

Amendment to USFS FHTET Cooperative Agreement

Development of Innovative Outreach Tools and Materials on Invasive Plant Identification and Biologically Based Management

1 PURPOSE

The purpose of this amendment is to 1) award an additional \$115,000 for the work outlined under point 2.8) and to extend the duration of this agreement until 19 April 2015.

2 DETAIL & SCOPE OF WORK

2.1 Biological Control of Weeds: A World Catalogue of Agents and Their Target Weeds

Julien's Catalogue, or Biological Control of Weeds: A World Catalogue of Agents and Their Target Weeds, has long been considered one of the single most important texts for the weed biocontrol practitioner. This document compiles invasive plant biological control efforts taking place throughout the world, and the results/lessons learned for all efforts. It has been cited in the literature on greater than 550 occasions. As biological control activities grow and expand from year to year, the catalogue must be updated accordingly. In the past, the catalogue was updated every six years, and the updating process was a large undertaking. The version of the catalogue currently available is the 4th edition, and was finished 13 years ago. Consequently, there is a great need for a revision and update of the catalogue as soon as it may be possible. Dr. Mic Julien (CSIRO, Brisbane, Queensland), the main author of the previous two editions of the catalogue, has been approached numerous times by biocontrol practitioners recognizing the need for an updated version. Though updating intentions were never brought to fruition due to funding issues, Dr Julien was able to develop a specific wish list for what a full update of the catalogue would require. The effort would depend upon the collaboration of biocontrol researchers from various locations to oversee the compilation of information from each of the main practicing continents. The brunt of the work would then need to be carried out by a trustworthy and efficient worker well versed in technical writing and biological control. The Center for Agriculture and Biosciences International (CABI) currently publishes the catalogue for a reasonable price, and would again be the publisher. More importantly, CABI would make all content available online in a full query database website.

2.2 CRISSP REU (Research Experience for Undergraduates Program)

The goals of the **CRISSP Summer Research Experience for Undergraduates (REU) Internship Program** are two-fold. First, we aim to involve undergraduate students, especially those from underrepresented groups (i.e. Native Americans, ethnic minorities, and women), in innovative and interdisciplinary research addressing regional and global natural resource issues. Second, we will foster development of skills, knowledge, and enthusiasm for successful completion of graduate study and preparation for careers in the natural resource sciences. The primary focus of the **CRISSP Summer Research Experience for Undergraduates (REU) Internship Program** is mentor-guided research. Participants will work as members of research teams (field or lab groups), will share authorship in publication of research results, and will be encouraged to present results at professional meetings. In addition, students will explore ethics in science and the environment, graduate school preparation, and application of the scientific

methods to natural resource issues. During the first two seasons, approximately half of the CRISSP REU students worked on invasive plant species, for example clarifying the resistance of different genotypes of *Chondrilla juncea* to one of its biological control agents *Puccinia chondrillina*, developing endophytic fungi as potential biological control agents for *Bromus tectorum*, or studying the interactions between healthy and endophyte-attacked *Centaurea stoebe* and its biological control agent *Larinus minutes*. CRISSP REU is considered extremely successful and we would like to expand it, especially towards the needs of the USFS as one of the largest land management agencies in the area. We are interested in working with the USFS to develop REU projects which meet USFS research needs while informing REU participants about career opportunities in the USFS. CRISSP nationally advertises summer research projects on the CRISSP website www.cnr.uidaho.edu/crissp and on the NSF website each January/February http://www.nsf.gov/crssprgm/reu/list_result.cfm?unitid=5047. CRISSP typically advertised ten research assistantships. A CRISSP faculty review panel reviews all application and selects the top 30 candidates. These 30 are then interviewed by telephone and the final ten are selected based upon those interviews. The NSF pays for the flights, student stipend, while here and specific program such as the ethics training and team-forming experiences. Each of the REU students will work on a specific research project closely advised by a faculty mentor and fully immersed in that faculty's research team. The typical undergraduate seniors conduct small scale graduate level research projects, which at the end of their stay have to be summarized and communicated as an oral or poster presentation. Some of our REU students have actually published their projects in refereed journals. It is a very involved process for both the faculty advisors and the students. During the last two years more than a third of the CRISSP REU students (seven) have worked on weed biological control systems. We would like to specifically expand that aspect of CRISSP REU in cooperation with the USFS. We would also like to organize field trips to USFS locations because we realized that these students have little to no understanding of the diversity of work conducted by the USFS.

2.3 Weed and Weed Biocontrol Wiki's (Wikipedia Contributions)

Information from the popular biological control card decks is currently made available online in the form of Bugwood Wiki Articles by University of Georgia staff. For an example click on http://wiki.bugwood.org/Bradyrrhoa_gilveolella. These articles provide the basis for most effective future outreach and extension efforts as Wiki articles are available for free online to literally hundreds of millions of Internet users. Wikipedia or "Wiki's" are the ideal platform for any and all weed and weed biocontrol information and used more than any other source globally. We intend to add substantial content, thoroughly edit the current weed biological control agent wiki's and add a bibliography for each agent that lists original scientific literature for each agents. In addition we will submit weed biological control information to existing noxious weed wiki's where appropriate and submit entire weed wiki's for those weeds covered under the FHTET's biology and biological control series. All efforts will be closely coordinated with the University of Georgia.

2.4 Aquatic New Invaders Field Guide

Based on our very popular "New Invaders of the Northwestern United States", we want to use the same format to produce a field guide identifying the new aquatic invasive species. We will include invasive species across taxa in this guide with an emphasis on aquatic freshwater plants and freshwater mollusks (snails and mussels) because we will be limited to approximately 60 species and because these are by far the two most threatening taxa for northwestern streams and

lakes. We may include riparian plant invaders if space allows. The best currently available source is a book published by the University of Washington Press “Invasive Species in the Pacific Northwest” (eds.: Boersma, Reichard, and Van Buren) but this book 1) covers only 12 freshwater plant invaders and 2 invasive freshwater mollusks, 2) has an emphasis on marine aquatic species, 3) doesn’t not cover the Northern Rocky Mountains and 4) is six years old, 5) only offers limited if any images, 6) uses a large format not suitable as a field guide for land managers and 7) costs \$29.95. Our field guide, will in contrast focus on the education and technology transfer and as such have greater applicability as outreach product. We are convinced that this product will be as successful as the “New Invaders” terrestrial plant field guide.

2.5 Invasive Saltcedars and Their Management

This product will be similar in format to the currently available 12 field guide card decks of the series “Noxious Weeds and their Biocontrol Agents”, however, it will focus on an identification key for invasive saltcedars and contrast these to horticultural, benign and closely related species. The guide will also feature images of both, the currently released biological control agent and the willow flycatcher to aid identification of either species. For many land managers and the public it seems impossible to identify and distinguish the various invasive phenotypes of *Tamarix* spp. From tree-growing horticultural related species, especially in the southwestern U.S. With the assistance of Dr. John Gaskin, we will develop an illustrated key featuring both photographic images and line drawings.

2.6 Prevalent and Most Effective Biocontrol Agents for Western Weeds

A booklet (similar to the “New Invaders of the Northwestern U.S.” format) that would be a professional consolidation of several poor quality print products in western states (e.g. Idaho, Wyoming and British Columbia), which depict prevalent weeds for which there are effective biocontrol agents available. Each weed would be introduced and would be followed by a few (3-4 pages describing the most abundant/effective agents (ADDEFD VALUE: including images of insect damage for easy identification). We would also include “rare” agents images (so that readers/land managers could identify them should they encounter those species). This product would provide recommendations for agents/agent combinations and we will add information on how to handle specific species, and how to report biocontrol agents on EDDsMaps Biocontrol.

2.7 Expanding EDDMapS to Support Weed Risk Modeling and Analysis

EDDMapS is a web based program which serves as a central sharing place for invasive species distribution data. EDDMapS users may input new distribution records directly into EDDMapS, and/ or share existing records stored in other databases with EDDMapS. Data is uploaded at the EDDMapS database and website and then distributed in report form. Currently available reports include: presence/absence county maps, point maps using Google Maps API, and Early Detection Rapid Response (EDRR) reports and maps. At this time EDDMapS cannot facilitate the sharing of data inside spatially enabled databases. The addition of this functionality would facilitate the work of researchers and land managers alike. We propose to create an enterprise geodatabase as part of the EDDMapS access point. By incorporating an ArcGIS Enterprise Server, EDDMapS will be able to accommodate a wider array of data, including data from spatially enabled databases. As part of this synchronizing technology, existing EDDMapS data will be published as ArcGIS instances and grouped into disciplines. The resulting group instances will be shared with the cooperating partners who will be granted access via layers in

their native ArcGIS Desktop environment. The data will be stored behind a firewall and will be protected at all levels. End users can then retrieve EDDMapS data via the ArcGIS Desktop interface and use it in their existing frameworks as a tool for managing landscapes, developing weed susceptibility models, or addressing other research questions. EDDMapS data will be delivered in a consistent format, and may be used to create user designed GIS layers.

2.8 Using *Mogulones borraginis*, a potential biocontrol agent for houndstongue, and *Ceutorhynchus cardariae*, a potential biocontrol agent for hoary cress, to develop host-specificity testing methods based on olfactory and visual host selection behavior

The eventual goal of this project is to receive USDA APHIS approval to release the seed feeding weevil *Mogulones borraginis* for the biological control of houndstongue and for the stem galling weevil *Ceutorhynchus cardariae* for the biological control of hoary cress. We intend to accomplish this through the development of host-specificity testing methods based on the olfactory and visual host selection behavior of *M. borraginis* and *C. cardariae*. This project will develop or refine host range testing for potentially all biological control agents (BCIP Project Priority No. 1) by providing a new level of experimental host-specificity data for *M. borraginis*, and developing and refining a process which can universally be applied to improve host range predictions for biocontrol candidate species (pre-release) and non-target risk assessments of released biocontrol agents (post-release). A complete project description is provided in a separate document.

3 BUDGET ESTIMATES

Year 1	University of Idaho Matching Funds	Funds provided by USFS FHP FHTET
SALARY AND FRINGE (Ikju Park & Jessica Rendon) 20 months graduate Research Assistantship (@ \$2,250/month) + 1% fringe/benefit (\$20.50/month)		\$45,000.00 \$450.00
OPERATIONAL EXPENSES Analytical costs for VOC by GC/MS: 300 samples @ \$15 (\$4500); laboratory consumables and chemicals for GCMS and VOC sample collections: \$1,000; partial support for bench fees for space at NWBIQ quarantine (\$3,000); field supplies (\$320)		\$8,820.00
TRAVEL Reimbursement for private vehicle mileage for travel to field sites to collect VOCs @ \$0.455/mile for 2,703 miles (\$1,230)		\$1,230.00

EQUIPMENT Partial support for purchase of new NIST mass spectral database (\$2000)		\$2,000.00
INDIRECT COST (45.2% partially waived as not allowed under this agreement \$11,117); partial salary Schwarzlaender plus Indirect Cost (\$5,539 and \$2,511)	\$11,117.00 \$5,539.00 \$2,511.00	
SUBTOTALS	\$19,167.00	\$57,500.00

Budget Justification Year 1:

Salaries: 20 months graduate Research Assistantship @ \$2,250/month and 1% fringe/benefit @ \$20.50/month (\$45,000 and \$450).

Operational Expenses: Analytical costs for VOC by GC-MS for 300 samples @ \$15/sample (\$4,500); laboratory consumables and chemicals for GC-MS analysis, S-SYD trials and VOC sample collections (\$1,000); contribution to annual bench fee (\$10,000) for NWBIQ quarantine @ 30% of annual fee (\$3,000); miscellaneous field supplies (\$320).

Travel: Partial reimbursement for repeated field trips travel to field sites in OR, WA, ID and CA to collect VOCs at \$0.455 per mile for approximately 2,703 miles (\$1,230).

Equipment: Partial contribution to support purchase of National Institute for Standards and Technology (NIST) Atomic Spectra database for GC-MS analysis of VOC (\$2,000).

University of Idaho Cost Sharing: Partially waived Indirect Costs @ 45.2% (\$11,117); and as RFP mandated partial matched salary of Principal Investigator Schwarzlaender (@ \$5,539 plus Indirect Costs \$2,511).

Year 2	University of Idaho Matching Funds	Funds provided by USFS FHP FHTET
SALARY AND FRINGE (Ikju Park & Jessica Rendon) 12 months graduate Research Assistantship (@ \$2,250/month) + 1% fringe/benefit (\$20.50/month)		\$45,000.00 \$450.00
OPERATIONAL EXPENSES Analytical costs for VOC by GC/MS: 200 samples @ \$15 (\$3000); laboratory consumables and chemicals for GCMS and VOC sample collections: \$1,000; partial support for bench fees for space at NWBIQ quarantine (\$3,000)		\$7,000.00

TRAVEL Reimbursement for private vehicle mileage for travel to field sites to collect VOCs @ \$0.455/mile for 2,703 miles (\$1,230)		\$1,230.00
EQUIPMENT Replacement cost laptop computer (\$2000), photo equipment (\$1820)		\$3,820.00
INDIRECT COST (45.3% partially waived as not allowed under this agreement \$11,117); partial salary Schwarzlaender plus Indirect Cost (\$5,539 and \$2,511)	\$11,117.00 \$5,539.00 \$2,511.00	
SUBTOTALS	\$19,167.00	\$57,500.00

Budget Justification Year 2:

Salaries: 20 months graduate Research Assistantship @ \$2,250/month and 1% fringe/benefit @ \$20.50/month (\$45,000 and \$450).

Operational Expenses: Analytical costs for VOC by GC-MS for 200 samples @ \$15/sample (\$3,000); laboratory consumables and chemicals for GC-MS analysis, S-SYD trials and VOC sample collections (\$1,000); contribution to annual bench fee (\$10,000) for NWBIQ quarantine @ 30% of annual fee (\$3,000).

Travel: Partial reimbursement for repeated field trips travel to field sites in OR, WA, ID and CA to collect VOCs at \$0.455 per mile for approximately 2,703 miles (\$1,230).

Equipment: Costs for laptop computer equipment/replacement (\$2,000), and equipment for macro/microphotography (\$1,820).

University of Idaho Cost Sharing: Partially waived Indirect Costs @ 45.3% (\$11,117); and as RFP mandated partial matched salary of Principal Investigator Schwarzlaender (@ \$5,539 plus Indirect Costs \$2,511).