

## USGS NSF GRIP, GSP Opportunity

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<span style="color: teal;">●</span>	<b>USGS Center:</b>	Southwest Biological Science Center
<span style="color: purple;">●</span>	<b>Project Title:</b>	Predicting the next high-impact insect invasions: Traits and factors determining the risk of introduced herbivorous insects on North American native plants
<span style="color: green;">●</span>	<b>Summary:</b>	<p>Would you like to join our fifteen-member USGS Powell working group of Federal and academic research ecologists and entomologists studying the theoretical and applied aspects of insect invasion. We are developing quantitative models to help predict the potential level of impact of newly invading herbivory-specialist insects and to test the enemy-release and defense-free space hypothesis in insect invasion. The Intern will have a lead role in further development of the TraFac database, developing and testing statistical models predicting insect invasion and host plant defense, and publishing results.</p>
<span style="color: purple;">●</span>	<b>Project Hypothesis or Objectives:</b>	<p>Our Powell working group has hypothesized that the impacts of herbivory-specialist invading insects on North American plants are driven by (1) the insects' and host plants' evolutionary history, (2) the hosts' defenses or lack thereof (defense-free space), and (3) presence of natural enemies or lack thereof (enemy release), (4) invader biological traits, and (5) geographic and temporal considerations. Understanding the relative contributions of these drivers to invasion impact creates the potential to explain extreme impacts of several herbivory-specialist invading insects globally. The emergent predictive framework will inform risk assessment by improving prediction of potentially high-impact insects prior to establishment.</p> <p>The working group has developed the structure of a Traits and Factors Database (TraFac) for herbivory-specialist insects (objective 1), and have provided its initial population with traits of conifer specialist invading insects. TraFac will ultimately be populated with traits of other invading insects specializing on other plant groups and of target herbivory specialist insects not yet established in North America but with a high likelihood of introduction. For the current invasions, the level of impact of the insect on each host is rated. The next step (objective 2) is to create a statistical model of species impact (response variable) as predicted by the traits and factors coded in TraFac (the predictor variables). We then will extend our model to species compiled in TraFac for the targeted herbivory-specialist insects that</p>

have not yet invaded (objective 3). As a pilot test of these objectives we have begun work with conifer-specialist invading insects. We are also testing the phylogenetic distance between North American and native host plants for the insect and between introduced and native insects on the same host.

 <b>Duration:</b>	Up to 12 months
 <b>Internship Location:</b>	Tucson, Arizona
 <b>Field(s) of Study:</b>	Life Science
 <b>Applicable NSF Division:</b>	DEB Environmental Biology
 <b>Intern Type Preference:</b>	NSF Graduate Research Fellow (GRF) via the Graduate Research Intern Program (GRIP)
 <b>Keywords:</b>	Invasive insects, invasion ecology, invasive species management, statistical modeling, entomology
 <b>Expected Outcome:</b>	The working group's goals are to: 1) develop a quantitative model that informs prediction of insect invasions that could be high-impact and 2) refine our working hypothesis so that the relative contributions of the defense-free space hypothesis and the enemy release hypothesis are more fully developed and the role of evolutionary history more fully specified. The Intern will be a fully functioning member of the Powell working group and will gain experience in the development, management, and documentation of a complex biological database; development and application of quantitative models predicting the impact of insect herbivory; and interaction with a dynamic team of researchers across the nation in tackling the theoretical and practical aspects of insect invasion. In addition, the Intern will have exposure to the USGS and governmental research environment as well as working collaboratively across multiple agency and university venues. This research issue is of national importance and is expected to provide a number of opportunities for continuing collaboration. The USGS Powell Center supported our working group with comment on the importance of the problem and potential impact that success would have on ecosystems, conservation science and applied conservation implementation.
 <b>Special skills/training Required:</b>	Strong background in entomology, management of biological databases, statistical modeling using R
 <b>Duties/Responsibilities:</b>	The Intern will conduct research with both applied and theoretical application. The Intern will lead with the continued population and application of the Traits and Factors Database, including a lead role in developing statistical models predicting the impact of herbivory-specialist invading insects, and will be part of the team publicizing findings in peer-reviewed scientific journals. The Intern will work in Tucson under the direct mentorship of a USGS research ecologist who is one of the Principal Investigators and will have access to USGS computing and modeling resources both in Tucson and with the Powell Center in Fort Collins. Work will be primarily office-based at USGS offices located on the University of Arizona campus.