Biocontrol in NYS
How it works and what’s happening in the SLELO region

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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”
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.
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

Generalist

Specialist

Native range

Introduced range

Indigenous plant

Invasive plant
Japan

Giant knotweed
Washington, USA

Bohemian knotweed
Washington, USA

Jennifer Andreas, WSU Extension

Fritzi Grevstad, OSU
How Weed Biocontrol Works

- Release of control agent
- Weed density
- Biocontrol agent density
- Desirable vegetation density
- Damage threshold
- Successful control

C. Randall, USFS
Predator/Prey Models

The graph shows the population dynamics of hare (HARE) and lynx (LYNX) over the years from 1845 to 1935. The hare population is represented by the green line, and the lynx population is represented by the red dashed line. Both populations exhibit a cyclical pattern with peaks and troughs, suggesting a predator-prey relationship.
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.
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*
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**

*Native range explorations*

1985-94

**Galerucella calmaricienss**

*First 3 species released*

1992

**Hyllobius transversovittatus**

*4th species released*

1994

**Nanophyes marmoratus**

*Implementation of monitoring protocol*

1996

*Mass production of root weevils*

1999

*Program evaluation*

Present

**Mass production of leaf beetles**
roadside surveys (2004, 2018/2019) show the insects are now widespread

Galerucella sp.

Nanophyes marmoratus
Montezuma, Tonawanda, Hudson River

10 – 25+ years of change
Long-term monitoring plots
Loosestrife stem density

yrs after insect release

0 5 10 15 20 25

- Increase in density
- No change in density
- Decline in density

- 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

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

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
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 for more information and links to resources
Japanese Knotweeds Biocontrol: *(Reynoutria sp.)*


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
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](image)
**Phragmites australis** Biocontrol:

**Archanara (Lenisa) sp.**

- **Program initiation**: 1988
- **Host specificity testing**: 2002-2008
- **TAG petition preparation**: 2015-2018
- **TAG approval**: 2019

**Species**:
- *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*

<table>
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<tr>
<th>Season (Fall – Spring)</th>
<th>No. Release Sites</th>
<th>No Ln Field Release</th>
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<td>2020-2021</td>
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<tr>
<td><strong>Total released</strong></td>
<td><strong>17,977</strong></td>
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- *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)

<table>
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<th>No. Leucopis Field Release</th>
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<td>8,313</td>
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<tr>
<td><strong>Total released</strong></td>
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<td><strong>25,239</strong></td>
</tr>
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