Proposal

Technology Development for the Biological Control of Invasive Native and Non-Native Plants—FY 2017
Knotweed Biological Control Program 2017-2019
Rearing, Release, and Monitoring

Principal Investigator
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Cooperators and Other Participating Institutions
Washington State University Extension---Jennifer Andreas will work with us to coordinate releases in the State of Washington
Washington Department of Agriculture will contribute matching funding to the project

Amount Requested
Year 1: $23,931 **Year 2:** $24,317 **Year 3:** $16,915 Total: $65,163

Leveraging (from Oregon State University and the Washington State Dept. of Agriculture)
Year 1: $26,248 **Year 2:** $26,429 **Year 3:** $22,950 Total: $75,627

Project Goals and Supporting Objectives
The overall goal of this project is to improve forest health and fish and wildlife habitat by providing an ecological, cost-effective, environmentally safe, and sustainable form of control for invasive knotweeds. The supporting objectives include:

1) Facilitate the completion of the release permit process, including addressing any future questions or concerns raised by the regulatory agencies.

2) Maintain colonies of both biotypes of the knotweed psyllid in the Oregon State University Quarantine until permitted for release.

3) Coordinate and monitor releases in the Northwestern U.S. and supply insects to cooperators for releases in the Northeastern and Midwestern U.S.

Project Justification/Urgency

Invasive knotweeds in North America are a complex of 3 closely related species in the family Polygonaceae that were introduced from Japan during the late 19th century (Barney 2006). They include *Fallopia sachalinensis* (giant knotweed), *F. japonica* (Japanese knotweed), and the hybrid between the two *F.* x *bohemica* (Bohemian or hybrid knotweed). These large herbaceous perennials have spread throughout much of North America with the greatest infestations in the Pacific Northwest (Oregon, Washington and British Columbia), the northeast of the United States, and eastern Canada. Knotweeds are present in at least 41 U.S. states and eight Canadian provinces and are classified as noxious in ten states ((USDA-NRCS 2011). Knotweeds have also invaded Europe, New Zealand, and Australia and are listed among the "world's worst invasive species" by the World Conservation Union (Lowe et al. 2000). While capable of growing in diverse habitats, the knotweeds have become especially problematic along the banks and floodplains of rivers and streams, where they crowd out native plants and potentially affect stream nutrients and food webs (Beerling and Dawah 1993; Maerz et al. 2005; Gerber et al. 2008; Urgenson et al. 2009; McIver and Grevstad 2010). Dense knotweed thickets displace native plants through a combination of shading (Siemens and Blossey 2007), nutrient competition, and allelopathy (Murrell et al. 2011; Urgenson et al.

2012). The inability of tree seedlings to grow along invading stream banks is potentially detrimental to fish and other stream inhabitants that benefit from the shade of trees. In restoration projects, knotweeds must be fully removed before native plantings are successful. The dense stands have no known value for wildlife.

Many federal, state, and local agencies have active control programs against knotweeds. However, the large scale of the knotweed invasion in North America, the inaccessibility of some of the infestations, and the difficulty with which the plants are killed, all suggest that complete eradication of this plant is unlikely. Classical biological control has the potential to provide widespread and sustained reduction in knotweed abundance at a very low cost. Without a biological control program, chemical and mechanical inputs are likely to be needed on a permanent basis with variable to limited success.

An eagerly awaited biological control program against Japanese and Giant knotweeds (Fallopia spp.) using the knotweed psyllid (Aphalara itadori) from Japan is currently under review for permitting by APHIS. The psyllid has been fully tested and was recommended for release by the Technical Advisory Group in November 2013. In 2014, APHIS requested additional testing to confirm no effect of adult stages on certain Threatened and Endangered plant species. We completed this additional testing in 2015, finding no measurable effects of adult stages on the non-target plants. A report of these results was submitted to APHIS in September 2015. A written follow-up response to questions from the U.S. Fish and Wildlife Service was provided in April 2016. With this information, APHIS is now completing the Biological Assessment to be reviewed by the US Fish and Wildlife Service for compliance with the Endangered Species Act.

Two biotypes of the knotweed psyllid are being maintained in the Oregon State University Quarantine. The two biotypes differ in their preference and performance on the various genetic types of knotweed. Both biotypes will be needed for the diversity of knotweed infestations that occur in North America. The northern biotype, from Hokkaido, Japan, performs best on giant knotweed (*Fallopia sachalinensis*) and is expected to be most effective as a biocontrol agent against this plant species. The southern biotype, from Kyushu, Japan, performs best on Japanese knotweed (*F. japonica*) and on hybrid knotweed (*F.* x *bohemica*). The two biotypes also differ in the critical day length that triggers photoperiod, which is important in determining the climates to which they will best perform. The northern biotype is cued into diapause when day lengths are shorter than 14.5 h, whereas the southern biotype enters diapause when day lengths are shorter than 14 h. This information is being used in a model that will predict phenology, voltinism (number of generations) and performance throughout the continent.

This proposed 3-year project requests minimal funding to maintain colonies of the knotweed psyllid in quarantine until a permit is issued by APHIS and to carry out initial rearing, release, and monitoring of the psyllid after the permit is issued.

Approach

Objective 1: Completion of the permitting process
At the time of submission of this proposal, APHIS should be in the process of finishing the Biological Assessment (BA) for the knotweed psyllid and incorporating new test results that were completed last year and submitted as a report to APHIS in September 2015. The project investigator will periodically check in with APHIS during the course of the year to encourage progress in the permit review and to assist them with any needed details for preparation of the review documents. When the BA is completed, it will be forwarded to the U.S. Fish and Wildlife and additional concerns of that agency may need to be addressed.

Objective 2: Maintain quarantine colonies and expand rearing
Throughout the project period, we will maintain healthy colonies of both biotypes of the psyllid. This requires maintaining a steady supply of knotweed plants--field collection of knotweed rhizomes, potting up the plants, watering, and controlling greenhouse pests. The plants are transferred into the quarantine colonies where they

support development of one to two generations of psyllids. Dead or depleted plants are removed from the cages as needed and disposed through the autoclave. In anticipation of releases, we will begin to increase our rearing operations in the quarantine. The goal will be to maintain 10,000-20,000 psyllids (as can be accomplished in the limited greenhouse space in the quarantine) through spring months so that releases can be made soon after permits are issued.

Objective 3: Coordinate and monitor releases

Although it is difficult to know when release permits will be issued, we are planning for a release in the summer of 2017. Once a release permit is issued by APHIS, the psyllid rearing will be moved to non-quarantine greenhouses Oregon State University and Oregon Department of Agriculture for mass rearing prior to release into target knotweed populations. Depending on timing, we will make initial field releases into Oregon and Washington field sites and provide insects to East Coast collaborators where further rearing/releases will occur. At each release site, we will set up permanent monitoring transects to quantify psyllid population density and plant performance. Sites will be visited at least 3 times per year. Monitoring methods will be coordinated among collaborators in other states.

Expected Products and Outcomes

If approved for release, the knotweed psyllid will be an extremely valuable control tool that will eventually be available for release into all locations where in North America where knotweeds are a problem. At best, the psyllid populations will expand to reach high densities wherever knotweed occurs, causing a substantial decline in its abundance and impacts. In the least, the psyllid will provide an added stress to the plant that will reduce its aggressiveness, slow its rate of spread, and make it easier to eliminate using integrated control tools. Either way the psyllid is likely to provide large economic and environmental benefits.

Timetable
(subject to APHIS permit timing)

Task	Year 1	Year 2	Year 3
Complete permit process	X		
Maintaining quarantine colonies	X	X	
Mass rearing		X	
Release monitoring		X	X

References

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Budget
Project Period: May 1, 2017 - April 30, 2020

Cost elements	Details	Year 1	Year 2	Year 3	Total
Direct costs					
Salaries					
Principal Investigator	10% FTE for 12 months	$8,459	$8,713	$8,974	$26,145
Fringe benefits					
Principal Investigator	OSU benefits rate = 52% of salary	$4,399	$4,531	$4,666	$13,596
	Total salaries and benefits	**$12,857**	**$1,243**	**$13,640**	**$39,741**
Travel	Travel costs for the P.I. to attend one national meeting per year	$1,550	$1,550	$1,550	$4,650
	Driving costs for collecting plants from field sites and attending meetings in Pacific Northwest (~1100 miles x $0.54/mile)	$594	$594	$594	$1,782
	Total travel	**$2,144**	**$2,144**	**$2,144**	**$6,432**
Supplies (expendable)	Supplies for growing plants and rearing insects: pots, soil, fertilizer, cage material	$330	$330	$330	$990
Other Direct Expenses	Quarantine costs: 52 weeks @ $150 per week	$7,800	$7,800		$15,600
	Non-quarantine greenhouse costs	$800	$800	$800	$2,400
Total Requested		**$23,931**	**$24,317**	**$16,914**	**$65,163**

Matching Contributions

Source	Details				
Oregon State University	Unrecovered indirect expeses (47% of requested total)	$11,248	$11,429	$7,950	$30,627
Washington State Department of Agriculture	Anticipated contribution	$15,000	$15,000	$15,000	$45,000
Total Match		$26,248	$26,429	$22,950	$75,627