

# **Invasive Earthworms in Northeastern Sugarbushes**



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# Getting Down & Dirty

Today's earthworms not native to Northern landscapes (from Europe, Asia & Africa)

- Extinction during last ice age (11,000 years ago)
- Returned with settlers (1600s)

Continued spread via human activities

- Disposal of purchased worm bait into the landscape
- Movement of plant stock/compost/mulch from nurseries to landscapes



The Canadian NightCrawler (*Lumbricus terrestris*) is a European worm commonly sold as bait

# A “Snake in the Grass”

Over 30 earthworm species in New England

- 10 are linked directly to greenhouses & composting facilities & products
- Asian earthworms particularly concerning

*Amyntas* species - Asian snake/Jumping worms

- Outcompetes most common European species like *Lumbricus terrestris*, the Canadian Nightcrawler
- Newer & not understood as well as European types



*Amyntas* spp. have a white ring (clitellum) that stretches all around the body & they flail/jump around when disturbed

# Invasions of Non-native Species Causes Biodiversity Loss

Earthworms change forest ecosystems

Consume & eliminate duff/organic layer

Create unsuitable soil substrate for seed germination = **reduced regeneration of seedlings (like Maple) & other flora**

Reduce productivity (increase soil erosion, nutrient leaching, disrupt mycorrhizal fungi networks, etc.)

Provide suitable habitat for invasive plant species (Barberry, Multiflora Rose, Honeysuckle, etc.)

Displace species that rely on duff layers (insects, salamanders, etc.), wildflowers, ferns, etc.



# The Amynthus Advantage

## How Do They Do It?

Earthworms are hermaphrodites (male & female)

Annual species with 2 generations per year (if warm)

Reproductive advantage over other worms

- Produce clones (no mating needed - offspring from unfertilized eggs)
- Nightcrawlers (*Lumbricus* sp.) & many other species need to mate

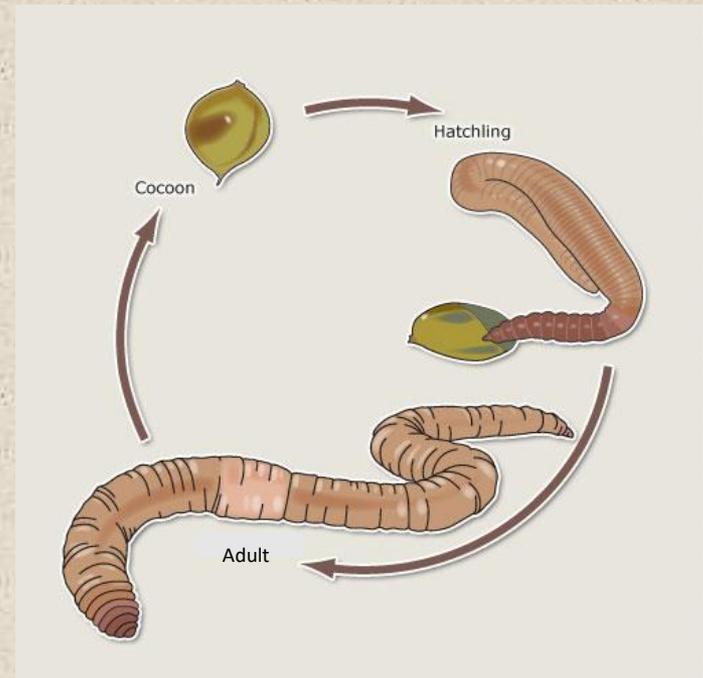
Adults make cocoons with 1-3 eggs

Cocoon stage survives severe winter cold (& droughts)

- Nightcrawlers hibernate deep in soil column

Hatch in spring when temps reach over 50°F

Spread rapidly (5-10 meters per year) once introduced by humans



# Worm Types – Functional Groups

## Feeding-Dwelling Behavior

*Amyntas* sp.

Red Wigglers (compost worms)



### EPI-ENDOGEIC

- surface feeder
- top & middle dweller

Top-Middle

### ENDOGEIC

- rich soil feeder
- topsoil (A) dweller

Middle

### EPIGEIC

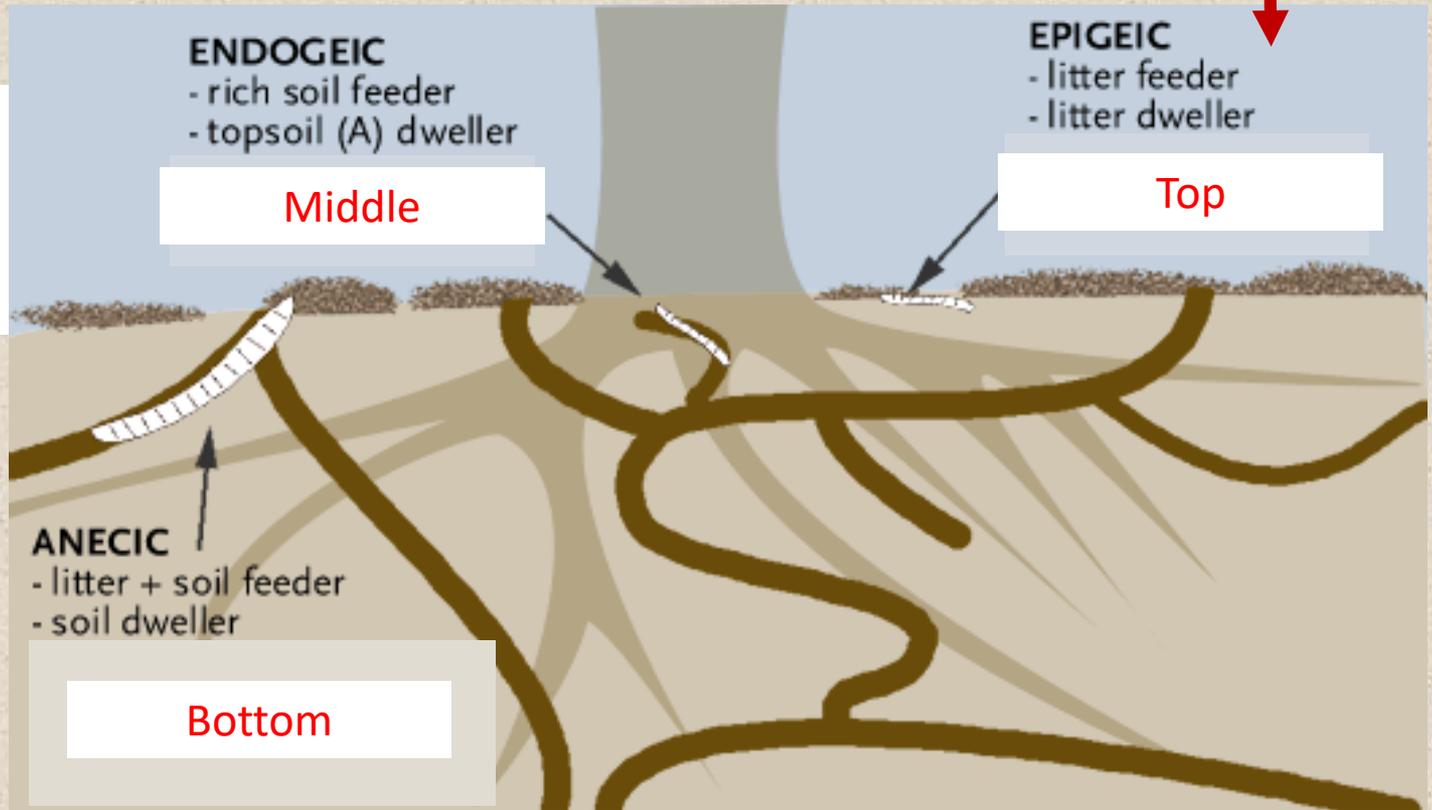
- litter feeder
- litter dweller

Top

### ANECIC

- litter + soil feeder
- soil dweller

Bottom



*Lumbricus terrestris* (nightcrawlers)

# Forest Structure Change

*Amynthas* can make leaf litter disappear within a few months, leaving bare soil with little to no understory plants



Not invaded – Camels Hump, VT



Invaded – Shelburne, VT

# What Have We Been Doing ?

Little is known about the distribution of invasive earthworms or their impact on Northeastern forests

## Research questions

1. Are earthworms present in sugarbushes & in what cold hardiness zones?
2. Is there a relationship between the presence of earthworms & maple regeneration?



# Digging Up Dirt

Sampled over 35 sites covering 5 cold hardiness zones (4a,b; 5a,b; 6a) & 5 states (CT, MA, NH, NY, VT)

In each site, examined series of 1m<sup>2</sup> plots

- Under & overstory vegetation (especially maples, invasive plant species, % cover)
- Damage assessed using the **Invasive Earthworm Rapid Assessment Tool (IERAT)** 1-no disturbance; 5-significant disturbance
- Earthworm community & soil structure assessed by excavating a ¼-m<sup>2</sup> area to a depth of 4-6 inches



IERAT damage rating example

# Results Highlights

## Quick Summary

Earthworms detected in all zones & every state

Over 50% of the sites had IERAT damage ratings of 4-5 (severe)

Maple forests with the highest IERAT ratings were typically infested with *Amyntas* &/or *Lumbricus*

Maple regeneration effects unclear & highly variable between sites, zones & years

- In general, sites with *Amyntas* tended to have highest damage decreased understory & fewer maples than those without worms

Table 1: Data subset from sites where *Amyntas* & *Lumbricus* earthworm species detected

Year	% Sites with Worms ( <i>Amyntas</i> &/or <i>Lumbricus</i> )	IERAT (with:without worms)	Mean no. Understory Maples per 1m <sup>2</sup> square (with:without worms)	Mean no. Understory Maples per 1m <sup>2</sup> square (with <i>Amyntas</i> )
2015	39%	5:2	3:6	1
2016	54%	4:3	4:2	3
2017	50%	4:2	3:2	2
Mean	48%	4:2	3:3	2

IERAT damage rating 5 = severe

# Results Highlights

## General Remarks

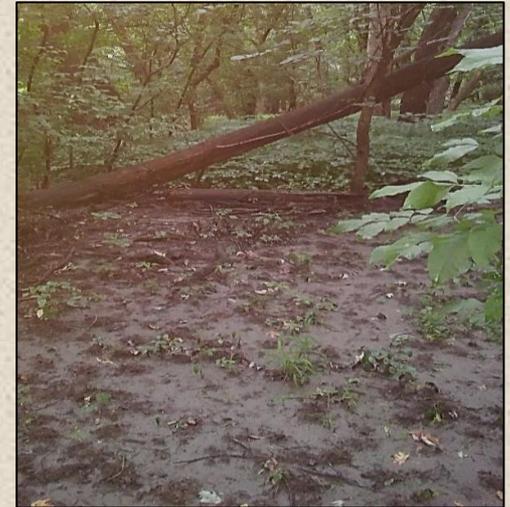
There can be a high IERAT rating with no worms found

- Timing of sampling vs stage of life cycle (mid summer vs early fall)
- Environmental conditions (drought moves some species down below sampling zones)

High IERAT rating not a reliable indicator of understory plant diversity or regeneration

- Multiple factors affect the amount & diversity (overstory, soil type, invasive species presence)

Sites with worms (especially *Amyntas*) need follow-up to detect long term regeneration effects



# What Does This Mean

Invasive earthworms are here & causing damage

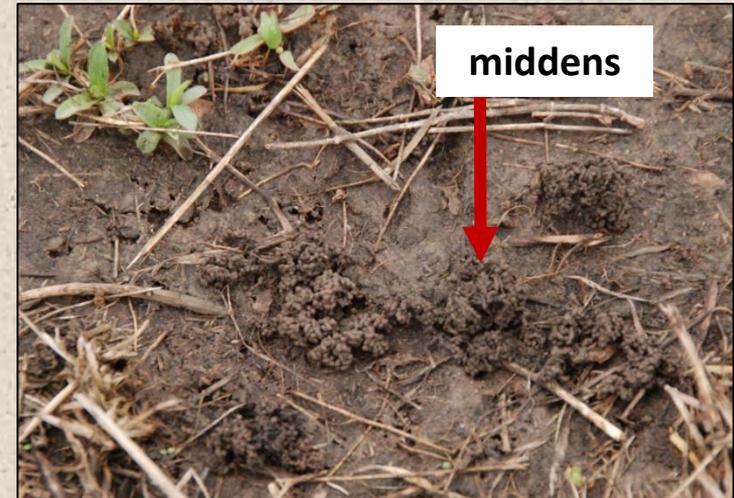
- Native biota becoming exposed to environmental conditions outside of their recent evolutionary experience – further research needed

No viable management solutions (yet)

- Vermicides for worms banned & seeking new chemistries
- Searching for biological control agents (fungi, bacteria, natural predators)

**Prevent in the now, Plan for the later**

- Don't dump horticultural debris or bait on wooded edges
- Monitor sugarbushes for worm presence
- Promote debris/organic matter (branches) if worms present



**This was occurring in a sugarbush in southern VT**

# Thanks! Questions?

**For more information, please visit the following:**

**UVM Entomology Lab:**

<http://www.uvm.edu/~entlab/Forest%20IPM/Worms/InvasiveWorms.html>

**Worm Watch:**

<https://www.naturewatch.ca/wormwatch/>

**Great Lakes Worm Watch:**

<http://www.greatlakeswormwatch.org/>

**Vermont Invasives:**

<https://vtinvasives.org/invasive/earthworms>



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