

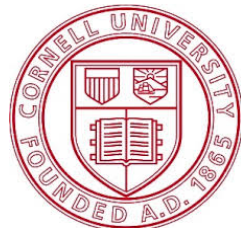
# Biocontrol in NYS

*How it works and what's happening in  
the SLELO region*

Carrie Brown-Lima

NY Invasive Species Research Institute, Cornell University

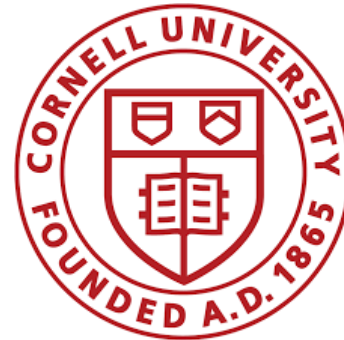
*With slides provided by Stacy Endriss, Bernd Blossey, Wade Simmons,  
Audrey Bowe, Jennifer Andreas, Carol Randall, and Marshall Lefebvre*



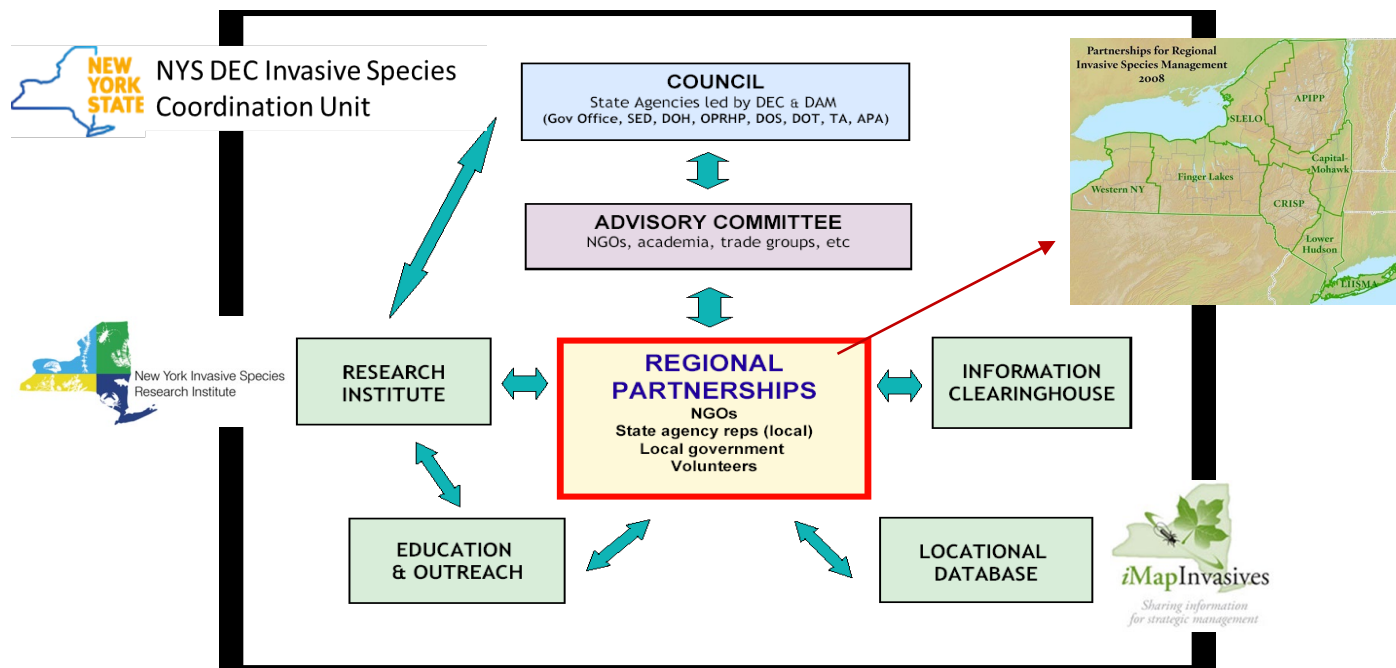
# The New York Invasive Species Research Institute

A bridging organization established in 2008 with the mission:

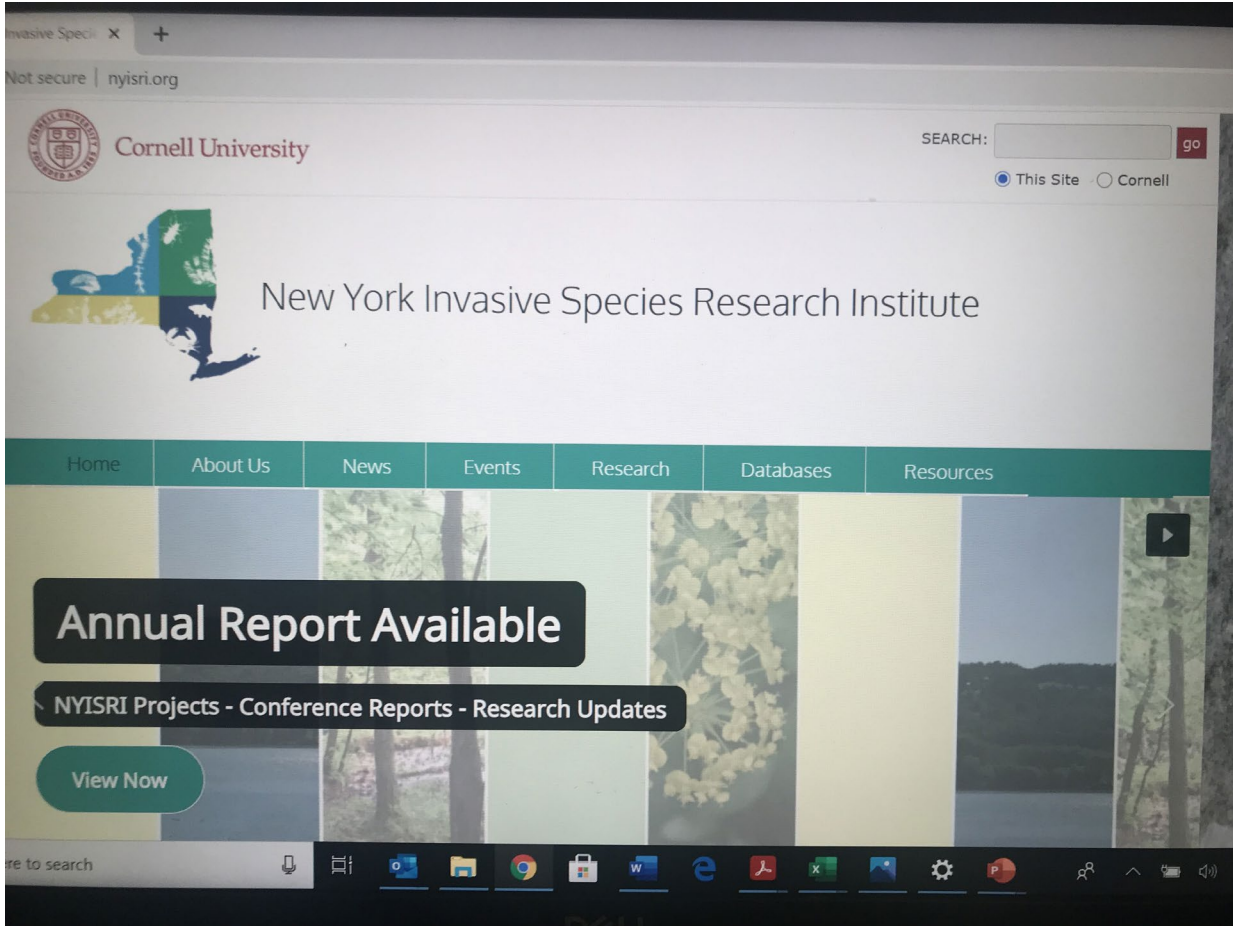
*“to coordinate invasive species research to help prevent and manage the impact of invasive species in New York State and beyond”*



# NYS Strategic System



Role of NYISRI to connect IS network with relevant research to improve the scientific basis of invasive species prevention and management and solicit research needs



[www.nyisri.org](http://www.nyisri.org)

## Swallow-wort Biocontrol

Invasive swallow-worts have a moth (*Hypena opulenta*) approved for its biocontrol, but approval isn't the end—logistical steps remain to see its effectiveness in the field. NYISRI has been working to advance this biocontrol program with research and outreach teams from around the state. This summer, the teams have been hard at work building demonstration cages, releasing moths, developing a monitoring protocol, and measuring progress. [Watch our presentation](#) with the Eastern Lake Ontario Swallow-wort collaborative to learn more.



## CCE In-Service

Registration is now open for Cornell Cooperative Extension's virtual In-Service. Our **Invasive Species Track** will present at **1-2pm** on **November 4-6**, with sessions on:

- Jumping Worm Research
- Identifying invasive species research priorities in New York State
- Invasive Species Education & Outreach During a Time of Social Distancing

There will also be a lunchtime invasive species networking session at **12pm** on **November 5<sup>th</sup>**, hosted by NYISRI and the CCE Invasive Species Program Work Team.



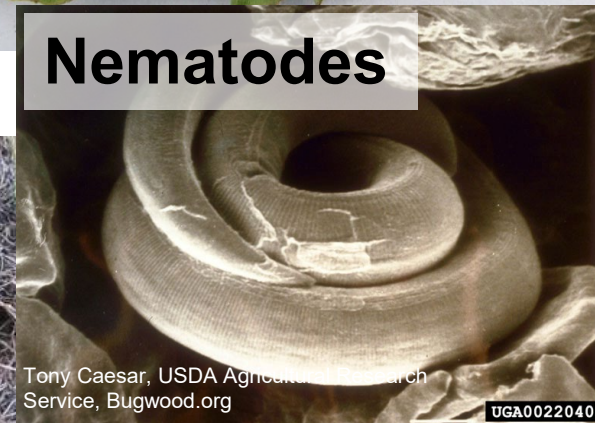
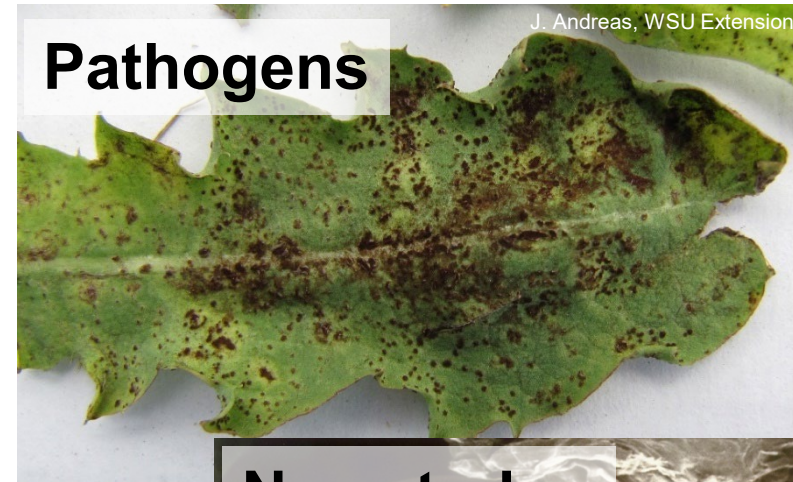
[FREE IN-SERVICE REGISTRATION](#)

<h3>Researcher Spotlight</h3> <p>Collaborating with a new generation of ecologists, Dr. Tim McCav is researching Asian Jumping Worms— an invasive species that's spreading "right under our noses."</p>	<h3>Research Summary</h3> <p>How do some aquatic species with low-mobility become widespread? This month's paper explores the stowaway pathway— read our summary here.</p>	<h3>Research Digest</h3> <p>Keep up to date on the published literature with our most recent digest. We scan the literature monthly for regionally relevant papers on invasive species impacts and management.</p>



# What is Biological Control?

The intentional use of one living organism to control/suppress another organism, such as *invasive plants*



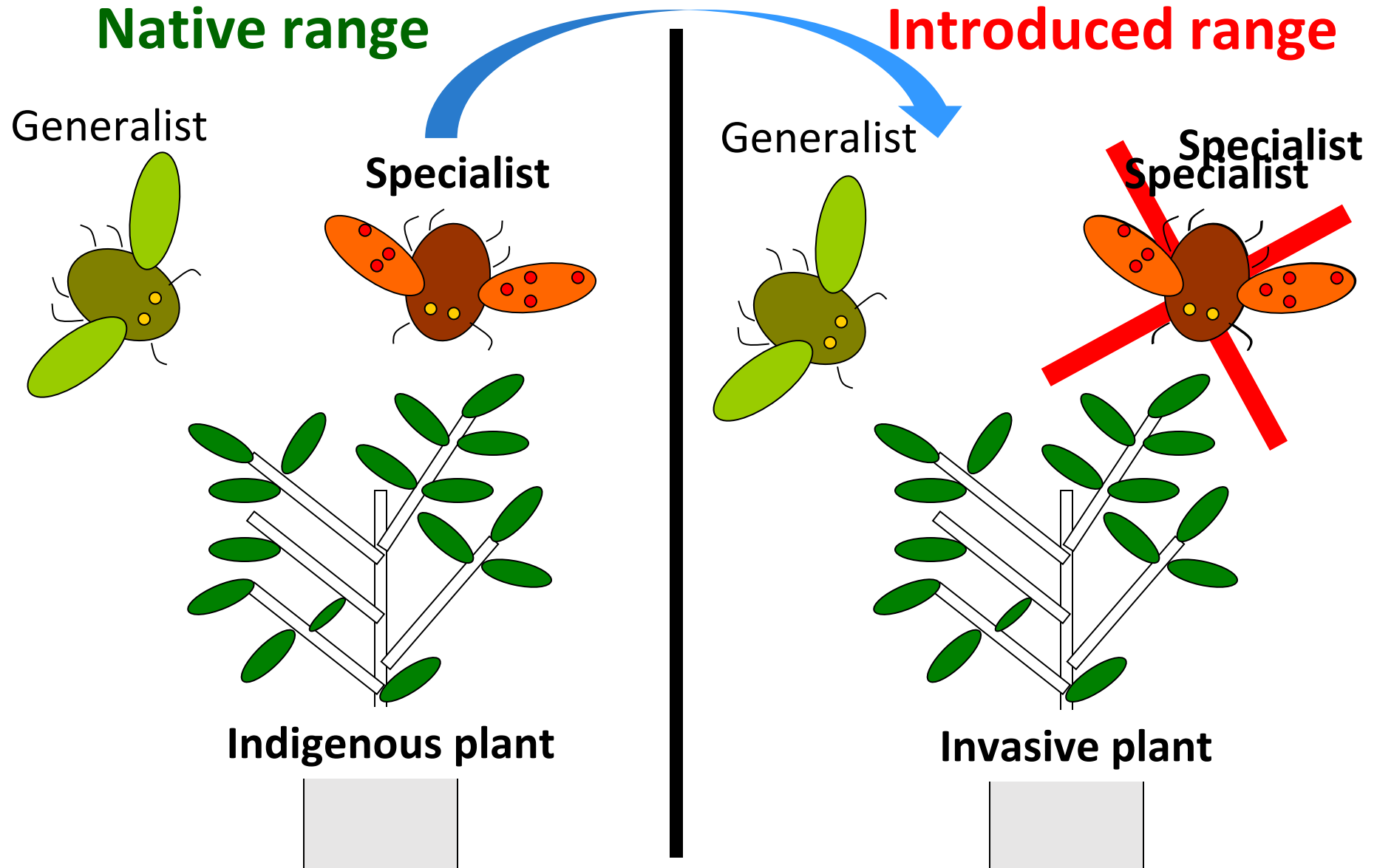
# Types of Biocontrol

- **Augmentative biocontrol:** periodic releases of natural enemy populations to control a pest population
- **Conservation biocontrol:** manipulations of natural enemy populations, i.e. modifications of the environment to favour the natural enemy (e.g. leave weeds in an orchard as sources of pollen, nectar & alternate hosts)
- **Cultural biocontrol:** utilizing other herbivores (e.g. goats)
- **Classical biocontrol:** the introduction of natural enemies to control an introduced pest

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# Enemy Release Hypothesis







Japan



Bohemian knotweed  
Washington, USA

Jennifer Andreas, WSU Extension



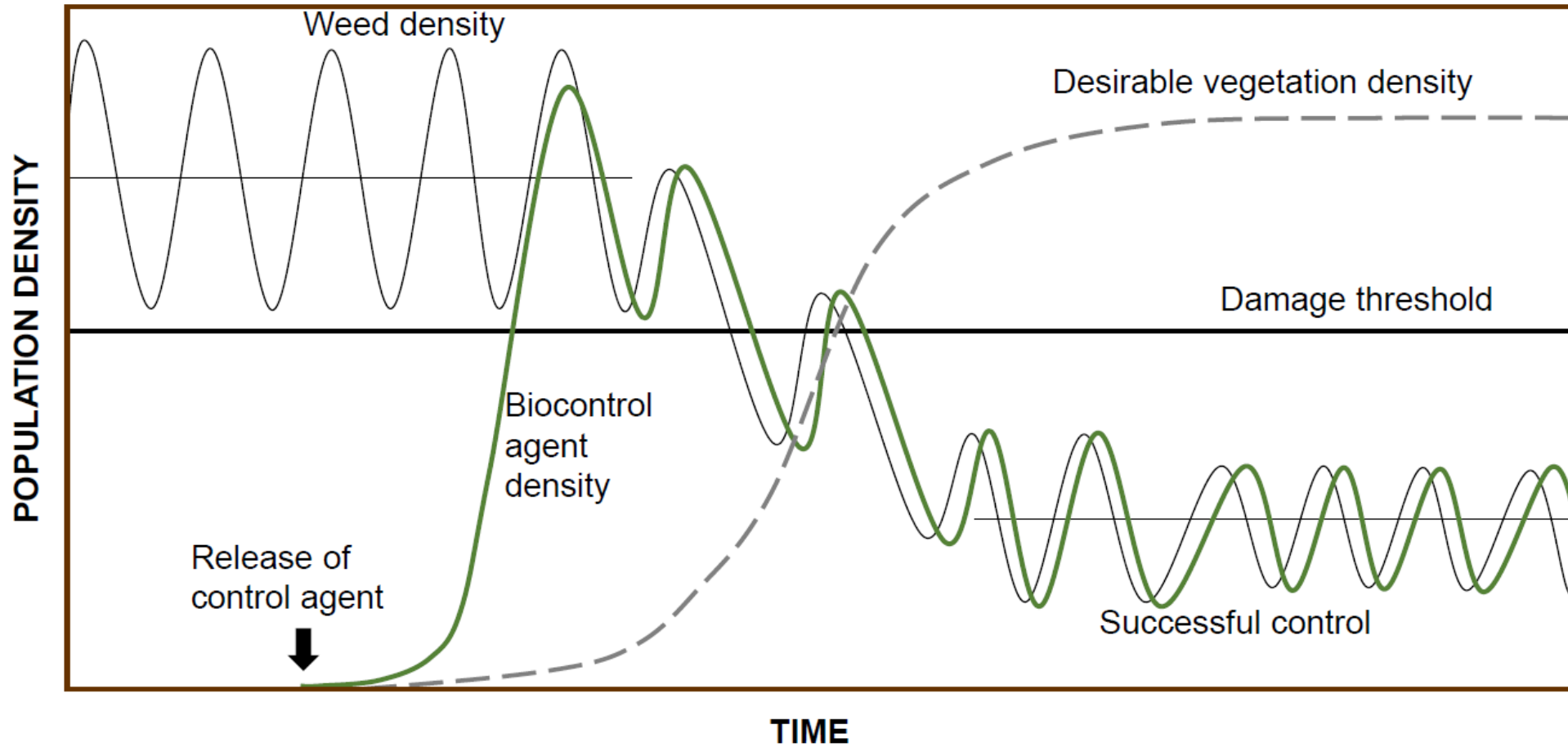
Giant knotweed  
Washington, USA

Jennifer Andreas, WSU Extension

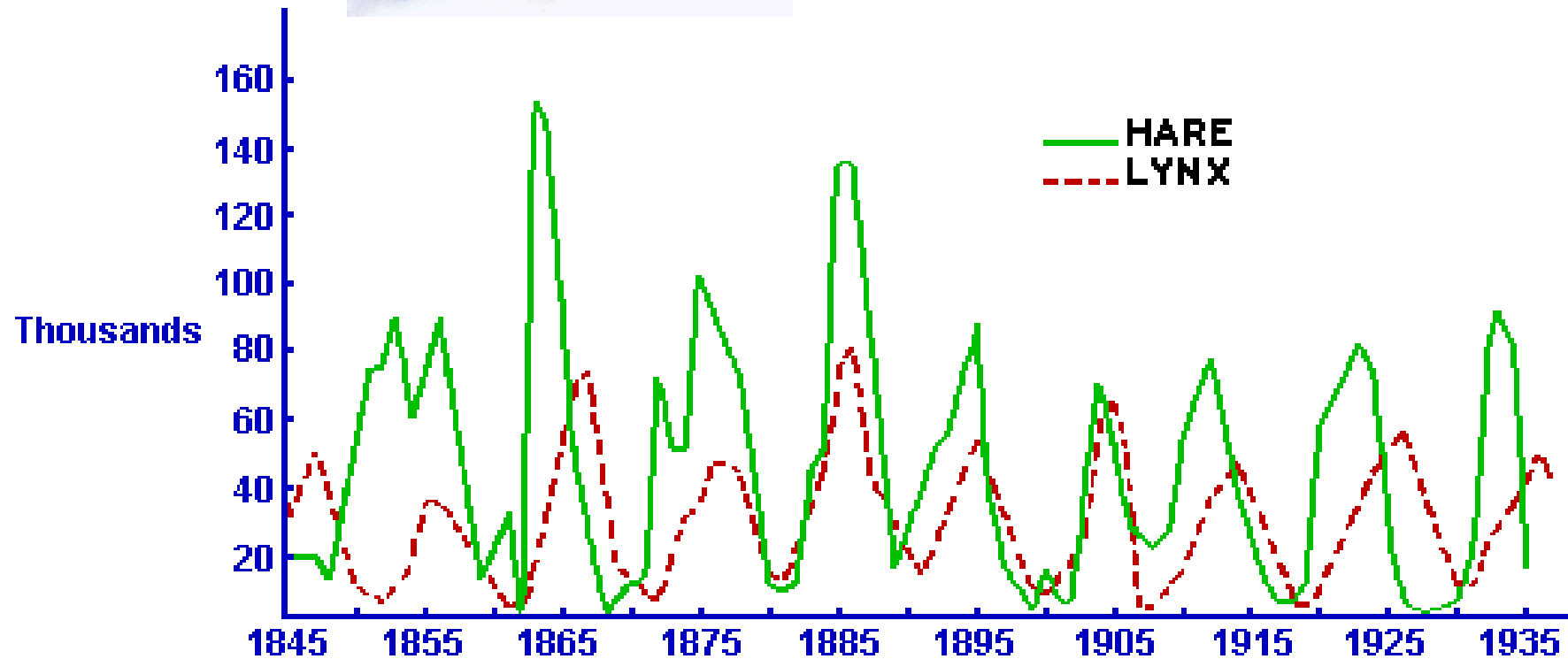
Fritzi Grevstad, OSU



# How Weed Biocontrol Works



# Predator/Prey Models

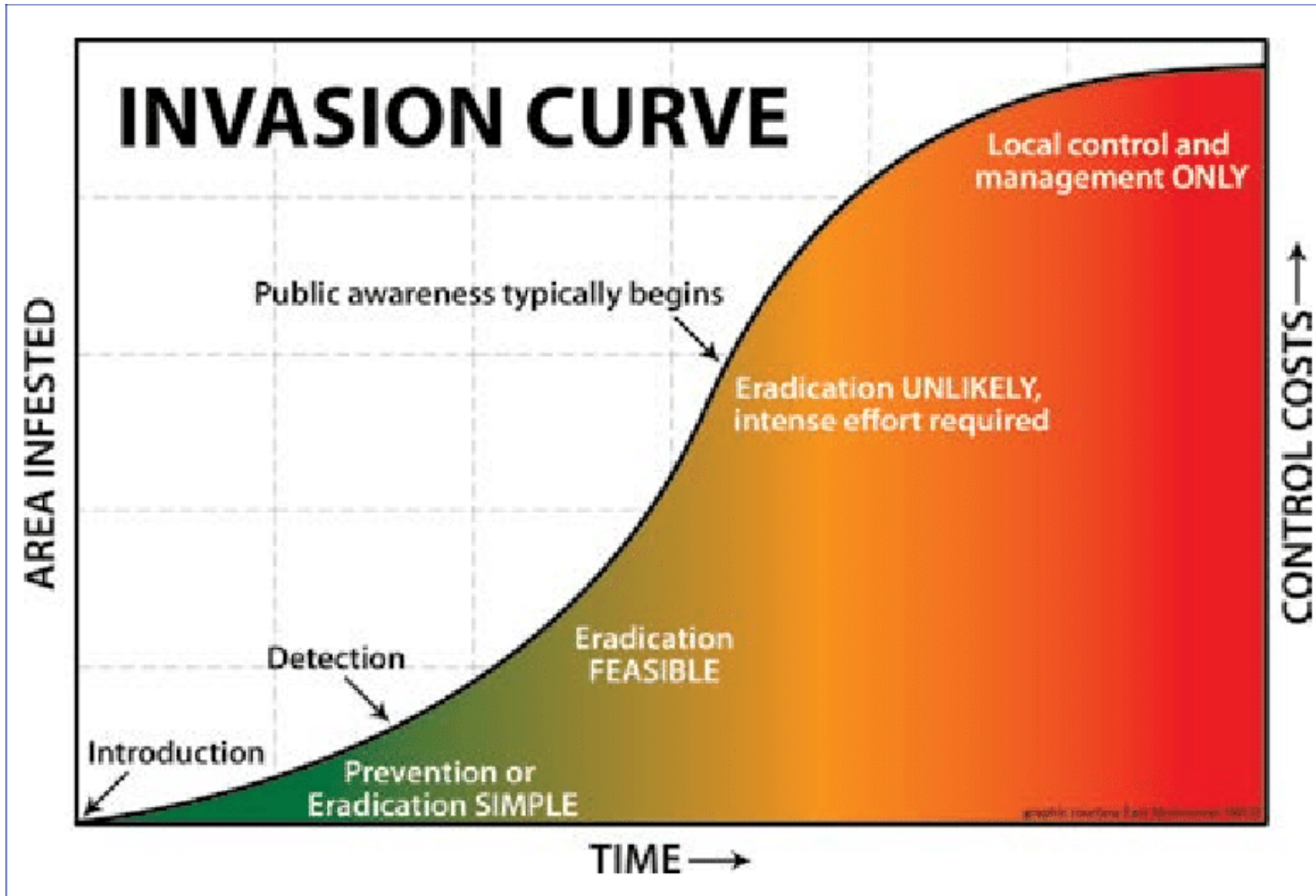


Biocontrol is a long-term solution to widespread IS that are difficult to manage with other techniques





# Invasion Curve



# Advantages of Using Biocontrol

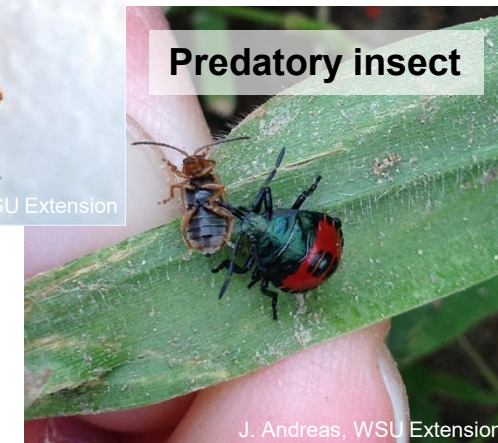
- Ecologically desirable
- Biocontrol agents are mobile
- Long-term solution
- Gradual in effect
- Cost effective particularly on low value land
- Safe – USDA APHIS approves biological control agents before introduction into U.S.



Donna Duncan, Otis Orchard WA

# Limitations of Using Biocontrol

- Long time to make impact
- Subject to predators
- May not establish or thrive at some sites
- Uncertain net effects in ecosystem
- Irreversible
- Very slow approval of new agents
- **No eradication**
  - not appropriate for sites if eradication is the goal



# Biocontrol Process

- 1) Planning
- 2) Exploration
- 3) Host-specificity testing
- 4) Shipment
- 5) Quarantine (more h-s testing)
- 6) Approval process (TAG & USDA APHIS PPQ)
- 7) Rearing
- 8) Colonization
- 9) Assessment of establishment
- 10) Evaluation of biocontrol

**Not mutually exclusive from each other**



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**\*DEPENDENT ON  
MANAGER NEEDS  
AND ON MANAGER  
PARTICIPATION\***



**Not mutually exclusive from each other**

# Defining success of a biocontrol agent:

For a biocontrol agent to be approved:

- Minimal non-target feeding (ie: only eats target invasive species)
- Significant impact to the target organism in the lab (eats a lot of it)

For a biocontrol program to be deemed successful:

- Establishment of agent in introduced range
- Decreased population of target organism (swallow-wort)
- Benefit to native species and ecosystems

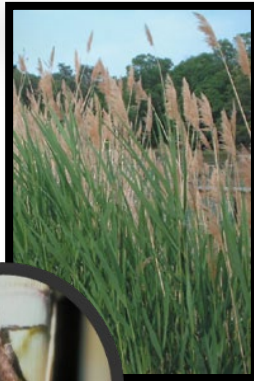
# Monitoring is essential

- Is biocontrol working?
- What agents are effective?
- How long does it take?
- How much does location matter?
- Plant community changes
  - What kind of vegetation moves in if the target weed moves out?
- Nontarget impacts



# Biocontrol Releases and Research in NYS

- Swallow wort
- Phragmites
- Japanese Knotweed
- Purple loosestrife
- Water chestnut
- Hemlock woolly adelgid





# Purple loosestrife: a biocontrol success story in NYS and across North America

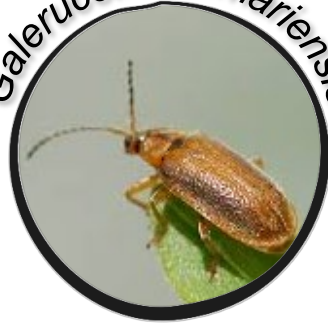
Assessing success nearly 30 years after release



*Galerucella pusilla*



*Galerucella californiensis*



*Hylobius transversovittatus*



*Nanophyes marmoratus*



mass production  
of leaf beetles

native range  
explorations

first 3 species  
released

4<sup>th</sup> species  
released

Implementation  
of monitoring  
protocol

Mass  
production of  
root weevils

Program  
evaluation

1985-94

1992

1994

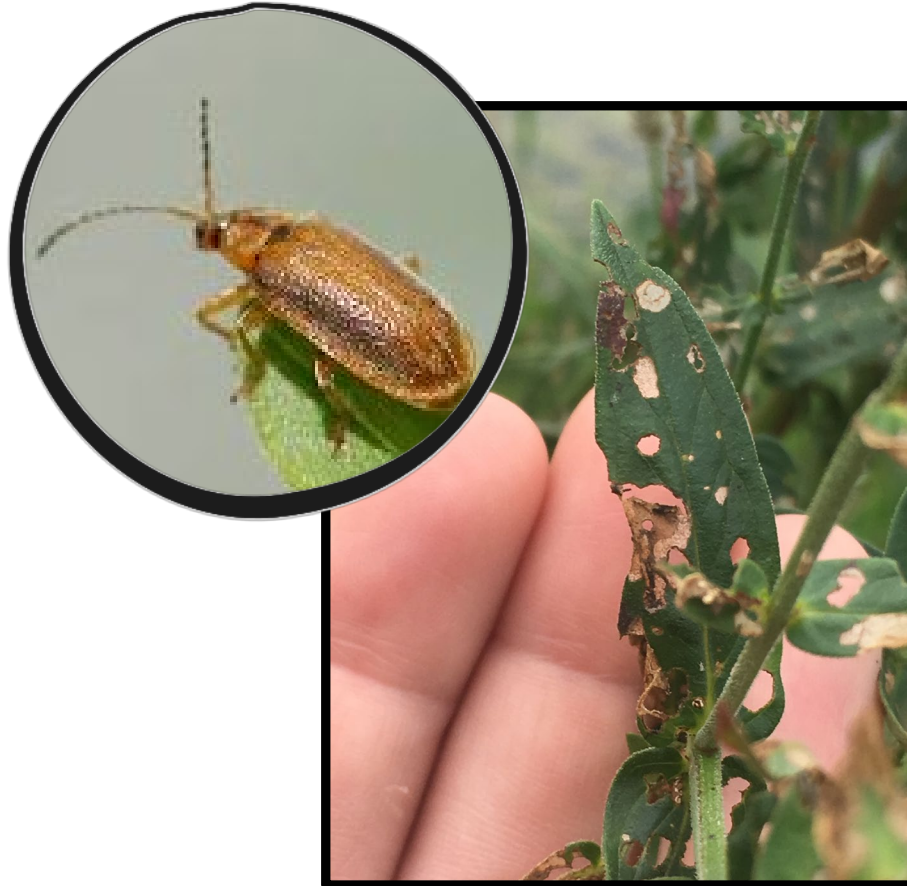
1996

1999

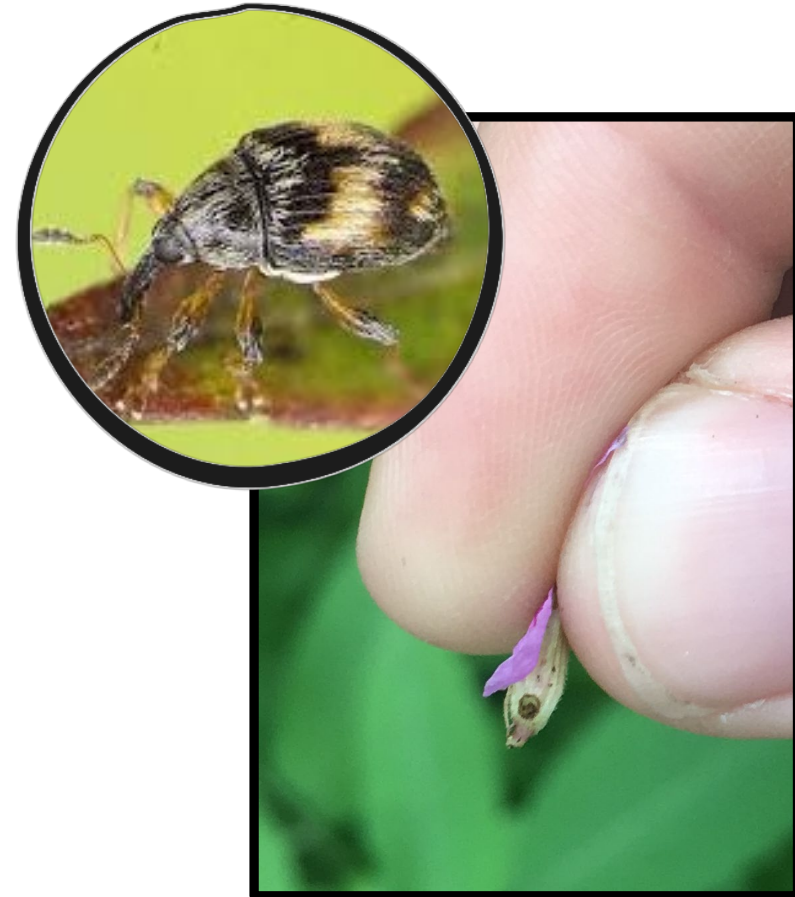
present



roadside surveys (2004, 2018/2019)  
show the insects are now widespread



*Galerucella sp.*



*Nanophyes  
marmoratus*



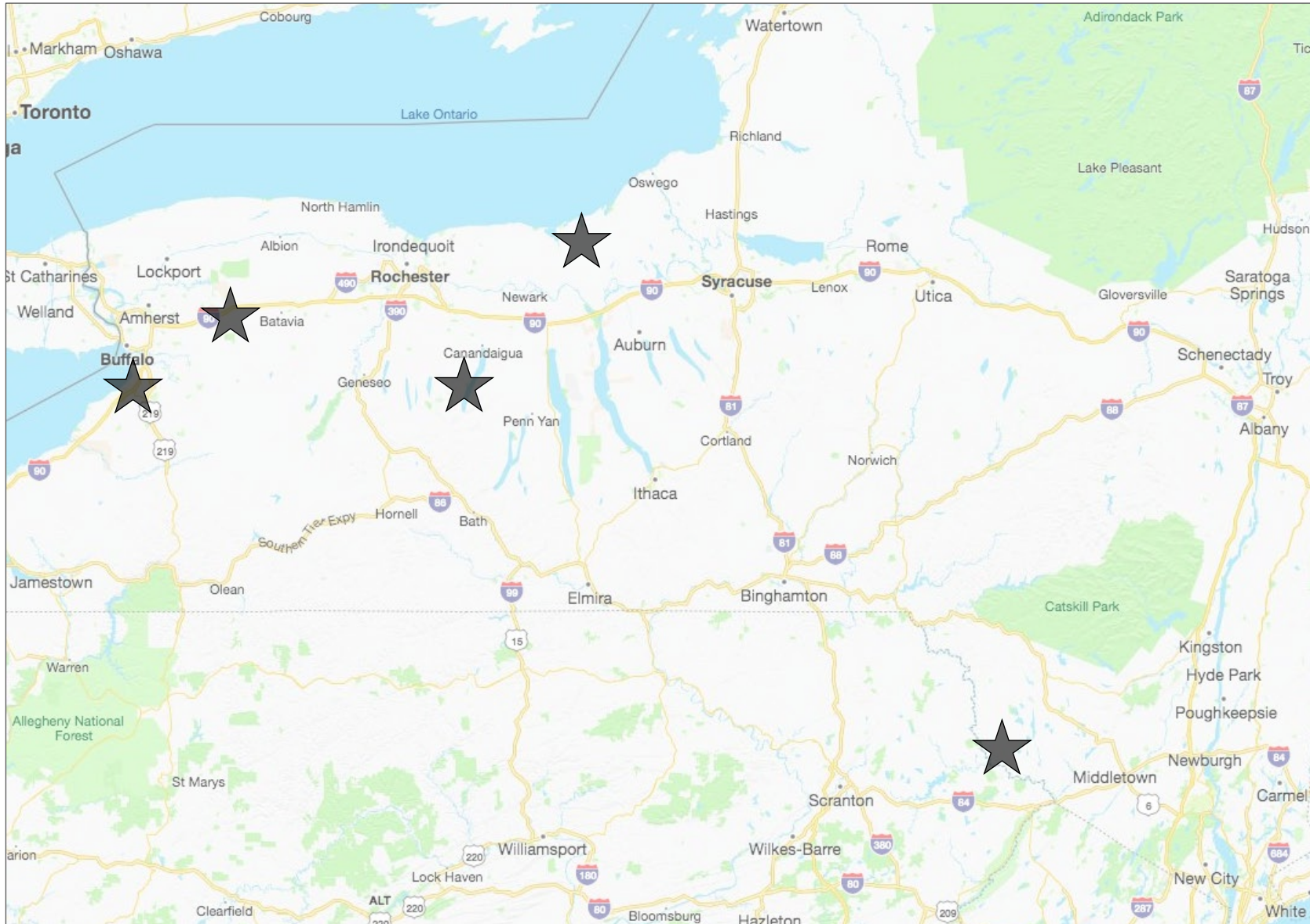
# Montezuma, Tonawanda, Hudson River

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10 – 25+ years of change



# Long-term monitoring plots



**Loosestrife  
stem density**



**yrs after  
insect release**



**plant  
diversity**

increase in  
density



no change  
in density



decline in  
density



0

5

10

15

20

25

decline in  
diversity



increase in  
diversity

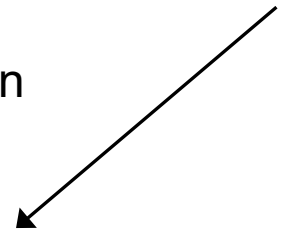


increase in  
richness and  
native plant  
diversity



biological  
success  
achieved

ecological  
success  
achieved







from ecological  
menace to  
roadside attraction

# Loosestrife Biocontrol Take-aways:

- Biocontrol of loosestrife a success in NY
  - insects quickly establish and disperse
  - ↓ loosestrife, ↑ in plant diversity & richness over time
  - ↑ in native plant cover with ↓ in loosestrife density
- However, biocontrol takes time (10+ years to detect ↓ in loosestrife, 10-20+ years to detect ↑ in plant diversity metrics)
- We need to be vigilant—in general native plant diversity ↑ over time, but other invaders are now establishing at these sites
- Patience needed- success takes time!





# Swallow-wort

Two species of are considered invasive in New York State: black swallow-wort (*Vincetoxicum nigrum*) and pale swallow-wort (*Vincetoxicum rossicum*).

**Biocontrol agent *Hypena opulenta***  
**Originally from Ukraine, forests**

Released in Canada 2013

Federal approval in U.S. in 2018



*Lindsey Milbrath, USDA*



# Two-tiered Program to Advance Biocontrol of Black and Pale Swallowworts Research and Outreach in NYS

## 1) RESEARCH

Brought together a collaborative group of researchers (SUNY ESF, SUNY Cortland, Wells College, URI, USDA ARS, Cornell)- Awarded 5 yrs of DOT funds for swallow wort experimental mass rearing and releases/monitoring in NYS



# Swallow-wort Research Group



Dr. Andrea Davalos  
SUNY Cortland



Dr. Jackie Schnurr  
Wells College



Dr. Dylan Parry  
SUNY ESF



Dr. Lindsey Milbrath  
Cornell  
University/USDA



Carrie Brown-Lima  
Cornell  
University/NYISRI



***Funding thanks to the New York Department of Transportation - PI: Dylan Parry***



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## 2) OUTREACH & IMPLEMENTATION

Partnered with CCE to develop an outreach and implementation program to inform land managers about biocontrol in general and specifically for swallow wort. Develop protocols, trainings and outreach materials to facilitate the transition from research to implementation



*Larvae and adults of *Hypera opulenta** Source: Richard Casagrande/URI



# Swallow-wort Outreach Group



Sharon Bachman  
CCE Erie



Arlene Wilson  
CCE Yates



Maggie Mahr  
CCE Yates



Laura Bailey  
CCE Yates



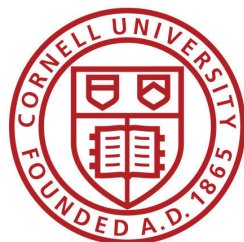
Carrie Brown-Lima  
Cornell  
University/NYISRI



Audrey Bowe  
Cornell  
University/NYISRI

Cornell Cooperative Extension | Erie County

**Cornell Cooperative Extension**  
**Yates County**



Cornell University  
Cooperative Extension

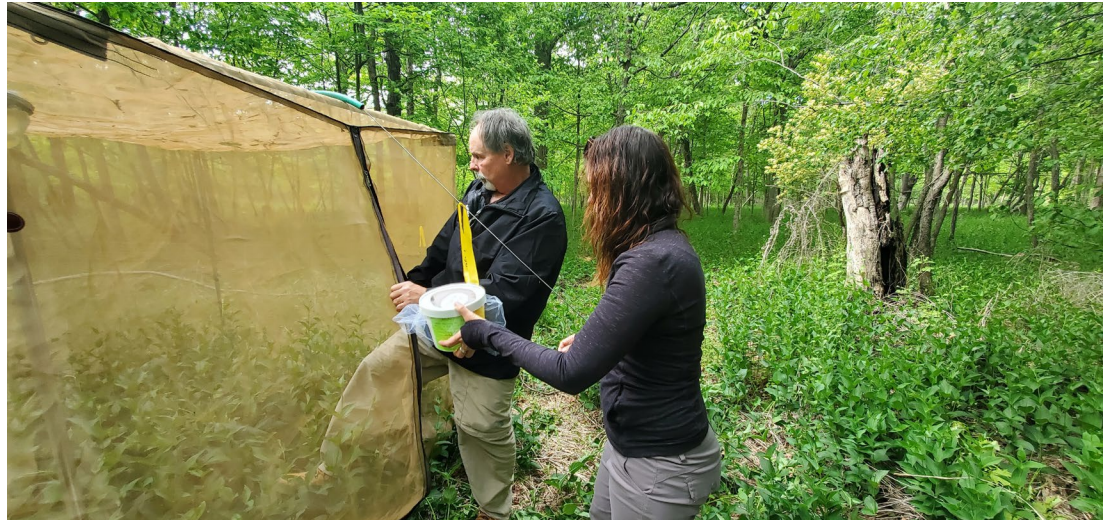


**NYISRI**

New York Invasive Species  
Research Institute

*Supported by the USDA National Institute of Food & Agriculture, Smith Lever Project - PI: Carrie Brown-Lima*

# 2 release sites in SLELO PRISM at Wehle SP and Grenadier Island in partnership with SLELO staff and TILT







Lydia Martin

# Concerns & Challenges

- Agent availability
- Overwintering success
- Establishment
- Ability to control swallow-wort populations





# Outreach Materials

- Training materials for those conducting future releases
  - Short videos of different parts of the process
  - Pocket guide for *Hypena* lifecycle and monitoring
- Form within iMapInvasives to collect vegetation and insect release data

Visit [nyisri.org](http://nyisri.org) for more information and links to resources

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# Eastern Lake Ontario

Swallow-wort collaborative

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*Linking People, Information & Action Through Enhanced Communication*

[www.swallowwortcollaborative.org](http://www.swallowwortcollaborative.org)

# Japanese Knotweeds Biocontrol: (*Reynoutria* sp.)



*Aphilalara itadori*

To date, UK and Canadian releases not successful



# Field Releases:

Released at two sites in the southern tier of NYS



## Field Releases: So far, no establishment.



Where do we go from here? :

- Lack of establishment in UK and Canada are not encouraging

Hope that they.....

- “secretively” build up populations and show success later

*Allantus luctifer*



*Gallerucida bifasciata*



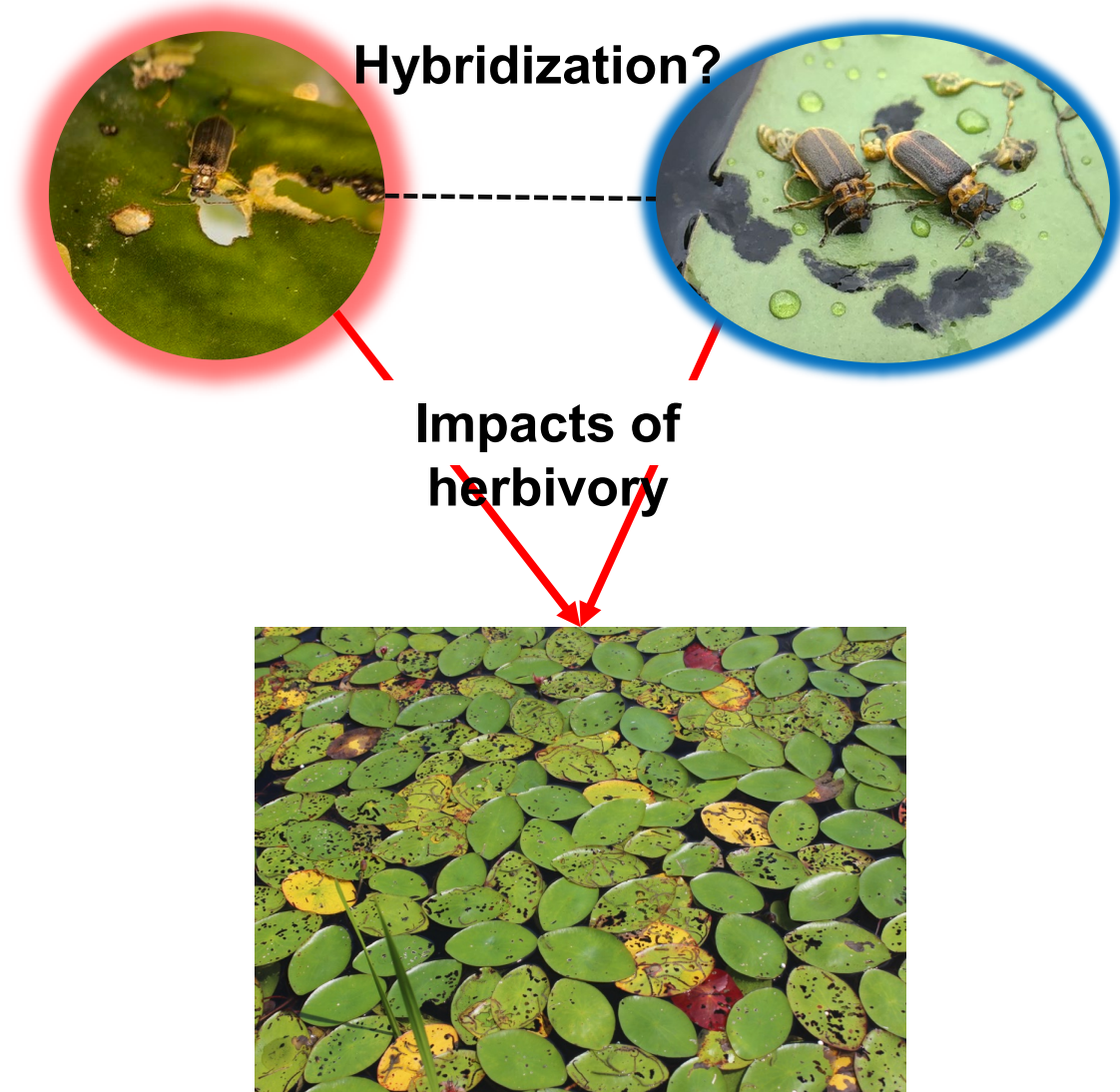
Early 'rejects' worth  
reconsidering



# Biological control of water chestnut update

by Wade Simmons, Cornell University

- Specialist insect: *Galerucella birmanica*
- Status in US: Quarantine lab research phase
- Safety testing
  - Host-specificity complete (57 tested plants)
  - Native plant water shield, *Brasenia schreberi*, able to support limited development of insect
- Current research:
  - Additional impact assessments to *B. schreberi*
  - Hybridization potential with native *Galerucella* species
- TAG Submission
  - Late 2021, to include data from summer experiments



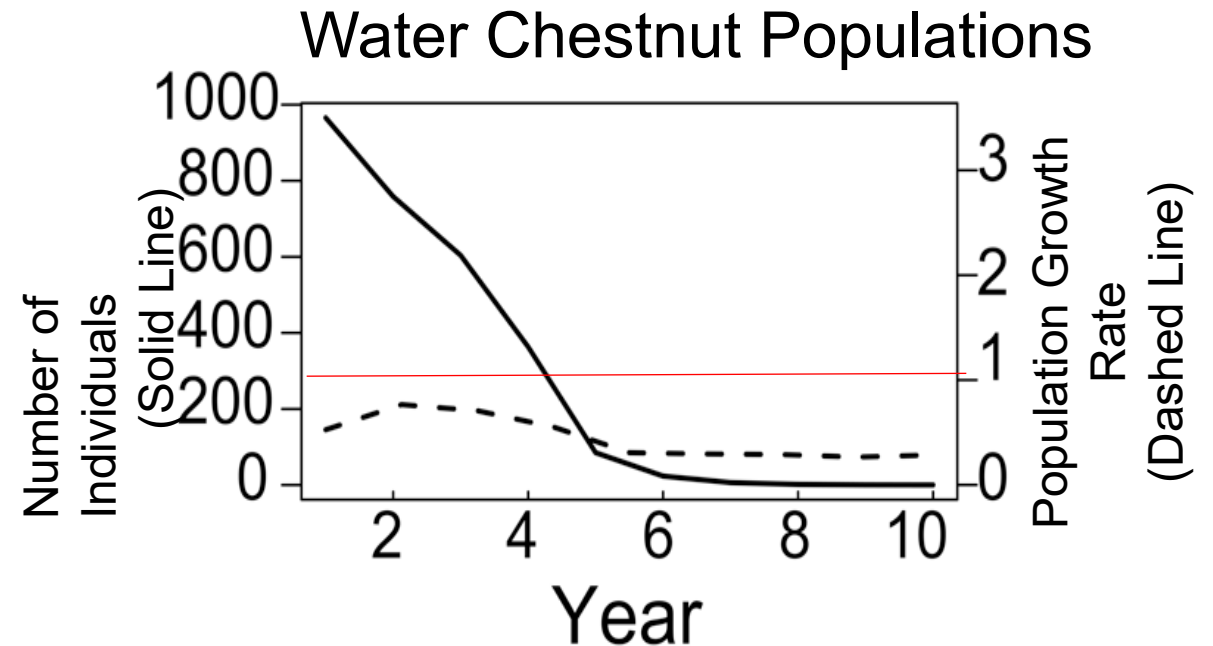
# Biological control of water chestnut update cont'd

## Effectiveness:

- Herbivory reduces *Trapa* seed set by 80% in native range
- Projected to shrink N. American *Trapa* populations

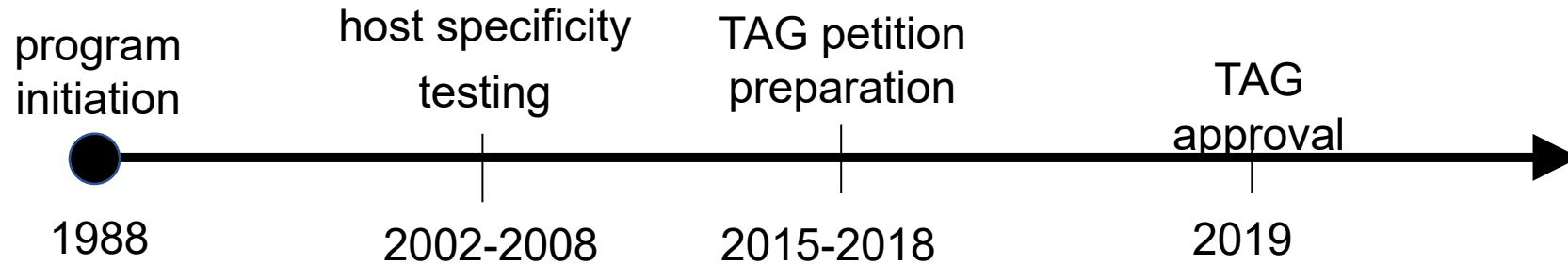


*Trapa* with insect feeding damage in China | Photo: Bernd Blossey



# *Phragmites australis* Biocontrol:

*Archanara (Lenisa) sp.*



*A. geminipuncta*



*A. neurica*



# APHIS has not approved U.S. field releases



But releases have happened in  
Canada

Insects **will** arrive, it is just  
a matter of when

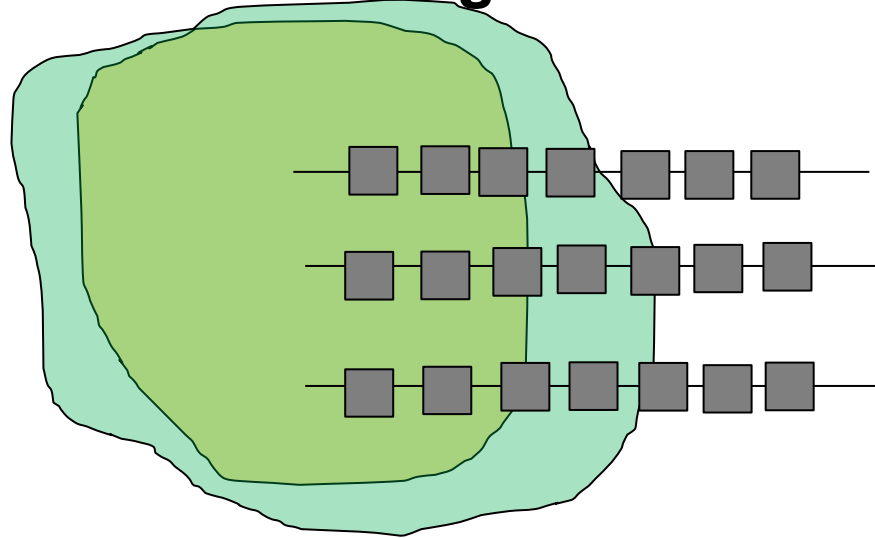
Pending U.S. approval, we will monitor  
for insect arrival into U.S. from Canada

# Mass production of insects already established



Continue and Expand on Long-term Monitoring:

## vegetation monitoring



## bioacoustic monitoring

(birds, bats, frogs)



Funding for pilot: USFWS

Holger Klinck, Dir. of Bioacoustics Program CLO

Derek Jaskula

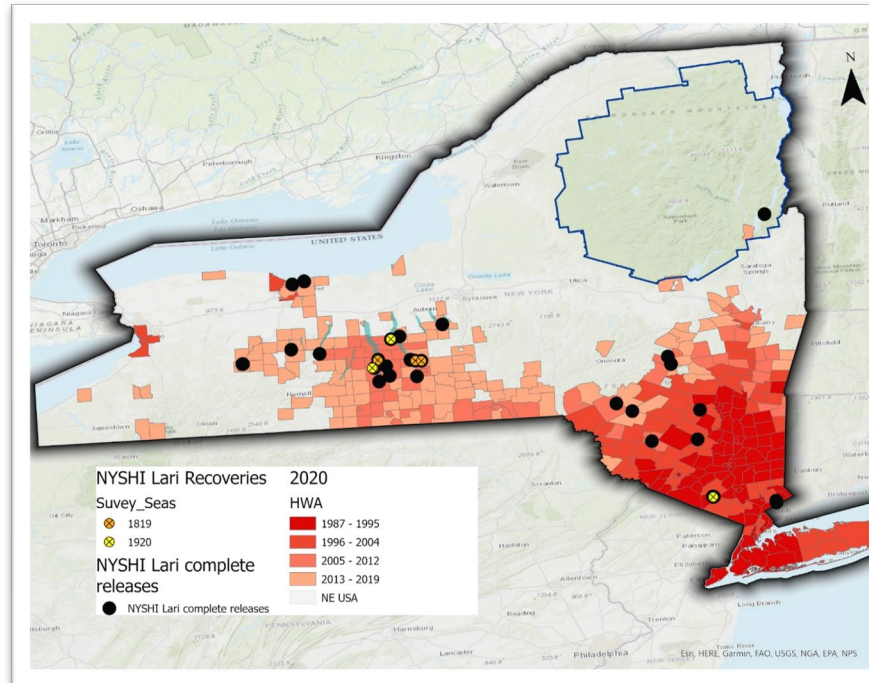
Stacy Endriss





# Hemlock Woolly Adelgid Biocontrol Updates 2021 – *Laricobius nigrinus*

Season (Fall – Spring)	No. Release Sites	No Ln Field Release
2008-2009	4	800
2012-2013	1	440
2013-2014	8	3,989
2014-2015	2	1,300
2016-2017	1	425
2017-2018	2	751
2018-2019	6	2,425
2019-2020	13	3,117
2020-2021	12	4,730
<b>Total released</b>		<b>17,977</b>



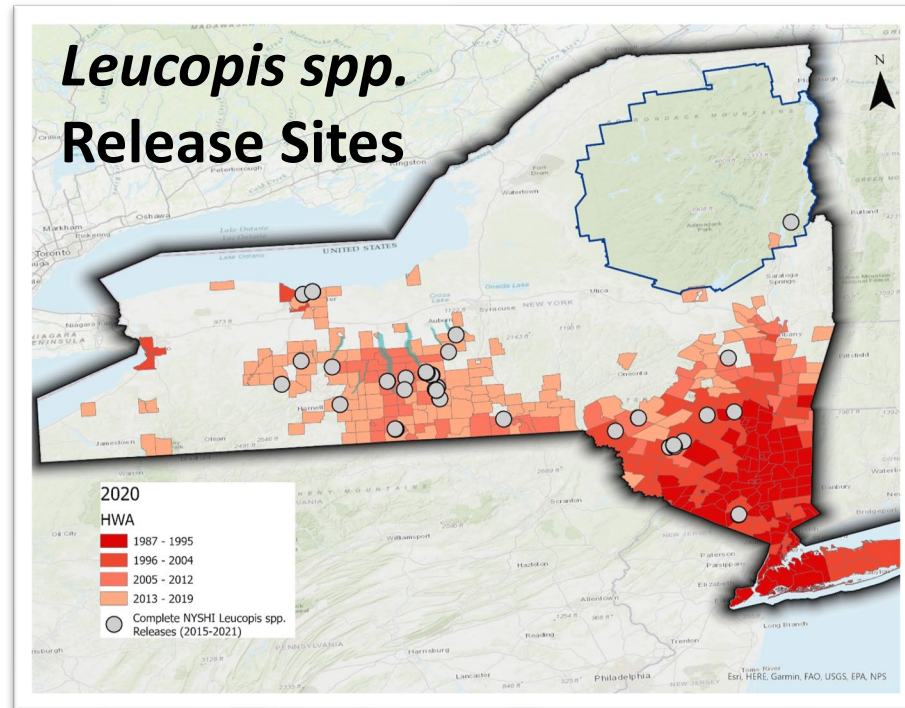
## *Laricobius* Release & Recovery



- *Laricobius nigrinus* establishment confirmed at 7 sites via beat-sheet surveys in the 2018-19 and 2019-20 seasons; further surveys planned for Fall 2021.

# NYSHI Updates 2021 – *Leucopis argenticollis* & *piniperda* (Silver Flies)

Season (Spring)	No. Release Sites	No. <i>Leucopis</i> Field Release
2015	4	139
2017	9	1,658
2018	6	748
2019	7	6,625
2020	11	7,756
2021	10	8,313
<b>Total released</b>		<b>25,239</b>



- A. *Le. argenticollis*, *Le. Piniperda*
- B. *Leucopis* puparium on Hemlock needle
- C. Adult *Leucopis* foraging on HWA



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Audrey Bowe



Wade Simmons



Jenn Andreas



Carol Randall



Marshall Lefebvre

