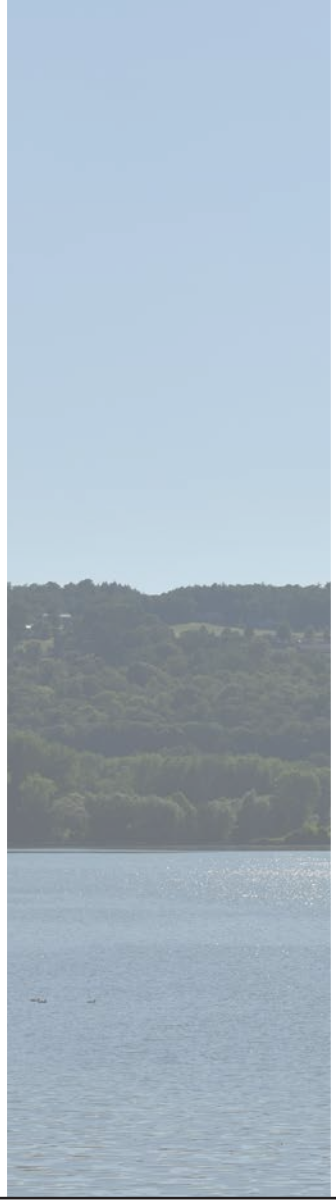
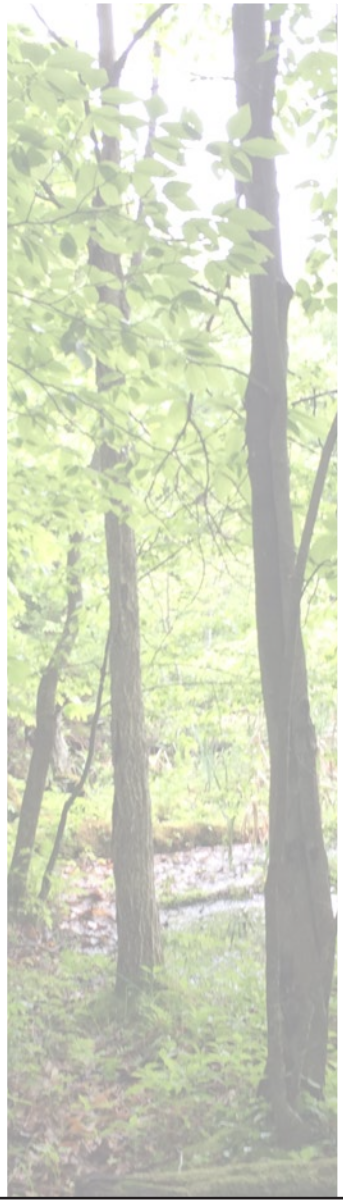
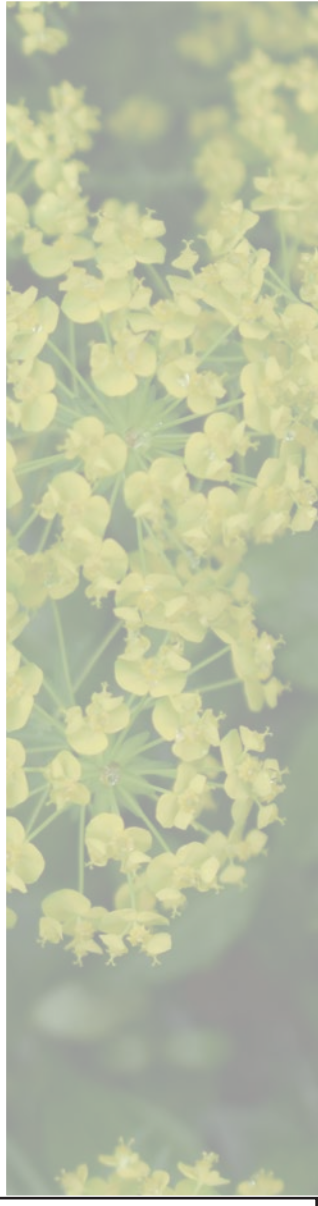




NYISRI

New York Invasive Species Research Institute

2019

ANNUAL REPORT



"Coordinating invasive species research to help prevent and manage the impact of invasive species in New York State"

Message From the Director

Dear Colleagues,

It is my pleasure to share the 2019 New York Invasive Species Research Institute Annual Report, which underscores our accomplishments and advances throughout the year as well as marks five years of partnership and support from the New York State Department of Environmental Conservation Invasive Species Coordination Unit and the NYS Environmental Protection Fund. Over the course of five years, NYISRI explored the challenges involved in invasive species management to better understand the information needs of practitioners on the ground, identified research gaps and sought ways to bridge those gaps through communication, collaboration and coordination. We looked near and far to seek out cutting edge research, ideas and technology to help us better achieve our goals in New York State and made strategic partnerships to help those move forward.

The five years of work culminated with an opportunity to co-host the North American Invasive Species Management Association annual conference with the theme "Connecting Science to Action" in Saratoga Springs, NY. This event provided a chance to showcase the projects and ideas from our incredible network of professionals across the state and the country.

As we close one cycle and transition into the next, we reflect upon our growth and experiences. Our mission is evolving and refining as we dive deeper into what it truly means to produce actionable invasive species science and to better understand the challenges that invasive species managers and policy makers are facing. We have also taken the time to share with others about what we have learned about serving as a bridging organization and what that looks like, how that happens, and the roles that such an organization can play.

We are extremely grateful for our many colleagues who have dedicated time to advancing collaborations and communications between the research and practice realms and look forward to strengthening and expanding these partnerships in the next five years to come.

Carrie Brown-Lima

Director
New York Invasive Species Research Institute
Department of Natural Resources
Cornell University

Acknowledgements

This report was written and designed by:

Audrey Bowe, Sam Talbot, and Carrie Brown-Lima.

Project updates were provided by Wade Simmons, Bernd Blossey, Stacy Endriss, and Jennifer Price Tack.

We could not do the work we do without the support and involvement of our partners at various universities, state partners at the New York Department of Environmental Conservation, iMapInvasives, and each one of the Partnerships for Regional Invasive Species Management.

We owe a great deal to Dr. Bernd Blossey and the Blossey lab group for their invaluable feedback on NYISRI projects and hard work in advancing priority research identified by state partners.

Thank you to Abby Bezrutczyk for reviewing and improving an earlier version of this report.

Funding for the New York Invasive Species Research Institute is provided by the Environmental Protection Fund as administered by the New York Department of Environmental Conservation. NYISRI is hosted by the Department of Natural Resources at Cornell University.

Contents

Background

Invasive species are a wicked problem, and straightforward solutions to invasive species issues are a rarity in our dynamic and multi-use New York landscapes. Yet, despite this complexity, managers and policymakers are continually asked to protect our natural land resources including recreation opportunities, historic value, and the native species they are home to.

The New York Invasive Species Research Institute aims to bring together those working in the field – whether managing on-the-ground or making programmatic decisions - with those working in the research sphere to better understand the biology, ecology, or impacts of invasive species. Facilitating synergistic partnerships between these two distinct, and typically disconnected, groups leads to more applicable research as well as more scientifically informed management strategies.

As one piece of the comprehensive invasive species network that New York State has had in place since 2014, NYISRI interacts frequently with the eight Partnerships for Regional Invasive Species Management (PRISMs) which coordinate invasive species management activities across the state, iMapInvasives, the public statewide invasive species database, and the New York Department of Conservation Invasive Species Coordination Unit which oversees the programs and spearheads statewide efforts. Input from these primary partners drive much of the work that we engage in.

NYISRI staff actively attend invasive species conferences and meetings to stay abreast of current research developments and needs to spark new ideas, forge novel partnerships, and facilitate the sharing of new invasive species information.

NYISRI also puts out a formal call for research needs and priorities from stakeholders and organizes state and regional workshops, conferences, presentations, working groups and research collaborations based on these needs.

Projects described in this report reflect research priorities that have emerged in previous years and have been identified as strategically impactful by NYISRI.

Identifying Research Priorities

Understanding the needs of invasive species managers is a critical requirement to establishing programs that meet these needs. Thus, an important and unique role that the New York Invasive Species Research Institute plays is that of collecting research needs from state partners.

In previous years, our call for research priorities took the form of conversations at meetings as well as administering an annual survey to PRISM leaders and DEC staff. While many ideas collected through these avenues were helpful and drove a large portion of the work that we have pursued throughout the years, various drawbacks and limitations led us to seek out alternative methods. In 2019, we engaged in a new approach known as Group Concept Mapping (GCM) with the hope of:

1) reaching a broader and more diverse audience in our call for research needs,

2) increasing transparency and standardization of the research needs solicitation process, and

3) introducing the opportunity for individuals to not only suggest ideas, but also give feedback as far as the importance and feasibility of these ideas.

From November to December, we invited a diverse group of stakeholders, including: members of the PRISM list-serves, NYISRI Advisory Board, New York Invasive Species Council, New York Invasive Species Research Institute Advisory Board, New York Department of Conservation Invasive Species Coordination Unit, iMapInvasives, and other key partners to participate in our 3-step process of 1) brainstorming, 2) sorting, and 3) rating research-related needs for New York State.

The results of this process, which will become available in early 2020, should be more representative of the needs of the diverse entities, and include rating of an idea's general importance as well as feasibility.

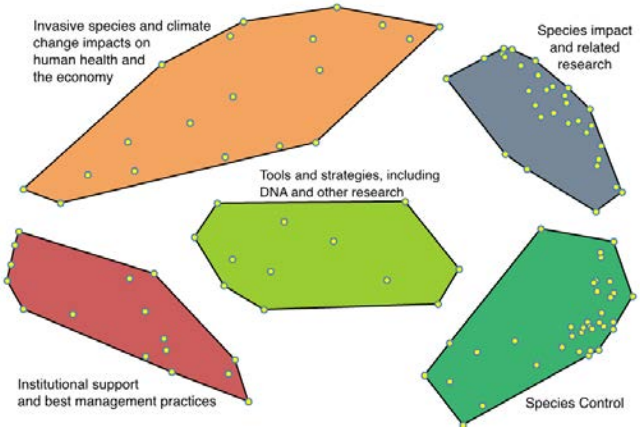


Figure 1. Cluster analysis map with grouping titles - one result of the sorting exercise. Credit: B. Dailey

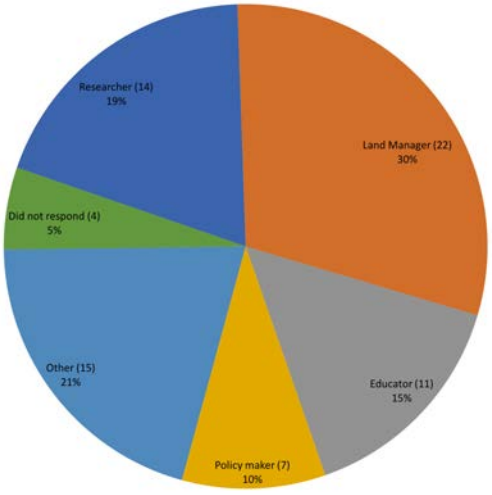


Figure 2. Roles of participants in the sorting and rating processes. Credit: B. Dailey

NYISRI Projects

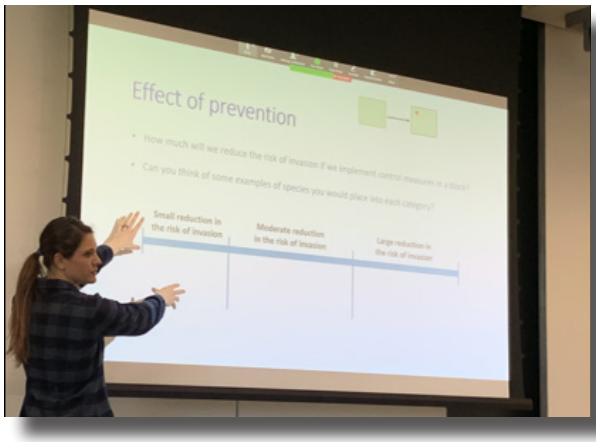


Figure 3. Dr. Price Tack presenting during a PRISM leader workshop

Figure 4. The biological control agent Hypena opulenta. Credit: L. Milbrath

Figure 5. Applying the Indicator Approach in wetlands of the Adirondacks

Based on yearly feedback on research needs paired with opportunity, NYISRI has spearheaded a number of initiatives to serve our stakeholders.

Projects we worked on in 2019 include:

- Developing a prioritization framework for informing decisions about invasive species management in the state (Page 9)
- Advancing biocontrol programs and monitoring for high-impact and widespread invasive species (swallow-wort, water chestnut, purple loosestrife) (Pages 10 & 20)
- Continuing to co-lead the Regional Invasive Species and Climate Change Management Network - a group dedicated to understanding how to manage invasive species in light of climate change (Page 14)
- Developing metrics land managers can use to document success in invasive species management (Page 12)

New York State Spatial Prioritization Project: An Update

Dr. Jen Price Tack

In New York, invasive species managers have expressed the need for tools to help inform the allocation of their limited resources. To address this need, we are developing a decision tool with and for state and regional managers to optimize the treatment of multiple species across the state.

We are collaborating with iMapInvasives to use their statewide database of invasive species occurrences to model species current and potential distributions. Our approach uses a decision-making framework that engages decision makers and stakeholders in the identification of the objectives and alternatives of management. Based on their needs, we are using optimization techniques to determine the combination of species, areas, and strategies expected to minimize negative ecological, social, and economic impacts at the greatest treatment effectiveness.

Over the last year, we finished developing the decision tool and have been applying it to invasive species decisions in each of the PRISMs. While our results are still preliminary, our model is showing that, in most cases, widespread and abundant species (Tier 4) are cost-prohibitive to treat at a regional scale. However, treating species may still be effective at finer scales, i.e., to minimize impacts of the invader in an area with a species of conservation concern.

We have also teamed with computer scientists at NatureServe to incorporate our model into iMapInvasives as a module that allows users to run the decision tool, query results, and display results on an interactive web map.

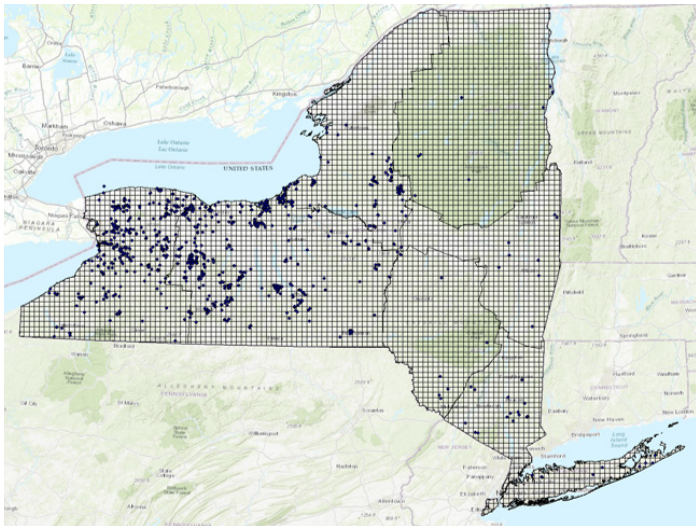


Figure 6. Giant Hogweed occurrence data from iMapInvasives. Species occurrence is one of several model inputs. Credit: S. Talbot

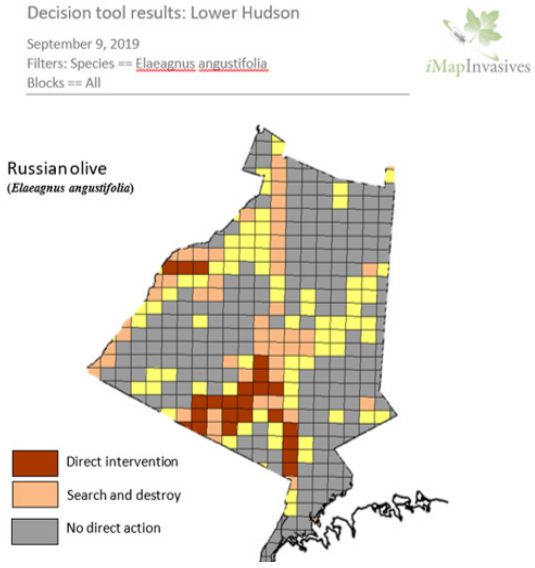


Figure 7. Example output from the iMapInvasives decision tool interface. Credit. JPT

Swallow-wort Biological Control Program

Approved in New York in 2017, a leaf-feeding moth *Hypena opulenta* is currently the only biological control agent available for invasive swallow-worts (*Vincetoxicum rossicum* and *V. nigrum*). Since its approval, the New York Invasive Species Research Institute has coordinated efforts around both research and outreach on this agent.

Swallow-wort Biocontrol Research

The swallow-wort biocontrol research collaborative was established in 2018 through the support of a grant from the New York Department of Transportation and includes researchers from SUNY ESF, Wells College, SUNY Cortland, the USDA ARS as well as the New York Invasive Species Research Institute. In the past year, members have:

- Established experimental field sites across central New York
- Conducted pre-release monitoring of native and swallow-wort vegetation at sites
- Set up a germination study to understand swallow-wort recruitment
- Established a new rearing colony of *Hypena opulenta* at SUNY ESF
- Presented on work at numerous conferences and on webinars
- Coordinated a meeting with researchers from Europe, Canada, and the US to share experiences and protocols

With the agents produced through the rearing colony, in 2020 the group plans to finalize a standardized monitoring protol and release *H. opulenta* at field sites.

Figure 8. (Left) A visit to the rearing facility of Dr. Dylan Parry at SUNY ESF. Figure 9. (Right) Dr. Andrea Davalos establishes a seed germination experiment. Credit: A. Bowe

Swallow-wort Biocontrol Outreach

The swallow-wort biocontrol outreach group consists of NYISRI staff and Cornell Cooperative Extension professionals in Yates and Erie counties and interfaces regularly with the research group. The goal of this partnership is to provide educational resources and training for pre- and post-release data collection of this recently approved and available biocontrol agent.

In 2019, we worked with partners to:

- Update outreach handouts, pamphlets, and posters
- Administer a preliminary survey on public perceptions of biological control
- Engage in discussions with researchers in the Pacific Northwest about collaborating on a national or regional survey of biocontrol perceptions in the management community
- Present at several conferences, including the 2019 NAISMA Conference and the 2019 Cornell Cooperative Extension In-service
- Engage in conversations with iMapInvasives, EDDMaps, and other biocontrol monitoring data platforms about expanding capacity to capture biocontrol data
- Identify field sites for establishing future demonstration cages for manager trainings.
- Host an outreach table about biological control at New York Farm Days in Aurora, NY

Figure 10. A candidate release site for H. opulenta in the Finger Lakes Region. Credit A. Bowe

Practitioner-Researcher Partnerships

Statewide, many organizations are working hard to eradicate, contain, and locally manage invasive species. However, success in on-the-ground invasive species management can be challenging to document. Commonly used metrics, including number of person-hours engaged, weight or volume harvested, or area covered, don't align well when matched with desired conservation outcomes.

Simultaneously, evidence on negative impacts is highly variable for different species, with documentation for some existing in abundance (ex. *Phragmites australis*), and almost completely lacking for others (ex. early detection species).

Developing tools to effectively assess both outcomes of invasive species management as well as impacts of invasive species on conservation targets has been identified as a research need. With this in mind, NYISRI and collaborators have been working to bring together researchers and managers to address these questions. Current projects include:

- Using native plant indicators to assess impacts of slender false brome (*Brachypodium sylvaticum)* in central New York, as well as impacts of *Phragmites australis* in the Adirondacks
- Understanding how management of swallow-wort impacts native plant communities in New York State Parks

Figure 11. Brachypodium sylvaticum interspersed with native vegetation on the forest floor. Credit A. Bowe

Conferences, Communication & Networks

Alongside advancing priority research projects, NYISRI both provides and attends venues for sharing between management and research professionals in the form of conferences, networks, and direct communications.

In 2019, significant time was dedicated to the planning and co-hosting of the 2019 North American Invasive Species Management Association Conference, which brought together researchers and managers nationwide for the first time in New York State (more details on Page 16). NYISRI staff also travelled to conference events to share and make regional and international connections. A full list of presentations given by NYISRI can be found in Appendix 3.

NYISRI continued to support an initiative to establish a regional collaboration on invasive species in the Northeast, pulling together a comprehensive report on each state's invasive species programming, and participating in strategic meetings with key stakeholders. Regionally, NYISRI also maintained involvement in the RISCC Network (Page 14), working to communicate information on invasive species and climate change to practitioners.

On the national level, NYISRI Director Carrie Brown-Lima was elected to chair the board of the North American Invasive Species Network (NAISN) in 2021 and continued to serve on the board of the North American Invasive Species Management Association (NAISMA) where she is co-chair of the Biocontrol and chair of the Conference Planning Committees.

Figure 12. NYISRI Director Carrie Brown-Lima participating in a Climate Change & Invasive Species Workshop.

Northeast Regional Invasive Species & Climate Change Management Network

Northeast RISCC Management Regional Invasive Species & Climate Change

The Northeast Regional Invasive Species and Climate Change (RISCC) Management Network is an ongoing collaboration between NYISRI, the University of Massachusetts Amherst, and the Northeast Climate Adaptation Science Center. This group aims to address the question "how can we manage for upcoming biological invasions in light of climate change?" through:

1) synthesizing existing research
2) conducting new research based on stakeholder needs, &
3) facilitating communication & understanding among researchers and managers

NYISRI is a co-founder of the RISCC and plays a coordination role in the Network and its initiatives. This year the NE RISCC Management Network expanded its reach beyond the northeast by actively engaging natural resource managers, policy makers, and researchers at the North American Invasive Species Management Association (NAISMA) conference and is currently helping colleagues in other regions to develop additional regional RISCC groups.

In lieu of the annual symposium, the RISCC team hosted a plenary talk, two special sessions, a workshop, and outreach table at the conference. Nearly 120 people attended the sessions and 50 attended the workshops.

The RISCC team's presentations focused on research that addresses the interactions between climate change and invasives species, as well as new tools, policy, and management perspectives.

RISCC Management Highlights

- Over 360 list serve subscribers
- 23 summaries of research papers produced and shared
- 21 presentations and webinars given
- Planned a workshop with invasive species councils in the Northeast to be hosted in early 2020
- Produced the Management Challenge: *Double trouble: Understanding risks from invasive from invasive species & climate change*

During the workshop, invasive species practitioners shared their own approach to incorporating climate change considerations into invasive species management. They also discussed potential barriers of turning ideas into action, including issues with available funding and need for prioritization tools.

Sessions were well received by participants, reflected in feedback from a post-conference survey including:

> *"I am so impressed and hopeful at what the Northeast RISCC group is doing for research, specifically, trying to bridge the divide between research and management. I've been on both sides of this issue and have direct experience observing the limited access (journal access fees) and intangibility of the research to managers."*

> *"I really appreciated the way that the RISCC Team developed interactive sessions to really have conversations between land managers, education and outreach folks, policy folks, etc. and researchers. I felt that those workshops were really the only place where true collaboration between land managers and researchers was happening"*

Figure 13. Participants listen to a RISCC Session presentation at the 2019 NAISMA Conference.

NAISMA - NYISRI
2019 Joint Annual Conference

During peak fall foliage in Saratoga Springs, New York, nearly 400 natural resource professionals came together for the 2019 NAISMA-NYISRI Joint Conference. The international group of researchers, managers, educators, and policy makers exchanged knowledge of invasive species management under a common goal: connect science to action. Moreover, the conference was locally represented; almost half of the participants were from New York State.

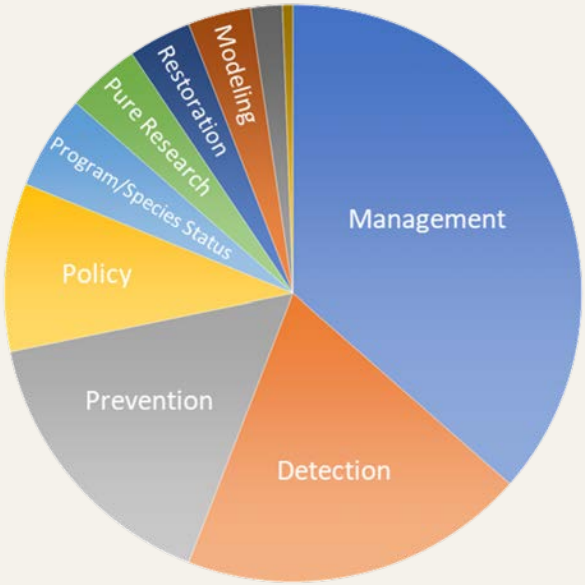
Presentations covered a wide range of themes including management, detection, prevention, and policy of invasive species. On each of the four days, several workshops allowed participants to spend time diving into specific topics, such as pest identification, distribution modeling, or the health effects of glyphosate. Field trips to local natural areas, both aquatic and terrestrial, provided a glimpse into natural resource management in New York. For those that couldn't attend the conference, a link to presentation pdf's is available on the NYISRI website.

During the conference, NYISRI staff facilitated side meetings to discuss species-specific research and management, including swallow-wort biocontrol. These meetings spurred productive discussions about methodologies for rearing, releasing, and monitoring biocontrol agents. The shared information will inform protocols in the lab and field, while promoting standardized practices among agencies.

"I ENJOYED THE MIX OF MANAGERS AND RESEARCHERS, WITH A MIX OF LOCAL, STATE, AND FEDERAL ATTENDEES."

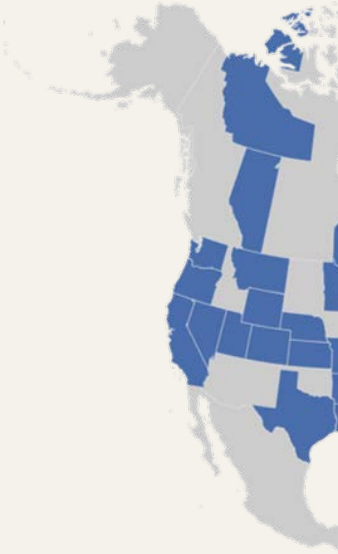
"THIS WAS A FANTASTIC CONFERENCE WITH A GREAT BLEND OF SCIENCE AND MANAGEMENT. ONE OF THE BEST THAT I HAVE ATTENDED."

What Were the Presentations About?



Presentations Per Category

- Management - 62
- Detection - 33
- Prevention - 27
- Policy - 16
- Program/Species Status - 9
- Pure Research - 7
- Restoration - 6
- Modeling - 6
- Monitoring - 3
- Human Health - 1



170 Presentations

22 Exhibitors

Top left: Congresswoman Elise Stefanik provides opening remarks; Top right: exhibitor Josh Thiel discusses NY DEC invasive species programs; Bottom left: conference poster session fosters in-depth conversations on a wide array of taxa and topics; Bottom right: field trip participants board the Lake George Floating Classroom; Opposite page: NAIS-MA director Belle Bergner and NYISRI director Carrie Brown-Lima

23 Posters

7 Field Trips

Who Attended the Conference?

- 395 Total Attendees
- 7 Countries
- 49 States and Provinces
- Nearly half of the conference attendees were from New York State

Website & Resources

Research Presentations

NYISRI selects speakers and topics for and hosts each monthly statewide call for the PRISM Network. In the past year, topics ranged from using eDNA for terrestrial applications to invasive slugs, snails, and mosquitoes. A full list of presentations can be found in Appendix 2.

In addition to these monthly meetings, NYISRI also organized several webinars on the following special topics:

- Biological Control of Water Chestnut
  (Wade Simmons & Dr. Bernd Blossey)
- Spotted Lanternfly: State of the Science
  (Drs. Miriam Cooperband, Julie Urban, Eric Clifton)
- Preparing for Japanese Stiltgrass
  (Dr. Luke Flory & Angela Sirois-Pitel)
- Biocontrol of Invasive Phragmites
  (Dr. Bernd Blossey)

Figure 14. Water chestnut - the target of an active biological control program - covering a section of the Seneca River in central New York. Credit: A. Bowe

Recordings of all presentations are publically accessible on the NY Invasives YouTube Channel and the NYISRI website (nyisri.org).

Web Resources

New York State has a rich network of professionals and researchers who are engaged with invasive species work. NYISRI hosts a centralized platform for profiles of these individuals in the form of the Researcher and Manager Databases on the NYISRI website. Contacts are searchable by research interests, species, regions, and more.

The NYISRI website also features monthly publications of “Research Digests” - concise lists of recently published primary literature relevant to those working in the state. Studies of the research-implementation divide have identified not having time or resources to access scientific journals as one barrier to practitioners using the most recent scientific findings.

Improving Communications

In Fall 2019, NYISRI commissioned Behan Communications to develop a formal communications plan. In 2020, we will be working to incorporate many of these suggestions to improve our website, email communications, and other resources.

Supporting Research

NYISRI supports the advancement of invasive species-focused research using several different approaches. The Research Institute frequently directly applies for funding for core research projects, establishes working groups around high-priority research topics, and also provides verbal, written, and networking support to researchers.

Working Groups

NYISRI frequently works in a "connector" capacity, bringing together researchers, managers, and other professionals to create working groups on priority topics. These working groups often seek out funding of their own, produce informational documents, or otherwise form new collaborations.

Current working groups that NYISRI has brought together include those on:

- Jumping Worm Outreach, Research & Management
- Non-herbicide Treatments for Giant Hogweed (Heatweed Technologies)
- Using Conservation Dogs to Detect Spotted Lanternfly (*Lycorma delicatula*)

Figures 15 (above, left): An invasive jumping worm in a gravel bed. Figure 16 (left): Spotted lanternfly adults feeding on a sugar maple in Pennsylvania. Credit: A. Bowe

Providing Information & Aiding Researchers

In 2019, NYISRI submitted multiple grant proposals to fund priority research on gamifying invasive species data collection, measuring success of on-the-ground invasive species management projects, and evaluating herbicide alternatives to treat Giant Hogweed.

Additionally, we provided letters of support for research proposals and programs working to advance biological control programs for swallow-wort, and understand the spread and biology of jumping worms.

Related Research Project Updates

In addition to core NYISRI projects, NYISRI also provides support to associated research projects on priority topics. Since 2015, NYISRI has supported 1) the advancement of a biological control program in the form of a leaf-feeding biocontrol candidate, *Galerucella birmanica* and 2) a 25-year assessement of the purple loosestrife (*Lythrum salicaria*) biocontrol program at Cornell University. Updates on these projects are provided below.

Biocontrol of Water Chestnut

Wade Simmons

We continued research to better understand the potential impact of water chestnut on native ecosystems and species, and further assessed the safety of implementing biocontrol of water chestnut using a highly specialized Chinese leaf beetle, *Galerucella birmanica* (Fig. 18). We have kept a colony of the leaf beetles since 2016 in a quarantine facility at Cornell University and in 2019 we have continued to improve the rearing protocols.

This past field season, we continued our assessments of how water chestnut beds may affect water chemistry in the Mohawk River, and we completed an important and required phase of tests examining the dietary choices of *Galerucella birmanica*. Described as multiple-choice tests, these experiments assess feeding and egg-laying (oviposition) behavior of the biocontrol insects when offered a selection of different plant species (Fig. 17).

We chose nine plants (both aquatic and terrestrial species) for testing because they showed either feeding or oviposition in no-choice tests. No-choice tests assess insect feeding or oviposition without offering alternative food choices. For the multiple choice experiments we arranged plants in a caged small pond within our quarantined greenhouse facility (Fig. 17). In each test, we released 50 adult insects onto a pedestal in the center of the pond. At the end of a 5-day test period, we removed insects and then we scored feeding damage and counted egg clusters. We replicated the experiment 10 times, each time using different individual plants and insect individuals, and randomly assigned plants to a new position within the pond.

Figure 17. Multiple choice test set-up. Credit: W.Simmons

Results from the multiple-choice tests confirm a strong preference by *Galerucella birmanica*

for water chestnut as a host plant. In each replicate, water chestnut was the most heavily attacked plant, and it had more than 80% of all eggs laid upon it. The multiple-choice results also confirm *Brasenia schreberi*, water shield, as a much less preferred host plant. As anticipated, insects fed and laid eggs upon *Brasenia* in each of the test replicates, but at much lower rates compared with water chestnut. Other studies, including work in China, seemed to indicate that this level of feeding damage is biologically insignificant for the plants survival and population dynamics. Furthermore, previous research has found that *G. birmanica* adults, when given a choice and not being confined in an experiment, will abandon Brasenia patches and search for their regular host plant. And when forced to continue to exist on *Brasenia* exclusively, populations rapidly decline and go extinct. While some additional modelling work will continue, we are also beginning to prepare a petition to regulatory federal agencies to allow field releases of *G. birmanica*.

This year we also began to investigate the interactions between *G. birmanica* and a closely related native beetle, the water lily leaf beetle (*Galerucella nymphaeae*) that uses both water chestnut and water shield as its host plant. Experiments planned for the upcoming year will help to determine if the interactions between these two *Galerucella* species extend beyond habitat co-occupation. In addition, an undergraduate honors project explored how different levels of feeding of leaf beetles on water chestnut, yellow water lily and water shield may affect aquatic food webs including tadpole development. This experiment involved a series of large mesocosms and the data are currently being processed.

Figure 18. Mating pairs of G. birmanica feeding on water chestnut. Credit: W. Simmons

Biocontrol of Purple Loosestrife

Drs. Bernd Blossey & Stacy Endriss

Beginning in 1992, 4 different species of insects (2 leaf-feeding beetles, a root-feeding weevil, and a flower-feeding weevil) were released in New York and across the US and Canada in an effort to provide biological control of purple loosestrife. To better understand how release of these insects would affect the wetlands of New York, we established monitoring locations using multiple permanent 1 square meter quadrats at 32 field sites across the state, from the Hudson Valley east towards Buffalo and north along Lake Ontario (Fig. 19).

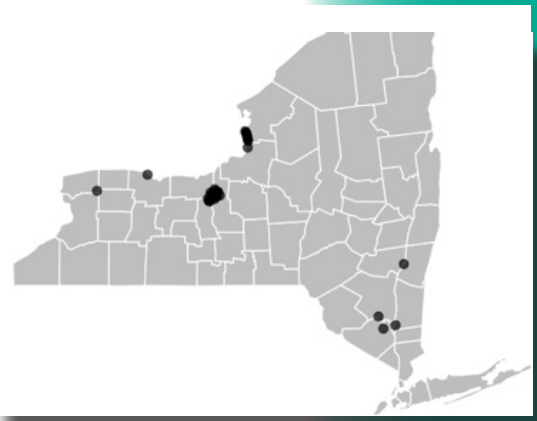


Fig 19. Map of long-term purple loosestrife monitoring sites in New York

Using a standardized monitoring protocol, we recorded detailed data about purple loosestrife growth and reproduction and also about the plant species co-occurring with purple loosestrife at each of the field sites. We initially visited all sites annually in June (to capture presence and abundance of the biocontrol insects) and August/September (to capture purple loosestrife's response to the insects, as well as co-occurring vegetation). In addition, to these impact assessments, we also used a roadside network around Ithaca to follow spread of the insects from a few original release locations in the 1990's.

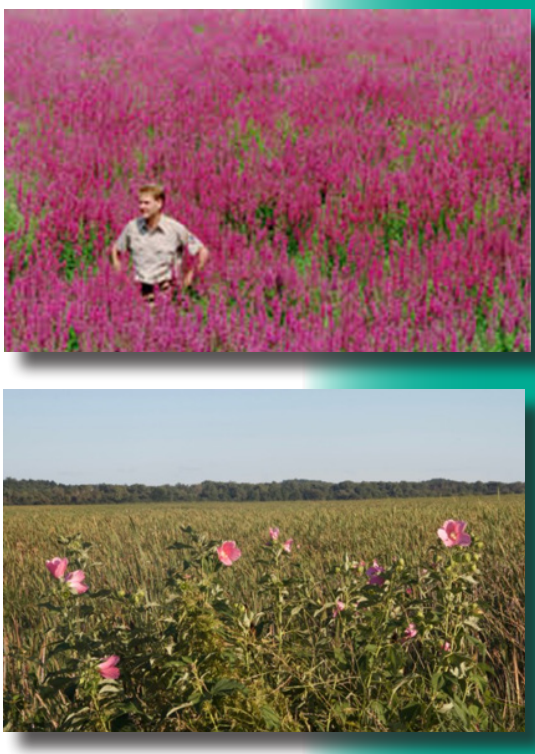


Fig. 20. Reduced dominance of purple loosestrife at the Montezuma NWR between 1992 (above photo) and 2019 (below photo).

We monitored many of these sites for a period of several years starting in the 1990s, but then funding ran out and we discontinued our annual assessments. With new funding in place, we conducted a comprehensive retrospective assessment of purple loosestrife biocontrol effectiveness in NYS in 2019. We returned to all 32 sites in August and September and using the same methodology we repeated our monitoring of both purple loosestrife and vegetation, as well as presence/absence of each of the four biocontrol agents. Fortunately, we had GPS locations of our quadrats, and in many locations the PVC stakes we used to demarcate quadrats remained in place, allowing us to return to the exact same spots as many years earlier. While we are still processing the data and preparing it for publication and extension/outreach materials, it is not too early to talk about some of the most important findings. While purple loosestrife is still widely distributed throughout the state, the once dominant near monocultures have largely disappeared (Fig. 20, above), often replaced by a diverse mix of native species (Fig. 20, below), but also occasionally by near monocultures of cattails and reed canary grass. All insects, including the secretive root feeding weevil *Hylobius transversovittaus*, have established and are now widespread in New York. Particularly the small flower feeding weevil has dispersed for

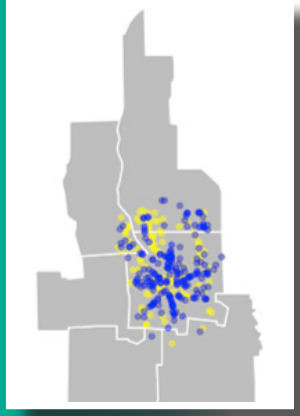


Fig 21. A map of the dispersal monitoring sites centered on Tompkins County and Ithaca. Yellow dots representing populations sampled in 2001-2004 and blue dots representing populations sampled in 2018 & 2019.

well >100 miles from the original release locations. Purple loosestrife still thrives in places that are disturbed or managed by mowing, such as along roadsides, although even here biological control has greatly reduced flowering and seed output. Active management such as mowing and spraying eliminates the possibility of effective biological control.

For our dispersal studies in the Ithaca area we re-surveyed roadside populations of purple loosestrife in 2018 and 2019 within a ten-mile radius of initial insect release sites in Ithaca, NY. For more than 200 purple loosestrife populations, we surveyed for the two leaf-feeding beetles (*Galerucella pusilla* and *G. calmariensis*) and the seed-feeding weevil (*Nanophyes marmoratus*). Importantly, we first surveyed roadside populations in 2001, allowing us to compare how well these insects had locally established and dispersed after their initial release (Fig. 21).

Our work indicated that dispersal was initially limited by topography in 2001, with insects only dispersing to the northeast of initial release sites (following prevailing wind directions). Twenty years after their initial release, however, these biological control agents are now widespread throughout central New York, including south and west of initial release sites and this includes the root-feeding weevil. Further, we found each of these insect species on purple loosestrife populations that consisted of a single plant, suggesting these insects have the potential to attack and exist in even small purple loosestrife populations. Indeed, the only locations where these insects appeared less common were either shaded (where loosestrife is less abundant to begin with), or highly disturbed due to flooding or mowing.

In conclusion, nearly 30 years after the initial insect releases, purple loosestrife is under successful and widespread biological control in the state, especially if left undisturbed by alternative management methods. The remnant populations serve as reservoirs for the insects to remain in the system, should plant outbreaks occur in the future (i.e. eradication is NOT desirable). The current abundance of purple loosestrife does fluctuate from year to year, but does not constitute ecological problems and wetland managers can rely on the insects to keep the plant in check.

Figure 22. Mixed wetland vegetation has largely replaced purple loosestrife at Eagle Point in the Montezuma wetlands in September 2019, (top left), but the plant is still present in low numbers as predicted. The middle picture shows Bernd Blossey trying to break through dense Decodon verticillatus to get to a monitoring quadrat; the bottom picture shows Bernd counting flowers on purple loosestrife at the edge of a floating cattail marsh in eastern Lake Ontario wetlands.

Appendices

Appendix 1. NYISRI Board Members

- Dr. Bernd Blossey, Associate Professor, Department of Natural Resources, Cornell University
- Dr. Bethany Bradley, Associate Professor of Spatial Ecology & Biogeography, University of Massachusetts Amherst
- Dr. Rebecca Epanchin-Niell, Fellow, Resources for the Future
- Karen Feldman, Commissioner, Adirondack Park Agency
- Dr. Angela Fuller, Leader, USGS New York Cooperative Fish and Wildlife Research Unit & Associate Professor, Cornell University
- Dr. Stuart Findlay, Aquatic Ecologist, Cary Institute of Ecosystem Studies
- Dr. Jennifer Grant, Director, New York State Integrated Pest Management Program, Cornell University
- Dr. David Lodge, The Francis J. DiSalvo Director, David R. Atkinson Center for a Sustainable Future, Cornell University
- Dr. Gary Lovett, Forest Ecologist, Cary Institute of Ecosystem Studies
- Dr. Dylan Parry, Associate Professor, SUNY College of Environmental Science and Forestry
- Laura Eaton, Assistant Regional Biologist, U.S. Fish and Wildlife Service & Invasives Coordinator, Northeast National Wildlife Refuges
- Hilary Smith, Senior Advisor for Invasive Species, U.S. Department of Interior
- Brendan Quirion, Adirondack Park Invasive Plant Program Manager, The Nature Conservancy – Adirondack Chapter
- Gregory Parra, Pest Exclusion Specialist, PPQ Center for Plant Health and Technology, USDA APHIS

Appendix 2. Monthly All PRISM Calls & Webinars

January 2019 - *How eDNA can be used to detect invasive species within terrestrial environments*
Dr. Rafael E. Valentin– Post-Doctoral Research Associate, Ecology, Evolution, and Natural Resources Department, Rutgers University

February 2019 - *Using impact assessments to prioritize range shifting invasive plants*
Dr. Bethany Bradley– Associate Professor, Dept. of Environmental Conservation, University of Massachusetts Amherst

March 2019 - *PlayCleanGo: the universal, international awareness campaign to leverage your invasive species outreach and change behavior*
Belle Bergner– Executive Director, North American Invasive Species Management Association

April 2019 - *Great Lakes Slender False Brome Working Group*
Brittany Hernon – Great Lakes Slender False Brome Project Manager

May 2019 - *NY Sea Grant Invasive Species eDNA Research Update*
Dr. Jesse Lepak - Great Lakes Fisheries and Ecosystem Health Specialist, New York Sea Grant
Dr. Paul Simonin – Postdoctoral Associate Department of Ecology and Evolutionary Biology, Cornell University

June 2019 - *The Real and Potential Effects of Pests and Pathogens on Carbon Storage and Sequestration by North America's Forests*
Brendan Quirion –Program Manager, Adirondack Park Invasive Plant Program, The Nature Conservancy

September 2019 - *Invasive Land Snails and Slugs of New York State: Species, Known Impacts, and Control*
Marla Coppolino –Research Associate, Paleontological Research Institution; Research Associate, Delaware Museum of Natural History

October 2019 - *The Spread of Invasive Ticks and Mosquitoes in New York State*
Dr. James Burtis – NEVBD Postdoctoral Associate, Cornell University
Talya Shragai – PhD Candidate, Cornell University

November 2019 - *Moving beyond prioritization: a tool for informing invasive management in New York*
Dr. Jennifer Price-Tack – Post-doctoral Associate, Cornell University

Appendix 3. Conference & Invited Presentations

- "Bridging the Gap Between Invasive Species Research and Management". February 26, 2019. National Invasive Species Awareness Week Webinar - Invited Speaker.
- "Bridging the Gap between Invasive Species Research and Management". May 15th 2019. North American Invasive Species Management Association Webinar - Invited Speaker.
- "Implications of Climate Change on Invasive Species in the Northeast and Considerations for Management". June 20, 2019. Eastern Lake Ontario 2019 Symposium - Invited Plenary.
- "Bridging the Gap Between Invasive Species Research and Management". March 2019. Florida Exotic Plant Pest Council 2019 Annual Conference - Invited Keynote.
- "Invasive Species Programs in New York State". June 2019. Cornell Local Roads Program 2019 Highway School – Invited Poster.
- "Invasive Species and iMapInvasives". November 2019. NTRES 2100 – Cornell University – Guest Speaker.
- "Implications of Climate Change on Invasive Species in the Northeast & Considerations for Management". November 2019. Cornell Cooperative Extension Agriculture, Food and Environmental Systems 2019 In-service – Invited Speaker.
- "Bridging the Research-Management Gap through the NE Regional Invasive Species and Climate Change (RISCC) Management Network" October 2019. North American Invasive Species Management Association 2019 Conference – Speaker.
- "Bridging the Gap between Invasive Species Research and Management". October 2019. International Conference on Aquatic Invasive Species in Montreal, Quebec, Canada - Speaker.

Appendix 4. Board and Committee Membership

- NYS Invasive Species Education & Outreach Committee
- NY Sea Grant Invasive Species Clearinghouse Advisory Committee
- Woody Invasives of the Great Lakes (WIGL)
- Invasive Species Awareness Week Capital District Planning Committee
- North American Invasive Species Management Association (NAISMA) Annual Conference Committee (Chair)
- North American Invasive Species Network (Incoming Chair)
- North American Invasive Species Management Association (NAISMA) Board of Directors
- Cornell Invasive Species Program Work Team (Co-chair)
- Forest Ecosystem Monitoring Collaborative (FEMC) New York Committee (Cornell Representative)
- NYS Invasive Species Documentary Advisory Committee
- New York Invasive Species Council
- New York Invasive Species Advisory Committee
- Great Lakes Slender False Brome Working Group
- iMapInvasives User Feedback Group

Appendix 5. Publicity

NYISRI is frequently contacted by news outlets and partners to provide information on invasive species. In 2019, Director Carrie Brown-Lima participated in the following:

- Interviewed by Brianne Ledda from Osprey Online
- Interviewed and filmed by NY Sea Grant to be as part of an effort to create outreach and training videos: See "Watercraft Inspection: Dispelling Common Myths (created 2019)"
- Interviewed by NY Times journalist Sanam Yar about Japanese knotweed
- Interviewed by CapRadio on Invasive species and climate change as part of podcast on invasive shrimp, Podcast picked up by NPR with links to the episode on Apple Podcasts, Google Podcasts and Spotify.
- Interviewed by Matthew Reitz Sr. Staff Reporter at The Palladium-Times
- Guest on NPR's 1A show titled Snakes on a Plain: Invasive Species and How We Handle Them
- Interviewed in the feature length documentary "Uninvited: The Spread of Invasive Species"