Kristin B. Hulvey
University of California-Santa Cruz, Santa Cruz, CA

2004 EPA STAR Graduate Fellowship Conference *Next Generation Scientists—Next Opportunities*

Determining the role of species abundance in invasion dynamics:

An investigation of Yellow Starthistle (Centaurea soltitialis) invasion in California grasslands

ENVIRONMENTAL ISSUE

Two primary concerns of ecosystem managers are:

(1) The spread of introduced species
(2) The loss of native species

Although introductions may lead to extinctions, it is more common for introduced organisms to lead to changes in the abundances of resident species (1).

Decreases in native abundance may result in **ecological extinction** — a situation where a population decreases to a size where it no longer plays a significant role in system functioning. The impact of ecological extinction on such functions such as invasion resistance is not well understood.

MODEL SYSTEM

Yellow starthistle (YST) invasion of California grasslands provides an opportunity to study ecological extinction.

YST is found in 56 of 58 counties and covers ~15 million acres (2). It reduces wildlife forage, displaces native plants, and decreases native species diversity (3).

Investigations show the native forb *Hemizonia congesta* decreases the biomass of invading YST (4) disproportionately to *Hemizonia* abundance (5).

RESEARCH OBJECTIVES

- ***Investigate the effects of abundance changes on system invasibility***
- ***Help stop the spread of yellow starthistle in California grasslands***

RESEARCH HIGHLIGHTS

Through controlled experiments, I will examine the impact of *Hemizonia* abundance on YST invasion and investigate the mechanisms controlling this relationship.

METHODS:

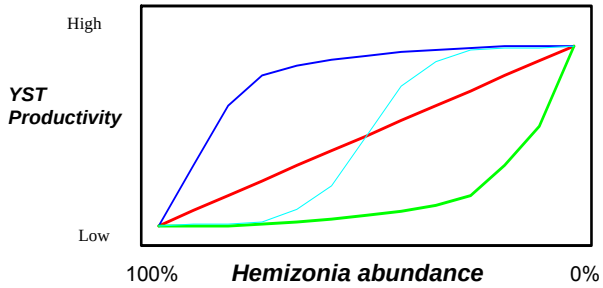
Year 1: *Hemizonia* will be planted at different abundances in pots open to ambient conditions. Half the pots will be invaded with YST, while the remaining pots will serve as controls. I will measure plant growth and cover, soil nutrient availability and moisture, light penetration, root biomass, and number of YST flowers produced.

Years 2 & 3: Utilizing knowledge gained in the first year of experiments, I will work with local land managers to investigate using *Hemizonia* as a restoration tool.

Literature cited
(1) Gerevitch and Dianna K. Padilla 2004. Are invasive species a major cause of extinctions? TRENDS in Ecology and Evolution 19(9), 470-474.
(2) Pitcairn, M. J., R. A. O'Connell, and J. M. Gendoron 1998b. Yellow starthistle: survey of statewide distribution. In: Woods, D. M. (ed.) Biological Control Program Annual Summary. California Department of Food and Agriculture. Plant Health and Pest Prevention Services. Sacramento, CA. P. 64-66.
(3) Sheley, R. L. and L. L. Larson 1994a. Observation : Comparative life-history of cheat grass and yellow starthistle. Journal of Range Management 47, 450-456.
(4) Dukes, Jeffery S. 2002. Species composition and diversity affect grassland susceptibility and response to invasion. Ecological Applications 12(2), 602-617.
(5) Zavaleta, E. S. and Hulvey, K. H. 2004. Realistic species losses disproportionately reduce grassland resistance to biological invaders. Science, In press.

EXPECTED RESULTS

The relationship between native species abundance and invader performance is currently unknown. The figure below presents multiple possibilities.



After determining the shape of the abundance/productivity curve for *Hemizonia* and YST, I can better explore mechanisms which drive this relationship.

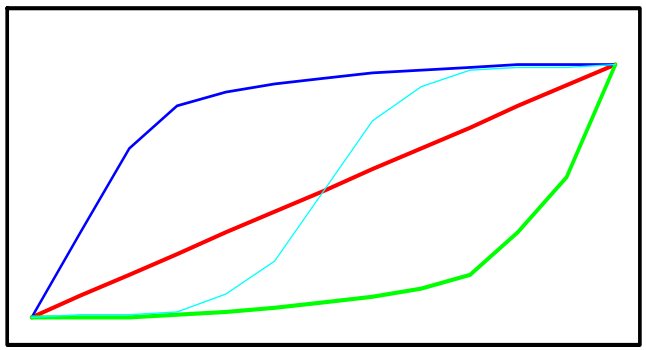
IMPACT

(1) A better understanding of ecological extinction may highlight the importance of native species management in the battle against invasive species.

(2) Understanding the impact *Hemizonia* abundance has on YST invasion may indicate new strategies for restoring CA grasslands.

(3) Cooperative work with California land managers will translate experimental results into direct conservation action.

This fellow is sponsored by EPA's STAR or Greater Research Opportunities (GRO) Program.



Literature cited
Dukes, Jeffery S. 2002. Species composition and diversity affect grassland susceptibility and response to invasion. Ecological Applications 12(2), 602-617.
Gerevitch and Dianna K. Padilla 2004. Are invasive species a major cause of extinctions? TRENDS in Ecology and Evolution 19(9), 470-474.
Pitcairn, M. J., R. A. O'Connell, and J. M. Gendoron 1998b. Yellow starthistle: survey of statewide distribution. In: Woods, D. M. (ed.) Biological Control Program Annual Summary.
California Department of Food and Agriculture. Plant Health and Pest Prevention Services. Sacramento, CA. P. 64-66.
Sheley, R. L. and L. L. Larson 1994a. Observation : Comparative life-history of cheat grass and yellow starthistle. Journal of Range Management 47, 450-456.
Zavaleta, E. S. and Hulvey, K. H. in process. Science.