Impacts of Jumping Worms and Multiple Stressors on Forest Regeneration

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Why study earthworms in forests?

The same traits that make earthworms helpful in some contexts make them destructive in others

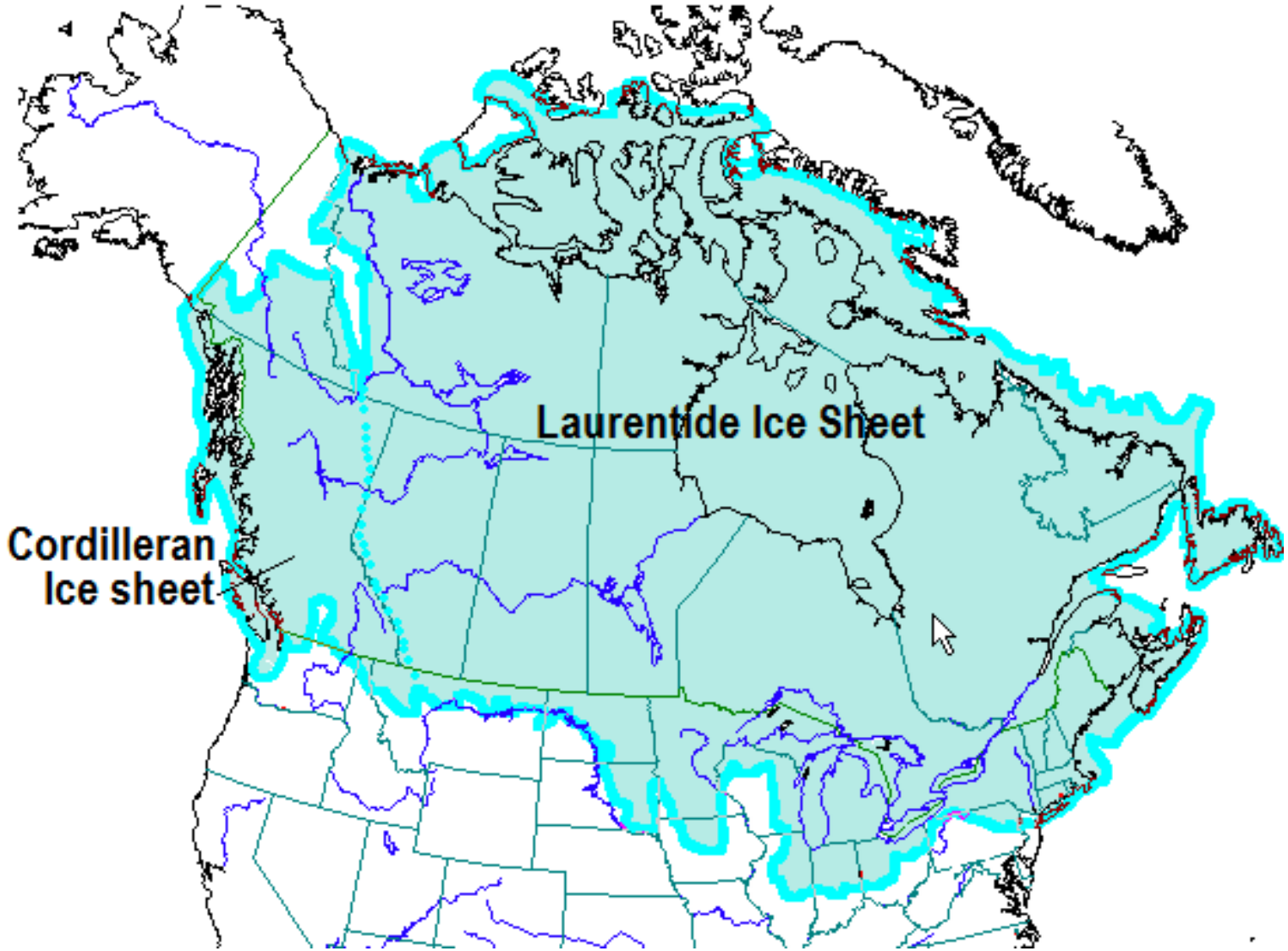
Uninvaded

Invaded (Lumbricid)

Invaded (Jumping worm)

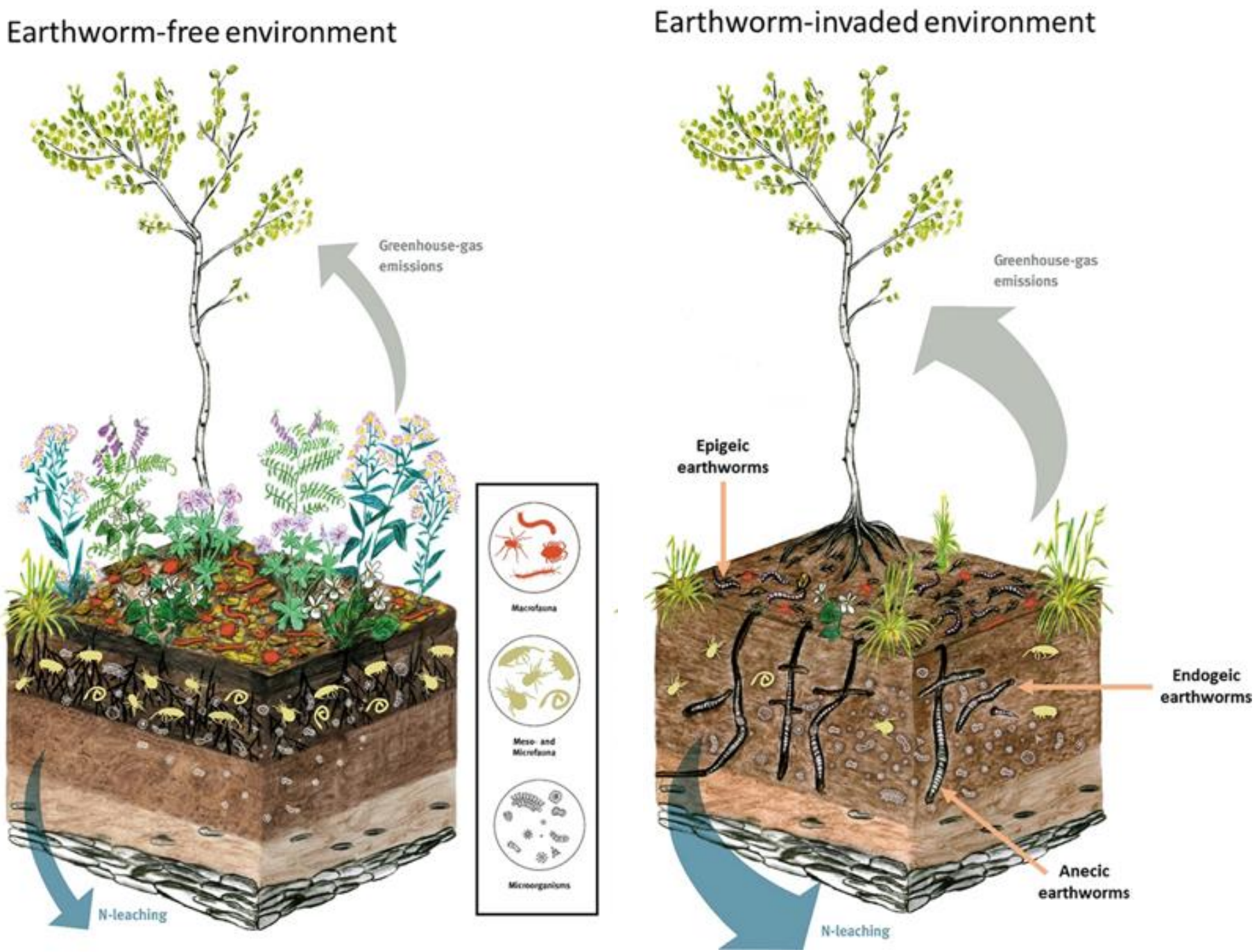
Overview

1. Jumping worm impacts
2. Interaction with other stressors
3. Jumping worm identification
4. How to limit spread
5. How to mitigate impacts


Laurentide Ice Sheet
Cordilleran
Ice sheet

Global “Worming”

- ~120 of 7000+ species are invasive
- Temperate and tropical ecosystems
- Displacing native earthworms, displacing earlier invasions, and invading new habitats


Earthworm-free environment
Greenhouse-gas emissions
N-leaching
Macrofauna
Meso- and Microfauna
Microorganisms
Earthworm-invaded environment
Greenhouse-gas emissions
Epigeic earthworms
Endogeic earthworms
Anecic earthworms
N-leaching

Ardnt

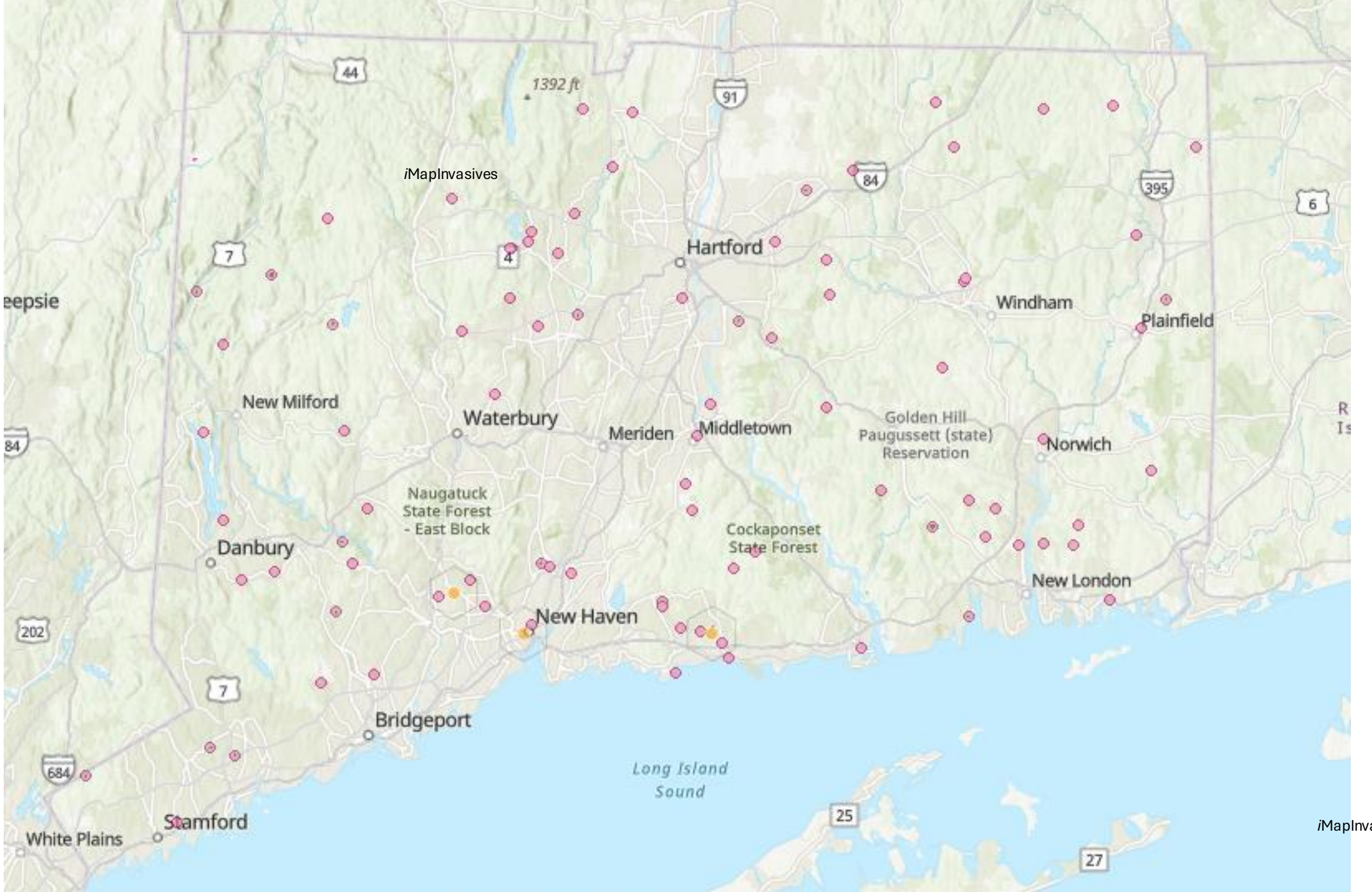
Repeated invasions over decades

1912, Washington DC
Cherry trees

1947, NYC
Bronx zoo

Albany, 1948
Florists' peat moss

Chang,...Dobson, et. al, 2021, *Biological Invasions*


iMapInvasives
1392 ft
Hartford
Windham
Plainfield
New Milford
Waterbury
Meriden
Middletown
Golden Hill
Paugussett (state)
Reservation
Norwich
Naugatuck
State Forest
- East Block
Cockaponset
State Forest
Danbury
New London
New Haven
Bridgeport
Long Island
Sound
Stamford
White Plains
44
91
84
395
6
7
4
84
202
7
684
25
27
iMapInvasives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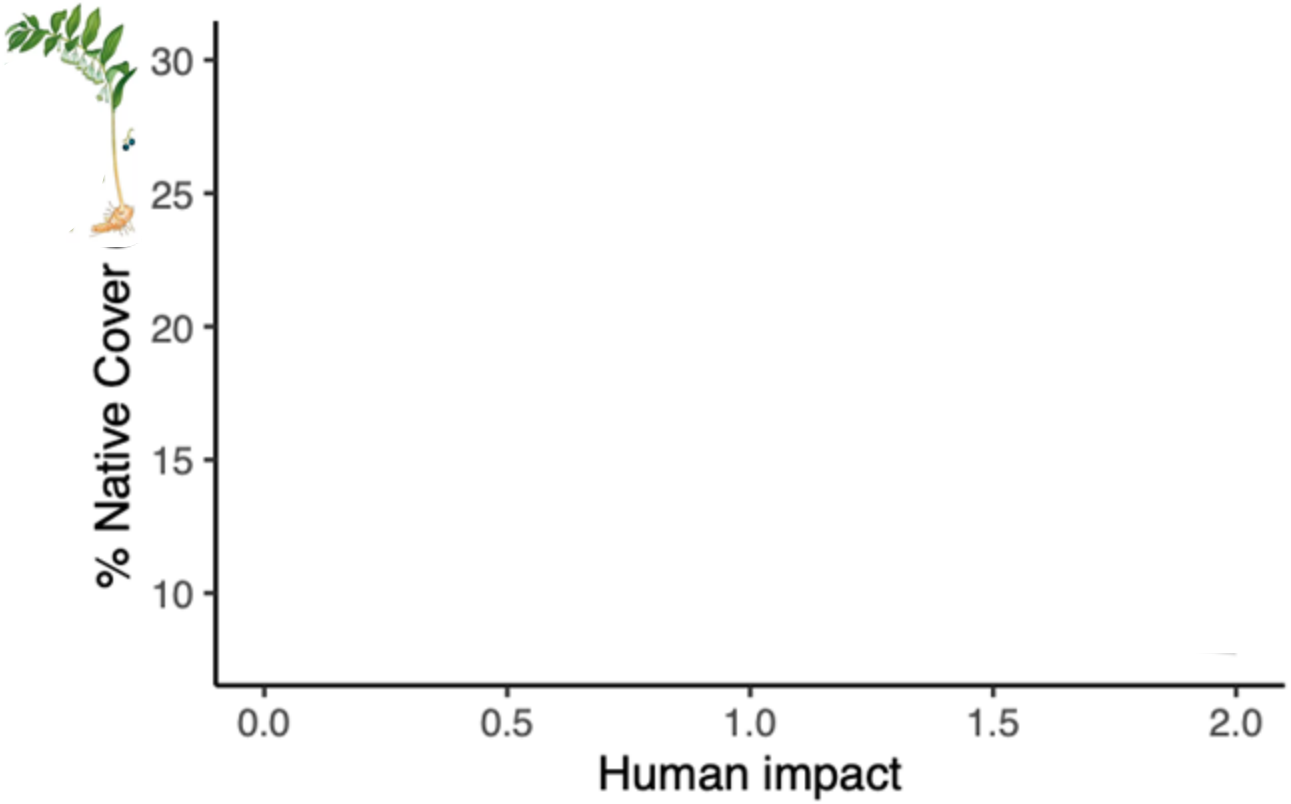
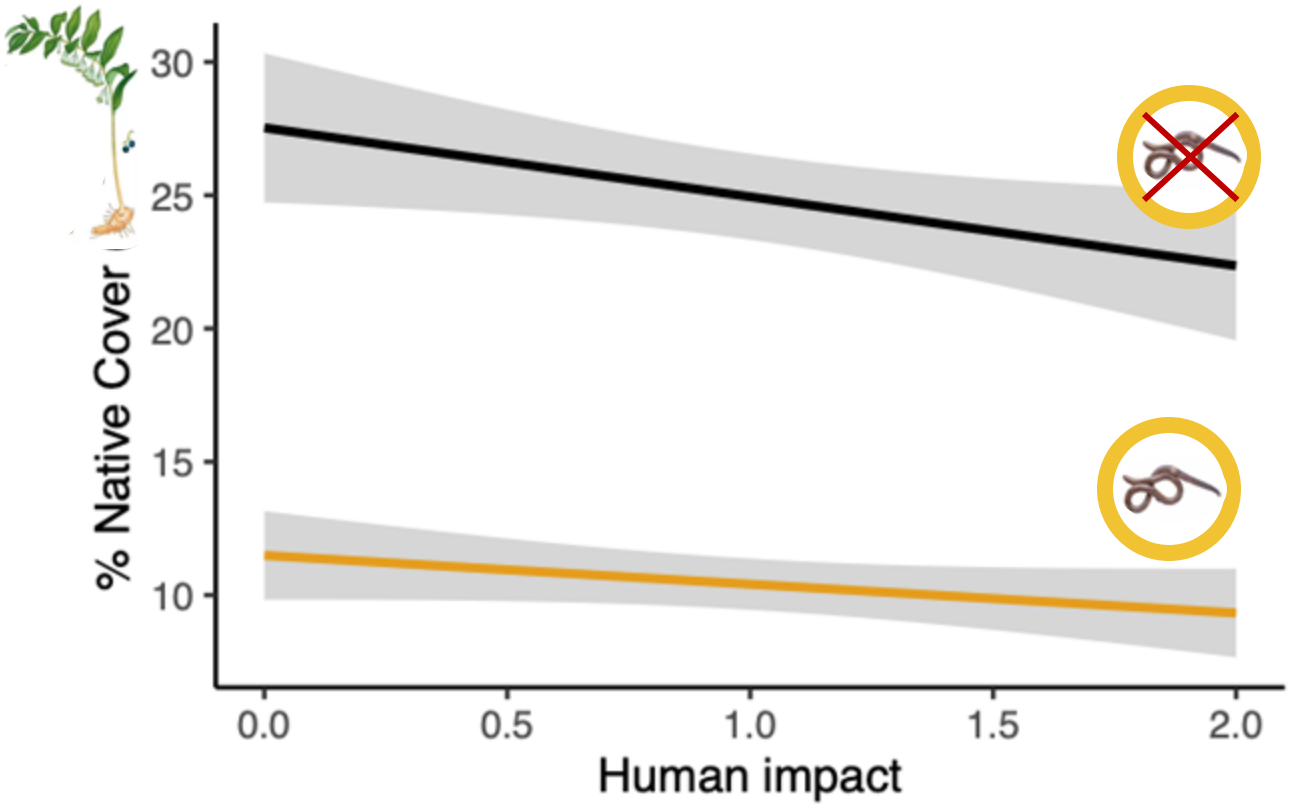
Are jumping worms associated with changes to plant communities?

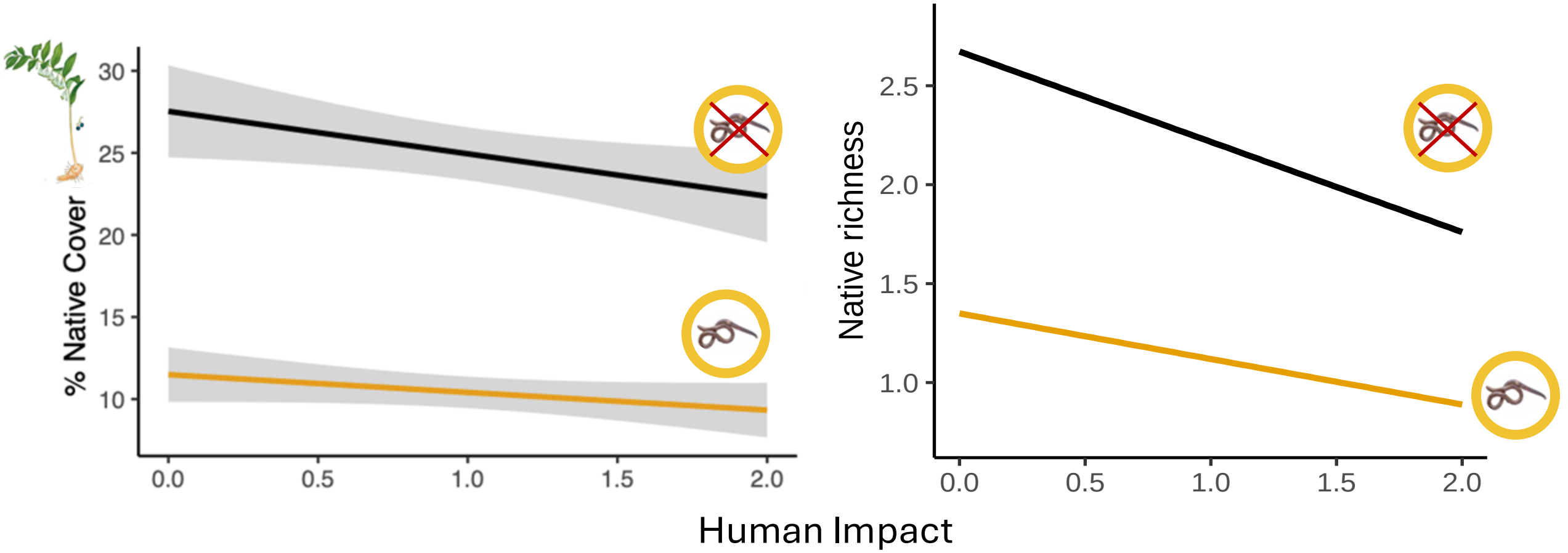
Clara Pregitzer, NAC



Jumping worms are associated with declines in native cover



Jumping worms are associated with declines in native cover and diversity



Jumping worms negatively impact native plants and trees

However, forests experience multiple stressors

White-tailed deer

Palatable species

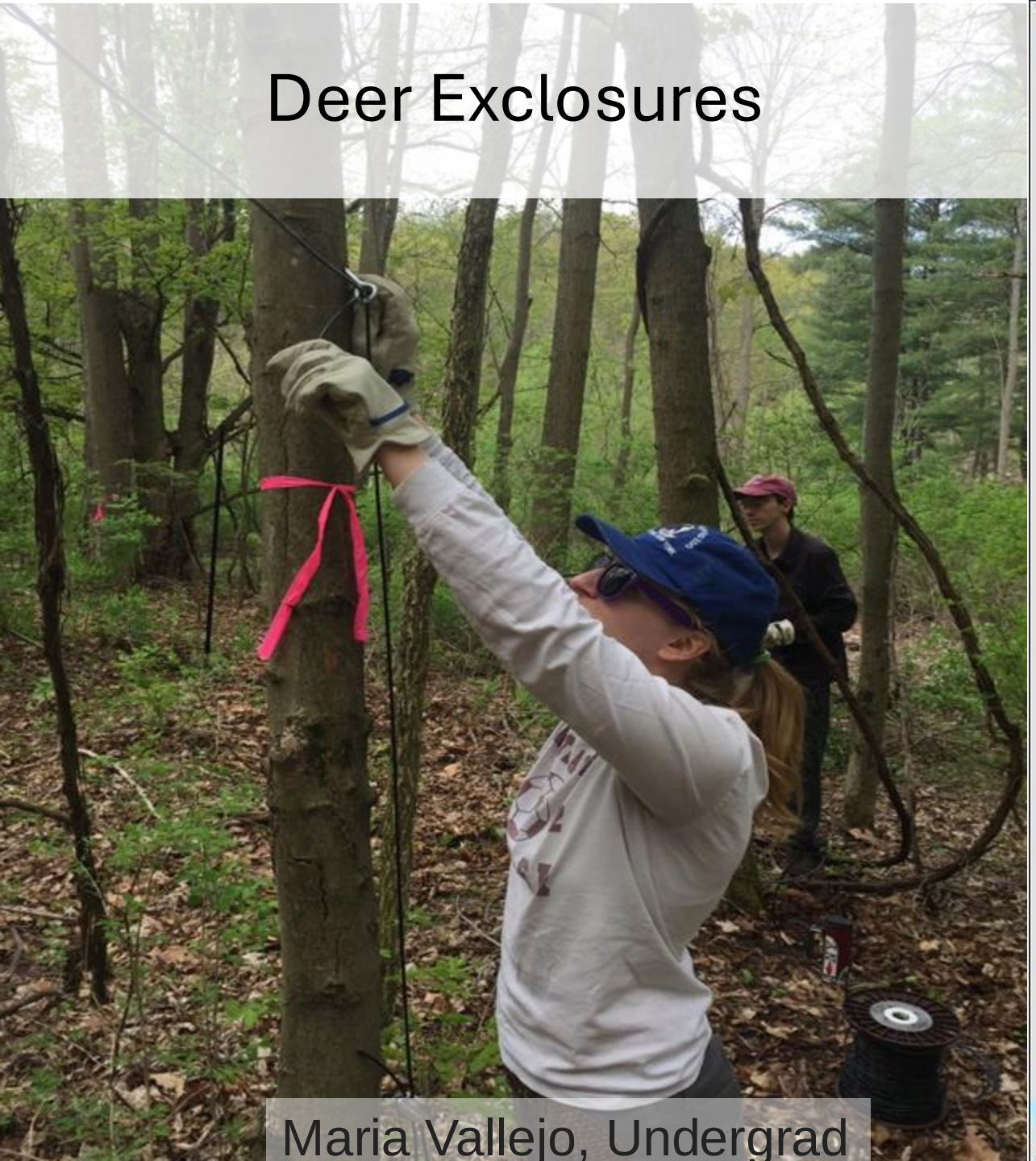
Largest individuals

Japanese stiltgrass

Competition

Nutrient cycling

Deer Exclosures



Maria Vallejo, Undergrad

Abundance Gradients

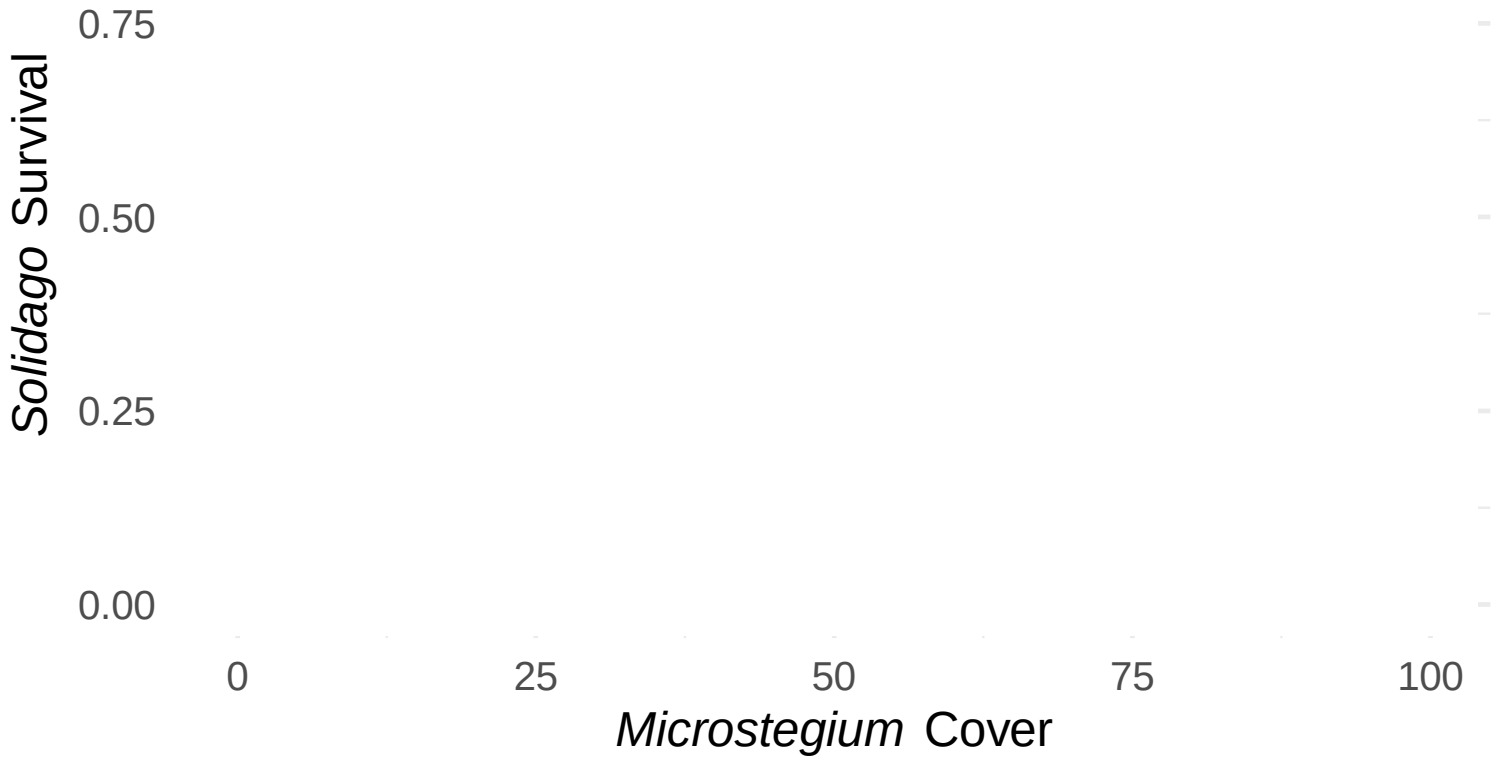
Quantifying impacts to plants – Sentinel planting

Azaria Laster, undergrad

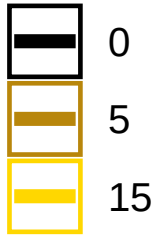
Kyleigh Frank, Sophie Pedzich, undergrads

Andrea Davalos

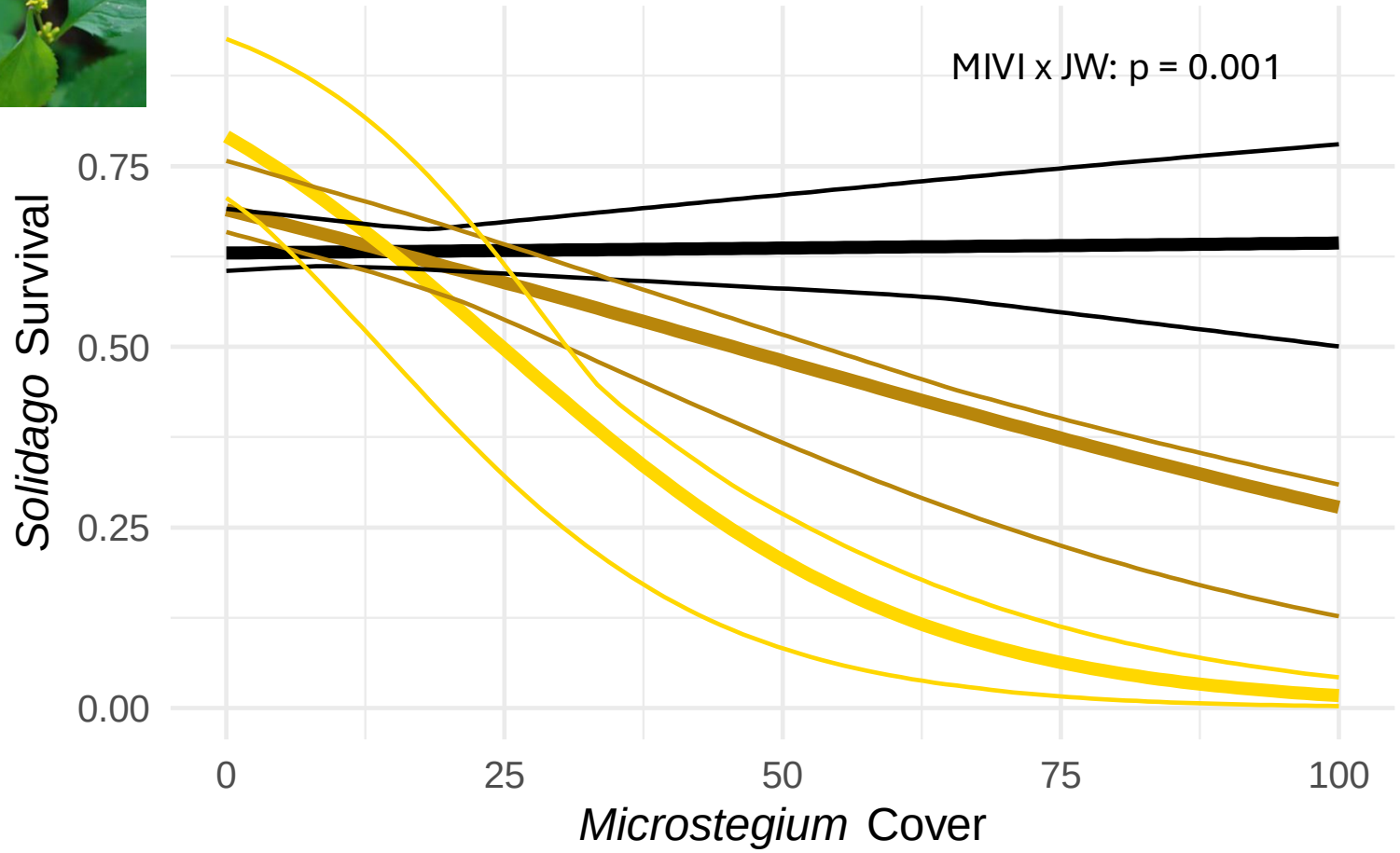
Tim McCay



Amynthas sp. (individuals per 0.25 m^2)



Only together do jumping worms and invasive plants decrease native plant survival



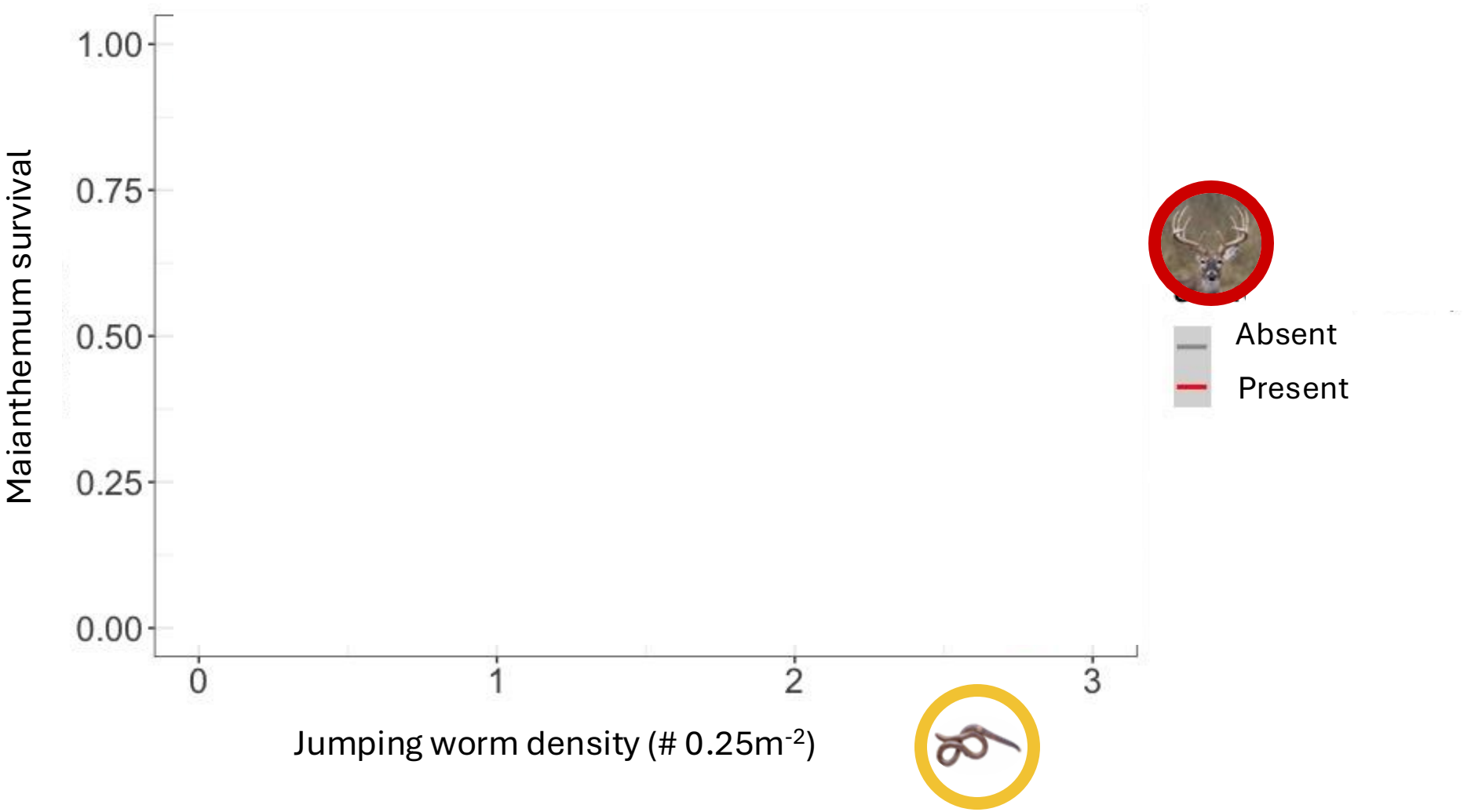
Amynthas sp. (individuals per 0.25 m^2)

0

5

15

Dobson et al., in prep



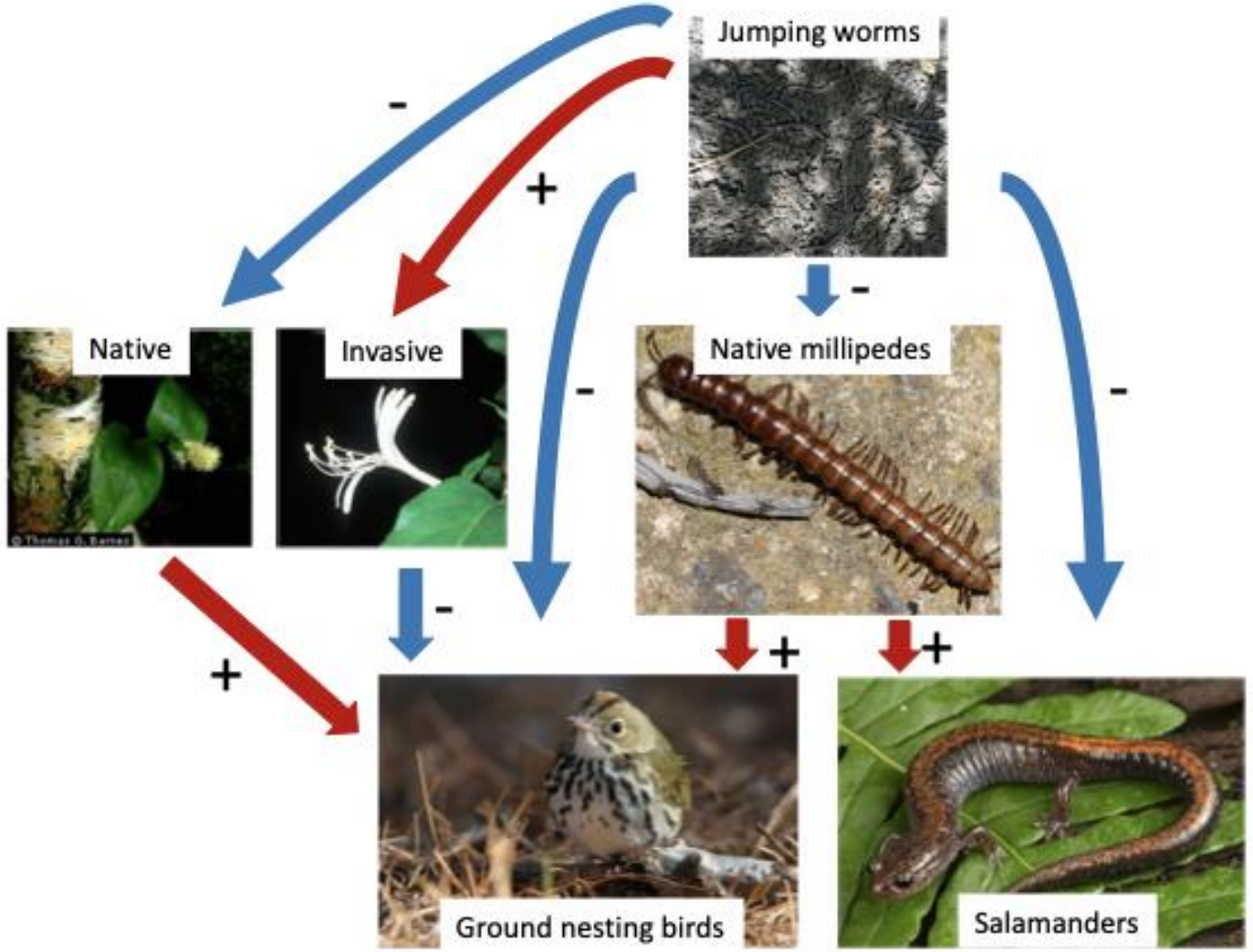
Dobson et al., *in prep*

Only together do jumping worms and deer decrease native plant survival

Dobson et al., *in prep*

Jumping worms have the greatest negative impact in combination with other stressors

Impacts – Food webs



Impacts – Economic

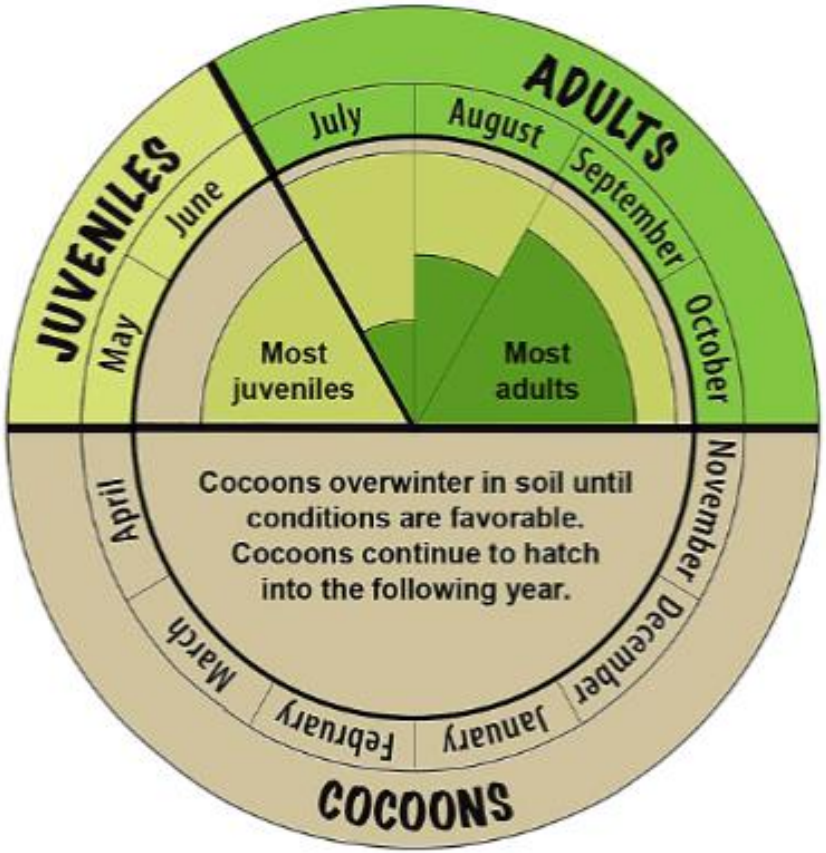







Jumping worm ID

Annual life cycle



Tips to stop the spread

Chestnut blight

Emerald Ash Borer

Jumping worms

Plant bare root

- Roots can be rinsed and visually inspected
- Eggs are visible to the human eye (look like a piece of Osmocote)

Don’t buy jumping worms for bait or compost

Red wrigglers are better for your compost and the environment

Don’t dump yard waste in natural areas

Shop local, communicate this as a priority

Buying mulch, topsoil, compost

Ensure it has been heat-treated to **104 F** for 3 days and hasn't been sitting around where jumping worms are present

Better still: make your own mulch and compost

Free/low cost from tree-removal businesses

Do it on your own property, or locally where you know the supply chain

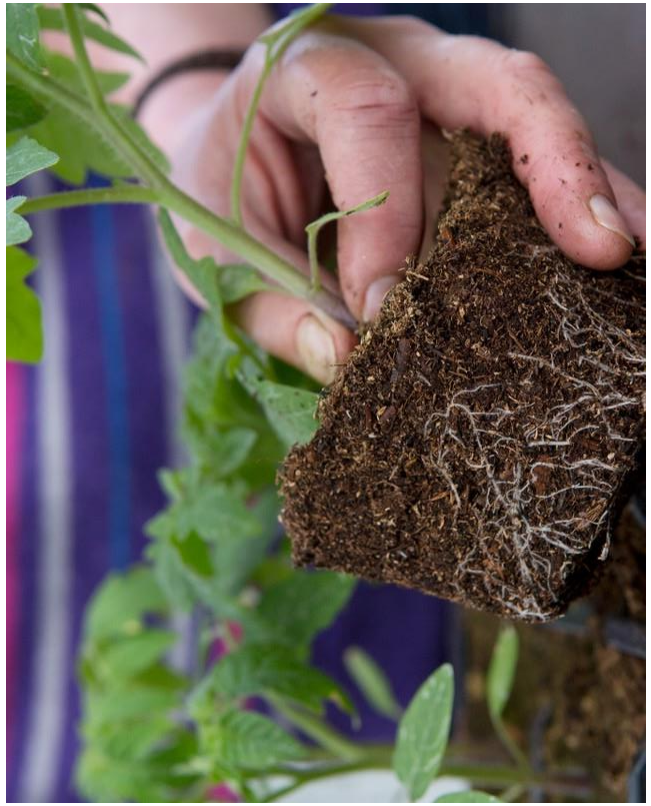
Logging/landscaping

- Clean soil from vehicles, personal gear, equipment between sites
- Include details in contracts

Check plant roots before planting

- Check for signs of castings whenever you bring in plants

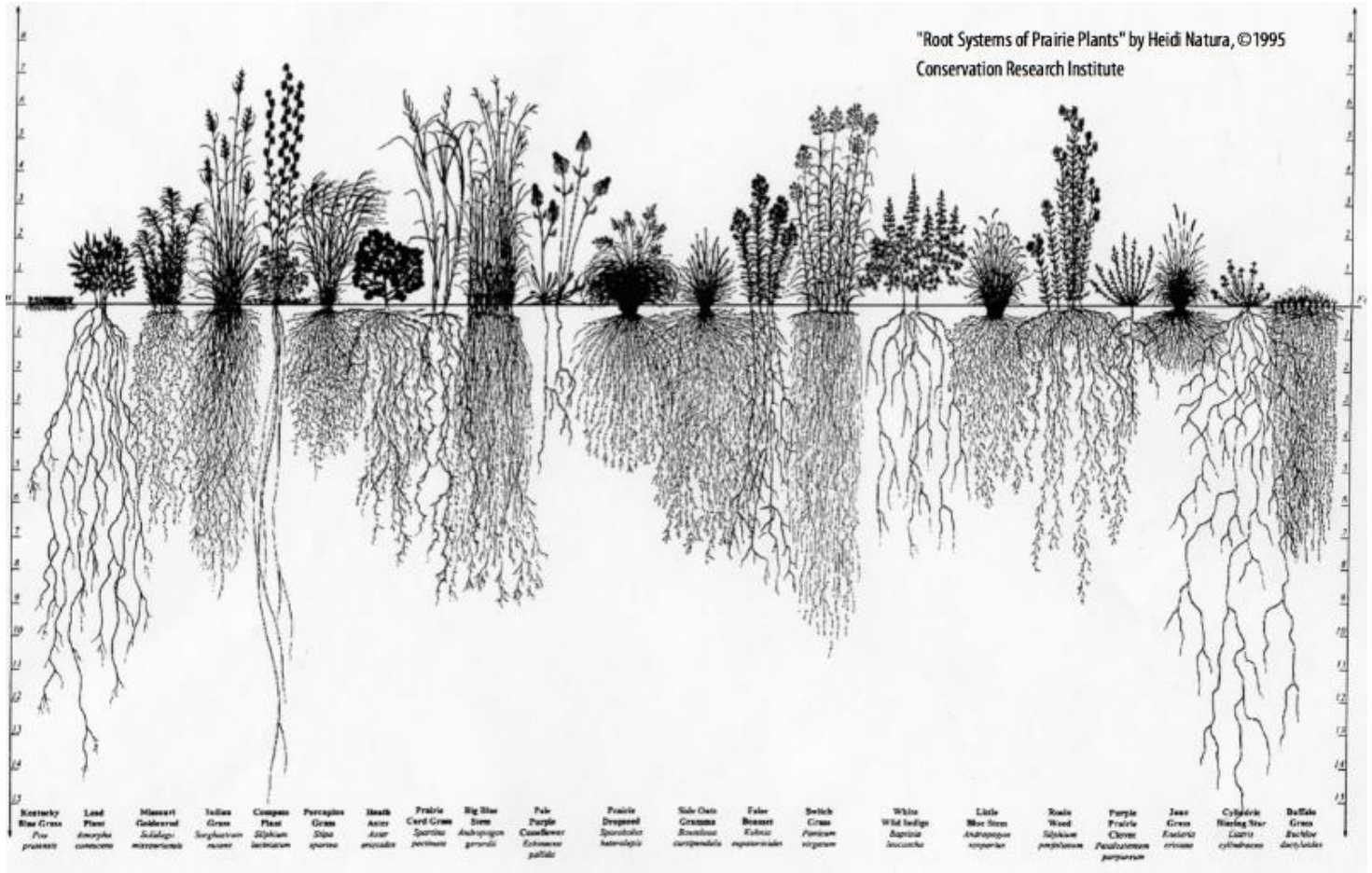
Uninfested



Jumping worm-infested

Mitigating the impact

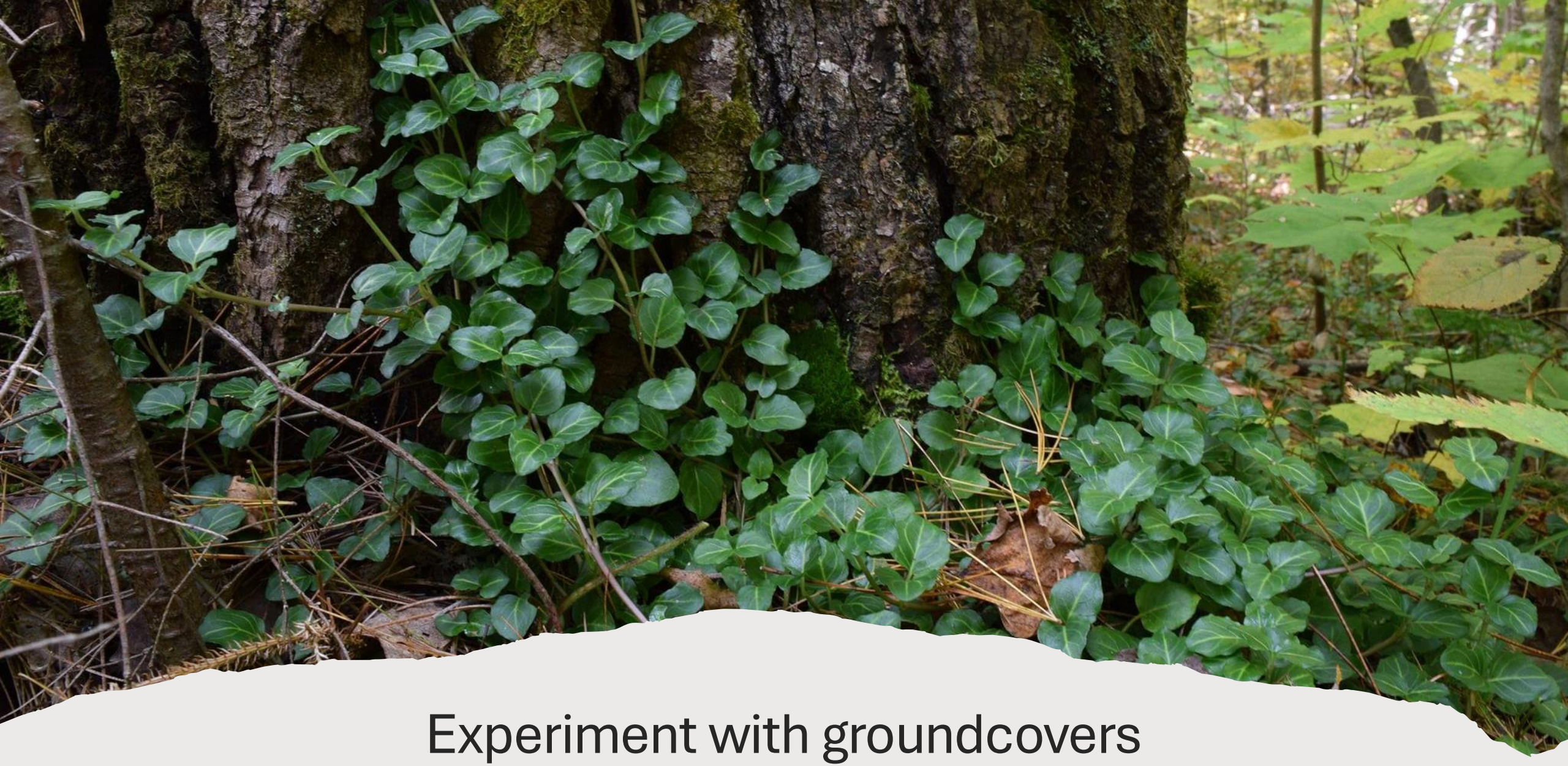
Cultivate deep rooted species



Tips for Restoration/Reforestation

- Protect from deer
- Select larger seedlings
- Plant earlier in spring/later in fall
- Additional watering
- Manage invasive plants

Stay tuned for species selection



Experiment with groundcovers

Native partridgeberry (*Mitchella repens*)

Management Research

Soil treatments

Physical

Management Research

Soil treatments

Physical

Heat

Management Research

Soil treatments

Physical

Heat

(**Top left**) In the 1890s Peter Lees, head greenkeeper at Mid-Surrey GC in England, introduced mowrah meal as a means of controlling earthworms on golf courses. (**Top right**) Watering in the mowrah meal. (**Bottom**) One of three wheelbarrow loads of earthworms removed from a putting green treated with mowrah meal. Photos published by R. Beale in 1908 (3) and reprinted by J. Beard (4)

Chemical

Management Research - Biocontrol

Beauvaria bassiana

Gregarinasina

Photos: Gorres, Dara

Takeaways

- Jumping worms impact native plants
- Greatest impacts seen in forests experiencing multiple stressors
- Worms may disappear but modified soil can be recognized all year round
- Limit spread by limiting movement of contaminated soil and mulch
- Mitigate with management of other stressors, site prep, and selecting larger seedlings

Thank you!

NYISRI
New York Invasive Species Research Institute
Connecting invasive species research and practice

iMapInvasives
Sharing information for strategic management

CRISP
Catskill Regional Invasive Species Partnership
www.catskillinvasives.com

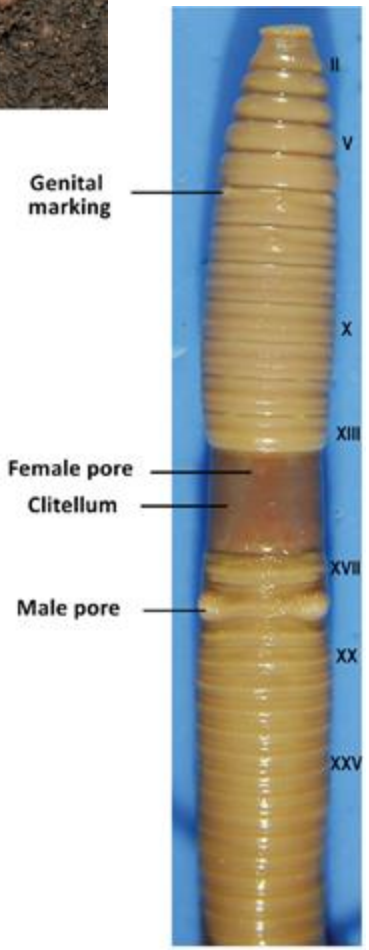
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
NEW YORK STATE

Art: Myriam Wares

Earthworm anatomy

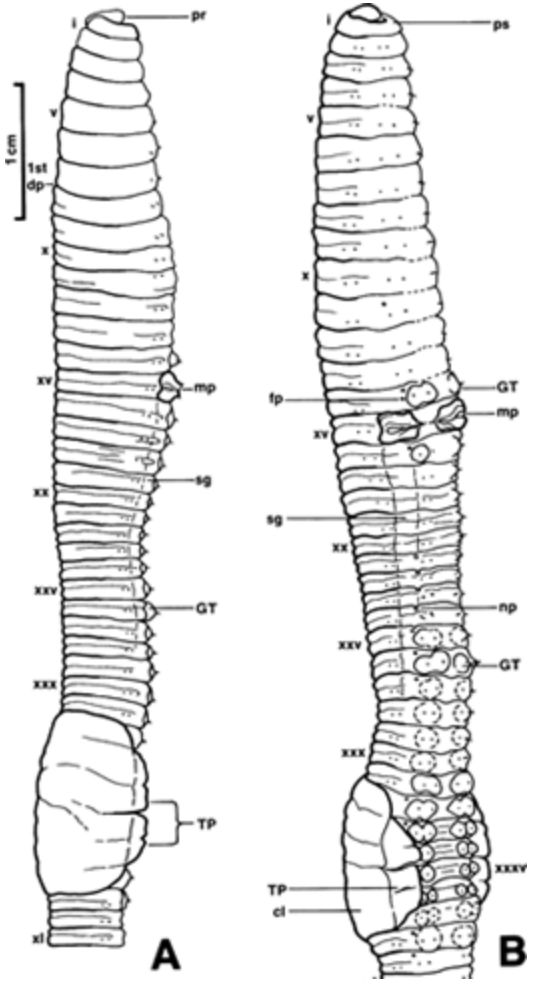
Jumping worm

- Dark or metallic pigment throughout
- Clitellum close to front of worm



European worm

- Becomes light at the tail
- Clitellum close to middle of worm
- Flattened beaver tail



Hale 2013
Chang et al 2016
Reynolds 2015

Jumping worm

- Ring-like clitellum
- Anterior (head) end of body

European (Lumbricid) worm

- Saddle-like clitellum
- Segmented clitellum

Samuel Wooster James, Susan Day

Setae: Hair-like extensions used for movement

Identifiable with a hand lens

European

(Lumbricid worm)

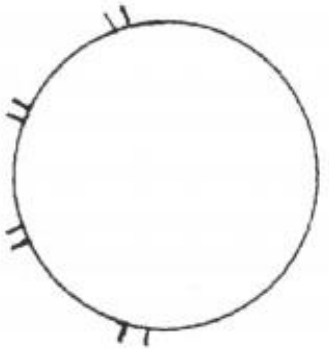


Figure 1. Lumbricine setal arrangement, cross sectional view.

Asian

(Jumping worm)

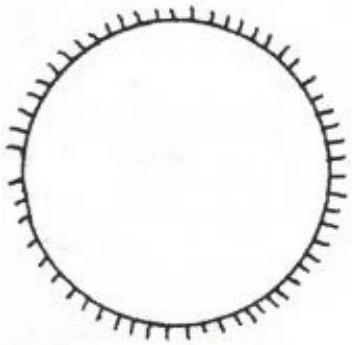


Figure 2. Perichaetine setal arrangement, cross sectional view.

James 2000

Jumping worm ID summary

Inspect soil for granular appearance
Observe thrashing behavior
Observe bristle-like setae in a ring around each segment
In adult worms, look for ring-like clitellum (inner-tube) close to the anterior (head) end of body

Overview