

# Invasive Jumping Worms: The Impact of a New Soil Invader

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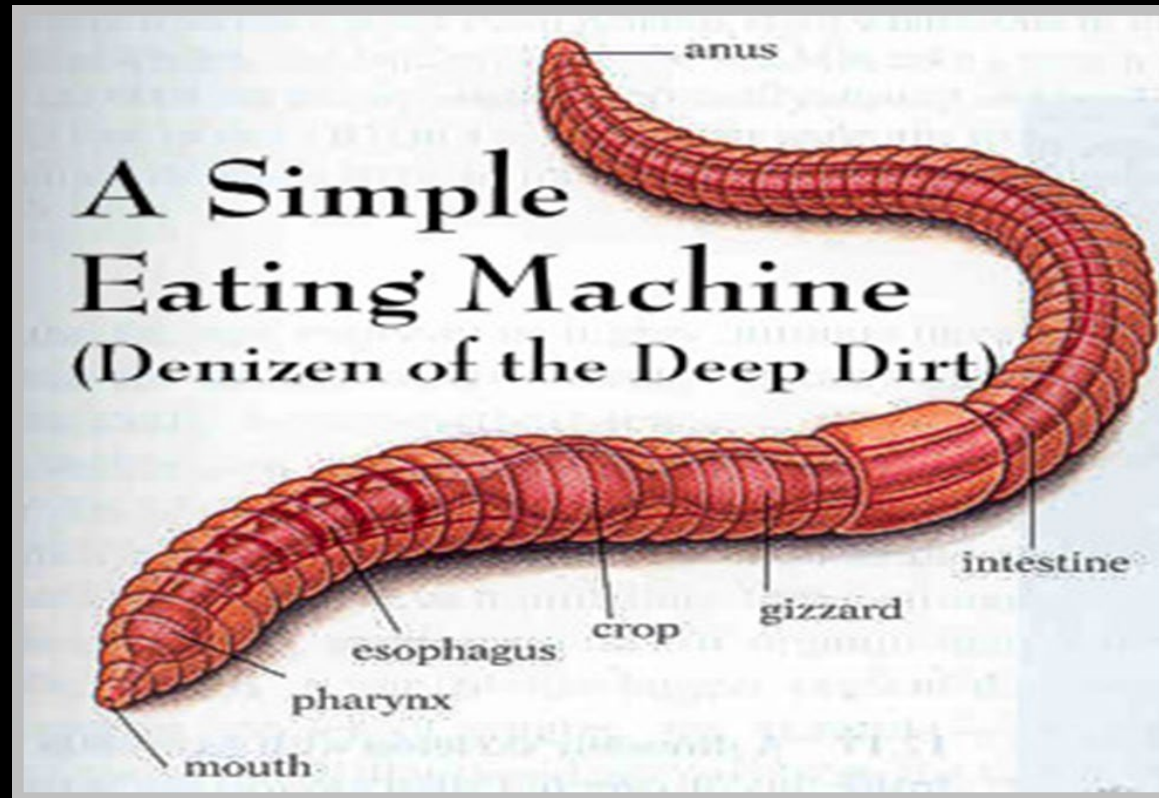
# Outline

- Basic earthworm biology and ecology
- The effect of earthworms on the environment
- Earthworm identification
- Asian jumping worms
  - Background
  - Why should we be concerned?
  - Impacts to gardens
  - How do they spread?
  - What can we do?

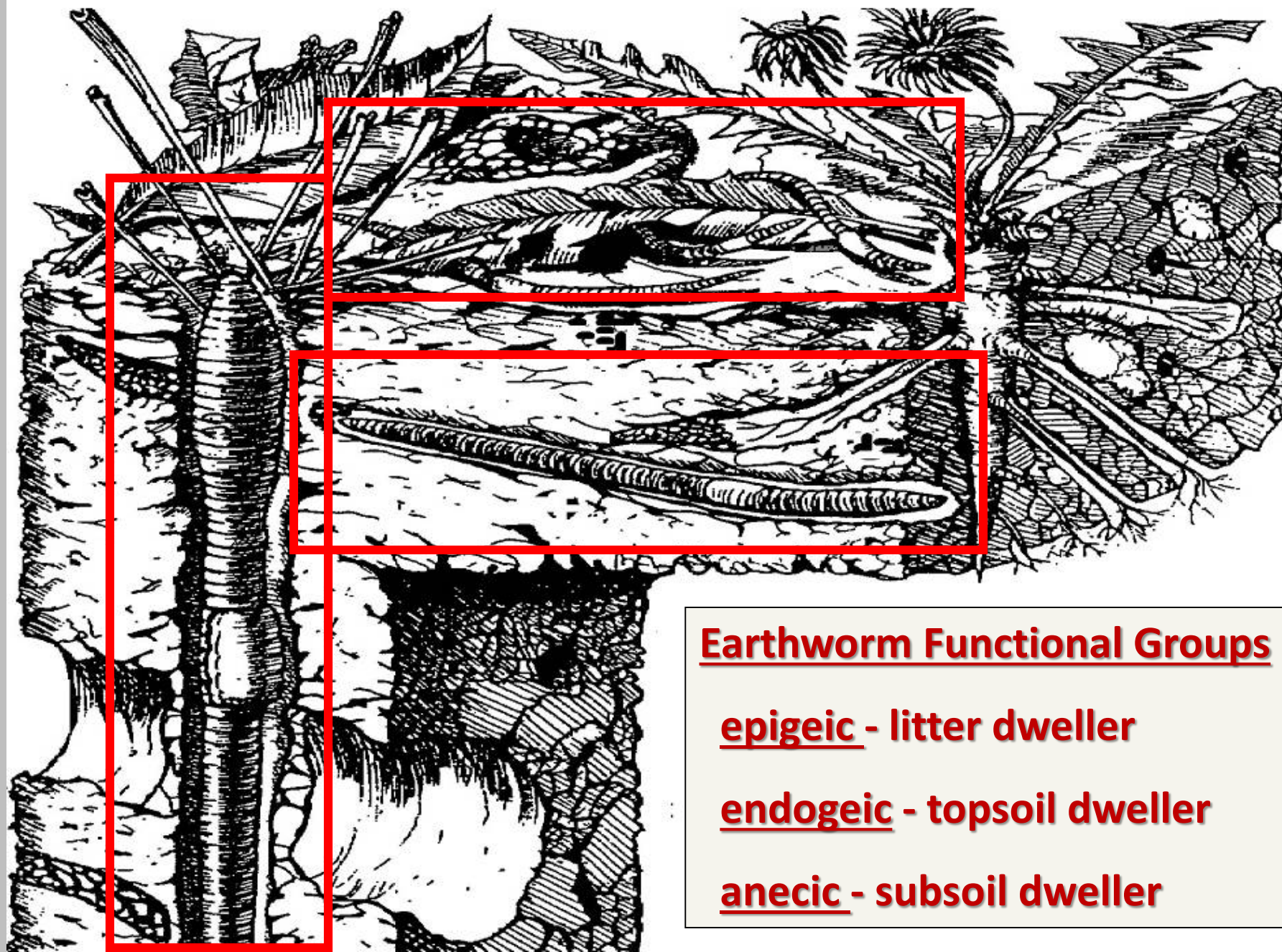




# Earthworm Biology



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



## Earthworm Functional Groups

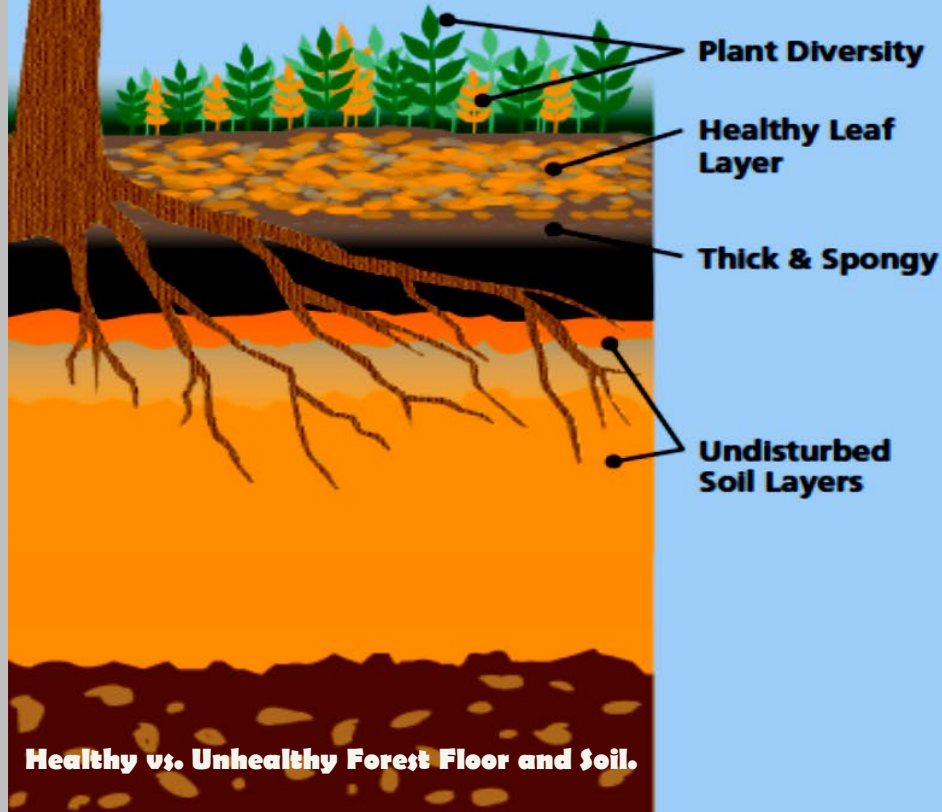
epigeic - litter dweller

endogeic - topsoil dweller

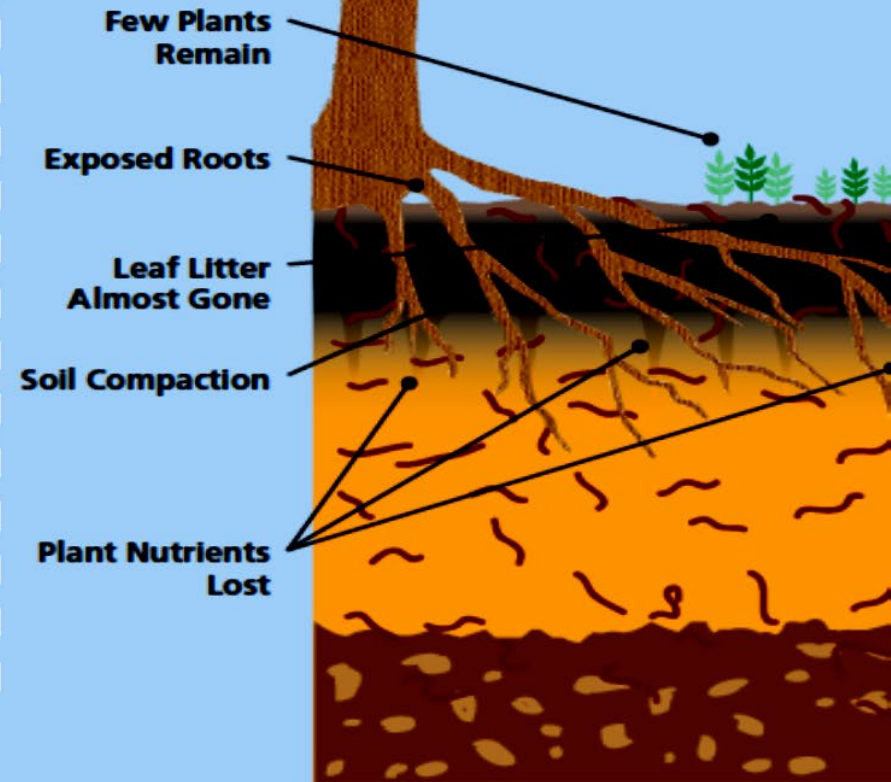
anecic - subsoil dweller

# What Happens to the Woods?

## Lightly Infested



## Heavily Infested



Earthworms have considerable capacity to change the nature of their environment to suit their survival. 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
- Change soil cation-exchange capacity

## Biological

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



# *Amyntas* spp. (Jumping worm)



- Native to Asia; commonly found in grasslands
- Hundreds of species and affiliated genera 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



# Earthworm Comparison

## *Amyntas* spp.



## *Lumbricus rubellus*



**Length:** 7 to 20 cm  
**Life Cycle:** Annual; over-winters as cocoon  
**Skin:** Darker dorsally than ventrally, slightly rigid  
**Clitellum:** Milky white, annular, smooth  
Clitellum from segments 14-16  
**Behavior:** Very active, snake like  
**Casts:** "Coffee grounds" soil signature  
Loses its tail when handled roughly

2 to 8 cm  
Burrows into soil during winter  
Reddish-brown  
Raised, pink/red, "saddle" shape  
Clitellum from segments 26-32  
Less active, "wiggly"  
Dispersed casts  
Will not drop tail



# Earthworm Comparison











Giant Gippsland Earthworm



# Soil Comparison



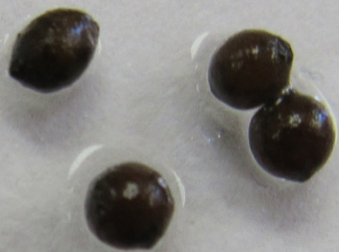
*Metaphire  
hilgendorfi*



*Amyntas  
agrestis*



*Amyntas  
tokioensis*





# Why should we be concerned?

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

- Significant reduction to the 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 *Amyntas* spp. will be similar, but more dramatic.**

- Parthenogenic and easily spread



# Why should we be concerned?

But wait, aren't earthworms good for my garden?





# Why should we be concerned?

Answer: Yes and no...

- Urban gardens and large scale agriculture often have compacted soil that need amendments.
- Deep dwelling earthworms like common night crawlers, create tunnels. These tunnels allow air and water to reach plant roots.



# Why should we be concerned?

- Earthworms eat organic matter, such as dead leaves, grass clippings, and even soil. After they digest their meal, they produce excrement called castings that helps enrich the soil further.



- These castings helps gardens grow because they're rich in phosphorus, calcium, nitrogen, and magnesium. These are all important nutrients for plant growth.

# Why should we be concerned?

However,

- Jumping worms live under the leaf litter and in the top few centimeters of soil, thus they are not effective at aerating the soil.
- They may create too much pore space, thus drying out the soil.
- Jumping worms can create very loose top soil which is highly erodible (castings).





# Why should we be concerned?

- Soil may become too loose for plant roots to establish, or established plants may decline in health.
- Jumping worms can turn over nutrients too fast, like a quick release fertilizer.
- At high abundance jumping worms can destroy turf grass.



- In some instances jumping worms will eat plant roots.



# How do they spread?





# How do they spread?





# How do they spread?





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# How do they spread?





# How do they spread?





# How do they spread?





# How do they spread?





# How do they spread?





# How do they spread?



# 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!





# What can we do?

## Earthworm Sampling

- Mix 1/3 cup dry mustard powder with 1 gallon of water.
- Remove leaves and other litter from soil surface.
- Pour half of the solution over 1 square foot of soil.
- Wait for a few minutes, then pour the other half.
- Collect earthworms as they come to the surface.







# What can we do?

- Early Bird (organic fertilizer) will reduce casts of European earthworms. Pilot study at the Arboretum showed almost 100% mortality of jumping worms at high dosage. Does not seem to effect cocoons. Only one study has looked at residual impacts to native soil biota.



- Biochar is reported to reduce numbers of European earthworms



# What can we do?

- Recent research shows that jumping worm cocoons will not survive 40°C (104° F) (Johnston and Herrick, 2019)
- In Wisconsin, commercial composters are required to heat piles to at least 55°C (131°F) for at least 3 days.
- Fire significantly reduced viability of jumping worm cocoons (Ikeda et al., 2015)



# What can we do?

- Consider reducing the amount of wood mulch applied to your garden.
  - Purchase mulch from a reputable source. Nurseries should know about the jumping worm.
- Experiment with pine needles, hay, or native grass mulch
- Experiment with heat applications (solarization, steam, torch, etc)



# Resources

## Wisconsin Department of Natural Resources

<http://dnr.wi.gov/topic/Invasives/fact/jumpingworm/index.html>

## UW-Madison Arboretum (Land Stewardship; Research)

<https://arboretum.wisc.edu/>

## Great Lakes Worm Watch

<http://greatlakeswormwatch.org/>



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# Questions?

