



CALFED Progress Report
California Sea Grant College Program

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TypeQuestionnaire\_2B Final Questionnaire

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Project Information

ProjectNo\_2C R/SF-17 StartDate\_3a March 2007 EndDate\_3b June 2010
ProjectTitle\_4 The role of exotics as ecosystem engineers affecting estuarine food webs in Suisun Marsh

CALFed Fellow contact information

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Additional Research Mentors and Community Mentors

Additional Research Mentors\_8

Form with 8 horizontal lines for entering additional research mentors.

Additional Community Mentors\_9

Form with 9 horizontal lines for entering additional community mentors.



**Project Objectives: Please type your responses, and answer the questions in a style appropriate for laymen.**

**ProjectObjectives\_10**

At Rush Ranch Open Space Preserve (RROSP), an important site within Suisun Marsh and a site within the San Francisco Bay National Estuarine Research Reserve (SF Bay NERR), we examined the hypothesis that an invasive plant, *Lepidium latifolium* or perennial pepperweed, affects biodiversity of native plant, insect and invertebrate communities, with significant consequences for the trophic function of the estuarine ecosystem. Our specific goals have been to (1) identify key functional differences among invaded and natural areas within the marsh, (2) to document if these differences are pervasive across different habitats, and (3) to develop the best methods of eradication in a setting where there are numerous constraints (permits; access; competing interest groups; presence of several listed species). In addition, we have worked with other managers and scientists to assemble regional knowledge and expertise about *L. latifolium* in order to develop a regional consensus and management strategy.

**Summary of progress in meeting each of these goals and objectives**

**ProgressSummary\_11**

We have collected two years (two seasons each year) of data on differences in plant, insect, and invertebrate communities in order to meet goal number 1. This past year has been focused on analyzing the collected insect samples (both canopy and ground-dwelling insects) as well as the infaunal invertebrates. In addition, we have processed an extensive amount of stable isotope data on the insects in order to understand the food web. This data is being analyzed now. In order to meet goal number two, we have replicated this sampling and analysis across three habitat types (low, middle, high marshes). Finally, we have met goal number three by pairing our sampling with ongoing management programs at Rush Ranch and conducting two large scale eradication experiments in two habitats (seasonal wetland, tidal marsh). This will increase the understanding of how these management efforts impact the target invasive plant as well as the non-target plant and insect communities. Finally, working with SFBay NERR and California Coastal Conservancy, we set up a symposium series designed to bring together researchers and managers to assess and share the current state of knowledge regarding perennial pepperweed's ecological impacts, the extent of invasion in the greater Bay Area, and best practices for control. Several documents and products are in progress now to share these results and discussions with the larger science and management community.

**PROJECT MODIFICATIONS:** Please explain any substantial modifications in research plans, including new directions pursued. Describe major problems encountered, especially problems with experimental protocols and how they were resolved. Describe any ancillary research topics developed.

**Modifications\_12**

The major project modification was discussed in prior reports; we reduced the scope of the project by eliminating two of the proposed invasive plants and focusing on *Lepidium latifolium* only. This has enabled us to do a more in-depth evaluation of the impacts of *Lepidium* on the natural marsh in three elevation zones. In addition, we have really increased our collaboration with Solano Land Trust to pair our results with their ongoing management project. The eradication monitoring and planning has greatly increased in scope and duration. We have used our preliminary work through CALFED to expand the eradication work into sediment testing to look for persistence and spread of herbicides post-treatment. We have also put a lot of effort in the symposium series to inform scientists and managers.

**BENEFITS AND APPLICATIONS:** Suggest the relevance of these new findings to management. Describe any accomplishment, that is significant effects your project has had on resource management or user group behavior. CALFED is looking for "management cue" (see <http://science.calwater.ca.gov/pdf/soemgmtcues.pdf>).

**BenefitsApplic\_13**

Once impacts of *Lepidium* are better understood, it will be possible 1) to determine areas (elevation zones, habitat types) of special concern or of eradication priority, 2) to predict the response of invasives to future conditions including climate change, and 3) to develop effective management and eradication strategies. In collaboration with Solano Land Trust, we have been working to develop an integrated approach to eradicating *Lepidium* across habitat zones by evaluating the effectiveness of eradication design and trying to minimize non-target impacts. This will produce transferable and measurable metrics that can be incorporated on a regional scale into ongoing *Lepidium* eradication programs. In conjunction with SF Bay National Estuarine Research Reserve, we organized a two-day symposium to gather local researchers, managers, scientists, and land-owners in order to share results and ongoing research and management. This required a two-pronged approach: 1) understanding the ecology and impacts of pepperweed and 2) discussing and designing effective management and control efforts. As a result of the symposium, we developed a set of important regional questions: Is *Lepidium* control possible? What herbicide control has been achieved? Should upstream or downstream sources be controlled first? What non-herbicide control has been achieved? How do we manage *Lepidium* where it co-occurs with endangered species?

**PUBLICATIONS:** List any publications, presentations, or posters that have resulted from this funded research. Give as many details as possible, including status of paper (e.g., in review; in press), journal name, conference location and date of presentation. Please note (as outlined in the conditions of the award) that each fellow is required to submit an abstract for an oral or poster presentation at each State of the Estuary conference and CALFED Science Conference during the duration of the fellowship.

**Publications 14**

- \*Invited speaker. 2008. Bay Area Lepidium Science and Management Series I. Whitcraft, C. Title: "The Impacts of Perennial Pepperweed Invasion on Sediment Community"
- \*From the Bench. Whitcraft, C. Title: "The Impacts of Perennial Pepperweed Invasion in Wetlands Along an Inundation Gradient"
- \*Invited speaker. 2008. Bay Area Lepidium Science and Management Series II. Whitcraft, C, Wallace, B, Grewell, B. Title: "Review of Lepidium Ecology"
- \*CALFED Annual Meeting. 2008. Whitcraft, C.R., D. Talley, B. Wallace, and B. Grewell. Title: "The Adaptive Management of Perennial Pepperweed Invasion Along an Inundation Gradient"
- \* Benthic Ecology Meeting. 2009. Whitcraft, C, Talley, D., and Wallace B. Title: "The Impacts of Perennial Pepperweed Invasion in Wetlands Along an Inundation Gradient". Session Chair
- \*CNSM Faculty Research Symposium. 2009, Whitcraft, C and Talley, D. Title: "The Impacts of Perennial Pepperweed Invasion in Wetlands Along an Inundation Gradient"
- \*State of the Estuary. 2009. Authors: Whitcraft, C.R., D. Talley, B. Wallace, B. Grewell, and M. Psaros. Poster title: "Control and Management of Perennial Pepperweed Invasion: An Obtainable Goal?"

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**COOPERATING ORGANIZATIONS:** List those agencies and/or persons who provided financial, technical or other assistance to your project since inception. Describe the nature of their collaboration.

**CoopOrganiz\_15**

Brenda Grewell (USDA, UCDavis) - time, expertise, Melanie Deninger (CA Coastal Conservancy) - money for the symposium, Solano Land Trust - equipment, personnel, California State University Long Beach (start-up funds, SCAC funds), SeaGrant Bridge funding - small supply money, Suisun Marsh Specific Fund - grant to SLT, money for sediment herbicide testing and travel to field site

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**AWARDS:** List any special awards or honors that you, or mentor or members of the research team, have received during the duration of this project.

**Awards\_16**

none

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**KEYWORDS:** List keywords that will be useful in indexing your project.

**Keywords\_17**

invasive species, Lepidium latifolium, pepperweed, insect, brackish marsh, management, eradication

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**PATENTS:** List any patents associated with your project.

**Patents\_18**

none

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