Report and Recommendations
NORTHEAST MULTISTATE ACTIVITIES COMMITTEE MEETING
September 21, 2023
11:00 AM - 12:00 PM ET Zoom Teleconference

Members: Matt Wilson (WVU-Chair), Puneet Srivastava (Maryland), Jason White (CT-New Haven), Blair Siegfried (Penn State), Cindy Fitch (WVU/NEED), Ali Mitchell (NEED) [Non-voting, ex officio: Rick Rhodes (NERA), David Leibovitz (NERA)]

Request to Approve Peer Reviewed Multistate Activities (MAC recommendations to NERA)

- NECC_TEMP29: *Northeastern Corn Improvement Conference*, 10/2023 – 09/2028 [Renewal of NECC29, AA: Margaret Smith – Cornell]
    - Corn improvement conference is held annually in February for 40-50 participants
    - Intent of the conference is networking and sharing across the industry
    - Conference has been held consistently for 77 years
    - Peer reviews were all positive and all recommended approval of this renewal
    - **The MAC unanimously recommends to NERA the approval of NECC_TEMP29.**
- NE_TEMP2332: *Biological control of Arthropod Pests and Weeds*, 10/2023 – 09/2028 [Renewal of NE1832, AA: Jason White – Connecticut-New Haven]
    - Peer reviews all recommended approval of this project proposal with revisions.
    - The proposal does not include an outreach plan, which is a required component of multistate project proposals.
    - **A motion to recommend approval of the NE_TEMP2332 proposal was introduced by Jason and seconded by Ali. Prior to approval, the motion was amended so that final approval is conditional upon the drafting of an outreach plan to be included in the proposal. The full committee approved this motion with the conditional amendment.**

Northeast Administrative Adviser Assignments to be addressed (MAC can make recommendations to NERA)

- Jessica Leahy (**changed position at UMaine**)
    - NE2101: *Eastern White Pine Health and Responses to Environmental Changes*
    - NE2231: *Collaborative Potato Breeding and Variety Development Activities to Enhance Farm Sustainability in the Eastern US*
- Olga Padilla-Zakour (**changed position at Cornell AgriTech**)
    - NE9: *Conservation and Utilization of Plant Genetic Resources*
    - NE1839: *Development and Evaluation of Broccoli Adapted to the Eastern US*
- Rick Rhodes (**serving as interim AA**)
    - NECC1901: *Integrating Genomics and Breeding for Improved Aquaculture Production of Molluscan Shellfish*

Informational Items

- NERA approved proposal awaiting NIMSS approval
  - NE_TEMP2338: *Weed Emergence in a Changing Climate*, 10/2023 – 09/2028 [Renewal of NE1838, AA: Margaret Smith – Cornell] **Approval was conditional upon the retroactive submission of annual reports, which have been uploaded to NIMSS**.
- NERA activities ending 09/30/2024
  - NE1939: Improving the health span of aging adults through diet and physical activity (**Greenlighted to renew**)
  - NE1942: Enhancing Poultry Production Systems through Emerging Technologies and Husbandry Practices (**Greenlighted to renew**)
  - NE1941: Environmental Impacts of Equine Operations (**exploring renewal or drafting a new proposal**)
  - NECC1901: Integrating Genomics and Breeding for Improved Aquaculture Production of Molluscan Shellfish (**interest in renewal TBD**)
  - NE1938: Carbon Dynamics and Hydromorphology in Depressional Wetland Systems (**interest in renewal TBD**)
  - NE1943: Biology, Ecology & Management of Emerging Disease Vectors (**interest in renewal TBD**)
- NERA activities up for Mid-term review in FY2024
  - NE2140: Sustainable Management of Nematodes in Plant and Soil Health Systems (AA: Anton Bekkerman – New Hampshire)
  - NE2101: Eastern White Pine Health and Responses to Environmental Changes (AA: Jessica Leahy – Maine)
  - NECC2103: High tunnel specialty crop production (AA: Anton Bekkerman – New Hampshire)
  - NEERA2104: Northeast Region Technical Committee on Integrated Pest Management (AA: Margaret Smith – Cornell)

NECC_TEMP29: Northeastern Corn Improvement Conference

Status: Submitted As Final

Duration	10/01/2023 to 09/30/2028
Admin Advisors:	[Margaret E. Smith]
NIFA Reps:	

Statement of Issues and Justification

The Corn Improvement Conference (formerly Northeastern Corn Improvement Conference or NECIC) facilitates information sharing and research collaboration on what is arguably the most important agricultural crop in the northeastern U.S. and beyond. Stakeholders that benefit from the Corn Improvement Conference include dairy and livestock producers (the largest agricultural enterprise in several major states and a business that continues to grow), corn grain producers who have increased their acreage for both traditional grain markets and ethanol production facilities, and a rapidly growing group of both "non-GMO" and organic grain and dairy producers. All of these groups need regionally appropriate germplasm testing and pest management information that is tailored for the changing climate conditions experienced during the crop cycle in the US and Canada and in expanding corn production areas. Results from agronomic research help to keep abreast of the latest technological developments and production issues, and knowledge about the realities of corn producers across the region and beyond are made apparent to and serve to guide the efforts of cutting-edge researchers.

NECIC has met annually since 1945, with the sole exception of 1950 when researchers were regrouping in the wake of World War II and one year during the COVID pandemic. Group interaction is focused primarily on this event, held close to February of each year and hosted by one of the participants. The annual meeting provides a crucial forum for networking among all the key players in corn production in the northeastern US and eastern Canada. Regionality has been expanding in recent years (since 2000s) because issues in other parts of the US and Canada mirror those of the Northeastern region, with participants joining from several central US states and Canadian provinces. Meeting participants include public sector corn researchers and students from the State Agricultural Experiment Stations and federal research programs in the northeastern U.S., and from Agriculture and Agri-Food Canada in eastern Canada, together with private sector scientists who have an interest in corn improvement in these regions. Plant breeders and geneticists have historically constituted the majority of the group, but it has expanded to agronomists, plant pathologists, seed scientists, crop physiologists, entomologists, and others with an interest in corn improvement. About 40 to 50 people attend each meeting.

Active participation of the private sector is a unique aspect of CIC. Public and private sector scientists have alternately served as chair of the organization, ensuring that the program is relevant to both and serving to strengthen the ties between state and industry scientists. Private sector scientists from the group have strongly encouraged support of public sector corn improvement research at the state and federal levels through letters and lobbying efforts. Such support would be much less likely without the types of public-private sector connections facilitated by CIC.

Annual CIC meetings have provided a forum for sharing and discussing research results related to corn improvement and for consideration of issues (e.g., policy, climate change) affecting corn research in the corn producing regions of the U.S. , Canada, and beyond. Scientific papers presented by participants allow all to keep abreast of others' research topics and results. State and industry reports provide information on emerging trends in corn production and the seed industry, and on corn improvement concerns in the region. Through this shared awareness and interest, collaborative research has been pursued when appropriate as illustrated by the following examples:

- The resurgence in the importance of northern leaf blight and the earlier emergence and northward migration of gray leaf spot as a serious corn pathogen in the eastern U.S. have both prompted collaborative efforts among corn breeders in this group to screen germplasm for resistance. Pathologists have collectively assessed recent recommendations for preventative fungicide sprays on corn.
- Evaluation of corn germplasm for resistance to multiple diseases of importance in the northeast, being conducted by Agriculture Canada's corn breeder in Ottawa, has included germplasm from Cornell University's breeding program. Graduate students have done portions of their research at other institutions (e.g., field evaluations, specialized laboratory research) and have had access to others' genetic materials.
- Breeders in the group exchange germplasm and participate in joint testing efforts.
- Agronomists from this group's affiliated institutions collaborated with private industry to evaluate the performance and feed quality characteristics of corn hybrids with stacked genetically engineered traits.

Agronomists have collaborated to identify novel production research questions, identify stress responses and yield impacts, and summarize current knowledge through peer-reviewed review papers.

Objectives

1. 1. Hold an annual meeting where agronomists, corn breeders, geneticists, pathologists, physiologists, and entomologists from the public and private sectors can exchange their current research results and explore new opportunities.
2. 2. Monitor and share information about the spread of issues of regional concern to US and Canada and conduct coordinated research on their management.
   Comments: (a) Existing and emerging diseases, like tar spot, and management options. (b) Herbicide resistant weed management. (c) Data-driven information regarding use of corn foliar fungicides as plant health enhancers when diseases are not present. (d) Insect and nematode damage and management options. (e) Development of genetic materials and management strategies to reduce ear rots in corn and associated mycotoxin contamination of grain in the region.
3. 3. Conduct multi-state research and share information about corn management.
   Comments: (a) Assessment of interactions of hybrids and management practices such as row spacing and plant population. (b) Development of models to predict nutrient needs for corn and reduce N and P inputs to improve water quality. (c) Seed sources and management for expanding “non-GMO”, silage, and organic production sectors. (d) Investigate corn responses to abiotic stresses increasing in frequency due to climate change. (e) Evaluation of novel production inputs (i.e., biologicals) on corn growth, yield, and soil parameters.
4. 4. Exchange corn germplasm among breeders in the region for evaluation and breeding purposes.
5. 5. Provide graduate students with research and professional development opportunities.
6. 6. Continue to increase the already-robust public and private sector participation in CIC.

Procedures and Activities

A two-day annual meeting is held (generally in mid-February) at a location determined by the incoming Chair of the group. This meeting includes research presentations by regular members (public and private) and graduate students, often offering them one of the first opportunities to make an oral presentation in front of their scientific peers. Reports about corn production are given by state, provincial, and industry members during the business meeting. All presentations and reports are assembled into an annual proceedings volume.

Expected Outcomes and Impacts

- Exchange of ideas and information/data among the region's corn workers.
- The region's corn workers keep abreast of emerging production issues regionally, nationally, and internationally.
- Exchange of germplasm to contribute to regional breeding efforts.
- Region-specific research results that provide corn growers with guidance on crop and pest management.
- Professional development of graduate students.

Educational Plan

All scientific presentations and reports from both public and private sector participants are summarized in an annual proceedings volume that is made available to participants and other interested parties.

Organization/Governance

The CIC has two officers, Chair and Secretary/Chair-elect. At each annual conference, the Chair convenes a business meeting. The Chair's primary responsibilities are to organize the annual conference and business meeting and coordinate publication of the proceedings. The Secretary takes the minutes and handles any routine correspondence. At the end of the meeting, the Secretary assumes the position of Chair and a new Secretary/Chair-elect is elected for the following year. Both public and private sector participants are encouraged to serve in these capacities, in order to continue the strong tradition of involvement from both of these groups. Administrative guidance is provided by an assigned Administrative Advisor and a NIFA Representative.

Literature Cited

Land Grant Participating States/Institutions

Non Land Grant Participating States/Institutions

Participation

Participant	Is Head	Station	Objective	Research						Extension	
				KA	SOI	FOS	SY	PY	TY	FTE	KA

Combined Participation

Combination of KA, SOI and FOS	Total SY	Total PY	Total TY
Grand Total:	0	0	0

Program/KA	Total FTE
Grand FTE Total:	0

Appendix J1: CC Evaluation (Submitted)

Status: Complete
Project ID / Title:
NECC_TEMP29: Northeastern Corn Improvement Conference

Questions

1. Goals and objectives clearly stated and appropriate to committee activity(s)	**Excellent**
2. There is a good potential to attain the objectives and plan identified in the activity.	**Excellent**
3. Activity addresses priority research and is not duplicative with existing activities.	**Good**
4. Activity has moved beyond individual activity(s) and ideas to a collective, interdependent activity.	**Excellent**
For renewal projects only:	
5a. Attendance of the preceding project has been adequate and reflects broad participation by designated project participants.	**Excellent**
5b. The project has developed and demonstrated technology transfer to clientele.	**Excellent**

Recommendation
Approve/continue with normal revision.
Comments:
I think this is an excellent initiative. Some unique aspects that are worth highlighting are the inclusion of both private and public corn researchers, inclusion of graduate students, and representation of diverse disciplines within the corn sector. I would encourage the group to think about opportunities for interdisciplinary research efforts across the corn sector, which may already be ongoing but was not perfectly clear from the proposal. Overall a great effort with diverse benefits.

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For renewal projects only:	
5a. Attendance of the preceding project has been adequate and reflects broad participation by designated project participants.	**Excellent**
5b. The project has developed and demonstrated technology transfer to clientele.	**Good**

Recommendation
Approve/continue with normal revision.
Comments:
The committee has a very good track record of collaboration and responding to important issues with corn production. There is evidence of academic and industry partnerships. As the committee moves forward, it may be helpful to incorporate more innovative research and technologies; perhaps starting with guest speakers but then inviting new members as full participants. Some examples could include A.I., drone surveillance, modern genetic editing techniques for crop improvement, etc.

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For renewal projects only:	
5a. Attendance of the preceding project has been adequate and reflects broad participation by designated project participants.	**Excellent**
5b. The project has developed and demonstrated technology transfer to clientele.	**Good**

Recommendation
Approve/continue with normal revision.
Comments:

NE_TEMP2332: Biological control of Arthropod Pests and Weeds

Status: Submitted As Final

Duration	10/01/2023 to 09/30/2028
Admin Advisors:	[Jason C White]
NIFA Reps:	

Statement of Issues and Justification

For over a century biological control has provided a safe and effective control method for many arthropod pests and weeds in the USA and throughout the world. The term ‘biological control’ refers to applied efforts to manage pest problems through importation, conservation, or augmentation of natural enemies, and it is generally distinguished from natural control, which is provided by unmanaged indigenous natural enemies in the native or introduced range of a pest species. Realizing that pests and management efforts cross state boundaries, the four regional associations of State Agricultural Experiment Stations have long maintained multi-state research projects in biological control of arthropods and weeds. This multi-state Hatch project fosters collaboration across a range pests to support efforts in releasing and monitoring biological control agents and to understand how abiotic and biotic environments influences population dynamics and efficacy of biocontrol agents, and provides opportunities for participants to meet and discuss emerging issues to foster further collaborations. We seek permission to renew NE-1832 Biological Control of Arthropod Pests and Weeds- a project that builds upon our national expertise in biological control and specifically addresses pest complexes and research opportunities that are unique to our region.

Non-native plants and insects introduced into North America generally come without the natural enemies that keep them in check in their native habitats. Freed from these natural controls, these species often increase in numbers and distribution, adversely affecting the environment, the economy, and human health (Pimentel et al. 2000). Classical Biological Control, a deliberate process whereby these pests are reunited with their effective natural enemies, offers a potential for permanent control of these pests over widespread areas (Van Driesche et al. 2008; Hajek & Eilenberg 2018). Despite such advances in pest management as more selective pesticides, use of behavior modifying chemicals, resistant varieties and transgenic plants, pest arthropods and weeds continue to damage our agricultural crops and natural ecosystems. Biological control, used singly or in combination with other management options, should be the centerpiece of successful pest management programs (Van Driesche et al. 2008; Hajek & Eilenberg 2018). In recent years, researchers in the northeast have worked with many types of biological control agents including predaceous insects, mites, parasitoids, nematodes and pathogens to successfully manage key pests including spongy moth, purple loosestrife, birch leafminers, mites on apples and vegetables, fruit moths, alfalfa weevil, Mexican bean beetle, whiteflies and other pests in greenhouses, imported cabbageworm, euonymus scale, etc. They are currently working against such critical pests as hemlock woolly adelgid, Asian longhorned beetle, emerald ash borer, spotted lanternfly, spotted wing drosophila, water chestnut, swallow-wort and mile-a-minute weed. These successes and ongoing efforts have generally involved cooperative work by scientists from several states and agencies.

Interdependencies: Those attributes that make Classical Biological Control so attractive also require careful consideration of target selection, agent discovery, and pre-and post-release evaluation of agents for both efficacy and impact on non-target organisms (Mason et al. 2005; Barratt et al. 2006). These issues generally require regional input and cooperative research over a range of environmental conditions. Individual agricultural experiment stations in the Northeast Region seldom have the resources or expertise to conduct a complete Classical Biological Control program, and thus we have a long history of cooperation among state Universities, as well as with scientists from USDA-ARS, USDA-APHIS, USFS, state departments of agriculture, and specialists in foreign countries. Success in developing and implementing biological control programs is closely linked to the development of effective communication and coordination among participants. Other biological control approaches, including augmentative and conservation biological control, also require collaboration across a range of regions and environmental conditions to be successful.

The focus of this multi-state research project is to enhance biological control of arthropod pests and weeds in the Northeast Region through increased communication and collaboration among practitioners in the region and beyond. The umbrella of a northeast multi-state project provides the framework for dialogue on pest target selection and pooling of expertise and resources to allow coordinated research and outreach programs.

Many biological control programs seek to permanently establish introduced species across a regional or even a continental scale. Conventional science, performed primarily by specialists, is not well-suited for monitoring at these broad temporal or spatial scales so researchers in the Northeast have been on the leading edge of utilizing citizen science to enhance monitoring for released biological control agents. Compared to conventional science, programs such as the Lost Ladybug Project (www.lostladybug.org) have proven to be superior for tracking introduced and native species (Soares et al. 2022) and more cost effective per data point gathered (Gardiner 2012).

Related, Current and Previous Work

This project is a continuation of NE-1832

Mission: The mission of this northeast regional project is like that of our counterparts in other states and several NE-2332 members work with other regional groups on key national pests including spotted wing drosophila, brown marmorated stink bug, and emerald ash borer. However, in general, the agricultural and natural ecosystems of the northeast differ from other regions of the country and our scientists address some unique pests. This northeastern regional project includes biological control of both weeds and arthropod pests because these two groups of pests have many similar research issues and many individual participants in this project already work on biological control of both arthropods and weeds.

Regional Cooperation and recent accomplishments: The participants in this program have a long history of information exchange and collaborative research. Beginning in 1985 and continuing today, we hold biological control symposia at the annual meeting of the Eastern Branch of the Entomological Society of America. Many of the members listed in Appendix E have attended and participated in these symposia, which have featured discussions of methods, issues, and opportunities in biological control of weeds and arthropods. Some successful projects, including birch leafminer and lily leaf beetle, have directly resulted from discussions initiated at those meetings. Since this collaboration was formalized with the creation of NE-1032 in 2008, our participants have organized 9 symposia with international participation, and this has greatly expanded collaborative efforts (reported on the NE-1832 website). Biological control practitioners in the northeast regularly assist in agent releases and surveys and often provide insect and plant samples for colleagues in other states, taking advantage of local knowledge and greatly reducing time and cost. For instance, colleagues in five northeastern states recently documented successful biological control of birch leafminer throughout the northeast and well into the Midwest (Casagrande et al. 2009). A similar survey of imported cabbageworm parasitoids has shown displacement of an inefficient parasitoid by a more effective and host specific parasitoid, and research has also evaluated the impact on a native butterfly (Herlihy et al. 2012, Morton et al. 2015). Damage to cultivated and native lilies from the introduced Lily leaf beetle has been reduced in New England states where parasitoids of the lily leaf beetle were released (Casagrande et al. 2022). Mile-a-minute weed insect herbivores have been released in eleven states (Hough-Goldstein et al. 2012, Smith and Hough-Goldstein 2014) and purple loosestrife herbivores were sent from NY and NJ across the US and Canada, and anecdotal and empirical evidence support the program's success (Blossey et al. 1995; Endriss et al. 2022). In addition to cooperative release and evaluation programs, there are also ongoing research programs where essential research components are conducted at cooperating institutions such as the Phragmites biological control program involving RI, NY, Canada, and CABI Bioscience in Switzerland (Blossey et al. 2018), and a coordinated research program on swallow-worts undertaken by URI, USDA, CABI, and Canadian colleagues (Bourchier et al. 2019). Other examples include hemlock woolly adelgid and winter moth research, briefly described under procedures (below). Project NE1832 provided support for many of these biological control successes, from increased rearing of natural enemies such as mile-a-minute and purple loosestrife specialists, to the identification of spotted lanternfly biological control agents and more. Participants in NE1832 published over 150 scientific articles and book chapters between 2018 and 2023 on biological control (Appendix B).

Regional Facilities and Expertise: Relative to the rest of the United States, we enjoy a high concentration of insect containment and rearing facilities with Cornell, URI, and VPI all maintaining USDA-approved primary insect quarantine laboratories. Other quarantine and rearing facilities are found at the Otis ANG base in MA, the Ansonia Forest Service lab in CT, the NJ Dept. of Ag.'s Phillip Alampi Beneficial Insect Rearing Laboratory (PABIL), and the ARS Beneficial Insects Introduction Research Unit on the campus of the University of Delaware, Newark, DE. These facilities are essential for Classical Biological Control research and are used extensively in establishment and augmentative biological control efforts. Many of the university researchers listed in Appendix E have used one or more of these facilities. The Northeast also has many biological control practitioners.

The goals, objectives, and research approaches of this regional project are like those of the Southern, North Central, and Western regional projects in biological control. Although we deal with different pest complexes and organize objectives differently, all regions share the general goals of improving biological control.

All existing biological control programs in the northeast fall under these general goals as indicated in Procedures. Goal four is particularly important in the Northeast because many of our target pests are found in natural areas and managers need to be convinced of positive long-term consequences and minimal risk associated with our programs.

Objectives

1. Conserve existing natural enemies and enhance ecosystem function
   Comments: Assessment of natural enemy populations and improved knowledge of the impact of insecticides, deliberate planting habitat for natural enemies (e.g., native perennials), and other habitat manipulations will lead to reduced risk to natural enemy populations and enhanced biological control in agriculture, including blueberry, field crops, and Christmas tree production. This sets the stage for additional biological control efforts such as augmentation and classical biological control if needed.
2. Augmentation programs involving repeated rearing and release
   Comments: Experimental augmentative releases of Trichogramma ostriniae against the European corn borer (Ostrinia nubilalis) will be made in NY to assess the role of volatiles released by host eggs on the efficacy of releases. Root aphids infesting Christmas trees in Vermont will be identified and releases of Hypoaspis miles made to determine effectiveness. Research is also underway to determine the efficacy of including entomopathogenic fungi in potting soils in a plant-mediated system for management of western flower thrips in greenhouse production of ornamentals. The Shields lab at Cornell has been successful utilizing nematodes for control of alfalfa snout beetle (Shields and Testa 2017), and research is continuing in this area. PABIL has continued to rear and release Pediobius foveloatus for Mexican bean beetle to fulfill requests from all Northeastern states. PABIL will pilot augmentative releases of Hadronotus pennsylvanicus for squash bug in collaboration with USDA Beltsville Lab.
3. Introduction of new natural enemies against invasive plants
   Comments: Completion of host range testing of potential biological control agents for common reed was completed and two biocontrol agents were determined to be safe for releases in Canada. No permit has been issued yet for the US. Releases of Hypena opulenta for management of swallow-worts in Canada (Bourchier et al 2019) and the Northeast (Tewksbury at URI, Parry at SUNY ESF and PABIL in NJ, are being monitored and evaluated. In another study, continuing research on the natural decline of garlic mustard populations will determine the cause of this decline and provide important information in the decision of whether releases of exotic agents against garlic mustard are needed. A new strain of the knotweed biological control agent (Aphlara itador) has been approved by USDA/APHIS. PABIL will continue to release A. itador in NJ and supply them to regional collaborators. The Blossey lab at Cornell University is revisiting the initial agent selection for Japanese knotweeds and will attempt to assess safety of additional species using demographic approaches. To control tree of heaven, a widespread invasive tree, development of bioherbicides from naturally occurring fungi shows great promise.
4. Introduction of new natural enemies against invasive insects
   Comments: As the emerald ash borer spreads throughout the northeast, scientists will participate in establishment and evaluation of biological control agents based upon the experience of Midwest States, and better understand the effects of host-shifts by emerald ash borer on biological control. It has been 20 years since Laricobius nigrinus was first released for hemlock woolly adelgid. With it and its congener L. osakensis being released and established throughout the eastern U.S., attention has now turned to the study and release of Leucotaraxis spp., silver flies. These predators are active at times when Laricobius is not. Therefore, there is optimism that population regulation of HWA by natural enemies is within reach. Drosophila suzukii continues to cause significant economic injury to berries, cherries and other soft-skinned fruit. A larval parasitoid originally from Asia, Ganaspis brasiliensis, shows promise for reducing D. suzukii populations. An USDA APHIS permit was granted in 2022 for the release of G. brasiliensis in the USA. Research is being conducted at several locations on establishment and impact of G. brasiliensis on D. suzukii as well as adventive populations of a second larval parasitoid originally from Asia, Leptopolina japonica, that has become established in the Northeast and several other regions of the USA and Canada over the past five years.

Methods

Methods

The procedures for the many aspects of this project are outlined below, under individual objectives. The key activities for the group include an annual meeting where progress of individual research programs is shared with other members of the project and feedback is sought on selection of biological control targets, host range testing, release methodology, and follow-up sampling. Likewise, these meetings feature biological control symposia organized around key topics, where members consider overarching issues and report on research and outreach efforts and identify new collaborations. Discussions of the various projects associated with this multistate project at the annual meeting and at other forums help to coordinate research, implementation, and evaluation programs. Because biological programs are diverse and encompass many different agricultural, forest and urban settings such interaction and integration of efforts is exceptionally valuable for the broad discipline of biological control of weed and arthropod pests.

Objective 1 (To conserve existing natural enemies and enhance ecosystem function)

In managed landscapes, conservation biological control seeks to restore natural predator-prey linkages by conserving natural enemies and their associated food resources.

At Cornell, researchers have looked at the impact of landscape structure on the success of biological control (Grab et al. 2018, Dunn 2020a, and Dunn 2020b). The next steps for this work will be to assess the impact of this habitat on pest populations on adjacent Christmas trees in a research field, and to help establish and monitor the impacts of planting habitat for natural enemies on commercial farms. In addition, we are determining which plant species are most likely to attract and nurture a key group of predators, Coccinellids (ladybugs). In particular, because predators benefit from nectar but lack a "tongue" structure and can only access nectar from plants with very shallow blooms, researchers will evaluate the effect of shallow blooms on predators and biological control for Christmas tree farms. This type of flower is most prevalent in the carrot family which includes several herbs like coriander and dill (Losey et al. 2022).

Leveraging recent funding from the Department of Energy, researchers at Cornell will work as part of a multi-disciplinary team to determine how vegetation around the rapidly increasing number of solar energy arrays on farmland can be optimally managed to produce natural enemies that can then disperse and reduce pest damage in surrounding fields.

In West Virginia, Elizabeth Rowen's group will investigate the effects of fertility manipulations on biological control, specifically comparing different types of cow manure as an organic amendment to increase ground predator abundance, diversity, and ground-dwelling insect and weed control (Halaj and Wise 2002, Purvis and Curry, 1984, Rowen et al. 2019, Rowen and Tooker 2020, 2021). The Rowen lab will also investigate the effects of cover crops in conserving predator populations in vegetables cropping systems (Rowen et al 2022).

Objective 2. (To release and evaluate augmentative biological control agents)

The New Jersey Phillip Alampi Beneficial Insect Rearing Laboratory will continue rearing and releasing the tropical parasitoid *Pediobius foveolatus* against the Mexican bean beetle in a program that has been a major success throughout the northeast region. PABIL will pilot augmentative releases of *Hadronotus pennsylvanicus*for squash bug in collaboration with USDA Beltsville Lab beginning in 2023. Over the past several years augmentative releases of *Trichogramma ostriniae* have been made in MA, VA, PA, ME, and in Quebec against the European corn borer (*Ostrinia nubilalis*). Most efforts are focused on sweet corn, but trials are also conducted in sweet peppers and potatoes.

Augmentative biological control will be attempted and evaluated in a variety of nursery and landscape settings. These studies include releases of lady beetles, lacewings, predatory mites, and entomopathogenic nematodes to control aphids, lace bugs, caterpillars, and phytophagous mites. This research will involve collaborators from University of Maryland, Rutgers University, the Smithsonian Institution, and several commercial and private enterprises.

Root aphids infesting Christmas trees in Vermont will be identified and releases of*Hypoaspis miles* will be made to determine effectiveness. Research is also underway to determine the efficacy of including entomopathogenic fungi in potting soils in a plant-mediated system for management of western flower thrips in greenhouse production of ornamentals. These trials will use marigolds as a trap plant, luring the pest out of the crop, where populations are managed with a combination of a granular formulation of the entomopathogenic fungus *Beauveria bassiana* in the soil and release of the predatory mite,*Neoseiulus cucumeris*, on the foliage. The effectiveness of this plant-mediated system will be tested in several commercial greenhouses in Vermont and New Hampshire. Evaluating the release methods of commercially produced predatory mites for thrips, whiteflies, and spider mites on greenhouse crops will be evaluated at Cornell.

The entomopathogenic fungus *Metarhizium brunneum*, strain F52 has been investigated for development and use as a biopesticide to help in eradication of Asian longhorned beetles. At Cornell, researchers will work with colleagues at the USDA ARS in the Midwest and Xavier University in Cincinnati to optimize formulations, especially toward improved moisture retention that would prolong and enhance activity of the formulated fungus.

Other augmentative release studies on greenhouse crops with predatory mites, predatory bugs, pathogens, and hymenopterous parasitoids will occur at Cornell and the University of Vermont. The use of entomopathogenic nematodes for use against a variety of soil-dwelling pests in crop systems as diverse as alfalfa, field corn, apples, turf, grapes, and greenhouses will be spearheaded by the Shields lab at Cornell with numerous collaborators. In some of these crops, the nematodes have persisted for years after an initial release.

For both conservation and augmentation, John Losey has established the first Ladybug Farm at a research facility just off the Cornell campus. Utilizing the insights gained from their citizen science program they will maintain their laboratory populations of the nine-spotted ladybug, *Coccinella novemnotata,* while also rearing much larger populations in the field.

Objective 3. (Classical Biological Control of Weeds)

Phragmites australis. The biological control program directed at introduced *Phragmites australis* provides a good example of regional cooperation spearheaded by scientists at Cornell and URI. In this project Cornell has taken the lead in regional surveys for native and exotic *Phragmites australis* populations and their herbivores while URI has measured impact of native and exotic herbivores on these plants. Both groups have funded and directed the efforts of CABI in Switzerland to identify and evaluate potential biological control agents. This program has completed host range testing at URI and CABI. A petition to release was submitted and approved by TAG in 2019, but USDA/APHIS is requesting additional host-specificity tests focusing on safety of native Phragmites and an evaluation of the potential utility of introduced Phragmites by wetland managers. Cornell will address these issues over the next several years (Casagrande et al. 2018, Blossey et al. 2018).

Swallow-worts. A program directed against swallow-worts (*Vincetoxicum nigrum* and *V. rossicum*) had URI and USDA/ARS (New York) scientists surveying Europe for potential natural enemies. CABI assisted in conducting surveys and field tests that can only be done in Europe. Host range testing was completed at URI for two agents (Hazlehurst et al. 2012), and pre and post release studies of a third agent are being conducted by ARS scientists at Cornell and Montpellier, France and pre-and (potential) post-release sites are under study. Scientists at Agriculture and AgriFood Canada-Lethbridge Research Centre are working closely with URI, CABI, and Carleton University in Ontario on this project. First releases of one agent, *Hypena opulenta* were made in Canada in 2014 and the U.S. in 2017. PABIL will continue to rear and release *H. opulenta* in NJ and supply them to regional collaborators such as SUNY and Cornell. URI released this agent in multiple locations in CT, RI and MA and is continuing to evaluate these releases for establishment. Dylan Parry at SUNY-ESF will commence host range trials for European genotypes of the beetle *Chrysochus asclepiadeus*, pending forthcoming certification of the SUNY-ESF containment facility,

Because deer can alter effectiveness of plant and invertebrate invasion in Northeastern forests, natural ecosystems are under evaluation at Cornell where the inter-relationships among introduced plants, deer, earthworms, salamanders, and slugs are studied in long-term plots with various manipulations, including excluding deer to monitor effect of deer browsing on weed and earthworm invasion (Gorchov et al. 2021). Work will continue at Cornell on a project evaluating potential facilitation between pale swallow-wort, deer, and European and Asian (jumping) earthworms in forest ecosystems.

Mile-a-minute weed (*Persicaria perfoliata*). Another cooperative venture is directed against mile-a-minute weed, an aggressive annual vine native to Asia that was accidentally introduced into PA in the 1930s and has so far spread into at least 11 states and DC. A joint research program initiated in 1996 has resulted in the establishment of a stem-feeding weevil, *Rhinoncomimus latipes* in all these states, though not in all areas invaded by the vine. The University of Delaware, US Forest Service, and PABIL are cooperating on this project, along with many state agencies, universities, and natural area land managers throughout the region (Hough-Goldstein et al. 2022). Present efforts focus on continued release of the weevil in mile-a-minute populations that have not yet been colonized, evaluation of impact on the target weed and associated plant community under different environmental conditions, and development of integrated weed management strategies incorporating the weevil.

Garlic mustard (*Alliaria petiolata*).

This cooperative effort involving scientists at Cornell, University of Minnesota and CABI Switzerland, has completed host range testing of potential biological control agents, but monitoring of long-term plots in many states has shown garlic mustard populations to decline dramatically in less than a decade after spread into an area and establishment (Blossey et al 2021). Research at Cornell will continue on the nature of this decline, which appears to be the result of negative soil feedback. It may be that biological control of garlic mustard is not needed.

Knotweeds. Japanese knotweed (*Reynoutria japonica*), Giant knotweed (*F. sachalinensis*), and their interspecific hybrid (*R. x bohemica*) have become serious widespread weeds throughout the Northeast and are the focus of a cooperative biological control project presently involving scientists at Cornell and U. Mass. working with colleagues in Oregon, Lethbridge Canada, and CABI in Great Britain. Releases of a biological control agent were approved and have been made across the country. Participants will continue to monitor these populations. In addition, a new population of *A. itadori*, collected from Murakami in Japan, has also been approved for release. This population has a greater impact on the knotweed hybrid, Bohemian knotweed (*Reynoutria* x *bohemica*), and a few states in the Northeast are planning releases of this population on hybrid knotweed. PABIL will continue to release *Aphlara itadori* in NJ and supply them to regional collaborators

Tree of heaven (*Alianthus altissima*). Virginia scientists are working on biological control of tree of heaven (*Alianthus altissima*) in collaboration with scientists at Penn State and in China. Strains of *Verticillium* fungus will be developed into a bioherbicide to control tree of heaven. After demonstrating efficacy at the experimental level (Brooks et al. 2020), a commercial bioherbicide formulation will need to progress through the regulatory process.

At VT, the Salom Lab will use *Verticillium nonalfalfae,* a naturally occurring fungus specific to Ailanthus, is a biological herbicide that rapidly (within months) causes wilt and kills the tree, spreading clonally and affecting most of the trees in a stand. Sites where Ailanthus is removed are at risk of being recolonized by different non-native plants. We will remove Ailanthus using this environmentally safe treatment and apply science-based restoration approaches to these sites. The goal of this project is to demonstrate an operational approach to removing SLF habitat (*Ailanthus* stands) using a treatment that is environmentally sustainable, followed by restoration of the treated sites with desired native plant species. For assessing plant re-colonization of sites where Ailanthus is removed, it is expected that re-colonization by plants will be influenced by forest types and land use following the removal of ailanthus. It is unknown how prevalent non-native invasive plants will be part of the plant composition that re-colonizes these sites. Six sites in VA dominated by Ailanthus and treated with the Verticillium bioherbicide in 2017 will be sampled in detail for plant species. All plants in each of the 4 quadrats for each of the 6 sites will be tallied and analyzed using ecological indices that measure abundance, richness, and diversity 6-8 years post-treatment. To actively restore native vegetation where Ailanthus has been treated with the Verticillium bioherbicide, the present understory vegetation will be sampled at the time of the treatment. Restoration species may include blight-resistant American chestnut tree, chestnut oak, white oak, black locust, common persimmon, sassafras, black cherry, Virginia pine, and loblolly pine. Sites will be monitored for up to 5 years following the planting of these trees to assess their establishment and ability to prevent incursion from non-native plants.

Additional Weed Problems. In addition to the above-mentioned projects that are well underway, scientists across the region are collaborating on other projects with application for the northeast. Water chestnut (*Trapa natans*) is the target of research involving collaborative efforts with Chinese scientists in cooperation with Cornell (Simmons and Blossey 2023). CABI scientists are involved in studies to assess the potential for biological control of glossy buckthorn (*Frangula alnus*). St. John's wort (*Hypericum perforatum*) is a significant weed pest in the Northeast. It is a recent invader in Maine where it has become established in glacial outwash areas that encompass the present blueberry production region of Downeast, Maine. Observations have shown the two *H. perforatum* biological control agents (Chrysolina beetles and the fungal pathogen, *Colletotrichum gloeosporioides*) also occur in Maine. Future studies will focus on the extent, abundance, and role that these biological control agents are currently having on this invasive plant species.

Objective 4. (Classical Biological Control of Insects)

Emerald ash borer (EAB), *Agrilus planipennis*, native to China and Russia, was found in Michigan in 2002. It currently is found in about 15 states and one Canadian province and is continuing to spread. It is the subject of intensive research by USDA-ARS, APHIS, and FS scientists, as well as university entomologists in DE, MA, MI, CT and abroad. Three parasitoids were approved by the USDA for environmental release and were released in 2007. Since then, at least two of these species have become established in one or more locations and releases continue, supported by an APHIS mass rearing laboratory in Brighton, MI. This pest is now found in NY, MD, MA, CT, NJ, NH, WV, and VT. Because complete larval development of EAB has been recorded on white fringe tree (*Chionanthus virginicus*), in DE, the Tallamy lab will assess the efficacy of biocontrol agents in the face of EAB host-range expansion. They will evaluate whether white fringe tree serves as enemy-free space for EAB. As EAB spreads throughout the northeast, scientists will participate in establishment and evaluation of biological controls (Bauer et al. 2015, Duan et al. 2017).

Hemlock woolly adelgid (HWA), *Adelges tsugae*, has been the subject of extensive cooperative biological control efforts over the past two decades. While several groups of predators have been studied and several species introduced, most current efforts are focused on release and evaluation of the western US species, *Laricobius nigrinus* (Story et al. 2012), *Leucotaraxis argenticollis*, and *Leucotaraxis piniperda* (Dietschler et al. 2021). *Laricobius osakensis* from Japan has been released since 2013. Releases of *L. nigrinus* have been made in most eastern states where HWA populations have been identified. Establishment and spread have been found in most release locations, especially in southern states. Impacts on the sistens generation of HWA have been described (Jubb et al. 2021), but these impacts were found to be largely mitigated by a density dependent response in the progrediens generation (Crandall et al. 2021). This provides short-term health benefits to hemlock trees (Preston et al. 2023). However, Crandall et al. (2020) demonstrated that the next generation of HWA is able to rebound with out the presence of *Laricobiu*s. Research will now focus on *Leucotaraxis argenticollis* and *Leucotaraxis piniperda*, two specialists (silver flies) of the progrediens generation from the Pacific Northwest. Research on *Leucotaraxis* spp. currently involves a coordinated effort among cooperators in several states to evaluate establishment. In addition, research on the biology and impacts of Leucotaraxis spp. is being carried out at Cornell and Virginia Tech. This research, funded and coordinated by US Forest Service and some state agencies, involves many state agencies and universities throughout the region, especially in GA, MA, NY, PA, TN, and VA.

The Entomology Insectary at Virginia Tech proposes to transition from *Laricobius*-only production to a combination of *Laricobius* production at a reduced rate and increased processing and release of *Leucotaraxis* flies, from regular shipments of flies from the western U.S. They will continue to monitor and help assess *Laricobius* beetle recoveries.

At this time, it is unknown if *Leucotaraxis* flies imported from western North America can be established in eastern hemlock stands. Releases since 2015 have not resulted in any confirmed recoveries past the F1 generation. So systematic studies have yet to be carried out on how many flies to release, when to release or attempt short-term closed cage or larger open releases. Since we know very little about adult fly behavior, it may help us to study it in the lab experimentally. Lastly, assessing the predator potential in terms of amt of prey eaten and reproduction capacity at different prey levels will help us better understand the impacts this predator could have on HWA populations.

The Salon Lab at VT will 1) rear beetles for release to land managers throughout the eastern U.S. andprovide some founding beetles to other rearing labs, 2) rear out flies from western HWA-infested hemlock branch collections and distribute throughout the eastern US, 3) assess open and closed releases, timing of releases, and species (*Leucotaraxis argenticollis* and *Le. piniperda*) released followed by annual monitoring of fly presence at the release sites, 4) use digital recording to document searching activity and strategy used by flies to find prey and lay eggs, at low and high densities, and analyze the behavior, using specialized tracking software, 5) measure functional (feeding) and numerical (reproductive) responses of each fly species to prey density, as a way to quantify what their predation capacity is.

Winter moth (*Operophtera brumata*) is another new pest in the northeastern USA. Based upon past biological control successes in Nova Scotia and the Pacific Northwest, scientists at U. Mass. have worked with USDA Forest Service and APHIS researchers in MA to rear, release, and evaluate the tachinid parasitoid *Cyzenis albicans* against this pest. Entomologists in RI and CT are assisting in locating suitable release sites in their states. Joe Elkinton's lab at UMASS has introduced many thousands of *C. albicans* distributed across 43 sites in eastern MA, RI, CT, and ME, and so far, have established the fly at 33 of those sites. As was seen in Nova Scotia, it typically takes 3 to 5 years before *C. albicans* are recovered at release sites. Since there is only one generation per year of both the fly and the winter moth, it takes several years for the 1500-2000 flies that are released at a site to catch up with the millions of winter moths that exist at that site. The fly has been recovered at all 17 of the sites where it was released prior to 2012 and at 21 of 22 release sites in MA (Elkinton and Boettner 2017, Elkinton et al. 2014).

Brown marmorated stink bug (BMSB), *Haylomorpha halys*, is an invasive pest of fruits and vegetables in North America. Foreign exploration, combined with host range testing and continuing monitoring of existing natural enemies is underway to determine the need and potential for biological control of the BMSB (Jones et al. 2017). PABIL is continuing to rear BMSB for use in regional research as well as the locally recovered strain of *Trissolcus japonicus*.

Spotted-wing drosophila (*Drosophilia suzukii*) is a pest of unripe berries and stone fruit that causes significant losses across the US. *Ganaspis brasiliensis*was approved for release against spotted-wing drosophila in 2022. Multiple laboratories have started mass-rearing for releases of the Gb1 strain material provided by the USDA research lab in Newark, DE. PABIL released 1,000 wasps each at 5 sites in 2022 in collaboration with Rutgers' Rodriguez-Saona Lab. It will expand releases each season. The Loeb lab at Cornell AgriTech released over 600 Gb1 strain parasitoids at four sites in NY in 2022 and are following up with additional releases in subsequent seasons. The Loeb lab is conducting experiments in the lab investigating interactions between Gb1 and a second larval parasitoid of *D. suzukii*, *Leptopolina japnonica,* that has established adventive populations in the Northeast and elsewhere in the US (e.g. how host fruit influences interspecific competition and parasitism rates). The Loeb lab will also initiate studies on how candidate repellents for managing *D. suzukii* influence behavior of exotic parasitoids. The Loeb lab, in collaboration with Dr. Philip Fanning's lab at the University of Maine, are investigating overwintering success of Gb1 in laboratory and field experiments.

Spongy moth (*Lymantria dispar dispar*) is a devastating introduced lepidopteran pest that was first brought to the US in the 1860s and has caused deforestation across the Northeast. Biological control with a variety of fungi, viruses, parasitoids, and predators has helped slow the spread. Dylan Parry at SUNY-ESF will continue evaluating wholesale changes in the parasitoid community of spongy moth, which is fundamentally different in the Northeast from that recorded in the 1970's. He is also evaluating an apparent failure of biological control in browntail moth (*Euproctis chrysorrhoea*) after a century of stability.

Additional Insect Pests.

Ann Hajek at Cornell is researching the use of nematodes as biological control agents for*Sirex noctilio* (Williams and Hajek 2017, Morris and Hajek 2014). As the invasive pine-killing woodwasp *Sirex noctilio* spreads from the northeast to the south, where pine forests are more extensive, the Hajek lab has been tasked with investigating whether the parasitic nematode, *Deladenus siricidicola*, used for control in Australia would be appropriate for use in North America. The Hajek lab at Cornell has found that a predominantly avirulent strain of the same nematode already occurs in *S. noctilio* in northeastern forests. The Hajek lab has also documented some horizontal transmission of this nematode to the native non-pest *Sirex nigricornis* that also develops in pines and an associated wood-boring beetle. Studies suggest that the strain of*D. siricidicola* commercialized in Australia might also hybridize with the already-present strain.

Scientists at Cornell are also testing entomopathogenic nematodes against the alfalfa snout weevil (*Otiorhynchus porcatus*) and evaluating the persistence and effectiveness of NY strains against endemic populations of plum curculio in both organic and conventionally grown apple orchards.

Measurement of Progress and Results

Outputs

- Output Comments: Ouputs include documentation of natural enemy host range, establishment of biological control agents, natural enemy spread, reduced pest problems and associated effects on other components of the ecosystem because of natural enemy releases. Another common output is increased knowledge about the science of biological control through publication and presentations in the region. • The specific biological control programs that comprise this regional project are at different steps in the sequences of programs and their progress will be reported annually, both individually to their parent organizations and collectively in the annual report of the regional project. • In addition to publishing journal articles (see Appendix B), biological control practitioners in the northeast regularly participate in regional publications and symposia proceedings. Through this regional project we will annually compile a list of publications by project participants to enhance communication within the project and with the general public. • Northeastern biological control specialists regularly make presentations at local, statewide, and regional meetings of scientific societies, conservation organizations, land managers and grower groups. • In the NY greenhouse industry, in 2017, more than 60% of growers indicated that they are now using some form of biological control.

Outcomes or Projected Impacts

- Overall impact The many research and outreach components of this regional project share common outcomes which can be documented. Impacts of this work include improved future programs based upon new knowledge and reduced need for pest control activities and attendant environmental and economic consequences because of successful biological control programs. In most cases, these results are not yet achieved and that is why we continue working on them. This section includes examples of potential benefits of ongoing work as well as documented impacts of some ongoing projects and others just completed through this regional project. Tangible outputs of the work of this regional project are the increased populations of natural enemies throughout the region. This is reflected in parasitism rates such as the 30% parasitism of winter moth in MA by a tachinid parasitoid and the recovery of the hemlock woolly adelgid predator (Laricobius nigrinis) 17 miles from release sites where a NJ population of this predator is rapidly increasing in density and distribution. Another example of a project output is provided by a collaborative regional effort against mile-a-minute weed where over 160,000 Rhinoncomimus latipes weevils have been reared by the Phillip Alampi Beneficial Insect Laboratory in NJ and released in CT, DE, MA, MD, NJ, NY, PA, RI, VA, and WV. Spread is over 4 km/yr from release sites. In another example from NJ, 376,000 adult Pediobius foveolatus were released against the Mexican bean beetle during the 2022 soybean growing season. • For Objective 1: Understanding what conservation practices, including flowering species for insectary strips, locations for habitat manipulations, or fertilizer types that promote biological control will lead to enhanced biological control in agricultural systems, and lower the need for pesticides. This will reduce impacts on the environment and costs to producers. In organic systems, increased biological control using fertility amendments can increase yield and economic returns for producers. • For Objective 2: The effectiveness of the ongoing NJ Mexican bean beetle program is demonstrated by New Jersey soybean growers have not used insecticides against the Mexican bean beetle (Epilachna varivestis) in over 25 years. We will continue this work to avoid outbreaks of Mexican bean beetle. Our goal is to achieve similar outcomes for European corn borer, western flower thrips, root aphids, and using generalist natural enemies in greenhouse, nursery, and landscape production • For Objective 3: For each invasive weed listed, our ultimate goal is to have natural enemies that are able to reduce the spread and help decrease the extent of invasion. For example, to date, it appears that Rhinoncomimus latipes will be extremely successful in controlling mile-a-minute weed (P. perfoliata) on its own in certain circumstances and will contribute to an integrated management program under other conditions. • For Objective 4: Like for objective 3, our goal is to release and establish populations of natural enemies that reduce invasive insect populations and or/slow the spread of those insects. For example, as a result of parasitoid releases and surveys conducted by regional project members, the birch leafminer is now known to be successfully controlled by Lathrolestes nigricollis throughout the Northeast and well into Canada and the mid-western states and there is no need for additional control efforts against this pest. For insects where release has been widespread (Emerald ashborer), we will document the effect of ecological changes on natural enemies (ie effects of host shifts by the pest on natural enemy ecology). For other species (e.g. winter moth, Brown marmorated stink bug), researchers are rearing and releasing biological control agents and our goal is to establish populations that can reduce pest densities.

Milestones

(**2023**):• Implement habitat modifications, horticultural practices, and pest suppression tactics to conserve natural enemy activity. • Characterize and identify pest and natural enemy communities and their interactions. • Assess ecological characteristics of natural enemies. • Survey indigenous natural enemies attacking pests

(**2024**):• Conduct foreign exploration and ecological studies in the native range of the pest. • Determine systematics and biogeography of the pest and natural enemies. • Develop procedures for rearing, storing, quality control and release of natural enemies, and conduct experimental releases to assess feasibility. • Determine environmental safety and potential efficacy of exotic candidates prior to release • Evaluate effect of previously established habitat modifications on natural enemies and biological control • Implement augmentation programs • Evaluate efficacy of conservation and augmentation programs on natural enemies.

(**2026**):• Evaluate efficacy of conservation and augmentation programs on natural enemies. • Release, establish and redistribute natural enemies. • Evaluate natural enemy efficacy and study ecological/physiological basis for interactions.

Outreach Plan

Organization/Governance

The regional project officers will consist of a Chair, Secretary, and Representative at Large elected from the regional project membership. These elected officials, plus the administrative advisor, comprise the Executive Committee. The Chair will prepare technical and executive meeting agendas, preside at meetings, and prepare an annual progress report on the research activities of the regional project. The Secretary will record the minutes of technical and executive committee meetings and perform other duties as necessary. The Representative at Large, who will be elected annually, will succeed the Secretary who will in turn succeed the Chair. Subcommittees may be appointed by the Chair to assist with project needs. The regional project will meet annually, unless otherwise planned, at a place and on dates designated by majority vote of the project membership.

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Land Grant Participating States/Institutions

WV,NJ,NY,VA

Non Land Grant Participating States/Institutions

Participation

Participant	Is Head	Station	Objective	Research						Extension	
				KA	SOI	FOS	SY	PY	TY	FTE	KA
Dunn, Amara		New York -Geneva : Cornell University	1	136	2410	1130	0.10	0.00	0.00	0.5	0
Hamilton, George		New Jersey - Rutgers University	4	215	620	1130	0.10	0.00	0.00	0	0
Loeb, Gregory M.		New York -Geneva : Cornell University	4	215	3110	1130	0.20	0.00	0.00	0	0
Rowen, Elizabeth	Yes	West Virginia - West Virginia University	1	215	2410	1070	0.10	0.00	0.00	0	0
Salom, Scott M.	Yes	Virginia - Virginia Polytechnic Institute and State University (VA Tech)	2,3,4	211 215 216	610 611 613	1130 1140 1160	0.01	0.00	0.00	0	0
Whitmore, Mark		New York -Ithaca : Cornell University	4	123 215 216	610 3110 3110	1130 1070 1130	0.10	0.00	0.00	0	0

Combined Participation

Combination of KA, SOI and FOS	Total SY	Total PY	Total TY
215-2410-1070	0.1	0	0
215-620-1130	0.1	0	0
215-3110-1130	0.2	0	0
136-2410-1130	0.1	0	0
211-610-1130	0	0	0
215-611-1140	0	0	0
216-613-1160	0	0	0
123-610-1130	0.03	0	0
215-3110-1070	0.03	0	0
216-3110-1130	0.03	0	0
Grand Total:	**0.61**	**0.00**	**0.00**

Program/KA	Total FTE
0	0
0	0
0	0
0	0.17
0	0
0	0
Grand FTE Total:	**0.5**

Projected participants

Elizabeth Rowen – West Virginia University – Elizabeth.rowen@mail.wvu.edu
Lisa Tewksbury – U Rhode Island – lisat@uri.edu
Scott Salom – Virginia Tech – salom@vt.edu
Amara Dunn – Cornell (NY IPM) - arc55@cornell.edu
Betsy Lamb – Cornell - eml38@cornell.edu
Alexandra Gillette – NJ Department of Agriculture - Alexandra.Villiard@ag.nj.gov
Mark Whitmore – Cornell – mcw42@cornell.edu
Dylan Parry – SUNY ESF – dparry@esf.edu
John Losey – Cornell – jel27@cornell.edu
Bernd Blossey – Cornell – bb22@cornell.edu
Greg Loeb – Cornell – gme1@cornell.edu
Doug Tallamy – U Delaware – dtallamy@udel.edu
Paula Shrewsbury – U Maryland – pshrewsb@umd.edu
Joe Elkinton – U Mass - elkinton@umass.edu
Ann Hajek – Cornell – aeh4@cornell.edu
George Hamilton – Rutgers – hamilton@njaes.rutgers.edu

Field Code Changed

2018

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REVIEW 1

Rate the technical merit of the project:

1. Sound Scientific approach: Approve/continue project
2. Achievable goals/objectives: Good

3. Appropriate scope of activity to accomplish objectives:
Excellent
4. Potential for significant outputs(products) and outcomes and/or impacts:
Excellent
5. Overall technical merit:
Excellent
Comments
Overall, this is a good but ambitious project. The project included major invasive insect pests and weeds in the mid-Atlantic States, which has the potential of high impact on agriculture and forestry in general.

However, the milestones may need to be revisited and thought out further. Here are a few comments.
1. (2023) "Assess biological characteristics of natural enemies". I am not sure about this because, if we have imported natural enemies, the biological characteristics of the imported natural enemies should have been well studied before the release in the landscape.

Despite the host range, temperature range etc, of imported natural enemies having been characterized when those species were imported, understanding how they adapt to new environments can fall within the scope of biological characteristics. For example, we are examining the efficacy of biocontrol agents of emerald ash-borer on fringe tree.

We are rewording to “Assess the ecological characteristics of natural enemies”

2. (2024) "Conduct foreign exploration and ecological studies in the native range of the pest". These efforts have been made by the USDA APHIS for all the invasive insect pests and weeds. So, I am not sure what this foreign exploration is for.

This refers to the work on swallow-worts being conducted in collaboration with USDA-ARS and Cornell scientists

3. (2026) "Evaluate efficacy of conservation and augmentation programs on natural enemies". Such a study needs multiple years to confirm the efficacy or effectiveness. I think this is over- optimistic.

We have included this milestone in multiple years to emphasize that this is ongoing work for these projects.

Your Recommendation:
Approve/continue project

REVIEW 2

Rate the technical merit of the project:

1. Sound Scientific approach:
Approve/continue project with revision
2. Achievable goals/objectives:
Fair
3. Appropriate scope of activity to accomplish objectives:
Good
4. Potential for significant outputs(products) and outcomes and/or impacts:
Good
5. Overall technical merit:
Fair
Comments
The proposal touches on many key pests of the region, encompasses a broad range of biological control projects, and is multi-disciplinary. There is substantial evidence of previous success of this group. It is understood that this is ongoing work, but this reads more as a “report” than a “proposal”. While it is useful to briefly summarize what work has been done to provide the reasoning for future directions, most of the “word space” should be devoted to explaining what the researchers intend to do for this project period. The goals and planned work are quite vague. In assessing the four areas requested in the peer review form, I find myself “filling in the blanks” for the researchers – based on their previous work, it is likely that they have a sound scientific approach, achievable goals, an appropriate scope of activity to accomplish the objectives, and a potential for significant outputs and outcomes. However, they are not providing me with much of that information.

Specific comments:

Statement of Issues and Justification - This section would benefit from an explicit statement of why the multi-state project in particular is needed (as opposed to biological control in general).

To address this comment, we have added the following language to the opening paragraph: “This multi-state Hatch project fosters collaboration across a range pests to support efforts in releasing and monitoring biological control agents and to understand how abiotic and biotic environments influences population dynamics and efficacy of biocontrol agents, and provides opportunities for participants to meet and discuss emerging issues to foster further collaborations"

Objectives
Because the four objectives are VERY broad, it would be helpful for the main goals of each project to be stated either here in the comments or in the methods.
Compared to the other three objectives, Objective 1's "comments" section is very vague and does not quite match the description later in the methods, where effects of exotic species are also mentioned.

We have revised the Objective title to remove the exotic species because this is not the focus of Objective 1

Methods – General
Very little detail provided throughout, making it challenging to assess the technical merit of the project. In many cases, it appears to just be a description of past work instead of proposed work and makes it difficult to assess feasibility or determine what is planned for this five-year period. Obj. 1 is particularly lacking in detail (with the exception of the Paragraph 2 project), so I have provided additional feedback on that section.

Methods - Objective 1
The methods of Obj. 1 would benefit from more detail about ongoing work so that the "next steps" outlined make more sense to the reader. Much of the methods for this section (Paragraphs 3-5) reads as a list of ongoing work without articulating what will be done for this project – more of the same (if so briefly describe) or what specifically in the ongoing work needs further investigation/what's the new direction? (The other paragraphs need to be more like Paragraph 2)

The tenses of these paragraphs are now in the future to reflect that this is new and future work.

"Natural ecosystems are under evaluation at Cornell where the inter-relationships among introduced plants, deer, earthworms, salamanders, and slugs are studied in long-term plots with various manipulations (Gorchov et al. 2021)." - It is particularly unclear how this fits in with the rest of the project/biocontrol and what the manipulations are (even a brief summary, or a "highlights" list) would be useful here.

This section has been expanded to increase clarity in the experimental treatments and moved to Objective 3 where it is a better fit.

I realize that space is limited in this proposal, but I have a better sense of the planned work for the other objectives compared to this one. Removing the first paragraph and focusing on briefly describing each planned project would be more helpful. Some minimal detail on target crops and main pests for each project would provide better context for the work. The paragraph regarding the Christmas tree farm/perennial habitat manipulations does the best job in this section of explaining the proposed research. However, the last sentence in this paragraph appears to have been truncated (ends with “and some”).

We have reduced the opening paragraph to an introductory sentence. The Christmas tree paragraph has been edited to remove truncation.

Outputs
Much of what is listed in the outputs section is previous outputs. While this does provide evidence that this group has been highly successful, this section should include more detail about anticipated outputs. Most of the previous outputs in roughly the first half of this section are >10 years old. There is also mention of a new book “to be printed in 2013” – is this a typo for 2023? While the numbers of biocontrol agents released (and where) is a useful output list (but again – what are the output goals for this proposal?), many of the items listed at the end of this section are outcomes (grower adoption, BCA spread), not outputs.

We’ve removed the list of previous outputs of this multi-state working group from the proposal.

Outcomes or Projected Impacts
In this section, it would be useful to have more specific projected impacts for some of the objectives. While it is helpful to see past outcomes, I would rather these be used to as evidence of likely projected impacts. For example, briefly state the previous success for each objective and then the likely future outcomes for this five-year renewal.

We have clarified the expected impacts for each objective in separate sections, and have expanded the outputs.

Outreach plan – it is unclear if an outreach plan is a required part of this proposal, but it is missing.

We do not have an outreach plan as part of this proposal because it is not required.

Your Recommendation:
Approve/continue project with revision

REVIEW 3

Rate the technical merit of the project:

1. Sound Scientific approach:
   Approve/continue project with revision
   2. Achievable goals/objectives:
   Excellent
   3. Appropriate scope of activity to accomplish objectives:
   Fair
   4. Potential for significant outputs(products) and outcomes and/or impacts:
   Excellent
   5. Overall technical merit:
   Good
   Comments
   The method part, especially on biological control of weeds, needs detailed information on how these experiments will be conducted (Researchers, locations, experiment design, and measurements etc.).

   We have added institutions that are conducting work and included more information about experiment design where it was missing in the methods.

   Your Recommendation:
   Approve/continue project with revision

Appendix G: Peer Review (Submitted) Status: Complete

REVIEW 4

Rate the technical merit of the project:

1. Sound Scientific approach: Approve/continue project
2. Achievable goals/objectives: Good

3. Appropriate scope of activity to accomplish objectives:
Good
4. Potential for significant outputs(products) and outcomes and/or impacts:
Good
5. Overall technical merit:
Excellent
Comments
This multi-state project aims to enhance biological control in agriculture through a comprehensive approach. It prioritizes the conservation of existing natural enemies by rigorously assessing their populations and understanding the impact of insecticides. Deliberate habitat manipulation, including native perennial planting, safeguards these beneficial organisms across various agricultural sectors like blueberries, field crops, and Christmas tree production. This holistic strategy minimizes risks to natural enemies,

establishing the groundwork for future biological control efforts, including augmentation and classical biological control. Augmentation programs involve repeated rearing and release of natural enemies to manage pests such as the European corn borer, root aphids in Christmas trees, and western flower thrips in ornamental greenhouse production. Additionally, the project explores introducing new natural enemies to combat invasive plants and insects, offering effective control measures for agriculture and ecosystems. This project, performed by entomologists in the land-grant system, promises to bolster U.S. agriculture with rigorous scientific foundations, potentially leading to valuable publications.
Limitations:
--- Conducting research, rearing natural enemies, and monitoring their impact may not be feasible in all agricultural or ecological contexts.
--- Thorough evaluation of unintended consequences when introducing new natural enemies is crucial. These introduced species may harm non-target species or disrupt existing ecological relationships, potentially causing ecological imbalances.

We are evaluating these through multiple programs in collaboration with the USDA etc. For example, for Phragmites australis, the team at Cornell will address USA/APHIDS concerns over host-specificity in the proposed biological control agents.

--- Climate change can disrupt the distribution and behavior of pests and natural enemies, posing challenges in predicting and effectively managing pest outbreaks.

This is a concern, but currently outside the scope of our proposal. However, by assessing the ecology of natural enemies, we may be able to provide future insight on the intersection of climate change and biological control.

Your Recommendation: Approve/continue project

REVIEW 5

Rate the technical merit of the project:

1. Sound Scientific approach: Approve/continue project
2. Achievable goals/objectives: Good

3. Appropriate scope of activity to accomplish objectives:
Excellent
4. Potential for significant outputs(products) and outcomes and/or impacts:
Excellent
5. Overall technical merit:
Excellent
Comments

This biological control working group/collaboration is of critical importance for addressing the impacts of invasive plant and animal species in the Northeast. This summary describes a range of ongoing cooperative efforts to identify, develop biologically based methods for control, and assess outcomes. While I understand that the 'pieces' of this summary were contributed by many authors, a better editorial effort was needed to provide more coherency between objectives and methods, as well as correct grammatical mistakes and typological errors. This will be especially important before being reviewed by political or funding entities.

We have revised the proposal and have addressed typos and coherence between sections.
Your Recommendation:
Approve/continue project

Appendix G: Peer Review (Submitted)

Status: Complete
Project ID/Title: NE_TEMP2332: Biological control of Arthropod Pests and Weeds

Rate the technical merit of the project:

1. Sound Scientific approach:
Approve/continue project
2. Achievable goals/objectives:
Good
3. Appropriate scope of activity to accomplish objectives:
Excellent
4. Potential for significant outputs(products) and outcomes and/or impacts:
Excellent
5. Overall technical merit:
Excellent
Comments
Overall, this is a good but ambitious project. The project included major invasive insect pests and weeds in the mid-Atlantic States, which has the potential of high impact on agriculture and forestry in general.

However, the milestones may need to be revisited and thought out further. Here are a few comments.
1. (2023) "Assess biological characteristics of natural enemies". I am not sure about this because, if we have imported natural enemies, the biological characteristics of the imported natural enemies should have been well studied before the release in the landscape.
2. (2024) "Conduct foreign exploration and ecological studies in the native range of the pest". These efforts have been made by the USDA APHIS for all the invasive insect pests and weeds. So, I am not sure what this foreign exploration is for.
3. (2026) "Evaluate efficacy of conservation and augmentation programs on natural enemies". Such a study needs multiple years to confirm the efficacy or effectiveness. I think this is over-optimistic.
Your Recommendation:
Approve/continue project

Appendix G: Peer Review (Submitted)

Status: Complete
Project ID/Title: NE_TEMP2332: Biological control of Arthropod Pests and Weeds

Rate the technical merit of the project:

1. Sound Scientific approach:
Approve/continue project with revision
2. Achievable goals/objectives:
Fair
3. Appropriate scope of activity to accomplish objectives:
Good
4. Potential for significant outputs(products) and outcomes and/or impacts:
Good
5. Overall technical merit:
Fair
Comments
The proposal touches on many key pests of the region, encompasses a broad range of biological control projects, and is multi-disciplinary. There is substantial evidence of previous success of this group. It is understood that this is ongoing work, but this reads more as a “report” than a “proposal”. While it is useful to briefly summarize what work has been done to provide the reasoning for future directions, most of the “word space” should be devoted to explaining what the researchers intend to do for this project period. The goals and planned work are quite vague. In assessing the four areas requested in the peer review form, I find myself “filling in the blanks” for the researchers – based on their previous work, it is likely that they have a sound scientific approach, achievable goals, an appropriate scope of activity to accomplish the objectives, and a potential for significant outputs and outcomes. However, they are not providing me with much of that information.

Specific comments:

Statement of Issues and Justification - This section would benefit from an explicit statement of why the multi-state project in particular is needed (as opposed to biological control in general).

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Because the four objectives are VERY broad, it would be helpful for the main goals of each project to be stated either here in the comments or in the methods.
Compared to the other three objectives, Objective 1's "comments" section is very vague and does not quite match the description later in the methods, where effects of exotic species are also mentioned.

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Very little detail provided throughout, making it challenging to assess the technical merit of the project. In many cases, it appears to just be a description of past work instead of proposed work and makes it difficult to assess feasibility or determine what is planned for this five-year period. Obj. 1 is particularly lacking in detail (with the exception of the Paragraph 2 project), so I have provided additional feedback on that section.

Methods - Objective 1
The methods of Obj. 1 would benefit from more detail about ongoing work so that the “next steps” outlined make more sense to the reader. Much of the methods for this section (Paragraphs 3-5) reads as a list of ongoing work without articulating what will be done for this project – continuing

more of the same (if so briefly describe) or what specifically in the ongoing work needs further investigation/what's the new direction? (The other paragraphs need to be more like Paragraph 2)

"Natural ecosystems are under evaluation at Cornell where the inter-relationships among introduced plants, deer, earthworms, salamanders, and slugs are studied in long-term plots with various manipulations (Gorchov et al. 2021)." - It is particularly unclear how this fits in with the rest of the project/biocontrol and what the manipulations are (even a brief summary, or a "highlights" list) would be useful here.

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Much of what is listed in the outputs section is previous outputs. While this does provide evidence that this group has been highly successful, this section should include more detail about anticipated outputs. Most of the previous outputs in roughly the first half of this section are >10 years old. There is also mention of a new book "to be printed in 2013" – is this a typo for 2023? While the numbers of biocontrol agents released (and where) is a useful output list (but again – what are the output goals for this proposal?), many of the items listed at the end of this section are outcomes (grower adoption, BCA spread), not outputs.

Outcomes or Projected Impacts
In this section, it would be useful to have more specific projected impacts for some of the objectives. While it is helpful to see past outcomes, I would rather these be used to as evidence of likely projected impacts. For example, briefly state the previous success for each objective and then the likely future outcomes for this five-year renewal.
Outreach plan – it is unclear if an outreach plan is a required part of this proposal, but it is missing.
Your Recommendation:
Approve/continue project with revision

Appendix G: Peer Review (Submitted)

Status: Complete
Project ID/Title: NE_TEMP2332: Biological control of Arthropod Pests and Weeds

Rate the technical merit of the project:

1. Sound Scientific approach:
Approve/continue project with revision
2. Achievable goals/objectives:
Excellent
3. Appropriate scope of activity to accomplish objectives:
Fair
4. Potential for significant outputs(products) and outcomes and/or impacts:
Excellent
5. Overall technical merit:
Good
Comments
The method part, especially on biological control of weeds, needs detailed information on how these experiments will be conducted (Researchers, locations, experiment design, and measurements etc.).
Your Recommendation:
Approve/continue project with revision

Appendix G: Peer Review (Submitted)

Status: Complete
Project ID/Title: NE_TEMP2332: Biological control of Arthropod Pests and Weeds

Rate the technical merit of the project:

1. Sound Scientific approach:
Approve/continue project
2. Achievable goals/objectives:
Good
3. Appropriate scope of activity to accomplish objectives:
Good
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5. Overall technical merit:
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Limitations:
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--- Thorough evaluation of unintended consequences when introducing new natural enemies is crucial. These introduced species may harm non-target species or disrupt existing ecological relationships, potentially causing ecological imbalances.
--- Climate change can disrupt the distribution and behavior of pests and natural enemies, posing challenges in predicting and effectively managing pest outbreaks.

Your Recommendation:
Approve/continue project

Appendix G: Peer Review (Submitted)

Status: Complete
Project ID/Title: NE_TEMP2332: Biological control of Arthropod Pests and Weeds

Rate the technical merit of the project:

1. Sound Scientific approach:
Approve/continue project
2. Achievable goals/objectives:
Good
3. Appropriate scope of activity to accomplish objectives:
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4. Potential for significant outputs(products) and outcomes and/or impacts:
Excellent
5. Overall technical merit:
Excellent
Comments
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Your Recommendation:
Approve/continue project