Wildlife and Invasive Plants:

Finding Common Ground to Protect Ecological Diversity

A joint symposium sponsored by:

California Invasive Plant Council
and
The Western Section of
The Wildlife Society

Program and Abstracts

January 30 and 31, 2007
Portola Plaza Hotel
Monterey, California

2007 Wildlife and Invasive Plants Symposium

California Invasive Plant Council and The Western Section of The Wildlife Society

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2007 Wildlife and Invasive Plants Symposium
De Anza Room, Portola Plaza Hotel
Schedule at a Glance

Each session ends with a short panel discussion to allow interaction among the speakers and participation from the audience. *= Invited speaker

TUESDAY, JANUARY 30

9:00 to 10:00	**Opening Remarks and Keynote Addresses**
10:00 to 10:20	**BREAK**
10:20 to 11:40	**Impacts of Invasive Plants on Wildlife** (Moderator: Elizabeth Brusati, Cal-IPC)
11:40 to 12:00	Panel discussion
12:00 to 1:00	**LUNCH** (boxed lunches provided in foyer)
1:00 to 2:20	**Wildlife Using and Dispersing Invasive Plants** (Moderator: Christy Brigham, National Park Service)
2:20 to 2:40	Panel discussion
2:40 to 3:00	**BREAK**
3:00 to 4:20	**Balancing Invasive Plant Control with Protecting Wildlife** (Moderator: John Knapp, Catalina Island Conservancy)
4:20 to 5:00	Panel discussion
5:00 to 8:00 pm	**Poster Session, Welcome Reception, and Mixer (light appetizers and no-host bar) in the Lower Atrium**

WEDNESDAY, JANUARY 31

8:30 to 9:50	**Balancing Chemical Treatment of Invasive Plants with Wildlife Protection** (Moderator: Doug Johnson, Cal-IPC)
9:50 to 10:10	Panel discussion
10:10 to 10:30	**BREAK**
10:30 to 12:00	**Final Panel and Synthesis** (Moderators: John Knapp and Christy Brigham)
12:00	**ADJOURN**

GENERAL INFORMATION

Registration Desk. Registration materials, general information, and Cal-IPC and Western Section membership applications can be picked up at the registration desk. Cal-IPC publications and Western Section merchandise are also available for purchase here.

Refreshment and Lunch Breaks. Refreshments will be provided at the morning and afternoon breaks. A box lunch will be provided on Tuesday only. For information on local restaurants and attractions, check the insert in your registration packet or inquire at the registration desk.

Practice Room. A speaker practice room will be available throughout the meeting from Tuesday, 8a.m. through Wednesday, 12 p.m. for speakers to practice their presentations. To get into the room, please visit the registration desk to obtain a key.

Job Board. Job announcements can be posted and viewed at the job board near the registration desk.

Messages and Announcements. Messages and announcements can be posted and viewed at the message board near the registration desk.

Continuing Education Credits. The Department of Pesticide Regulation has approved 10.0 hrs of continuing education credit for this symposium in the "Other" category. You must sign an attendance sheet each day and turn in a scantron form for each day to receive credit. Codes are A-0276-07 (January 30, 7.0 hrs) and A-0277-07 (January 31, 3.0 hrs). Cal-IPC will report hours earned to DPR.

Professional Development. The number of contact hours for the symposium is equal to the number of actual hours spent in session and does not include time allotted for breaks or lunch. Maximum contact hours are 7.0 hours for January 30 and 3.0 hours for January 31. Information on the TWS professional development certificate is available on the TWS website by clicking on the link in the Western Section website at: www.tws-west.org

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California Invasive Plant Council
1442-A Walnut Street #462, Berkeley, CA 94709
www.cal-ipc.org

The Western Section of The Wildlife Society
P.O. Box 3275, Oakland, CA 94609 - 0275
www.tws-west.org

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Symposium Schedule

Each session ends with a short panel discussion to allow interaction among the speakers and participation from the audience. *= Invited speaker

TUESDAY, JANUARY 30

9:00 Opening Remarks. ***Elizabeth Brusati****, California Invasive Plant Council and* ***Christy Brigham****, National Park Service*

9:20 *Whacking Weeds While Wooing Wildlife. ***Steve Schoenig****, California Department of Food and Agriculture*

9:40 *Invasive Species Initiatives: A Summary of Current Programs and Efforts, ***Kevin Hunting****, California Department of Fish and Game*

10:00 BREAK

Impacts of Invasive Plants on Wildlife
(Moderator: Elizabeth Brusati, Cal-IPC)

10:20 * Impacts, Effects, and Food Webs: The Importance of Distinguishing Conservation and Ecological Perspectives in Animal-Invasive Plant Interactions. ***Rob Klinger****, UC Davis*

10:40 * Population, Community, and Ecosystem Consequences of an Invasive Plant in a Desert Sand Dune Landscape. ***Cameron Barrows****, UC Riverside*

11:00 * Impact of *Spartina alterniflora* Invasion on Resident Bird Species in San Francisco Bay Tidal Salt Marshes, ***J. Cully Nordby****, UCLA Institute of the Environment*

11:20 Yellow Star-Thistle On Santa Cruz Island: An Overview of 20 Years of Studies. ***John F. Barthell****, University of Central Oklahoma****;*** Robbin W. Thorp, *UC Davis; Adrian M. Wenner, UC Santa Barbara; Harrington Wells, University of Tulsa; John M. Randall, UC Davis and The Nature Conservancy*

11:40 Panel discussion

12:00 LUNCH (boxed lunches provided in lower atrium)

Wildlife Using and Dispersing Invasive Plants
(Moderator: Christy Brigham, National Park Service)

1:00 * The Role of Bird Dispersal in Plant Invasion Pattern. ***Clare E. Aslan*** *and Marcel Rejmanek, UC Davis*

1:20 * Nonnative Ungulates as Agents for Spread of Invasive Plants in Island and Mainland Ecosystems. ***Rick A. Sweitzer****, University of North Dakota*

1:40 * Stop Planting Those Pine Nuts! Seed Dispersal by Native Animals as a Factor in Invasive Plant Control Programs. ***Sarah Chaney****, Channel Islands National Park*

2:00 * Comparison of Wildlife Use of Invaded, Intact, and Restored Coastal Sage Scrub Habitats in Southern California. ***Christy A. Brigham****, National Park Service, Santa Monica Mountains National Recreation Area*

2:20 Panel discussion

2:40 BREAK

Balancing Invasive Plant Control with Protecting Wildlife
(Moderator: John Knapp, Catalina Island Conservancy)

3:00 * Controlling Invasive Plants and Animals: Observations and Lessons from Island Restoration Projects. ***Peter Schuyler***

3:20 * San Francisco Estuary *Spartina* Control with California Clapper Rail Habitat. ***Erik Grijalva,*** *CA Coastal Conservancy Invasive Spartina Project*

3:40 Analysis of Threats to Mammal and Bird Colonies from Non-Native Invasive Plants on Offshore Islands of the California Coastal National Monument. ***James Weigand****, USDI Bureau of Land Management, Julieanne Hopkins, Land Trust of Santa Cruz County, Jennifer Wheeler, USDI Bureau of Land Management*

4:00 * The Santa Ana River Watershed Program, 1997-2006. ***Dick Zembal****, Orange County Water District*

4:20 Panel discussion

5:00 **Poster Session, Welcome Reception, and Mixer (light appetizers and no-host bar) in the Lower Atrium**

1. Southern Watersnakes (*Nerodia fasciata*) in Folsom, California: A New and Potentially Invasive Species in Northern California. ***Peter Balfour****, ECORP Consulting, Inc., and Eric Stitt, Environmental Planning Group*
2. Monitoring Federally Listed Wildlife Species in Conjunction with Weed Control within Camp Pendleton Riparian Areas. ***Todd Easley*** *and Benjamin Lardiere, MCB Camp Pendleton*
3. The Invasive Species Program at the California Department of Fish and Game. *Susan Ellis and* ***Julie Horenstein****, California Dept. of Fish and Game*
4. Use of a Land Imprinter for Native Grass Planting in the Sierra Nevada Foothills, Central California. ***James S. Jones*** *and Kent Reeves, East Bay Municipal Utility District*
5. Using Native Perennial Grasses to Control Yellow Starthistle (*Centaurea solstitialis*). ***James S. Jones*** *and Kent Reeves, East Bay Municipal Utility District*
6. How Animals Influenced and Were Influenced by the Large-Scale Expansion and Small-Scale Contraction of Fennel on Santa Cruz Island, California. ***Rob Klinger****, UC Davis, Jennifer Gibson, Whiskeytown National Recreation Area, Robbin W. Thorp, UC Davis, William K. Fox, Ventura College*
7. Using Nuisance Phone Call Reports to Determine The Urban Habitat Preferences of Raccoons, Opossums, And Skunks in Brevard County, Florida. ***Christine Klinkowski****, Michael Kutilek, John Matson, and Shannon Bros, San Jose State University, Department of Biological Sciences.*
8. Evaluating Habitat Threats in Rangeland Ecosystems of the Western U.S. ***Mary Rowland***[1]*, Lowell H. Suring*[1]*, Michael J. Wisdom*[1]*, Robin J. Tausch*[1]*, Bryan Endress*[2]*.* [1]*USDA Forest Service,* [2]*Oregon State University*
9. Restoration and Successional Patterns of Native Habitats in the Moss Landing Region. ***Peter Slattery*** *and Gage Dayton, Moss Landing Marine Laboratory*
10. Grassland Restoration Impacted by Herbivore-Mediated Apparent Competition with *Brassica nigra*. ***Marti Witter***[1]*, John Orrock*[2] *and O. J. Reichman*[2]
[1]*National Park Service, Santa Monica Mountains National Recreation Area, Thousand Oaks, CA,* [2]*National Center for Ecological Analysis and Synthesis, University of California, Santa Barbara, Santa Barbara, CA*

WEDNESDAY, JANUARY 31

Balancing Chemical Treatment of Invasive Plants with Wildlife Protection
(Moderator: Doug Johnson, Cal-IPC)

8:30 * Potential Wildlife Impacts of Herbicides Used in Restoration: Background and Current Status. ***Joel Trumbo***, *California Department of Fish and Game*
8:50 * USDA Forest Service Pesticide Risk Assessments: Methods, Utility and Limitations. ***David Bakke***, *USDA Forest Service*
9:10 * A Summary of Herbicide Effects to Wildlife. ***Shawna L. Bautista,*** *USDA Forest Service*
9:30 Herbicide Impacts on Wildlife: Emerging Issues. ***Caroline Cox***, *Center for Environmental Health*
9:50 Panel discussion

10:10 BREAK

10:30 **Final panel and synthesis**
(Moderators: John Knapp and Christy Brigham)
Several of our invited speakers will participate in a panel discussion and synthesis of issues raised during the past day and a half. Panelists will discuss how weed workers and wildlife biologists can best work together to protect biodiversity and ecosystem functions, as well as the gaps in research or management protocols that need to be addressed. Symposium attendees will be invited to submit questions using cards placed in their registration packets.

12:00 ADJOURN

Abstracts for Wildlife and Invasive Plants Symposium

Oral Presentations

The Role of Bird Dispersal in Plant Invasion Pattern
***Clare E. Aslan*[1]** and Marcel Rejmánek[2], University of California, Davis, Department of Evolution and Ecology, One Shields Avenue, Davis, CA 95616; 530/752-1092; [1]ceaslan@ucdavis.edu, [2]mrejmanek@ucdavis.edu

A number of habitually bird-dispersed plants that have been introduced to central California show little colonizing tendency here, despite their impact as invasive species in similar climates elsewhere. We review known patterns of bird-mediated dispersal of nonnative plants, identify gaps that might explain surprising noninvasiveness, and propose several studies examining the relationship between California's birds and nonnative plants exhibiting a spectrum of invasiveness. Toward one end of this spectrum lies *Olea europaea*, which exhibits only limited spread in the Central Valley, but is problematic in Australia. At the other end is *Rubus armeniacus*, a widespread, successfully bird-dispersed invader in California. Are local patterns of bird dispersal of a) invasive, b) native, and c) noninvasive, nonnative plants sufficient to dictate level of invasiveness? How can this spectrum approach address uncertainties including the mechanisms underlying invasion lag phase and the effects of fragmentation and reserve design on bird-mediated dispersal? Our conceptual framework and methods have been informed by a questionnaire distributed to ornithologists in four states in July-October, 2006, wherein records of bird use of nonnative plant species were assembled and will form the foundation of an internet-based database useful in this and other studies of the bird/invasive plant interface.

USDA Forest Service Pesticide Risk Assessments: Methods, Utility and Limitations
David Bakke, USDA Forest Service, Pacific Southwest Region, 1323 Club Drive, Vallejo, CA 94592; 707/562-8916; dbakke@fs.fed.us

Since 1995, the USDA Forest Service has developed a series of pesticide risk assessments. These risk assessments evaluate both human health risks and the risks to wildlife and plants from the use of pesticides. Over twenty pesticides have been evaluated through these peer-reviewed assessments, including some herbicides used in weed control. These assessments are used by the Forest Service as well as other agencies, such as the Bureau of Land Management and the National Park Service. Assessments are based on accepted risk assessment methodology, and utilize a wide range of test data. These assessments examine numerous exposure scenarios, which serve as the basis for conclusions on risk. The assessments are available online, and it is useful for land managers to understand how these documents are developed, what they contain, and how they can be used to assess risks to wildlife. As is always the case with such analysis, it is also important to understand the limitations inherent in these risk assessments.

Population, Community, and Ecosystem Consequences of an Invasive Plant in a Desert Sand Dune Landscape
Cameron Barrows, University of California at Riverside, 75-080 Frank Sinatra Dr., Palm Desert, CA, 92211; 760/834-0594; cbarrows@ucr.edu

Exotic species invasions are second only to habitat destruction as a threat to that biodiversity, but not all exotic species invasions result in measurable effects. Understanding the impacts of a given weed enables managers and scientists to practice informed triage, marshalling their limited resources to control those species with the greatest potential to impact native species. Our objective here was to determine whether Saharan mustard, *Brassica tournefortii*, is a threat to regional goals for protecting biodiversity. For those species measured, the result was an 80-90% reduction in flower and seed production for native annuals growing beneath the mustard canopy compared to those released from mustard competition. For the endangered Coachella Valley milkvetch, *Astragalus lentiginosus* var *coachellae*, plants on weeded plot averaged 40-50 seed pods per plant while on adjacent non-weeded plots the average was 5 pods. The impacts on vertebrates are more indirect; by disrupting aeolian processes that otherwise result in the loosely compacted sand preferred by many of the dune endemics, aeolian communities become increasingly comprised of habitat generalists. Of the vertebrate species measured only the threatened Coachella Valley fringe-toed lizard, *Uma inornata*, and the desert kangaroo rat, *Dipodomys deserti*, had negative responses to the occurrence of Saharan mustard.

Yellow Star-Thistle on Santa Cruz Island: An Overview of 20 Years of Studies

John F. Barthell, University of Central Oklahoma, 100 North University Drive, Edmond, OK, 73034; 405/974-2481; jbarthell@ucok.edu
Robbin W. Thorp, University of California, Davis, One Shields Avenue, Davis, CA, 95616; 530/752-0482; rwthorp@ucdavis.edu
Adrian M. Wenner, University of California, Santa Barbara, 967 Garcia Road, Santa Barbara, CA, 93103; 805/963-8508; wenner@lifesci.ucsb.edu
Harrington Wells, University of Tulsa, 600 South College, Tulsa, OK, 74104; 918/631-3071; harrington-wells@utulsa.edu
John M. Randall, University of California and The Nature Conservancy, One Shields Avenue, Davis, CA, 95616; 530/754-8890; jrandall@tnc.org

For the last twenty years our group has been studying ecological interactions among native and non-native plant and insect species on Santa Cruz Island, California. Much of this work focused on the role of positive (mutualism) and negative (competition and herbivory) interactions of insect species with the highly invasive, non-native plant yellow star-thistle, *Centaurea solstitialis*. Our early efforts identified the pollinator guilds of native and non-native host plants. Subsequent studies tested for a positive impact by a non-native pollinator species (the honey bee) on the reproductive capacity of the thistle. We then discovered, ten years later, the negative impact of non-native seed head predators (tephritid flies) on the same thistle populations. We are currently examining the role of another negative interaction (competition for pollinators) between the non-native thistle and a native gumplant, *Grindelia camporum*. Positive interactions (pollination among non-natives) may be most important during the early stages of invasion while negative interactions caused by natural enemies (e.g., seed head predators) may ultimately dampen range expansion. Colonization and range expansion may be further augmented by a non-native plant's ability to garner pre-existing, native pollinators from the environment (through competition) as well as its ability to attract non-native pollinators (through mutualism).

A Summary of Herbicide Effects to Wildlife

Shawna L. Bautista, USDA Forest Service, Pacific Northwest Region, PO Box 3623, Portland, OR 97208; 503/808-2697; sbautista@fs.fed.us

National herbicide risk assessments and peer-reviewed literature were used to characterize effects of herbicide use on free ranging wildlife present on National Forests in Oregon and Washington. These analyses significantly modified some of the typical thresholds of concern used to evaluate risk to wildlife. These modifications added a degree of caution to account for the value placed on wildlife species in the Pacific Northwest and the uncertainty inherent to the risk assessment process. The results of these analyses found that several commonly used herbicides may pose some unexpected risks to certain groups of wildlife that have not been reported before, most notably for grass-eating or insect-eating mammals and birds. 2,4-D exceeded these thresholds of concern in many scenarios. Triclopyr and dicamba pose significant risks to some animals in certain circumstances, including adverse affects to reproduction and mortality. Surprisingly, even glyphosate posed risks of adverse effects in some scenarios. The newer herbicides, including acetolactate synthesis (ALS) inhibitors, appear to pose very low risk to free-ranging wildlife, based on data currently available. This information was used to develop standards for herbicide use across the Pacific Northwest Region of the Forest Service.

Comparison of Wildlife Use of Invaded, Intact, and Restored Coastal Sage Scrub Habitats in Southern California

Christy A Brigham, National Park Service, Santa Monica Mountains National Recreation Area, 401 West Hillcrest Dr., Thousand Oaks, CA 91360; 805/370-2386; Christy_Brigham@nps.gov

Two assumptions are often made regarding invasive plant species, ecological restoration, and wildlife: 1) invasive plant species reduce habitat quality for wildlife and are not used as food or nesting material by animals; 2) if invasive plants are removed and native plants are established during a restoration project, animal use of a site will increase. In this study of coastal sage scrub restoration sites in Southern California I test these assumptions using an observational study of four sets of restored, invaded, and intact areas. In each of four study sites during the summer of 2006, 100 meter-long wildlife use transects were installed in a restored area, an invaded weedy area, and an intact habitat area. All sampling areas were located within 200 meters of one another. On each transect, I recorded data on scat, browsed plants, wildlife trails, gopher mounds, and woodrat nests. Here, I report on the first 5 months of sampling. Initial data indicate that restoration areas have a higher density of scat, browsed plants, and trails than either intact or invaded areas. In addition, animals appear to be browsing on some of the non-native invasive plant species in restoration areas but not in invaded sites.

STOP PLANTING THOSE PINE NUTS! Seed Dispersal by Native Animals as a Factor in Invasive Plant Control Programs

Sarah Chaney, Channel Islands National Park

Many plants introduced to the Channel Islands for ornament or utility have become invasive in their new habitat, often because their seeds or fruits are attractive to native and non-native animals, who act as efficient long-range dispersers of seeds. Land managers are presented with an interesting challenge trying to predict and contain spread of these plants, particularly when the plants also have historic or landscape values, so that eradication of the source population is not a favored option. On Santa Cruz Island, the relationship of Italian Stone Pine (*Pinus pinea*) on and the Santa Cruz Island Scrub Jay (*Aphelocoma insularis*) presents an interesting example of this challenging interaction. Control of domestic olive (*Olea europaea*) and Peruvian peppertree (*Schinus molle*) are also complicated by the presence of native and non-native animal vectors of their seeds.

Herbicide Impacts on Wildlife: Emerging Issues

Caroline Cox, Center for Environmental Health, 528 61st Street, Oakland, CA; 94609; 510/594-9864; caroline@cehca.org

Invasive plants can impact wildlife by altering habitat, food sources, and other resources necessary for wildlife survival. However, the tools that are used to manage invasive plants can also impact wildlife. In this presentation, I review recent research showing that herbicides, commonly used to manage invasive plants, can impact wildlife in what are often unexpected ways.

For example, the invasive plant herbicide imazapic can damage aquatic plants at low concentrations, thus potentially impacting the aquatic food chain and the wildlife that depend on it. Herbicides containing glyphosate, widely used to control invasive plants, can cause tadpoles to develop gonads with intersex characteristics. The herbicide 2,4-D can cause mutations in plants at low exposure levels that do not cause physiological effects, potentially having long-term impacts on wildlife food resources.

These kinds of impacts illustrate the importance of a multi-faceted approach to managing invasive plants. Long-term strategies for managing invasive plants will be most successful when the prevention of invasive plant problems is a primary component, and when control of invasive plants is done in the context of ecosystem restoration. These approaches avoid repeated herbicide applications with their potential for unintended impacts on wildlife.

San Francisco Estuary *Spartina* Control within California Clapper Rail Habitat

Erik Grijalva, CA Coastal Conservancy Invasive Spartina Project, 2560 9th Street, Suite 216, Berkeley CA 94710; 510/548-2359x202; ekgrijalva@earthlink.net

Joy Albertson, US Fish and Wildlife Service, 1 Marshlands Road, Fremont, CA, 94560; 510/792-0222x32; joy_albertson@fws.gov

Tidal marsh systems of the San Francisco Estuary have been invaded by four species of non-native Cordgrass (*Spartina*). Two species, *S. alterniflora* and *S. densiflora*, have wide distributions within the Estuary, and occupy marsh elevations shared by the federally endangered California clapper rail (*Rallus longirostris obsoletus*). A major *Spartina* eradication effort sponsored by federal and state entities is currently underway throughout the estuary. Much of this *Spartina* control work takes place directly in clapper rail occupied habitat, and surveys of clapper rail populations show increased use of fringing marsh areas invaded by non-native *Spartina* stands. In order to assess the short and medium term effects of *Spartina* control operations on populations of clapper rail, the Invasive Spartina Project (ISP) in collaboration with the US Fish and Wildlife Service developed a habitat model that integrates treatment approaches with clapper rail distribution and population data. This model was used to develop site-specific plans for each of the 136 *Spartina*-infested marshlands of the estuary. However, much about clapper rail life history is unknown. In an effort to fill in data gaps, the ISP coordinates yearly clapper rail surveys in all marshes targeted for *Spartina* treatment work, and is involved in further research on clapper rail habits within and between marshes.

Invasive Species Initiatives: A Summary of Current Programs and Efforts

Kevin Hunting, California Department of Fish and Game, Habitat Conservation Branch, 1416 Ninth Street, Sacramento, CA 95814; khunting@dfg.ca.gov

Invasive species impacts on ecological systems and particularly declining or vulnerable wildlife populations is well documented and has eclipsed other factors as one of the biggest threats to these systems and species faced by resource managers today. A recent initiative by the California Resources Agency to identify invasive species programs currently operating within California resulted in a summit intended to create opportunities for inter-agency collaboration on detection, prevention, and management approaches. The successful summit involving 23 state and

federal agencies revealed a wide variety of programs and efforts most of which remain under-funded. This paper will summarize the various programs underway, describe specific actions identified in the Departments California Wildlife Action Plan, and provide an update on the status of the initiative and statewide invasive species plan.

Impacts, Effects, and Food Webs: The Importance of Distinguishing Conservation and Ecological Perspectives in Animal-Invasive Plant Interactions.

Rob Klinger, Section of Evolution & Ecology, Storer 5328/5335, University of California, Davis, CA 95616; 530/752-1092; rcklinger@ucdavis.edu

A number of examples from island and mainland systems provide compelling evidence of the complex relationships between animals and invasive plants. Unanticipated outcomes have resulted from these interactions, many of which have not been desirable from a conservation perspective. But, from an ecological perspective, these outcomes are not surprising. While unanticipated outcomes are a result in part of the complexity inherent in ecological systems, they also reveal subtle biases that confound ecological and conservation perspectives. Conservation perspectives are value based, but ecological perspectives are not. A critical implication of the ecological perspective is that management of invasive plant species, especially those present for long periods of time, is likely to send systems on unpredictable trajectories. This may lead to various states and transitions, some of which may or may not meet "restoration" or "recovery" goals. Within a given phase of invasion, the influence animals and invasive plants have on one another will depend on: (1) the direction and strength of interaction between animal and invasive plant species; and, (2) stochastic environmental events that alter interaction strengths. Because of the inherent complexity in ecological systems, invasive species management programs would benefit greatly by: (1) using multi-trophic level conceptual models as a management program framework; (2) identifying the phase of the invasion process target species are in; and (3) separately evaluate program outcomes from conservation and ecological perspectives.

Impact of *Spartina alterniflora* Invasion On Resident Bird Species In San Francisco Bay Tidal Salt Marshes

J. Cully Nordby, UCLA Institute of the Environment, La Kretz Hall, Suite 300, Box 951496, Los Angeles, CA, 90095-1496; 310/276-5607; nordby@ucla.edu

Atlantic smooth cordgrass (*Spartina alterniflora*) was introduced into San Francisco Bay in the 1970s, and has since spread and hybridized with native cordgrass (*S. foliosa*). The profound changes in habitat structure and composition that accompany the hybrid invasion will likely have the greatest impact on species, such as birds, that are wholly dependent on the tidal salt marsh system. California clapper rails (*Rallus longirostris obsoletus*), a federally endangered species, and Alameda song sparrows (*Melospiza melodia pusillula*), a California Species of Special Concern, are two members of this community that reside entirely within the salt marshes in San Francisco Bay. These birds, particularly song sparrows, are affected not only by the hybrid *Spartina* invasion directly, but also indirectly by an increase in competitive interactions with marsh wrens (*Cistothorus palustris*) who are occupying the newly available habitat. A comparison of the distribution and abundance of species in invaded marshes and uninvaded marshes reveals that while native birds may occupy invaded marshes, alteration of tidal marsh habitat associated with the invasion may be favoring marsh wrens, who normally occupy fresh- or brackish-water marshes, over saltmarsh-obligate species.

Whacking Weeds While Wooing Wildlife

Steve Schoenig, California Department of Food and Agriculture, 1220 N Street, Room A357, Sacramento, CA, 95814; sschoenig@cdfa.ca.gov

"Weed workers" (those who work to control invasive plants) and wildlife biologists share common goals of protecting biodiversity and ecosystem services, and more specifically, preserving native plants and wildlife. Conflicts can arise when projects to protect one species have negative impacts on another. We all tend to think inside our own boxes; this symposium provides an opportunity to understand each others' perspectives.
Weed workers focus on the plants that form the base of the food web and the structure of habitat. We work to reduce the impacts of invasive plants, such as the changes to fire regimes and nutrient cycles, and the dense monocultures that eliminate native vegetation (and often its associated wildlife). While our projects have a stated goal of removing a particular plant, the larger goal is always to restore habitat and improve native biodiversity, with the implied goal of supporting all levels of the food web to produce a better-functioning ecosystem. Of course, not all invasive plants have negative impacts on all wildlife, and the success of our ultimate goal depends upon balancing the needs of plants and animals.
Finally, weed workers represent a broad range of interests. For example, the membership of Cal-IPC includes agency employees, researchers, and other professional biologists, but also ranchers, native plant enthusiasts, and volunteers who use weed work as a means of learning about their local habitats.

Controlling Invasive Plants and Animals
Peter Schuyler
Removal or control of invasive plant and animal species known to have negative effects on native species or ecosystems is often a management objective of natural area resource managers. Success of these control efforts is dependent not only on understanding the biological and ecological impacts of the actual control program but also by anticipating and planning for the likely consequences of removing the invasive species from the ecosystem. Clearly stating management objectives and establishing monitoring protocols at the outset to not only measure progress towards reaching desired outcomes but to also detect unexpected consequences is critical to successful program implementation. Likewise, understanding the cultural, social and economic values that surround the species is important to achieve success. Invasive species control efforts on the California Channel Islands, in Hawaii, and on other Pacific islands provide good examples of the complexities and challenges faced by land managers. Evaluating desired outcomes as well as highlighting unexpected consequences while reviewing practical and logistical program considerations may help provide a framework to structure future invasive species control efforts to achieve desired biological and ecological outcomes in an efficient and effective manner.

Non-Native Ungulates as Agents for Spread of Invasive Plants in Island and Mainland Ecosystems
Rick A. Sweitzer, University of North Dakota, Department of Biology, Grand Forks, ND, 58202; 701/777-4676; richard_sweitzer@und.nodak.edu

Hooved mammals (ungulates) have long been important to human societies for performing labor, providing transportation, as sources of food and other products when they are harvested or slaughtered, and as symbols of the beauty and wildness of nature. Humans have been something of an invasive species by our spread to all corners of the Earth. We also contributed to establishment of many feral ungulates when domestic livestock were allowed to free range in different island and continental ecosystems. Feral pigs were established around several coastal Spanish settlements in California by the 1850s, whereas bison were introduced to Santa Catalina Island in the 1920s to film a western movie. Feral pigs are now widespread across most of mainland California and bison roam over all but a relatively small area of Santa Catalina Island. Invasive plants are commonly associated with disturbance, which feral pigs produce when rooting for belowground plant parts and invertebrates, and which bison cause when wallowing to shed hair or during mating displays. In this paper, I will present information from several current studies where my colleagues and I are investigating how wallowing by bison may serve as an important mechanism for dispersal of invasive plants on Santa Catalina Island, and how rooting by feral pigs may be contributing to the spread and persistence of many types of nonnative grasses and other vascular plants in oak woodland ecosystems of mainland California.

Potential Wildlife Impacts of Herbicides Used in Restoration: Background and Current Status
Joel Trumbo, California Department of Fish and Game, 1701 Nimbus Road, Suite F, Rancho Cordova, CA 95670; 916/358-2952; jtrumbo@ospr.dfg.ca.gov

Over the last 20 years, land managers have increasingly relied on herbicides as tools for restoring wildlife habitats, particularly in areas that have been invaded by exotic plant species. In spite of this trend, questions still remain about the ecological appropriateness of herbicide use in wildland sites. Herbicide impacts on amphibians and the role of herbicides in wildlife endocrine disruption are just two examples from this debate.
Answering the question whether or not an herbicide is appropriate for use in a wildland setting requires a good understanding of several topics. Among these are the relationship amongst hazard, toxicity and exposure; the difference between lethal and sublethal impacts; and the role herbicides may play in increasing the impacts of other hazards to wildlife including predation and non-pesticide pollution. An examination of these, and other similar issues, must be undertaken before a land manager can make an informed decision about herbicide use to control invasive species in wildland areas.

Analysis of Threats to Mammal and Bird Colonies from Non-Native Invasive Plants on Offshore Islands of the California Coastal National Monument
James Weigand, USDI Bureau of Land Management, 2800 Cottage Way, Sacramento CA, 95825; James_Weigand@ca.blm.gov
Julieanne Hopkins, Land Trust of Santa Cruz County, 617 Water St., Santa Cruz, CA 95060; julieannehopkins@landtrustsantacruz.org
Jennifer Wheeler, USDI Bureau of Land Management, 1695 Heindon Rd., Arcata, CA 95521; Jennifer_Wheeler@ca.blm.gov

Extent of the invasive, non-native flora is poorly known for the 15,000+ California sea stacks and other coastal islands less than 5 ha in area. Diverse coastline ecosystems nearby, however, have more than 550 non-native vascular plant species and of which some 43 constitute major invasions. The USDI Bureau of Land Management has assessed the risk of plant invasions to these islands, the role of native and non-native animals as vectors, and the subsequent threats to native vegetation in habitats of marine mammal and bird colonies on monument islands. The greatest effort for control and management is needed for islets off the Sonoma and Mendocino coasts. Hottentot fig (*Carpobrotus edulis*) presents the greatest risk to transform habitat, but invasive Poaceae collectively present the greatest technical challenges to control. Management for invasive plant species that occur in California can find useful guidance from practices in place in Australia and New Zealand for small islands that are home to colonies of Hydrobatidae and other burrow- and crevice-nesting species. Logistical obstacles to access, assess, and treat invasive plant populations on these islands remain formidable and spike management costs.

The Santa Ana River Watershed Program 1997-2006

Richard Zembal, Natural Resources Director, Orange County Water District, 10500 Ellis Avenue, Fountain Valley, CA 92708; 714/378-3213; rzembal@ocwd.com

Encompassing 3,200 square miles, the Santa Ana River Watershed is the largest drainage in coastal southern California. The river originates in the San Bernardino and San Gabriel Mountains and flows over 100 miles through San Bernardino, Riverside, Los Angeles and Orange Counties to the Pacific Ocean. The river's natural resources are still abundant and are highlighted in this presentation but they are greatly affected by the large and growing human population in the watershed. The Santa Ana River Watershed Program was formed in 1997 to restore the natural functions of the river through control of destructive, invasive species, restoration of habitat, and wildlife management emphasizing rare and endangered species. The Watershed Program is a collaborative attempt of the Santa Ana Watershed Association to focus public and private funding on prioritized natural resources issues. The component agencies include the four Resource Conservation Districts on the river, Orange County Water District, and the U.S. Army Corps of Engineers. There are many other participants including the U.S. Fish and Wildlife Service, Regional Water Quality Control Board, Santa Ana Watershed Project Authority, Riverside County Parks and Open Space District, the counties, cities, among many others. Nearly 3,000 acres of giant reed, *Arundo donax* have been removed at a cost of approximately $16,000,000 and native riparian habitat has expanded into at least 60% of the reclaimed floodplain.

Posters

Southern Watersnakes (*Nerodia fasciata*) in Folsom, California: A New and Potentially Invasive Species in Northern California.

Peter S. Balfour, ECORP Consulting, Inc., 2525 Warren Drive, Rocklin, CA 95670; 916/782-9100; pbalfour@ecorpconsulting.com
Eric W. Stitt, Environmental Planning Group, 330 E. 13th Street, Tucson AZ, 85701; 520/795-2001; estitt@epgaz.com

An introduced population of southern watersnake (*N. fasciata*) in Folsom, California, discovered in 1992, persists within the Humbug-Willow Creek drainage, including its confluence with the American River. An eradication effort was undertaken by California Dept. of Fish and Game in 1992 and 1993 and by us in 1999 through the present. We recently completed a study, funded by the Central Valley Project Improvement Act (CVPIA), to evaluate the current distribution of *N. fasciata* and to eradicate snakes as we encountered them. We employed various trapping techniques including modified minnow traps, coverboard arrays, and aquatic "mist nets," and used radiotelemetry to determine patterns of behavior and space use. In many instances, *N. fasciata* used non-native upland and wetland plant species for cover. Snakes were found to readily retreat into dense patches of yellow star thistle (*Centaurea solstitialis*) and Himalayan blackberry (*Rubus discolor*) in upland areas, while water hyacinth (*Eichornia crassipes*) and Azolla (*Azolla spp*.) represented aquatic cover species.
While the snakes appear to be less abundant following our efforts, *N. fasciata* undoubtedly still persists. This species has a wide breadth of physiological tolerances, occurs in all types of freshwater systems within its native range, and is quite fecund. Although only speculative at this point, we believe that *N. fasciata* poses a potential threat to native wildlife in northern California, including threatened and endangered species (e.g. *Thamnophis gigas*). We suggest that certain life-history traits may predispose watersnakes to establishing extralimital populations, and that the evidence supports listing watersnakes as potentially injurious invasive species. Their use of non-native invasive plants as sources of cover makes capture efforts increasing difficult.

Monitoring Federally-listed Wildlife Species in Conjunction with Weed Control within Camp Pendleton Riparian Areas

Todd A Easley, Wildlife Management Branch; AC/S Environmental, Bldg. 22165, MCB Camp Pendleton, CA 92055; 760/763-5848; todd.easley@usmc.mil
Benjamin M. Lardiere, Land Management Branch, AC/S Environmental, Bldg. 22165, MCB Camp Pendleton, CA 92055; 760/763-5850; benjamin.lardiere.ctr@usmc.mil

From the mid-1990's through the mid-2000's extensive invasive weed control occurred and continues within Camp Pendleton's (US Marine Corps Base, CA) riparian areas, primarily focusing on *Arundo donax*, *Tamarix spp*., and *Lepidium latifolium*. These invasive weed species have been known to form dense stands within riparian areas of coastal Southern California, potentially displacing the native habitat supporting the federally endangered least Bell s vireo (*Vireo bellii pusillus*), Southwestern willow flycatcher (*Empidonax traillii extimus*), and the Southwestern arroyo toad (*Bufo californicus*). It is expected that the weed control will facilitate the recovery of native habitat and promote the increase in sensitive wildlife species populations. The main objectives of this poster are to show the current and historical efforts of riparian weed control and the resulting increase in sensitive wildlife species; additionally displaying data on the distribution, abundance and breeding activities of federally listed wildlife species occurring in these riparian areas on Camp Pendleton.

The Invasive Species Program at the California Department of Fish and Game

Susan Ellis and Julie Horenstein, Habitat Conservation Planning Branch, California Department of Fish and Game, Sacramento, CA; jhorenstein@dfg.ca.gov

The Invasive Species Program is a relatively new program located within the Habitat Conservation Planning Branch at the California Department of Fish & Game (DFG). Its mission is to reduce the impacts of nonnative invasive species on California's natural resources. Nonnative species reduce the native biodiversity in this state through predation, parasitism, disease infection, competition for resources, and habitat degradation. The Invasive Species Program works throughout California with agencies at all government levels, the academic community, professional organizations, community and interest groups on cooperative planning and actions to achieve their mission. We work on plants and animals in terrestrial and aquatic environments. Recently, under the direction of the Program's Coordinator, Susan Ellis and Abe Doherty of the State Coastal Conservancy, the draft "California Aquatic Invasive

Species Management Plan" has been completed, undergone public review and is now being finalized. The "Draft Rapid Response Plan for Aquatic Invasive Species in California" was also recently completed by Invasive Species Program staff.
Prior to the formation of the Invasive Species Program, invasive species control within DFG focused primarily on weed control on staffed DFG Wildlife Areas and enforcement of laws that regulate the importation, transport or possession of non-native species. As more decision-makers around the country became aware of the problems posed by non-native invasive species, it became important for DFG to have a centralized program to connect with the coordination, planning and funding entities that have mushroomed around this topic in the approximately last fifteen years. The Invasive Species Program fills that role and also works to support invasive species detection, control and enforcement efforts carried out through various DFG programs. We will work with others in DFG to implement best management practices for invasive species control in all DFG programs. Related state-wide programs within DFG include the Pesticide Investigations Unit and the Ballast Water Program, both of which are located in the DFG Office of Spill Prevention and Response. We also work frequently with DFG Marine Region staff on efforts to detect and control the spread of non-native marine species in coastal areas.

Use of a Land Imprinter for Native Grass Planting in the Sierra Nevada Foothills, Central California
James S. Jones, and Kent A. Reeves, East Bay Municipal Utility District, 1 Winemasters Way Suite K2, Lodi, CA 95240; Jones: 209/365-1097; jjones@ebmud.com; Reeves: 209/365-1096; kreeves@ebmud.com

The process of grassland restoration is complicated enough without creating problems. Equipment choice can directly influence the amount of work associated with a restoration project. In 2001 East Bay Municipal Utility District (EBMUD) began a test project on 6 hectares of annual grassland/blue oak woodland to reduce and control yellow starthistle (*Centaurea solstitialis*). A seeding method was sought that was reliable, would limit erosion concerns, required less site preparation (removal of plant matter), and could simultaneously apply a variety of seed sizes. A land imprinter was chosen for the project. The advantages and disadvantages of using the land imprinter will be discussed. The success of the restoration site will also be discussed.

Using Native Perennial Grasses to Control Yellow Starthistle (Cenaturea solstitialis)
James S. Jones, and Kent A. Reeves, East Bay Municipal Utility District, 1 Winemasters Way Suite K2, Lodi, CA 95240; Jones: 209/365-1097; jjones@ebmud.com; Reeves: 209/365-1096; kreeves@ebmud.com

The removal of weed species by itself is insufficient to restore native grasslands. Spaces left in the ecological system will be filled, either by undesirable or desirable species. The desirable species composition can be influenced by planting self-sustaining native grasses. In 2001 EBMUD began a test project on six hectares of annual grassland/blue oak woodland to reduce and control yellow starthistle. Prior to planting, the site was prepared with controlled burns and herbicide application in the summer and fall 2001. A land imprinter was used to seed the site in winter 2002. A mixture of purple needlegrass (*Nassella pulchra*), nodding needlegrass (*N. cernua*), California oniongrass (*Melica californica*), big squirreltail (*Elymus multisetus*), blue wildrye (*Elymus glaucus*), California brome (*Bromus carinatus*), Idaho fescue (*Festuca idahoensis*), and pine bluegrass (*Poa secunda secunda*) were seeded at a density of 2,153 seeds/square meter. Mycorrhizal fungi was applied, at a rate of 40 kg/hectare, with the seeds. The site was again treated with herbicides for weed suppression in spring 2002 and 2003. The site has been monitored annually using percent species composition. Native grasses are well established and yellow starthistle is significantly reduced. Changes in the species composition and types of weed control will be discussed.

How Animals Influenced and Were Influenced by the Large-Scale Expansion and Small-Scale Contraction of Fennel on Santa Cruz Island, California.

Rob Klinger, Section of Evolution & Ecology, Storer 5328/5335, University of California, Davis, CA 95616; 530/ 752-1092; rcklinger@ucdavis.edu.
Jennifer Gibson, National Park Service, Whiskeytown National Recreation Area, 14412 Kennedy Memorial Drive, Whiskeytown, CA 96095; 530/242-3457; Jennifer_Gibson@nps.gov
Robbin W. Thorp, Department of Entomology, University of California, Davis, CA 95616; 530/752-0482; rwthorp@ucdavis.edu
William K. Fox, Department of Biological Science, 4667 Telegraph Road, Ventura College, Ventura, CA 93003; 805/654-6400; leaddawg@earthlink.net

Fennel, a perennial non-native forb from the Mediterranean region, underwent a period of rapid spread following removal of non-native grazing mammals from Santa Cruz Island, California. The distribution and cover of fennel doubled in one year, and within seven years it occurred across 15% of the island, often in virtual monocultures that

exceeded two m in average height. Results of long-term (1990-2001) monitoring and experimental studies indicated complex interactions between fennel, native and non-native plants, and native and non-native animals. Direct and indirect effects of the spread and control of fennel on plants and animals were due to herbivory, dispersal limitation, resource availability, and altered habitat structure. Removal of grazing pressure was a key factor in the expansion of fennel, but several other factors were important as well, including seed dispersal by feral pigs, native rodents and birds. Although native plant species tended to have a negative relationship with increased fennel cover, many native animals showed a positive response. Species richness and/or population density of rodents and birds was as great or greater in fennel stands than other vegetation types. However, lizard distribution and abundance were related to structural changes in habitat, with increased fennel cover favoring one species (southern alligator lizard; *Elgaria multicarinata*) but displacing another (side-blotched lizard; *Uta stansburiana*). Patterns of diversity and species composition of invertebrate guilds were driven primarily by an interaction between rainfall and alteration of vegetation structure. Diversity of aerial-dwelling families decreased in areas where fennel was controlled, but this was offset by a greater increase in diversity of ground-dwelling families. Changes in abundance of lizard species were observed in fennel control areas as well; the abundance of side-blotched lizards increased while that of southern alligator lizards decreased. The vast majority of studies on non-native plant invasions have focused on impacts to native plant species, but animals may show very different responses than that of vegetation. Programs targeted at controlling non-native plants need to consider not just how these will affect vegetation, but also the magnitude and duration to which control programs will affect higher-order interactions involving animals.

Using Nuisance Phone Call Reports to Determine the Urban Habitat Preferences of Raccoons, Opossums, and Skunks in Brevard County, Florida

Klinkowski, Christine A. M.S. Candidate, Department of Biological Sciences, San Jose State University, 10010 Phar Lap Drive, Cupertino, CA 95014, USA, (408) 482-8573; c_klinkowski@hotmail.com.
Kutilek, Michael. San Jose State University, Department of Biological Sciences, One Washington Square, San Jose, CA 95192, E-mail: mkutilek@email.sjsu.edu.
Matson, John O. San Jose State University, Department of Biological Sciences, One Washington Square, San Jose, CA 95192, E-mail: jmatson@email.sjsu.edu.
Bros, Shannon. San Jose State University, Department of Biological Sciences, One Washington Square, San Jose, CA 95192. E-mail: sbros@biology.sjsu.edu.

The focus of the present study was to determine the urban habitat preference of mesocarnivores using nuisance phone call reports from the public. I used verified phone calls made to Brevard Animal Services over four years (2000, 2003, 2004 and 2005) as indicators of mesocarnivore presence. I included the calls in a GIS along with census tract demographics and a land use land cover layer. Non-adjacent quadrats were created for sampling using a random raster with 2.0 km^2 grid cells. I used backwards stepwise multiple linear regression analyses to determine which land cover categories may best predict habitat preference of raccoons, opossums, and skunks in urban areas. I tested areas of land covers as the independent variables and verified sightings as the dependent variables. The results show that raccoons are more abundant in commercial areas and less abundant in areas with upland forest, agriculture, and areas with large bodies of water. Opossums are more abundant in commercial, industrial, and residential high-density categories and less abundant in areas with agriculture. Skunks are more abundant in commercial and upland non-forested areas but less abundant in areas with transportation (plus communications and utilities), residential high-density categories, and areas with large bodies of water.

Evaluating Habitat Threats in Rangeland Ecosystems of the Western United States

Mary M. Rowland, USDA Forest Service, PNW Res. Station, 1401 Gekeler Lane, La Grande, OR 97850; 541/962-6582; mrowland@fs.fed.us
Lowell H. Suring, USDA Forest Service, WO Aquatic Sciences Laboratory, 322 E. Front St., Suite 401, Boise, ID 83702; 208/373-4351; lsuring@fs.fed.us
Michael J. Wisdom, USDA Forest Service, PNW Res. Station, 1401 Gekeler Lane, La Grande, OR, 97850; 541/962-6532; mwisdom@fs.fed.us
Robin J. Tausch, USDA Forest Service, Rocky Mt. Res. Station, 920 Valley Rd., Reno, NV 89512; 775/784-5329; rtausch@fs.fed.us
Bryan Endress, Oregon State University, FRSL, 1401 Gekeler Lane, La Grande, OR, 97850; 541/962-6533; Bryan.Endress@oregonstate.edu

Threats to wildlife habitats from invasive plants assume myriad forms, but two such threats displacement of native vegetation by cheatgrass (*Bromus tectorum*) and expanding pinyon-juniper (*Pinus spp.-Juniperus spp.*) woodlands currently impact extensive areas of the Great Basin and adjacent ecoregions. Using rule-based predictive models,

we estimated area of habitat at risk from these two threats for a suite of 40 sagebrush-associated terrestrial vertebrates. Vertebrates were grouped by similarities in habitat associations into five groups: sagebrush, sagebrush-woodland, salt desert shrub, shrubland, and generalist. We estimated that 15.3 million ha (~53%) of the Great Basin is at moderate or greater risk of displacement by cheatgrass. Similarly, we estimated that >40% of the sagebrush (*Artemisia spp*.) in the eastern Great Basin is at moderate or greater risk of displacement by pinyon-juniper woodlands. Habitats for the salt desert shrub group were most at risk from cheatgrass, and sagebrush habitats for a variety of species were at risk from woodland encroachment. We are currently evaluating both models with remotely sensed imagery and field data to be collected in 2007. Initial evaluation of the models will occur in the John Day Province of central Oregon and the Mono Province of Eastern California and Western Nevada.

Restoration and Successional Patterns of Native Habitats in the Moss Landing Region
Peter Slattery**,** Moss Landing Marine Labs, 8272 Moss Landing Road, Moss Landing, CA 95039;
John Oliver, Robert Burton and ***Gage Dayton***, gdayton@mlml.calstate.edu

Planting and seeding fast growing native plant species play a critical role in establishing native flora on restoration sites. Rapid establishment and greater coverage enables native species to get a "foot hold" prior to invasive species becoming established. Here we present the results of restoration efforts (as well as natural succession patterns) in wetland, dune, and oak woodland habitats in the Moss Landing Region of Central California.

Grassland Restoration Impacted by Herbivore-mediated Apparent Competition with *Brassica nigra*.
Marti Witter[1], John Orrock[2] and O. J. Reichman[2]; [1]National Park Service, Santa Monica Mountains National Recreation Area, Thousand Oaks, CA; [2]National Center for Ecological Analysis and Synthesis, University of California, Santa Barbara, Santa Barbara, CA

Recent work has suggested that consumer-mediated indirect effects may play an unappreciated role in the dynamics of biological invasions. We examined the hypothesis that the restoration of native grasslands in California that have been invaded by an exotic forb (*Brassica nigra*) may be compromised because *B. nigra* increases the impact of native consumers on native plants (i.e. apparent competition). We tested this hypothesis by seeding a native grass, *Nassella pulchra*, into forb-dominated communities without *B. nigra* and into communities dominated by *B. nigra*. In each community type, experimental exclosures were used to control consumer access. We found that native *N. pulchra* may be unable to invade communities dominated by exotic *B. nigra* because consumer pressure on natives is substantially greater in *B. nigra*. In addition, we find a gradient of consumption whereby consumer impact on native *N. pulchra* decreases with distance to the nearest patch of *B. nigra*, suggesting that the protective cover offered by *B. nigra* may affect the spatial extent of consumer-mediated apparent competition. Our results offer evidence that restoration and natural regeneration of native grasses may be limited by the way non-native plants increase the impact of native consumers on native plants.

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