

**Final Report for:  
Center for Invasive Plant Management  
Seed Money Grant Program**

**Project Title: Do Native Consumers and Patch Shape Affect the Dominance of Invasive Plants?**

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Award: \$5000

Award duration: March 2004 – September 2005

## Proposal

Consumers may play a critical role in the success or failure of invasive plants. For example, a common theme in the biological control of invasive plants is that invasive plants can be controlled by introducing consumers from their original range. However, this focus has largely neglected the possibility that invasive plants may dominate native plants by affecting native consumers. We obtained support from CIPM to test a novel mechanism by which invasive plants maintain their dominance of 9.2 million hectares of California grassland: by promoting large consumer populations and changing consumer activity patterns, invasive plants suppress native species (i.e. apparent competition).

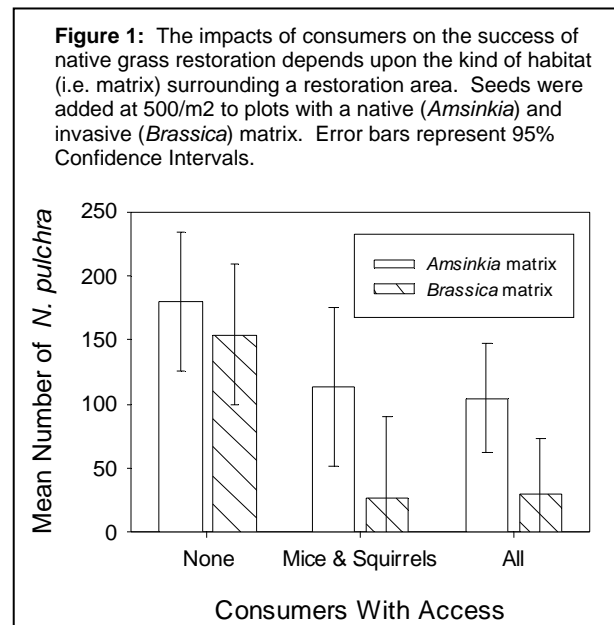
The goal of our proposal, 'Do native consumers and patch shape affect the dominance of invasive plants', was to secure critical baseline data documenting the importance of rodent consumers in affecting the invasion of California grasslands. These baseline data were to form the basis of proposals for long-term research. By examining the same patches over many years, our study will be able to monitor shifts in the boundaries that delineate native vs. invasive plant communities and document the conditions that promote these shifts (e.g. differences in consumer abundance, patch shape). Ultimately, our work will provide insight into the forces that promote invasion and maintain the dominance of invasive plants, and offer a different perspective on the planning of successful conservation and restoration efforts.

## Results

We have conducted preliminary trapping of rodent populations in habitats dominated either by native perennial and invasive annual plants. During 4288 trap-nights of effort, we obtained 356 captures of 9 small-mammal species. In addition to this preliminary consumer sampling, we have also begun three separate experiments to determine the impact of rodent consumers on the invasion of California grasslands.

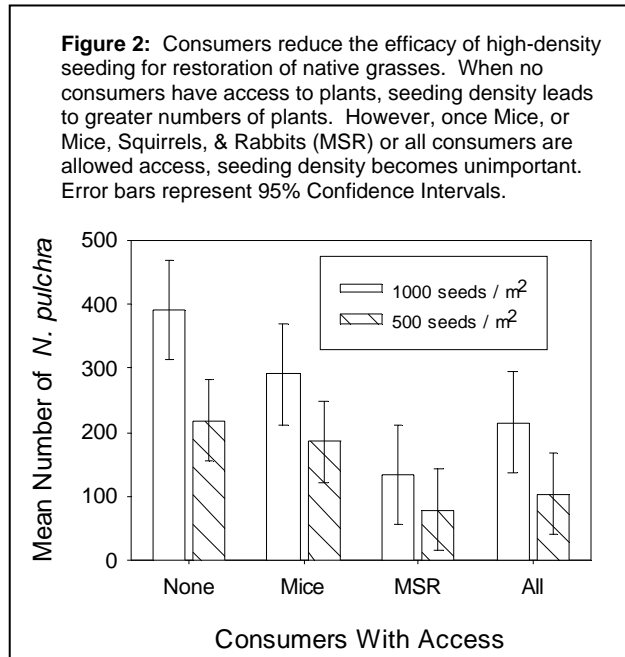
### *Experiment 1: Rodent consumers and restoration of native grasslands.*

In collaboration with the U.S. Park Service, we have started an experiment to determine how rodent consumers affect the restoration of a native grassland species, *Nassella pulchra*. Using CIPM funds, we have established a series of experimental exclosures at the Upper Cheeseboro Open Space north of Los Angeles, California. This project has already yielded results that suggest that consumers play an important role in suppressing native species: seeded plots yield significantly more native plants when consumers are excluded. Importantly, the impact of consumers depends upon the type of habitat where the additions occurred (Figure 1), suggesting that restoration of native grasslands may be habitat-dependent because of habitat-specific differences in consumer



abundance and behavior. Moreover, these results suggest that the ability of invasive, non-native plants (e.g. *Brassica nigra*) to usurp native species and discourage restoration may be due to how invasive plants alter the behavior of native consumers.

This project also included a study on the role of different seeding densities in the restoration of *Nassella pulchra*. Within four different types of exclosures (Figure 2), we added two seed density treatments and observed plant recruitment and survival. This experiment revealed that consumers reduce the efficacy of different levels of seeding: when all consumers have access to seeds and seedlings, the average density of surviving plants is independent of seeding density (Figure 2).



Finally, this project also included a study on the role of consumers in affecting restoration when native *N. pulchra* were added as seedlings. As with the other two components of this study, the impact of consumers was dramatic. However, our preliminary data are still being prepared for analysis at this time.

*Experiment 2: The impact of rodent consumers on intact native and invasive grassland communities.*

We have constructed experimental exclosures in intact grasslands that vary in the degree to which they are invaded by exotic grasses at the University of California's Sedgwick Reserve near Santa Ynez, California. While our first experiment focused on the role of consumers in the restoration of a single native species (*Nassella pulchra*), this experiment has a community-level focus. This work will allow us to measure the long-term impacts of rodent consumers and determine whether rodents play a role in maintaining the dominance of invasive exotic grasses within intact grassland communities. Biomass samples from all exclosures are currently being processed and we have established rodent-sampling grids for our sampling rodent consumers.

*Experiment 3: Rodent consumers and the reestablishment of native grasses in invaded environments.*

We have also constructed experimental exclosures in intact grasslands that are completely invaded (i.e. no native perennial grasses present) at Sedgwick Reserve. The objective of this experiment is to determine if native plants can re-establish in areas where they have been excluded by invasive grasses when consumer access is experimentally manipulated.

**Publications**

Due to the long-term nature of the work, our project has not yet resulted in any publications. However, we plan to submit two manuscripts outlining the results of the restoration work (Experiment 1) by the end of 2005 (one to Ecological Applications and

the other to Restoration Ecology). We anticipate that two manuscripts from the long-term experiment in intact grasslands will be submitted in mid-2006, one manuscript describing the dynamics of rodent consumers, and the other detailing the short-term impacts these consumers have on intact grasslands under different levels of invasion. As the experiment progresses, we anticipate several more publications and presentations that document the long-term implications of rodent consumers on invasive plants in California grasslands.

### **Long-term goal and continued progress of research**

All of our exclosure experiments will be monitored for at least three years to determine how native consumers influence grassland dynamics. This monitoring includes bi-annual surveys of plant communities, surveys of consumer communities, and use of stable isotopes to examine seasonal shifts in consumer feeding habits. Thanks to long-term funding secured with the help of CIPM (see below), this monitoring effort now has the necessary financial support.

### **Benefits of seed money**

Seed money from CIPM was critical for establishing the three experiments outlined above. These three experiments form the foundation of our long-term monitoring and we would not have been able to establish them without CIPM support. Moreover, these CIPM-funded experiments forged a new partnership between researchers at the National Park Service and the University of California – a partnership focused on more effective management of 9.2 million hectares of California grassland.

Importantly, rodent traps purchased with seed money were instrumental for gathering preliminary data that was used to fortify a proposal to the National Science Foundation. We are extremely pleased to report that this proposal was recently approved for three years of funding (\$199,000 from 2005-2008). By helping us secure additional funding, the seed money from CIPM will allow us to perform the long-term, in-depth studies that are needed to make progress towards the effective management of invasive plants.

### **Further assistance in advancing this research**

Due to its unique connections with researchers and managers, CIPM could assist this research by making our report broadly available to individuals and agencies actively engaging in restoration. This could be done by posting research reports on the web site as well as by providing overviews of pertinent research reports during interactive CIPM workshops. CIPM could also facilitate future research by alerting researchers about meetings, workshops, and funding sources related to their work topic.