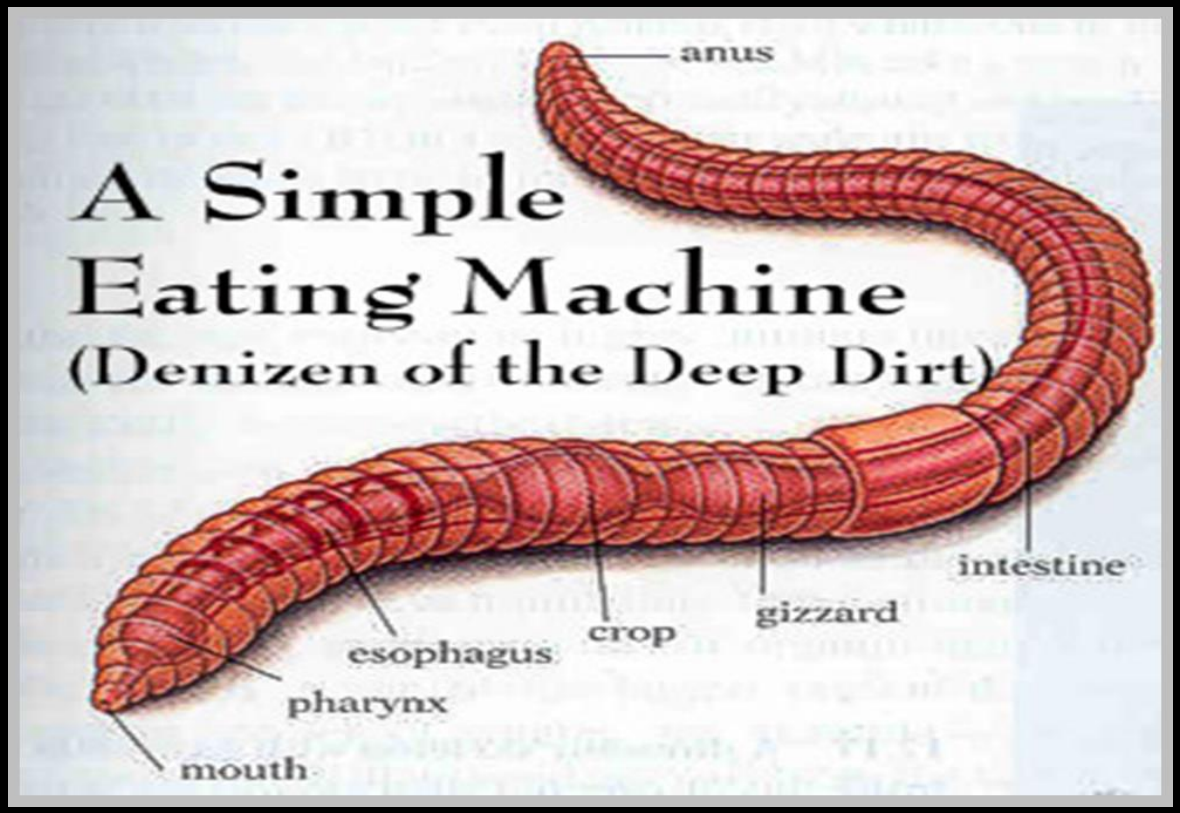
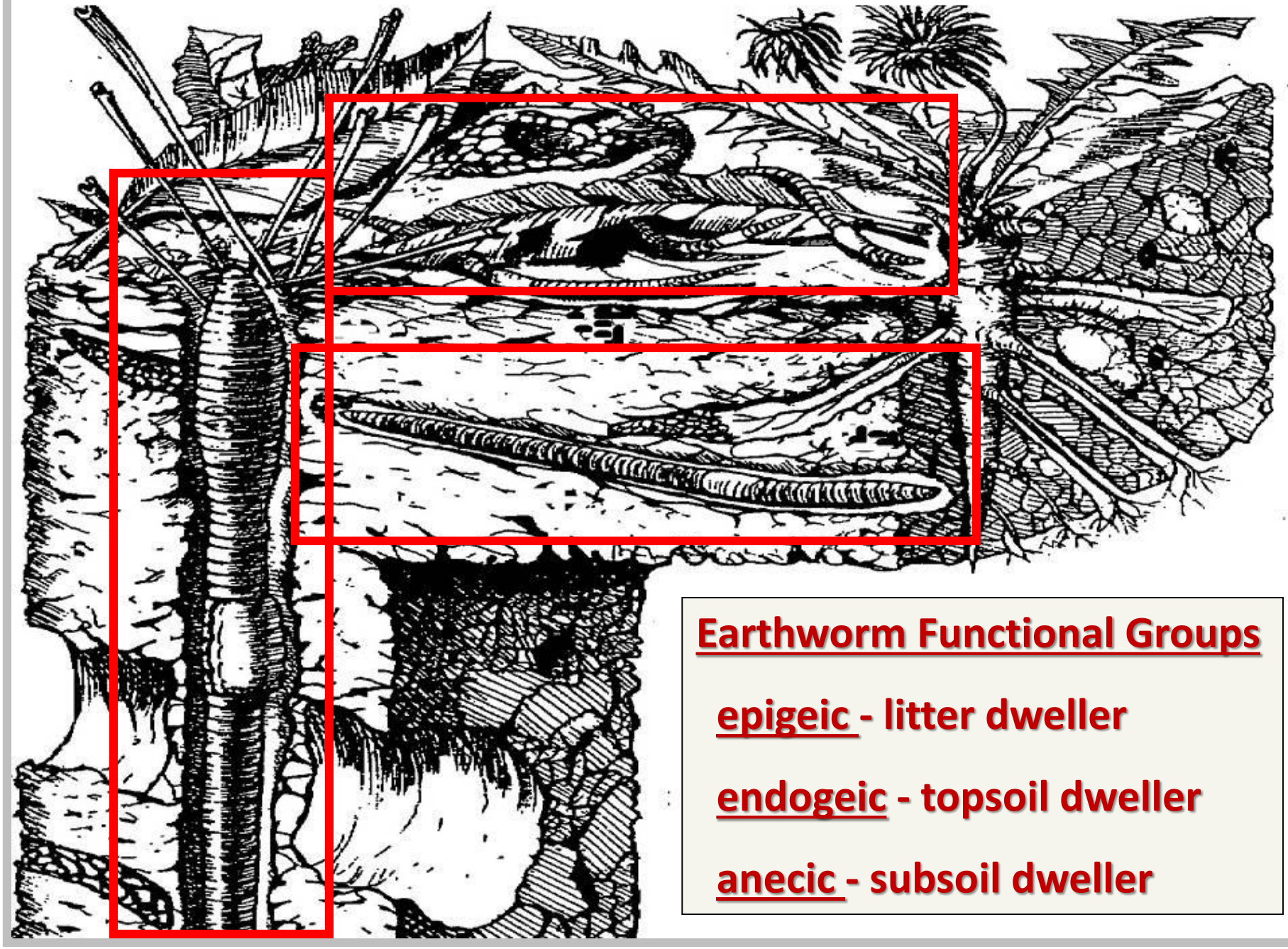
Earthworm Biology



- **Feed on soil and organic matter (leaf litter).**
- **Promiscuous, polygamous, hermaphrodites but some can reproduce parthenogenetically.**



Earthworm Functional Groups

epigeic - litter dweller

endogeic - topsoil dweller

anecic - subsoil dweller

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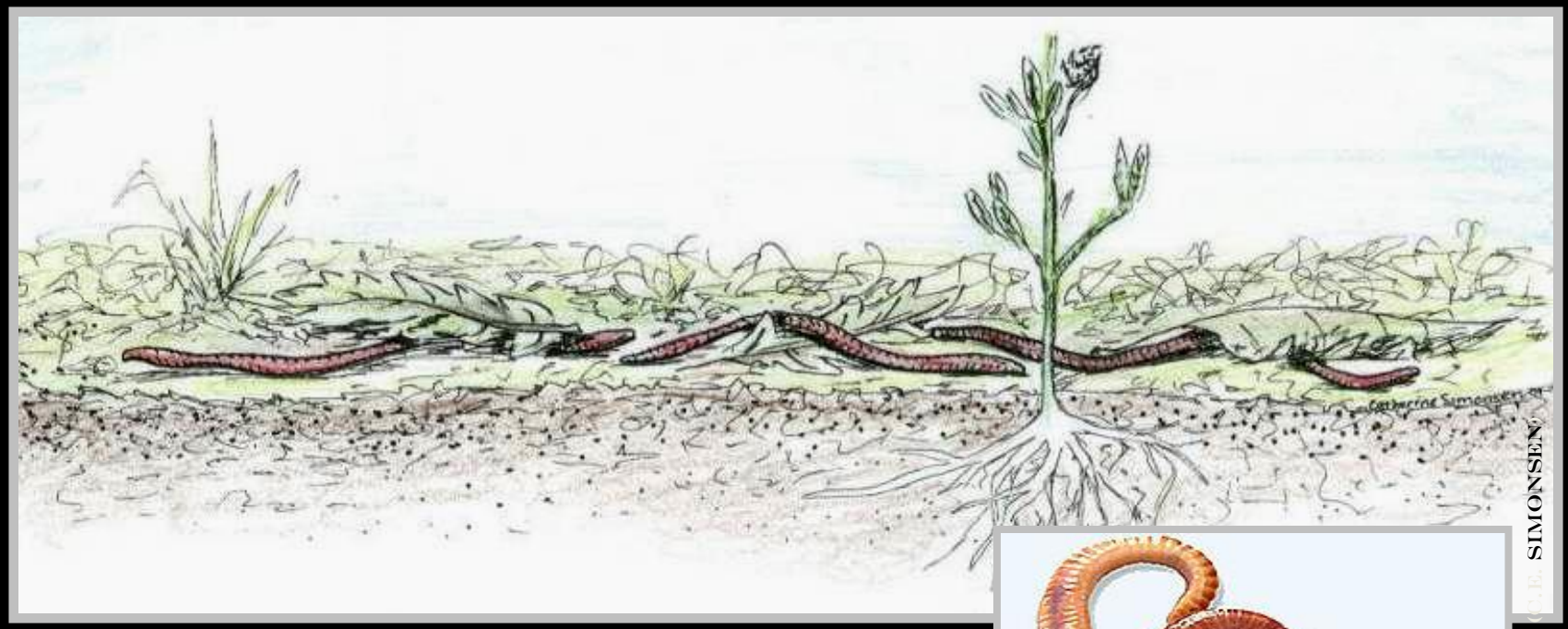
Earthworm Functional Groups



- **Epigeics-Litter dwelling**
- Endogeics-Topsoil dwelling
- Anecics-Subsoil dwelling

Red Wiggler or Tiger Worm,
Eisenia fetida

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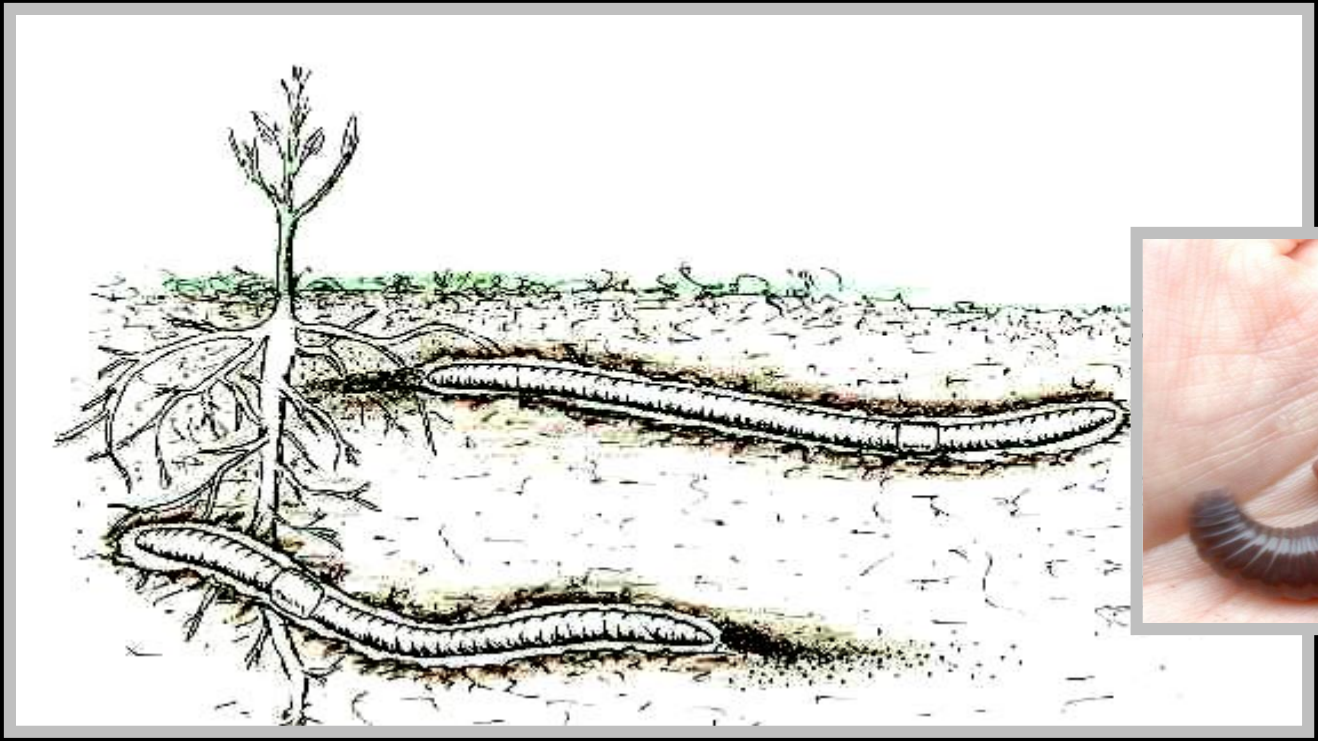
Earthworm Functional Groups



Red Worm or Leaf worm,
Lumbricus rubellus

- Epigeics-Litter dwelling
- **Endogeics-Topsoil dwelling**
- Anecics-Subsoil dwelling

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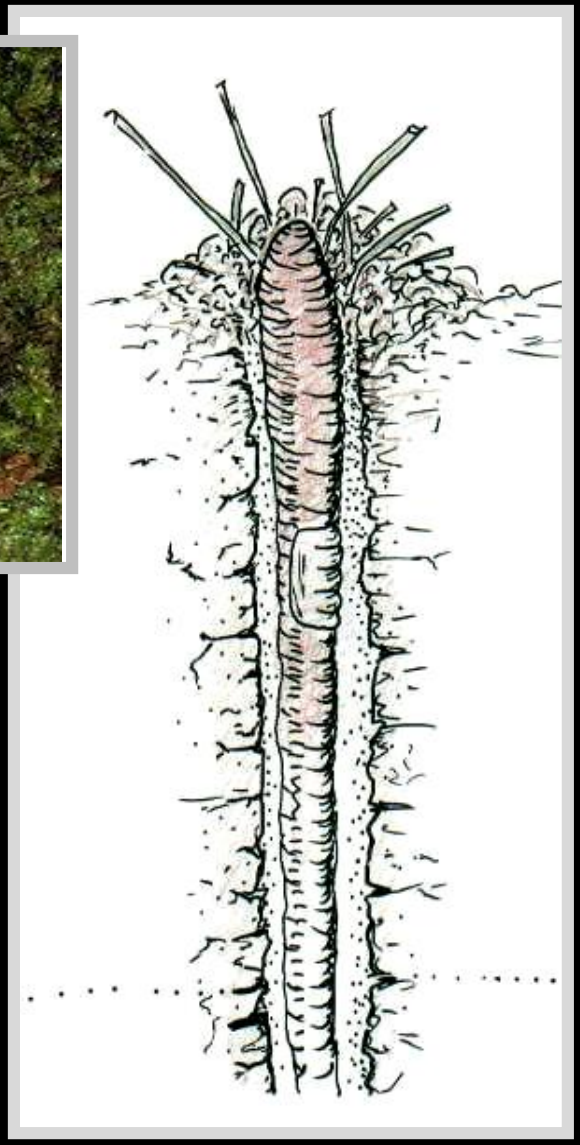
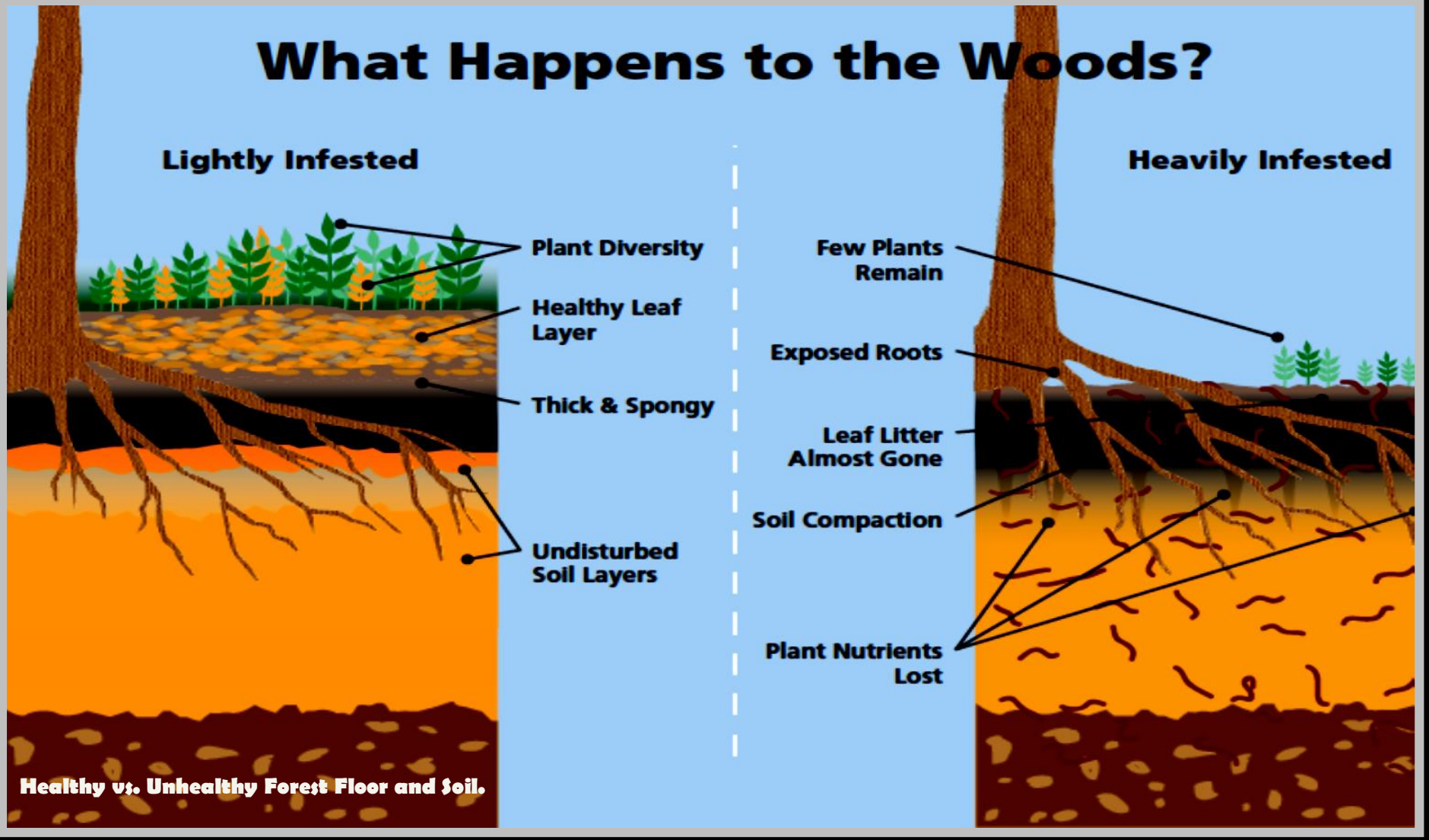
Earthworm Functional Groups

Common Nightcrawler
Lumbricus terrestris



- Epigeics-Litter dwelling
- Endogeics-Topsoil dwelling
- **Anecics-Subsoil dwelling**



Earthworms have considerable capacity to <u>change the nature of their environment to suit their survival</u>. Ecological requirements (moisture, temperature, and food supply) greatly influence the rates of reproduction and growth

Changes to the Soil Environment

Earthworms influence the physical, chemical, and biological properties of the soil through:

- Burrowing
- Casting
- Feeding
- Mucus secretion
  Death/decomposition

The effects of the above depends on the functional group of earthworms.

Physical

- Mixing of the soil profile
- Incorporation of organic materials
- Water infiltration & holding capacity
- Soil aeration
- Soil erosion
- Soil structure & aggregate formation

Chemical

- Nutrient pools and dynamics
- Deplete soil cations

Biological

- Micro/Macro organisms
- Nematodes
- Food source for birds and mammals
- Plant productivity

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Amynthas spp. (Jumping worm)

- Native to Asia; commonly found in grasslands
- Hundreds of species and affiliated genre worldwide
- First WI record at the Arboretum in 2013
- Listed as “restricted” under WI NR 40
- Three most common species that co-occur in upper Midwest include:
  - *A. tokioensis*
  - *A. agrestis*
  - *M. hilgendorfi*
- All three are epi-endogeic and parthenogenic

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Earthworm Comparison

	Amynthas spp.	*Lumbricus rubellus*
		
Length:	**7 to 20 cm**	**2 to 8 cm**
Life Cycle:	**Annual; over-winters as cocoon**	**Burrows into soil during winter**
Skin:	**Darker dorsally than ventrally, slightly rigid**	**Reddish-brown**
Clitellum:	**Milky white, annular, smooth**	**Raised, pink/red, “saddle” shape**
Clitellum from segments	**14-16**	**26-32**
Behavior:	**Very active, snake like**	**Less active, “wiggly”**
Casts:	**“Coffee grounds” soil signature**	**Dispersed casts**
Loses its tail when handled roughly		**Will not drop tail**

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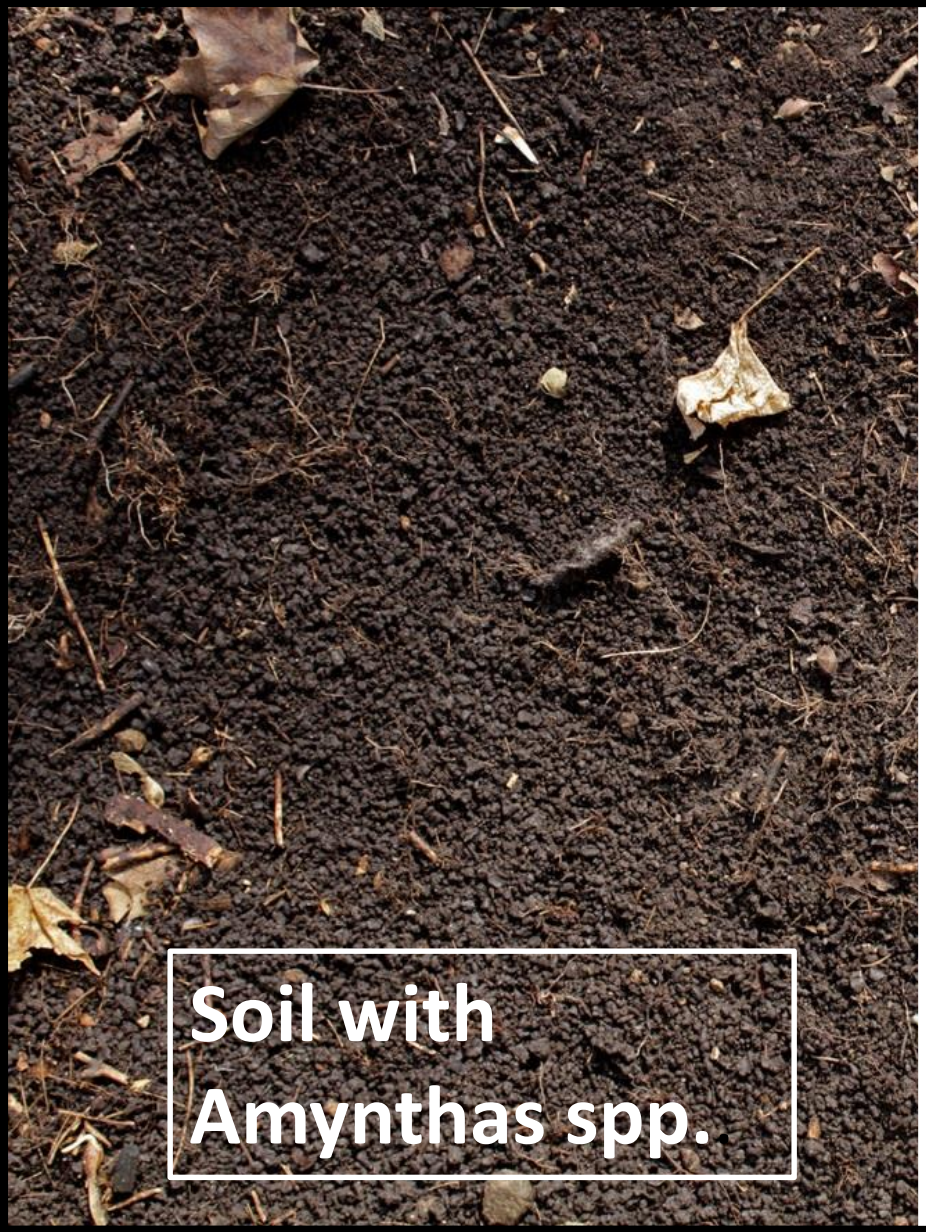
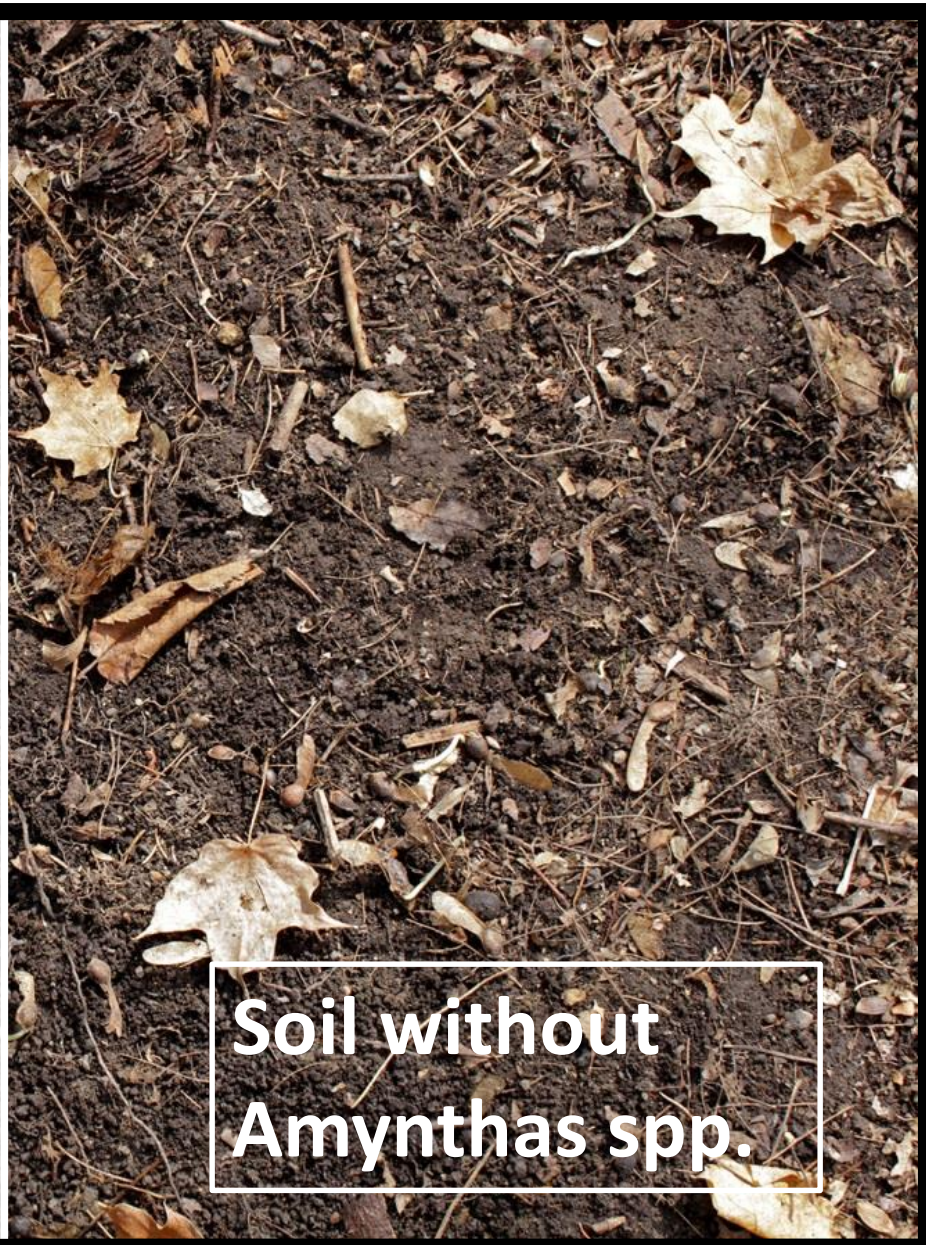
Earthworm Comparison





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Why should we be concerned?

The effect of European earthworms on forest ecosystems has been well studied and include:

- Significant reduction of litter layer in deciduous forests
    - Loss of native plant diversity and increase in exotic, invasive plant species.
- Changes in soil nutrient dynamics

We think the effects of *Amynthas* spp. will be similar, but more dramatic.

- Parthenogenic and easily spread

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How do they spread?

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How do they spread?

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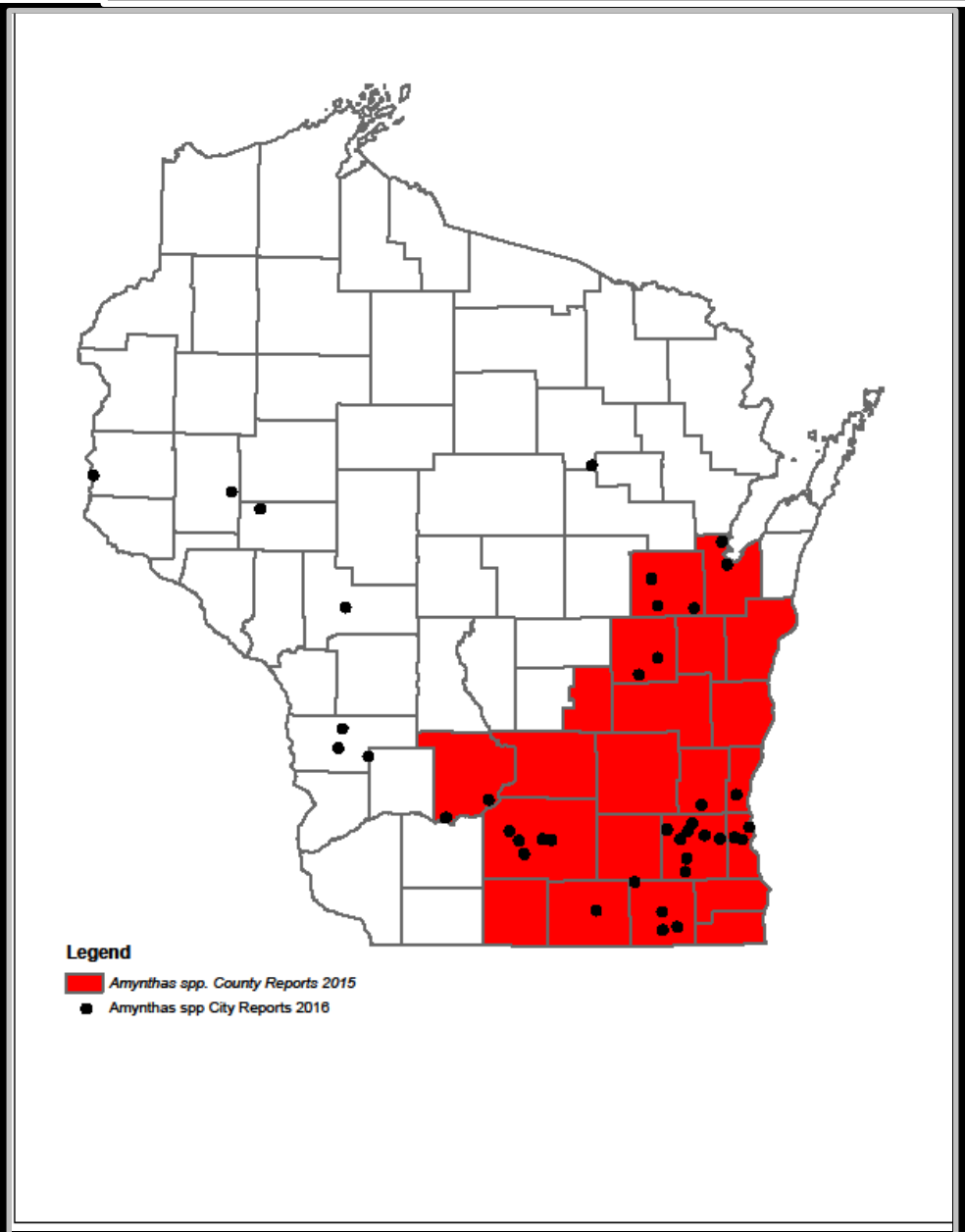
Where are they?



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What can we do?

Best Management Practices (BMP's)

1. Watch for jumping worms and signs of their presence.

2. Educate yourself and others to recognize jumping worms.

3. Only use, sell, plant, purchase, trade landscape and gardening materials and plants that appear to be free of jumping worms.

4. Only sell, purchase or trade compost that was heated to appropriate temperatures and duration following protocols for reduction in pathogens (PFRP's-detailed under NR 502.12).

5. Arrive clean, leave clean. Clean soil and debris from vehicles, equipment and personal gear before moving to and from a work or recreational area.

Stop the Spread!

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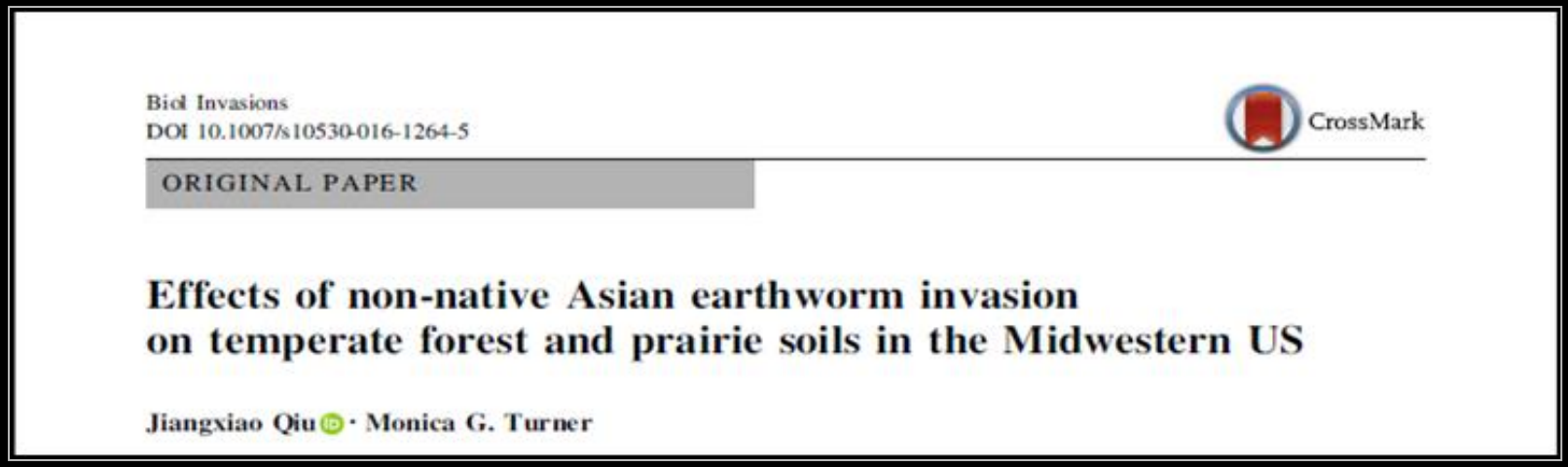
Research at the UW-Arboretum



Biol Invasions
DOI 10.1007/s10530-016-1264-5

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ORIGINAL PAPER

Effects of non-native Asian earthworm invasion on temperate forest and prairie soils in the Midwestern US

Jiangxiao Qiu · Monica G. Turner

- *A. agrestis* and *A. tokioensis* substantially reduced leaf litter, and increased total carbon, total N, and avail. P from 0-5cm.
- Increased inorganic N and TOC from 0-25cm.
- Effects were observed in both forest and prairie soil, with stronger effects in forests.
- Depletion of litter layer and rapid mineralization of nutrients may make ecosystems more susceptible to nutrient losses.

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Research at the UW-Arboretum

- Effects of *Amynthas* spp. on woodland herbs and woody seedlings and saplings – *Katie Laushman*
- Interaction between *Amynthas* spp. and buckthorn litter – *Carly Ziter*
- Abiotic controls to cocoon hatching – *Marie Johnston*
- Effect of an organic fertilizer on *Amynthas* spp. and soil arthropods - *Herrick*

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Questions?