The Rare and Endangered Species and Invasive Species Threats (RESIST) program for invasive species management in sensitive species habitats

Final Report

Andrea S. Thorpe, Corinne M. Duncan, Thomas N. Kaye, and Amy S. Young

Institute for Applied Ecology

This project jointly funded by
Institute for Applied Ecology, Corvallis, Oregon
USDI Bureau of Land Management, Roseburg District

This report is the result of a cooperative Challenge Cost Share project between the Institute for Applied Ecology (IAE) and a federal agency. IAE is a non-profit organization whose mission is conservation of native ecosystems through restoration, research and education. Our aim is to provide a service to public and private agencies and individuals by developing and communicating information on ecosystems, species, and effective management strategies and by conducting research, monitoring, and experiments. IAE offers educational opportunities through 3-4 month internships. Our current activities are concentrated on rare and endangered plants and invasive species.

Questions regarding this report or IAE should be directed to:
Andrea S. Thorpe (Program Director)
Institute for Applied Ecology
PO Box 2855
Corvallis, Oregon 97339-2855

phone: 541-753-3099, ext. 401
fax: 541-753-3098
andrea@appliedeco.org

ACKNOWLEDGMENTS

We wish to thank Susan Carter and Gary Basham of the Roseburg District BLM for their support of this project. Claire Hibler also provided valuable input regarding her experience working with invasive species in the Salem District BLM. We thank IAE staff Michelle Allen, Denise Giles-Johnson, Thomas N. Kaye, John Grottenfend, and Shell Whittington for their valuable contributions.

Cover photograph: Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*) and Himalayan blackberry (*Rubus armeniacus*) at China Ditch, Roseburg BLM. *Photo by Andrea Thorpe.*

REFERENCE

Thorpe, A. S., C. M. Duncan, and A. S. Young. 2010. RESIST (Rare and Endangered Species and Invasive Species Threats) program for invasive weed management in Sensitive Species habitats. 2010 Final Report. Prepared by Institute for Applied Ecology for Roseburg District BLM. vii + 69 pp.

EXECUTIVE SUMMARY

Rare and Endangered Species and Invasive Species Threats (RESIST) is a program designed to provide BLM land managers with an updated and centralized information resource for:

1. Documenting and assessing the risks of fire, habitat degradation, competitive exclusion, and other threats caused by invasive weed infestations within Bureau Sensitive Species habitats,
2. Describing and/or developing methods for safely reducing these weed threats in ways that are compatible with BLM District policies for sensitive species populations, and
3. Identifying invasive weed species common among agency districts and sensitive species habitat.

We used literature surveys and personal interviews to assess the information that was available on rare and non-native species interactions and methods that were used to reduce the impacts of invasive plants. We identified several issues that contributed to a paucity of documented information, including (1) an effective system to encourage documentation of weed control treatments (including within rare species habitats) currently does not exist, and (2) a tendency to not update habitat data when revisiting sites associated with a Sensitive Species Sighting report. A lack of time, funding, and available personnel were contributors to both of these issues.

To facilitate documentation of interactions between rare and invasive species, we developed a standardized reporting form for BLM employees or contractors to use to monitor weed infestations in listed species habitat and identify high priority locations for weed management. This form was tested using field visits to several Bureau Sensitive Species sites in the Roseburg District in 2009.

We utilized the information that we gathered to develop a website to communicate known interactions of rare and invasive species and the control methods that had been used to manage invasive species in the presence of rare plants. This website,

http://resist.appliedeco.org/wiki/Main_Page

is intended to be a user-driven site. It was developed using a wiki format, which will allow users to contribute and edit information. This website will be publicly advertised following approval by the Roseburg District BLM.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Native species decline, including extirpation of rare taxa, is often attributed to invasion by non-native species. Non-native species have been ranked as the second highest threat to imperiled species based on analyses of USFWS Recovery Plans and the Natural Heritage Central Database, and interviews with biologists, (Wilcove et al. 1998, Lawler et al. 2002). During the 1990s, non-native weeds were identified as a key conservation threat by over 50% of respondents in surveys of National Park Service and The Nature Conservancy personnel (Randall 1996). However, it is highly likely that multiple factors, of which invasive species may be one, actually contribute to rare species' decline (Gurevitch and Padilla 2004).

Managing lands with rare native plants requires an understanding of regionally- and biologically-specific information on the specific interactions of rare and non-native species. Although numerous observational studies have inferred a threat of non-natives on rare species (Adersen 1989, Mauchamp et al. 1998, Lambrinos 2000, Farnsworth 2004, Miller and Duncan 2004, Gray et al. 2005, Kingston and Waldren 2005), more empirical data is needed to help elucidate the factors and mechanisms potentially involved in interactions between rare and non-native species. At least two models have been developed to measure the level of invasive and native species interaction (Thompson 2005, Miler et al. 2010). These models do a good job explaining interactions for which empirical data is available but for many rare species such data is lacking.

An additional challenge to managing lands where rare and non-native species interact is a lack of information on effective control methods for invasive species that do not have adverse impacts on rare species. As Huenneke and Thomson (1995) astutely addressed, this information gap can make land managers cautious to invest money in control programs which can lead to non-native infestations that are impossible to reduce without significant damage to the native population.

In an effort to reduce this information gap, **Rare and Endangered Species and Invasive Species Threats (RESIST)** is a program designed to provide land managers with an updated and centralized information resource for:

1. Documenting and assessing the risks of fire, habitat degradation, competitive exclusion, and other threats caused by invasive weed infestations within Bureau Sensitive Species habitats;
2. Describing and/or developing methods for safely reducing these weed threats in ways that are compatible with BLM District policies for sensitive species populations, and
3. Identifying invasive weed species common among agency districts and sensitive species habitat.

For this project, we refer to "rare species" as those which are listed by the Endangered Species Act or included on other agencies' lists of imperiled species, such as state threatened and endangered species lists or BLM Bureau Sensitive species. Our definition of non-native species is broad, and applies to any plant species that has been introduced. At times, we may interchangeably refer to these weedy species as "non-native", "exotic" or "invasive".

We used multiple methods to meet the objectives of our project. We first searched published primary literature, grey literature, and online resources (e.g. Center for Plant Conservation and NatureServe databases) for reports of interactions between rare and invasive species. For each of the reports that met our search criteria, we documented the identity of all species and, when available, techniques for control of the invasive species that were compatible with maintaining rare species populations. As part of a related project, we developed an online survey to assess land managers' knowledge of the interactions between non-native and threatened and endangered (rare) plant species across the country. While not officially affiliated with the RESIST project, this survey provides a valuable perspective on the general state of knowledge and the information needs of land managers. In order to meet our second objective, we used discussions with botanists with the Roseburg District BLM and site visits to develop a protocol for collecting information about interactions and management techniques that could be used as a template for expanding the RESIST invasive weed management program to other BLM districts and agencies in Oregon and other states. Finally, we used all of the information we gathered to develop an open access website that allows users to search for information on rare and non-native species interactions and successful management techniques. This website uses a "Wiki" format that also allows users to add and edit information so that its utility should increase with time.

AVAILABLE LITERATURE ON THE THREAT OF NON-NATIVE SPECIES ON RARE PLANTS

We used a literature search to determine the extent to which non-native and rare species interactions have been documented. Our search included grey literature reported on the Center for Plant Conservation and USDA Forest Service webpages and peer reviewed articles. Although multiple published studies referred to non-native species as having an impact on native species, few quantified the extent of these interactions. We limited our search to those studies that quantified the extent and/or type of interaction. Finally, we provide examples of grey literature studies that are typically available on a more local scale.

Online resources

One of the objectives of the RESIST project was to determine what information on rare and non-native species interactions is readily accessible to managers. There are many sources of grey literature reports. However, many of these reports are difficult to access

(e.g. only available directly from agencies) or find (e.g. published on webpages that are not frequently visited). Although these reports may contain valuable information, they are functionally unavailable due to the time and effort involved in finding them. Here, we describe information that is available on two national websites, the Center for Plant Conservation and US Forest Service Celebrating Wildflowers program.

The Center for Plant Conservation (CPC) works with various institutions across the United States to preserve plant material of almost 700 threatened or endangered native plants. The CPC has plant profiles of most of these species available online (CPC 2008). In September 2008, we searched the CPC website for plant profiles using the terms "invasive", "alien", "non-native", "exotic" and "introduced".

Thirty-five percent of the available reports (207/584) listed non-native species as a threat. However, only 39% of those reports (81/207) explicitly listed a specific non-native taxon of concern. Action items, such as management plans or research experiments, were described in less than half of the plant profiles that had identified non-native species as a threat (89/207). It should be noted that descriptions of management plans varied substantially, and sometimes just included references to plans for "weed control". Thus, although the threat of non-native species to rare plants was frequently alluded to, it was rarely substantiated. The lack of detailed information may in part be because the CPC plant profiles are primarily intended to provide the public with a general background on rare plant species and are therefore not comprehensive reports.

The USDA Forest Service (USFS) maintains an informative website "Celebrating Wildflowers" that showcases native plant species that occur on national forests and grasslands (USDA Forest Service 2008). There are over one hundred rare plant profiles on the website. In addition to being located on USFS land, these species must either be listed by the U.S. Fish and Wildlife Service as candidate, threatened, or endangered species, or ranked as critically imperiled by NatureServe. In October 2008, we searched the plant profiles for those that listed some aspect of non-native plants as at least one of the threats to the species. Threat descriptions were summarized into categories (invasive plants, introduction of non-native plants, timber harvest effects, competition with non-native plants, competition with non-native plants and treatment effects, and alteration of habitat by non-native plants) for comparative purposes. The Alaska region was not included in the analysis because it had no rare plant profiles posted on the website.

Based on these criteria, there were 45 occurrences of stated threats to rare species by non-native species, including 41 unique species and 4 species that occurred in more than one USFS region. The proportion of rare plants threatened by non-native species varied substantially across eight regions, from 14% (Intermountain, 1/7) to 86% (Pacific Northwest, 6/7). "Competition with non-native plants" was the most cited threat (17/45), followed by "introduction of non-native plants" (11/45). Only nine occurrences stated a specific non-native taxon as causing the threat.

Thus, the two largest online websites for information on rare species suggest non-native species may have important impacts on rare species. However, these sources do not enough detail for practical use by managers.

Peer reviewed literature

We conducted a literature search to locate articles documenting the coexistence of rare and invasive species and/or management practices used when rare and non-native plant species coexisted. Our searches used eight keywords (rare, threatened, endangered, plants, non-native, alien, weeds, and invasive). We used two search engines, the EBSCO Host Academic Search Premier provided by the Oregon State University Valley Library, and Google Scholar. We also searched seven websites (California Invasive Plant Council, Center for Plant Conservation National Collection of Endangered Plants, Invasive Plant Council of British Columbia , Invasive.org Center for Invasive Species Information and Ecosystem Health, NatureServe Explorer, USDA PLANTS Database, and the Western Weed Science Society) known to provide information on invasive or rare plant management. Thousands of search results were obtained. The top 100 closest matches for each search technique were evaluated. Those that provided data on specific rare and non-native species interactions (versus papers that just stated that non-native species were a threat to rare species) were incorporated into the RESIST database and website (described below).

We found 16 studies that examined the interaction between non-native species and rare plants. Non-natives were found to have a negative (Clampitt 1987, Huenneke and Thomson 1995, Lesica and Shelly 1996, Walck et al. 1999, Kaye 2004, Miller and Duncan 2004, Thomson 2005, Rhazi et al. 2009), mixed (Carlsen et al. 2000, Matarczyk et al. 2002, Munk et al. 2002, Lloyd et al. 2002, Denoth and Myers 2007, Castillo et al. 2008) or neutral (Wester 1994, Menke and Muir 2004) effect on rare plant species. We did not find evidence for strictly positive relationships.

Competition was the primary interaction examined with the majority of studies including vegetation removal treatments, replacement series (de Wit) and/or phytometer experiments in the greenhouse (Lesica and Shelly 1996, Miller and Duncan 2004, Thomson 2005). Lesica and Shelly (1996) found that recruitment and population growth rate of the rare forb *Arabis fecunda* was higher in plots where the non-native forb *Centaurea stoebe* ssp. *micranthos* (nee C. *maculosa*) had been removed. There was no effect on survival, growth, or fecundity. In an evaluation of the threat of the invasive forb, *Dipsacus sylvestris* (teasel), on the federally-listed *Cirsium vinaceum*, Huenneke and Thomson (1995) found that *D. sylvestris* reduced the growth of C. *vinaceum* in greenhouse conditions while C. *vinaceum* had no effects on the invasive species. They also found that while there were no differences in measured habitat characteristics, *D. sylvestris* was better able to germinate in low light than C. *vinaceum*, suggesting that *D. sylvestris* would be better able to recruit in dense vegetation stands.

Habitat variation can have an important impact on rare and invasive species interactions. In a study investigating *Bolboschoenus maritimus* (cosmopolitan bulrush) invasion in vernal pools (Rhazi et al. 2009), it was found that though *B. maritimus* always eventually outcompeted the rare species *Isoetes setacea* (spiny-spore quillwort), this competitive advantage lessened under drier conditions. Castillo et al. (2008) found that within stands of the rare species *Spartina maritima*, biomass and shoot densities of the invasive *Spartina densiflora* were lower under wetter conditions.

Oenothera deltoids ssp. *howellii* (Antioch Dunes evening primrose) is a federally listed short-lived forb restricted to dunes along California's Sacramento-San Joaquin river delta. Thomson (2005) conducted vegetation removal treatments to assess the severity of the threat of the exotic annual grass, *Bromus diandrus,* to this plant at different life stages (seedlings, adults), and habitats over a four year period. Although survival and recruitment was relatively high in nearby natural populations, none of the *O. deltoids* ssp. *howellii* in the restored populations survived up to a year in the restored population, despite the overall lower cover of invasive grasses. These results suggest that competition with *B. diandrus* was not the only factor impacting *O. deltoids* ssp. *howellii* success at these sites.

The endangered *Abronia umbellata* ssp. *brevifolia (*pink sand-verbena) historically occurred along much of North America's Pacific coastline (Kaye 2004). The primary threat to this species appears to be the spread of the non-native grass, *Ammophila arenaria* (European beachgrass), which was introduced for dune stabilization. Long-term monitoring of *A. umbellata* ssp. *brevifolia* populations indicates that disturbance, specifically annual discing to eradicate beachgrass, does not adversely impact *A. umbellata* ssp. *brevifolia* populations, but the absence of disturbance can lead to sharp population declines (Thorpe et al. 2009). Thus, the decline of *A. umbellata* ssp. *brevifolia* may be due to direct competition with *A. arenearia* and/or habitat changes associated with *A. arenearia* invasion.

In some cases, the presence of non-native species may be another symptom of habitat changes, not specifically the cause of rare species decline. The Hawaiian fern, *Marsilea villosa*, endemic to shallow depressions, significantly increased in cover following a large flood event, whereas the number of non-native species present at the site decreased after the disturbance (Wester 1994). However, as simply removing surrounding non-native species did not affect the cover of *M. villosa*, additional factors likely controlled the size of the *M. villosa* populations.

Other native plant species may also affect the interactions between rare and non-native species. Several studies found evidence of native plant species being stronger competitors relative to non-native species (Clampitt 1987, Carlsen et al. 2000, Munk et al. 2002, Denoth and Meyers 2007). *Cirsium arvense* (Canada thistle) was believed to limit recruitment of the rare *Gaura neomexicana* ssp. *coloradensis*, which has several declining

populations in Wyoming (Munk et al. 2002). Removal of C. *arvense* alone had no effects on G. *neomexicana* ssp. *coloradensis* recruitment. In contrast, removal of native forbs, grasses, and litter increased rosette density for two years after treatment.

There are even fewer published studies on methods to control non-native species in rare species habitat. The few studies that we found focused unexpected consequences of methods that had previously been assumed to positively affect native species while controlling non-natives. For example, in New South Wales, Australia, glyphosate is typically applied in the winter to control *Chrysanthemoides monilifera* ssp. *rotundata* (bitou bush) based on the assumption that native shrubs, including the endangered *Pimella spicata*, can tolerate exposure to herbicide due to slow growth during the water stressed winter (Matarczyk et al. 2002). However, in a greenhouse study that included a water limitation treatment to simulate the slow growth of native shrubs in the winter, the non-native C. *monilifera* actually had higher tolerance and the rare *P. spicata* had lower tolerance for glyphosate under water stressed conditions.

Phillips and Crisp (2001) conducted a seven-year study of the effect of prescribed fire on the rare perennial herb, *Hedeoma diffusa* (Flagstaff pennyroyal). Although it had not appeared in annual counts from 1989 – 1995, the non-native forb, *Linaria genistifolia* (Dalmation toadflax), was observed in the study area in 1999. In 2000, a census revealed that *L. genistifolia* was present in all four of the plots burned in June, before the seasonal monsoons. *Linaria genistifolia* was also present in 1 of the 2 control plots, but was not present in any of the plots burned in October, after the monsoon season. These results suggest that if prescribed fire is to be used in this system, it should be carefully timed so as to not promote the growth of non-native species.

Thus, while the majority of published studies suggest a negative effect of non-native species on rare species, several studies suggest that other factors, including habitat variability and competition with native plant species may also contribute to the decline of rare species. There are even fewer examples of how interactions between rare and non-native species can be managed in a way that does not cause further harm to rare species. The lack information of interactions and effective management methods suggests the need for a central platform for efficient accumulation of rare-invasive plant interaction data.

Grey literature

Although the number of grey literature studies on the interactions of non-native and rare species likely vastly outnumber peer-reviewed manuscripts, these reports are generally difficult to find. In addition, as they have not been through the peer-review process, their results may need to be evaluated more carefully than those in the published literature. In Oregon, documented interactions between non-native and rare plants and successful management techniques are typically available in agency records or reports produced by private, non-profit, or public organizations. For example the Institute for Applied Ecology (IAE) and the Oregon Department of Agriculture (ODA) Rare Plant Program have over ten

years of experience conducting research in these areas in cooperation with the USDI Bureau of Land Management, USDA Forest Service, and other federal and state agencies.

IAE has conducted numerous studies throughout Oregon focused on various aspects of rare plant populations and habitat restoration. In a query of annual reports, we found documentation of interactions between non-native species and populations of Federally Endangered (*Erigeron decumbens* ssp. *decumbens, Lupinus sulphureus* ssp. *kincaidii*), Federal Species of Concern (*Eucephalis vialis*, *Horkelia congesta* ssp. *congesta*, *Calochortus greenei*, *Lathyrus holochlorus*, *Sisyrinchium hitchcockii*) and State Candidate (*Sidalcea campestris*) species (Table 3).

IAE has also tested the effectiveness of mowing and burning in controlling invasive species in the presence of two federally listed species. Burning and mowing, particularly mowing twice a year, were effective at reducing cover of the invasive shrub, *Rubus armeniacus* (Himalayan blackberry) as well as promoting cover and reproductive output of the threated *Lupinus sulphureus* ssp. *kincaidii* (Thorpe and Kaye 2007b). While burning and annual mowing also appeared to provide some benefit to the endangered forb, *Erigeron decumbens*, this technique might simultaneously promote growth of the invasive grass, *Anthoxathum oderatum*.

Similarly, ODA has conducted research on introduction and habitat maintenance of several rare species in Oregon. Since the late 1990s, ODA has been working with the Roseburg District BLM to create two populations (Soggy Bottoms and Westgate) of the Federally Endangered *Plagiobothrys hirtus* within the North Bank Habitat Management area (Silvernail et al. 2007). Both sites received a late season mowing treatment (2001) and had no grazing; Soggy Bottoms was accidentally burned in 2003. Annual censuses revealed that the two populations had similar population declines from 2005-2006. However, in 2007, the population at Soggy Bottoms (the burned site) declined dramatically, from 1869 to 37 plants (Table 4). In contrast, the Westgate population increased from 2673 to 13,590 plants in 2007. The decline at Soggy Bottoms was attributed to a combination of altered hydrology following fire and increased competition from exotic weeds, such as *M. puligeum* (pennyroyal). Photoplot images documented an increase in cover of *M. puligium* in the burned areas, particularly in 2005. It is important to note that short-term monitoring would have suggested that fire had a positive effect on the *P. hirtus* as there was a significant increase in reproductive capacity immediately after the burn.

Several greenhouse experiments were recently conducted to explore competitive and allelopathic interactions between *M. puligeum* and *Plagiobothrys hirtus* and Bureau sensitive *Perideridia erythrorhiza* (Amsberry and Meinke 2008). Both ground and intact *M. puligeum* extract significantly inhibited *Plagiobothrys hirtus* germination. There were no consistent trends of *M. puligeum* extract on on *Perideridia erythrorhiza*. Under low nutrient conditions, *Plagiobothrys hirtus* growth was significantly higher when grown with *M.*

puligeum than in the presence of a conspecific associate. Similar increases in biomass were observed when activated carbon (which binds to organic compounds and thus would eliminate allelopathic effects) was added to the soil. Intraspecific competition also reduced *Plagiobothrys hirtus* biomass under high nutrient conditions. When grown in a mixture of commercial peat moss and native soil, biomass of *Plagiobothrys hirtus* plants was still lowest when planted with conspecifics. There was no difference in growth between solitary *Plagiobothrys hirtus* plants and those grown with *M. puligeum*.

These experiments suggest that the decline in population size at Soggy Bottoms that associated with increased cover of *M. puligeum* may have been due to allelopathic inhibition of germination, not competition with adult plants. It is important that these results be followed up with rigorous field studies. Allelopathic compounds often have very different effects in the field compared to greenhouse and laboratory conditions. Although the burning treatment was unintentional, long-term monitoring suggests that in this habitat, fire should not be used as a management technique due to the negative effects of altered hydrology and promotion of *M. pelugium*.

NATIONAL PERSPECTIVES OF THE THREAT OF NON-NATIVE SPECIES ON RARE PLANTS

> *"NOXIOUS WEEDS, AS A THREAT TO T&E SPECIES, SEEMS TO BE INCREASING AND I WOULD LOVE TO DO SOMETHING NOW THAN WAIT UNTIL IT IS AT A CRITICAL LEVEL" – OREGON BLM EMPLOYEE*

As part of an independent project, the Institute for Applied Ecology conducted an on-line survey to gather information on the extent to which land managers assess how rare and non-native species interact and design appropriate management plans. While this survey was not part of the RESIST project, we are including the results here as it provides valuable information for this project.

The online survey was developed and advertised over the Plant Conservation Alliance, Society for Conservation Biology, Society for Ecological Restoration, IUCN/ISSG Aliens-L, and The Nature Conservancy Global Invasive Species Team listservs and bulletin boards. Participants were asked general questions about their management experience, as well as their observations regarding the threats and impacts posed by non-native species on rare plants (Appendix A). Our analysis below includes survey responses from October 31 – December 31, 2008.

A total of 137 people completed the survey, representing 40 States as well as Canada, Puerto Rico and the Caribbean Islands. While the majority of respondents worked for federal or state agencies, occupations in other sectors were also represented (Figure 1).

Seventy one percent of respondents described themselves as having experience managing both rare and non-native species. According to our survey, a typical land manager was either in charge of fewer than 10 (58%) or more than 25 (25%) rare species. There was a resounding trend of non-native species occurring in rare species habitat (114/137 responses).

Hand-pulling, herbicides and mowing were the most frequently used weed control techniques (Figure 2). The efficacy of these treatments—based solely on the respondent's self-assessment—was highly variable. Herbicides (90%) and hand-pulling (73%) were the most effective of the 3 popular treatments. On average, respondents identified weed treatments to be effective 65% of the time. This trend seems somewhat biased considering the perceived difficulty of weed management across the landscape; follow-up surveys would need to further identify which species were being managed, what the management objectives were, and how efficacy was measured.

Over 82% of respondents have access to herbicides as a management tool. There was little feedback on what factors restricted the use of herbicides. Of the 41 responses, agency, district, or county restrictions (29%), negative public attitude (27%), and concern of impacts to rare species (15%) were most frequently cited. Fifteen people identified restrictions even though they responded that they had access to herbicides.

We provided eight alternatives for potential threats of non-native species on rare species, but also offered respondents the option to write-in additional threats. Competition was the most cited threat, with over 77% of responses identifying this mechanism (Table 1). While most respondents identified 3 – 7 threats of non-native species on rare plants, over 40% of respondents selected just one specific impact of non-native species on rare plants. Reduction of population size, reproductive output and plant growth were the most commonly reported impacts (Table 2). Thirty people reported that extirpation was an impact, however only one respondent provided a specific example. *Centaurea stoebe* ssp. *micranthos* is thought to have caused the local extinction of *Botrychium rugulosum* (ternate grape fern) in Wisconsin. The lack of detailed response was despite the inclusion of the questions, "What was the listed species that was extirpated" and "Which invasive species caused the extirpation".

Half of the respondents (50%) identified funding was the key limiting factor to managing non-native species in rare habitat, followed by "scale of problem" (21%), and efficacy of control (12%). Fifty percent of respondents said that knowledge of control was a moderate or high limit to management of non-native species in rare species habitats.

> *"Funding for prevention of the interactions between listed and exotic species needs to be elevated as a high priority. In Alaska, we have limited distribution of invasive plants, and with proper funding we can keep it that way." - Alaska Dept. Natural Resources*

"I WISH THERE WERE MORE SURVEYS AND REPORTS LIKE THIS AVAILABLE OR GOING ON HERE IN IOWA" - ROADSIDE VEGETATION MANAGER, IOWA CITY

The most salient take-home message of the online survey was that the determining that natures of interactions between non-native and rare plants and effective methods for control one of managers' greatest concerns. Furthermore, although managers are gaining valuable local experience on how to manage non-native species when they interact with rare species, there are few opportunities for managers to share their experiences or learn from the experiences of others.

BLM WEEDS AND RARITIES

Overview

Based on a 2006 evaluation by district weed coordinators, there are 136 non-native plant species known to occur on land within Western Oregon BLM districts (Coos Bay, Eugene, Klamath Falls, Medford, Roseburg, and Salem). The number of invasive species present per district ranged from 49 to 92 in Klamath Falls and Medford, respectively (Figure 3). Fifty species are of particular concern because they occur in over half of the districts (Table 5).

There are 483 documented and suspected Bureau Sensitive vascular plant species distributed across all of the Oregon-Washington BLM districts. Of these, seventy species have been documented in more than one district. Most notably, *Carex gynodynama* (hairy sedge), *Cimicifuga elata* var. *elata* (tall bugbane), *Heliotropium curassavicum* (salt heliotrope), and *Rorippa columbiae* (Columbia cress) have distributions that span four districts. The Spokane District had the highest frequency of documented and suspected sensitive plant species (214), followed by Vale (130) and Medford (98).

While there has yet to be a strategic evaluation of the impact of invasive species on sensitive plants, there are multiple efforts within the agency to address this potential threat. For example, the "Westside Salem Integrated Non-Native Plant Management Plan Environmental Assessment and Finding of No Significant Impact" (2008) includes the invasive species as a factor having negative impacts on sensitive plants. Top priority sites for control of non-native plants included bureau special status plant locations as well as other types of special management areas. When evaluating the "No Action Alternative" to an integrated non-native plant management plan, there was discussion on how "threatened and endangered and bureau special status botanical and fungal species could be displaced from the encroachment of noxious weeds."

RESIST program development – Roseburg District

The initial step of developing the RESIST program for Oregon/Washington BLM was to assess what information was available at the Roseburg District regarding non-native

plants and Bureau sensitive species. Conversations with district botanists revealed several setbacks to this process (S. Carter, pers. comm., G. Bashum, pers. comm.). First, there didn't seem to be an effective system in place to encourage documentation of weed control treatments; most information was "in the botanists' heads" or otherwise not systematically recorded. They also noted the tendency for people not to update habitat data when revisiting sites associated with a Sensitive Species Sighting report. Lack of time, funding, and available personnel were the main factors attributed to this observation. Finally, the same constraints have restricted the botanists from adequately mapping populations of Bureau sensitive species, which is a necessary parameter for the evaluation of impacts of invasive plants.

Analysis of Special Status Sighting Reports – Roseburg District

Eighty five "Special Status Sighting Reports" were reviewed for 17 sensitive plant species documented from the BLM Roseburg district. Associated species were noted and, when applicable, classified as "non-native weed" based on USDA Plants database and/or a list of invasive weeds of Douglas County, Oregon generated by several online sources[1]. The percentage of sighting reports containing at least one non-native weed was highly variable among species, ranging from 0 – 100% (Table 6). *Arabis koehleri* var. *koehleri*, *Carex serratodens*, *Cicendia quadrangularis*, *Pellaea andromedifolia*, *Perideridia erythrorhiza, Sisyrinchium hitchcockii* were associated with non-native weeds in at least 50% of their reports.

While a total of 28 non-native weeds were identified, *Cynosurus echinatus* (bristly dogstail grass) was the most prevalent weed, listed on 14 reports for 6 species (Table 7). Of note, four of the weed species were on the Roseburg district's noxious weed species list (Table 8): *Hypericum perforatum* (5 occurences, 4 species), *Mentha pulegium* (4 occurrences, 2 species), *Rubus discolor* (2 occurences, 2 species) and *Taenaitherum caput-medusae* (5 occurences, 2 species). The rare *Perideridia erythrorhiza* had a total of 30 non-native weed occurrences across all of its reported sites, including all the aforementioned noxious weeds. *Pellaea andromedifolia* was the species with the next highest non-native weed occurrences (15), including 3 of the BLM noxious weed species.

The majority of the sighting reports analyzed were written in the 1980s and 1990s (Figure 4). It is possible that this trend reflects the shift within BLM from paper records to data entry in the GEOBOB database. Despite the lack of current information, these records not only provide information on weeds that may currently affect rare species populations, but also the history of the weeds the sites. For example, the reports indicated that weed infestations at *Perideridia erythrorhiza* sites were first documented in the early 1980s. Similarly, the presence of *Cynosurus echinatus* at an *Arabis koehleri* var. *koehleri*

[1] Online sources: Invaders database (http://invader.dbs.umt.edu), Weedmapper (http://www.weedmapper.org/douglas_maps.html), and Western Invasive Networks (www.westerninvasivesnetwork.org/pages/interactivemap.html)

site was noted to occur sometime between 1983 and 1994 based on its absence from an earlier sighting report.

There are several major limitations to this dataset. Sixty-four percent of the reports did not list any associated vegetation, and it was presumed that the species information that was available on other sighting reports was not always comprehensive. It was not clear if an official report had been completed for all known sensitive species populations, limiting the ability to evaluate the severity of weed infestations across all species occurrences. Finally, this outdated information is not useful for assessing and managing current threats. For example, data from sighting reports indicate that *Calochortus coxii* co-occurs with two non-native weeds: *Cynosurus cristatus* and *Luzula campestris*. This information does not capture the known *Centaurea solstitialis* (yellow starthistle) infestation in close proximity to one *C. coxii* population (G. Bashum, pers comm)

As mentioned previously, grey literature reports prepared for agencies may also containe valuable information on the interactions for rare and non-native species. For example, in 2003, IAE surveyed several populations of the threatened *Lupinus sulphureus* ssp. *kincaidii* in the Roseburg District (Menke and Kaye 2003). A total of 16 non-native weed species, including shrubs, grasses and forbs, were documented at four *L. sulphureus* ssp. *kincaidii* sites (Table 9). Letitia Creek and two sub-populations at Loose Laces did not appear to have any non-native plant species as part of the associated vegetation. Callahan Meadows and all China Ditch subpopulations had between 4 – 7 weed species in close proximity. *Cynosurus echinatus* was again the most frequently observed weed (n = 4), followed by *Linum perenne* (n = 3) and the noxious weed *Hypericum perforatum* (n = 3). Another noxious weed, *Rubus discolor*, occurred at 2 locations.

Thus, while there is substantial information suggesting that non-native species may be interacting with several populations of rare species, the majority of these records are older and inconsistent about the type of information they recorded. To address this issue, we have developed a standardized reporting form for BLM employees to use to monitor weed infestations in listed species habitat (Figure 5) that was refined after field visits spring-summer 2009. It is our hope that such a form will facilitate documentation of non-native species within rare species habitats and weed control treatments that have occurred within the vicinity of BLM sensitive species. At the very least, we recommend adding a field to the "Special Status Sighting Reports" that requires the reporter to note the presence and identity of invasive weeds. This information would help identify high priority locations for weed management as well as provide data on whether weed control techniques are successful and/or impacting sensitive species.

Baseline Monitoring of High Priority Species – Roseburg Distrcit

The Roseburg District has identified five species, *Calochortus coxii*, *Calochortus umpquaensis*, *Lupinus sulphureus* ssp. *kincaidii*, *Perideridia erythrorhiza*, and *Plagiobothrys hirtus*, as high priorities for documenting weed threats. In 2009, we visited six *L.*

sulphureus ssp. *kincaidii*, two C. *umpquaensis*, and one *P. erythrorhiza* population to document interactions. At each population, we noted the presence of exotic species, the degree to which they intermingled with the rare species, approximate cover of the exotic plant, and any additional notes (such as impacts of the exotic species on the rare species) (Appendix B). We used this information to refine the "Rare and Invasive Species Interactions" form, a draft of which had previously been developed with input from BLM botanists. This form is intended to provide more detailed information about the threat that invasive species post to Bureau Sensitive species in order to provide more detailed information to guide management.

Invasive species at these rare species sites included *Taeniatherum caput-medusae*, *Cynosurus echinatus*, *Bromus hordeaceus*, *Rubus discolor* (*Rubus armendiacus*), *Mentha pelugium*, *Cirsium arvense*, and *Silybum marianum*. At most of the *L. sulphureus* ssp. *kincaidii* sites, when invasive species were present, they were located on the periphery of the *L. sulphureus* ssp. *kincaidii* population; thus, although they present a threat if not prevented from spreading, they currently are having relatively few effects on the rare plants. In contrast, invasive species heavily intermingled with the rare species at one of the C. *umpquansis* sites (Callahan Meadows) and all of the *P. erythrorhiza* sites we visited. This data can be used to prioritize sites for control. By completing this form at each site visit, spread or decline in non-native species can be tracked and thus this form can assist in adaptive management of rare and non-native species.

THE RESIST WEBSITE

In order to help reach the objectives of the RESIST Program, we developed a website to facilitate information sharing about the interactions between native and non-native species and methods to manage these interactions. This website is a wiki site that is intended to be user-driven and require little maintenance.

The structure of the website is straight forward. There are four primary page types, the main page (Figure 6), the contributor's page (Figure 7), rare species pages (Figure 8), and invasive species pages (Figure 9). The main page describes the purpose of the RESIST website and contains three important links. The first is a link to the contributor's page. This page describes more specifically what type of contribution material is encouraged and provides a contact at the Institute for Applied Ecology for contribution submissions. The second two provide links to rare and invasive species lists. Information pertaining to a particular species is accessed from these lists. To learn specifics about rare-invasive interactions, the rare species list can be searched. To find out what rare species might be associated with an invasive of interest, the invasive species list can be searched. In addition, the rare and invasive pages from either list are linked. For example, when looking at a rare species page, the list of associated invasive species is also a list of links to the corresponding invasive species page. The rare species pages include USDA PLANTS

Database links to all rare and invasive species and at the bottom of each of these pages is a list of useful links to facilitate obtaining further information.

Currently, there are 102 rare species (appendix A) and 96 invasive species (appendix B) listed on the RESIST website. The information currently captured on the RESIST website comes from the sources as described in this report, including the Center for Plant Conservation National Collection of Endangered Plants.

To contribute information to the RESIST website, users compile material using suggestions from the contributor's page and submit it to the website administrator at the Institute for Applied Ecology. The administrator will then review the material and post it to the website if the information contributes to the goals of RESIST. Currently, the RESIST website administrator is Andrea Thorpe (andrea@appliedeco.org).

At the present time, the information contained in the RESIST website is very limited. In many cases, only documentation of rare and invasive species co-occurrence exists. A major function of this website is to provide a platform where additional and more precise information can be compiled and made readily available to land managers. Our hope is that the information housed at the website will improve with future user contributions.

SUMMARY OF FINDINGS

1. Results from a literature review and online survey provide a foundation for evaluating interactions between non-native weeds and rare plants.
    - 1.1 The two largest databases dedicated to descriptions of rare species in the United States, the Center for Plant Conservation and US Forest Service Celebrating Wildflowers program, document non-native species as threatening ⅓ to ½ of species listed. However, these records generally lack sufficient detail to determine the mechanism or extent of the threat.
    - 1.2 Although numerous peer-reviewed articles mention that non-native species are a threat to rare species, few quantify the impact and/or mechanism of this threat. Even fewer articles provide examples of methods that can be used to control non-native species in the presence of rare species.
    - 1.3 Grey literature may provide more detailed examples of interactions and treatment methods for rare and non-native species. However, these reports may be difficult to access and generally are not peer reviewed.
2. In a national survey targeting land managers, the vast majority of respondents indicated that management of non-native species in rare species habitat was a primary concern, but they were frequently hindered by both a lack of information and resources.

3. Based on 2006 data, the Western Oregon BLM districts have 136 invasive weeds, of which 50 species occur in over half of the districts.
    3.1 There are a total of 483 documented and suspected Bureau sensitive species distributed across the Oregon and Washington BLM districts. Four of these species are distributed across multiple BLM districts.
    3.2 The largest setback to evaluating the impact of non-native species on Bureau sensitive plants is lack of documentation of weed infestations within sensitive species habitat. We have developed a standardized form to assist in recording infestations and control techniques. We also recommend modifying the "Special Status Sighting form" to require that the reporter note the presence of any invasive weeds within the population. The following points highlight information that is currently known about the impacts of non-native weeds on threatened plants on the Roseburg District BLM.
        3.3.1 Six out of 17 Bureau sensitive species had non-native weeds listed as part of the associated vegetation in at least 50% of their Special Status Sighting Reports.
        3.3.2 *Perideridia erythrorhiza* reports indicated that there were 30 non-native species, including noxious weeds, growing across all of its recorded sites. *Pellaea andromedifolia* had the second highest occurrence of non-native weeds (n=15).
        3.3.3 *Cynosurus echinatus* was the most frequently cited non-native species growing in sensitive species habitat. The noxious weeds *Hypericum perforatum*, *Mentha pulegium*, *Rubus discolor*, and *Taenaitherum caput-medusae* were often recorded on Special Status Sighting forms.
        3.3.4 Two populations of *Lupinus sulphureus* ssp. *kincaidii* on the Roseburg District had limited non-native vegetation occurring within the populations, whereas the remaining populations had at least four weed species near the sensitive habitat. *Cynosurus echinatus* was the most frequently observed weed.
        3.3.5 Invasive weeds, specifically *Mentha puligeum*, are a threat to *Plagiobothrys hirtus*. Research indicates that *M. puligeum* has a negative impact on *P. hirtus* germination and recruitment.
4. As a result of the implementation of the RESIST website, data related to invasive and rare species interactions now has both a platform for centralization and an outlet for badly needed data accumulation.

WORKS CITED

Adersen, H. 1989. The rare plants of the Galapagos Islands (Ecuador) and their conservation. Biological Conservation 47:49-77.

Amsberry, K. and R. Meinke. 2008. Evaluating allelopathic effects of pennyroyal (*Mentha pulegium*) on two native plant species. Final report to Bureau of Land Management, Roseburg District. Native Plant Conservation Program, Oregon Department of Agriculture, Salem, Oregon. 25 pp.

Blakeley-Smith, M. and T.N. Kaye. 2005. Monitoring study of 6 sensitive plant species on the Upper Willamette Resource Area, Eugene District. Final report to Bureau of Land Management, Eugene District. Institute for Applied Ecology, Corvallis, Oregon. 42 pp.

Carlsen, T.M., J.W. Menke, and B.M. Pavlik. 2000. Reducing competitive suppression of a rare annual forb by restoring native California perennial grasslands. Restoration Ecology 8:18-29.

Castillo, J., Mateos-Naranjo, E., Nieva, F., and Figueroa, E. 2008. Plant zonation at salt marshes of the endangered cord grass *Spartina maritima* invaded by *Spartina densiflora*. Hydrobiologia 614:363-371.

Clampitt, C.A. 1987. Reproductive biology of *Aster curtus* (Asteraceae), a Pacific Northwest endemic. American Journal of Botany 74:941-946.

Center for Plant Conservation. 2008, 2009. National Collection of Endangered Plants. St. Louis, Missouri, USA. Accessed September 2008 - 2009. http://centerforplantconservation.org/NC_Choice.html

Denoth, M. and J.H. Myers. 2007. Competition between *Lythrum salicaria* and a rare species: combining evidence from experiments and long-term monitoring. Plant Ecology 191:153-161.

Exeter, R. and K. Heckeroth. 2008. Westside Salem integrated non-native plant management plan environmental assessment and finding of no significant impact. Environmental Assessment Number OR-080-06-09. Bureau of Land Management, Oregon State Office.

Farnsworth, E.J. 2004. Patterns of plant invasions at sites with rare plant species throughout New England. Rhodora 106:97-117.

Gray, A., T. Pelembe, and S. Stroud. 2005. The conservation of the endemic vascular flora of Ascension Island and threats from alien species. Oryx 39: 449-453.

Grime, J.P. 1979. Plant strategies and vegetation processes. John Wiley & Sons, New York.

Gurevitch, J. and D.K. Padilla. 2004. Are invasive species a major cause of extinction? Trends in Ecology and Evolution 19:470-474.

Huenneke, L.F. and J.K. Thomson. 1995. Potential interference between a threatened endemic thistle and an invasive nonnative plant. Conservation Biology 9:416-425.

Kaye, T.N. 2004. Reintroducing the endangered pink sand-verbena to pacific coast beaches: direct seeding and out-planting, pp 131 – 139. In [Brooks, M.B., S.K. Carothers & T. LaBanca, eds.] The ecology and management of rare plants of northwestern California: Proceedings from a 2002 symposium of the North Coast Chapter of the California Native Plant Society. California Native Plant Society, Sacramento, CA

Kingston, N. and S. Waldren. 2005. A conservation appraisal of the rare and endemic vascular plants of Pitcairn Island. Biodiversity and Conservation 14:781-800.

Lambrinos, J.G. 2000. The impact of the invasive annual grass *Cortaderia jubata* (Lemoine) Stapf on an endangered Mediterranean-type shrubland in California. Diversity and Distributions 6:217-232.

Lawler, J.J., S.P. Campbell, A.D. Guerry, M. B. Kolozsvary, R. J. O'Connor, and L. C. N. Seward. 2002. The scope and treatment of threats in endangered species recovery plans. Ecological Applications 12:663-667

Lesica, P. and J.S. Shelly. 1996. Competitive effects of *Centaurea maculosa* on the population dynamics of *Arabis fecunda*. Bulletin of the Torrey Botanical Club 123:111-121.

Lloyd, K.M., W.G. Lee, and J.B. Wilson. 2002. Competitive abilities of rare and common plants: comparisons using *Acaena* (Rosaceae) and *Chionochloa* (Poaceae) from New Zealand. Conservation Biology 16:975-985.

Matarczyk, J.A., A. J. Willis, J. A. Vranjic, and J.E. Ash. 2002. Herbicides, weeds and endangered species: management of bitou bush (*Chrysanthemoides monilifera* ssp. *rotundata*) with glyphosate and impacts on the endangered shrub, *Pimelea spicata*. Biological Conservation 108:133-141.

Mauchamp, A., I. Aldaz, E. Ortiz, and H. Valdebenito. 1998. Threatened species, a re-evaluation of the status of eight endemic plants of the Galápagos. Biodiversity and Conservation 7:97-107.

Menke, C.A. and T.N. Kaye. 2003. Population monitoring and survey for *Lupinus sulphureus* ssp. *kincaidii* on the BLM Roseburg District. Progress report to Bureau of Land Management, Roseburg District. Institute for Applied Ecology, Corvallis, Oregon. 91 pp.

Menke, C.A. and T.N. Kaye. 2007. Population monitoring and effects of grazing on *Calochortus greenei* on the Cascade-Siskiyou National Monument. Progress report to

Bureau of Land Management, Medford District. Institute for Applied Ecology, Corvallis, Oregon. 34 pp.

Menke, C.A. and P.S. Muir. 2004. Patterns and influences of exotic species invasion into the grassland habitat of the threatened plant *Silene spaldingii*. Natural Areas Journal 24: 119-128.

Miller, A.L. and R.P. Duncan. 2004. The impact of exotic weed competition on a rare New Zealand outcrop herb, *Pachycladon cheesemanii* (Brassicaceae). New Zealand Journal of Ecology 28:113-124.

Miller, T.K., Allen, C.R., Landis, W.G., and Merchant, J.W. 2010. Risk assessment: Simultaneously prioritizing the control of invasive plant species and the conservation of rare plant species. Biological Conservation 143:2070-2079.

Munk, L.M., A.L. Hild, and T.D. Whitson. 2002. Rosette recruitment of a rare endemic forb (*Gaura neomexicana* subsp. *coloradensis*) with canopy removal of associated species. Restoration Ecology 10:122-128.

Phillips, B.G. and D. Crisp. 2001. Dalmatian toadflax, an invasive exotic noxious weed, threatens Flagstaff pennyroyal community following prescribed fire. In [J. Maschinski and L. Holter, eds.] Southwestern rare and endangered plants: proceedings of the third conference. Proceedings RMRS-P-23. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 250 pp.

Randall, J.M. 1996. Weed control for the preservation of biological diversity. Weed Technology 10:370-383.

Rhazi, M., Grillas, P., Rhazi, L., Charpentier, A., and Medail, F. 2009. Competition in microcosm between a clonal plant species (*Bilboschoenus maritimus*) and a rare quillwort (*Isoetes setacea*) for Medeteranean temporary pools of southern France. Hydrobiologia 634:115-124.

Silvernail, I., K. Amsberry, and B. Meinke. 2007. Reintroduction and population monitoring of *Plagiobothrys hirtus*. Report for Bureau of Land Management, Roseburg District. Native Plant Conservation Program, Oregon Department of Agriculture, Salem, Oregon.

Thomson, D. 2005. Measuring the effects of invasive species on the demography of a rare endemic plant. Biological Invasions 7:615-624.

Thompson, D.M. 2005. Matrix model as a tool for understanding invasive plant and native plant interactions. Conservation Biology 19:917-928.

Thorpe, A. 2007. Habitat Sampling at Fir Butte, Oxbow West, and Vinci. Final report to Bureau of Land Management, Eugene District. Institute for Applied Ecology, Corvallis, Oregon, 26 pp.

Thorpe, A.S. and T.N. Kaye. 2007a. *Erigeron decumbens* spp. *decumbens* (Willamette daisy): Population monitoring and evaluation of mowing and burning at Oxbow West (West Eugene Wetlands). Progress report to Bureau of Land Management, Eugene District. Institute for Applied Ecology, Corvallis, Oregon. 30 pp.

Thorpe, A.S. and T.N. Kaye. 2007b. *Lupinus sulphureous* ssp. *kincaidii* (Kincaid's lupine) and *Icaricia icarioides fenderi* (Fender's blue butterfly) in the West Eugene Wetlands: Population monitoring, reintroduction success, and an evaluation of experimental treatments. Progress report to Bureau of Land Management, Eugene District. Institute for Applied Ecology, Corvallis, Oregon. 43 pp.

Thorpe, A.S., B.A. Martin, and T.N. Kaye. 2007. Experimental habitat manipulation of wayside aster (*Eucephalis vialis*). Progress report to Bureau of Land Management, Eugene District, and National Fish and Wildlife Foundation. Institute for Applied Ecology, Corvallis, Oregon. 36 pp.

Thorpe, A.S., D.E.L. Giles-Johnson, R.T. Massatti, and T.N. Kaye. 2009. *Abronia umbellata* var. *breviflora* on the Oregon coast: Reintroduction and population monitoring. Institute for Applied Ecology, Corvallis, Oregon, USDA Forest Service, Siuslaw National Forest, USDI Bureau of Land Management, Coos Bay District, and Oregon Department of Parks and Recreation. vii + 52 pp.

USDA Forest Service. 2008. Celebrating Wildflowers: Rare Plant Profiles. Accessed October 2008. _http://www.fs.fed.us/wildflowers/rareplants/profiles/index.php.

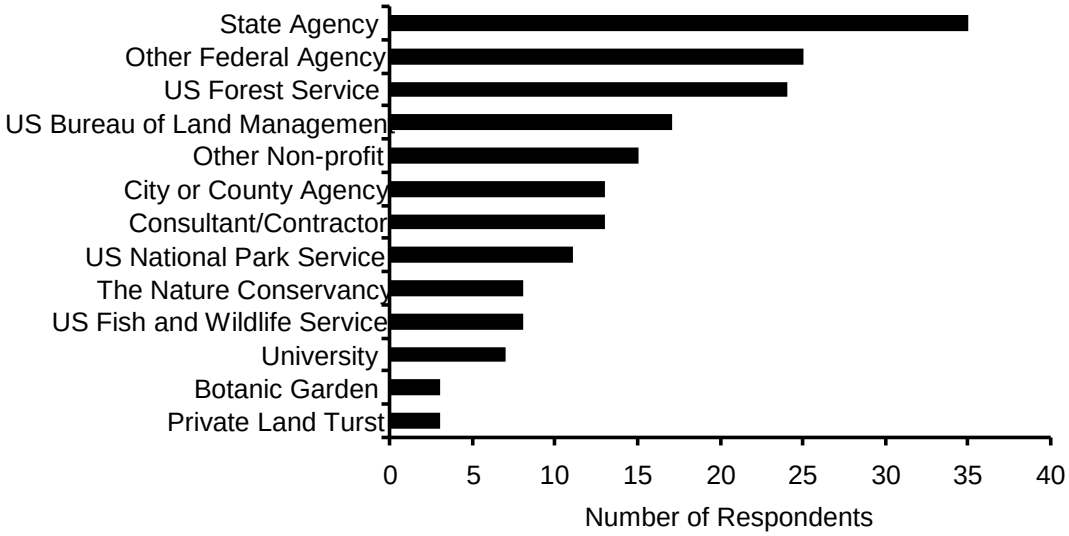
Walck, J.L., J.M. Baskin, and C.C. Baskin. 1999. Effects of competition from introduced plants on establishment, survival, growth and reproduction of the rare plant *Solidago shortii* (Asteraceae). Biological Conservation 88:213-219.

Wester, L. 1994. Weed management and the habitat protection of rare species: a case study of the endemic Hawaiian fern *Marsilea villosa*. Biological Conservation 68:1-9.

Wilcove, D.S., D. Rothstein, J. Dubow, A. Phillips, and E. Losos. 1998. Quantifying threats to imperiled species in the United States. Bioscience 48:607-615.

FIGURES

Figure 1. Occupations of RESIST survey respondents. Some categories have been combined[1].



[1] "Other Federal Agency" includes USDA Natural Resources Conservation Service, military, and USDA Animal and Plant Inspection Service. "State Agency" include Department of Fish and Game, Department of Natural Resources, Department of Transportation, Natural Heritage Program, State Forestry, State Parks)

Figure 2. Weed control methods used and their efficacy, as reported by RESIST survey respondents.

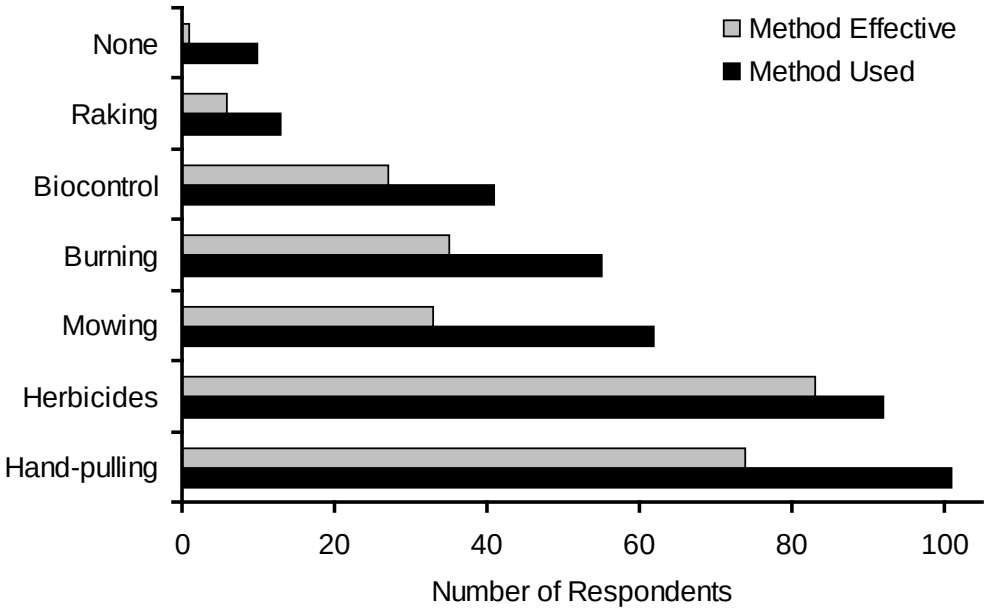


Figure 3. 2006 data on number of invasive plant species present in the six Western Oregon BLM Districts (Coos Bay, Eugene, Klamath Falls, Medford, Roseburg, Salem).

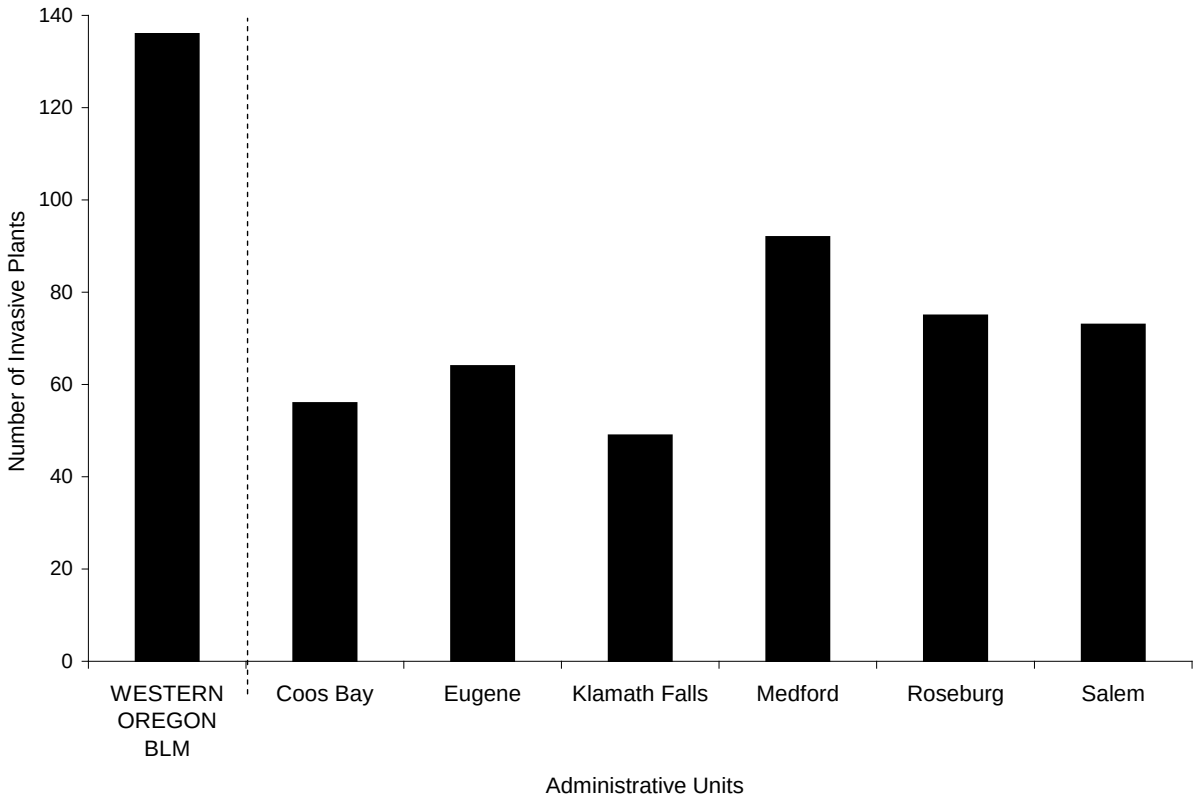


Figure 4. Total number of Sensitive Species Reports filled out for vascular plants on Roseburg District from 1982 – 2005.

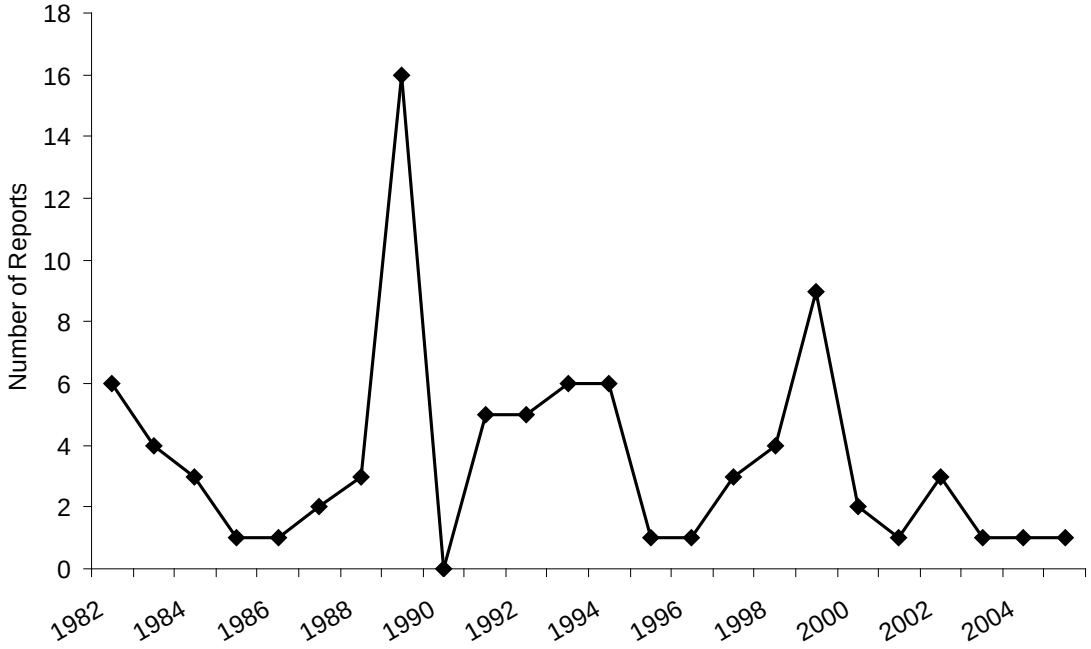


Figure 5. Copy of form for land managers to document invasive species information at Bureau sensitive species locations. A copy of this form is available at http://resist.appliedeco.org/wiki/Main_Page

Date:	

Rare and Invasive Species Interactions

For each rare species site, please document presence of invasive species and degree to which they comingle with the rare species. For example, if an invasive species is present at the site, but is not within the population boundaries of the rare species, it would receive a "none", though be marked as present. Include comments such as observed impacts to rare species (e.g. increased thatch, reduced light).

General Information			
Completed by?		**Organization:**	
Native plant:		**BLM status:**	
Site Name: (County)		**District:**	
Other site disturbances?			

Invasive Information			
Invasive species:		**Degree of commingling:**	--
Comments:			
Invasive species:		**Degree of commingling:**	--
Comments:			
Invasive species:		**Degree of commingling:**	--
Comments:			
Invasive species:		**Degree of commingling:**	--
Comments:			
Invasive species:		**Degree of commingling:**	--
Comments:			
Invasive species:		**Degree of commingling:**	--
Comments:			
Invasive species:		**Degree of commingling:**	--
Comments:			
Invasive species:		**Degree of commingling:**	--
Comments:			
Invasive species:		**Degree of commingling:**	--
Comments:			

Figure 6. RESIST Website Main Page.

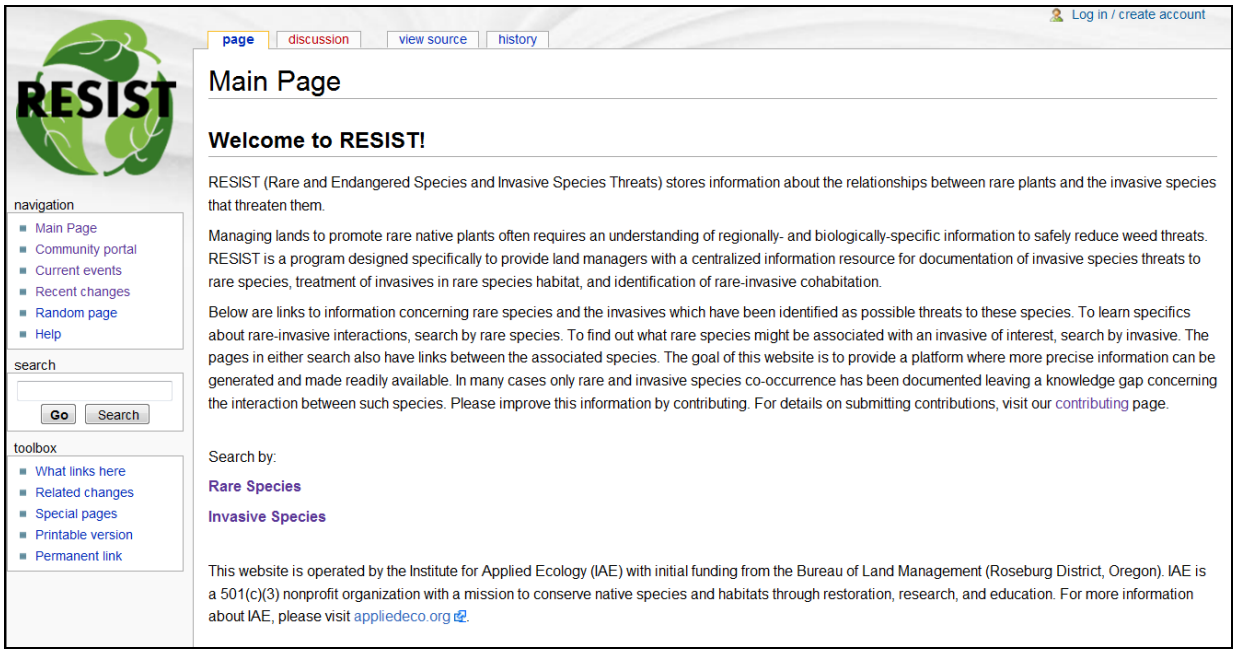


Figure 7. RESIST Website Contributor's Page.

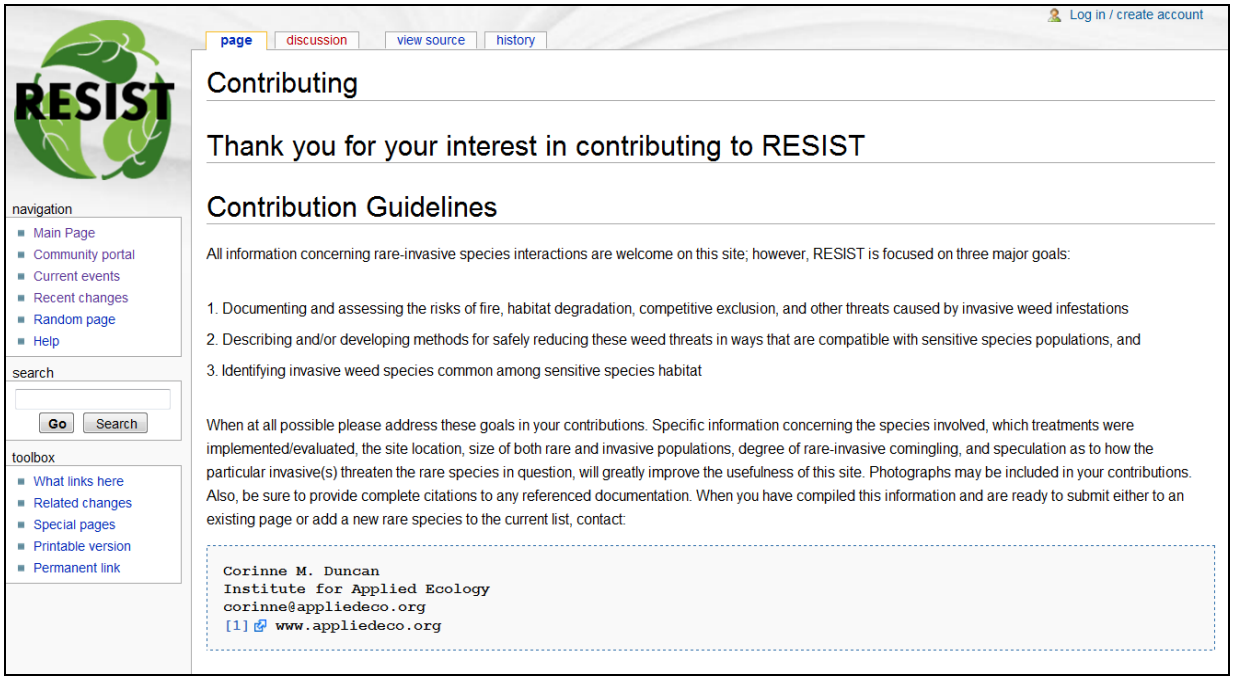


Figure 8. Example of RESIST Website Rare Species Page.

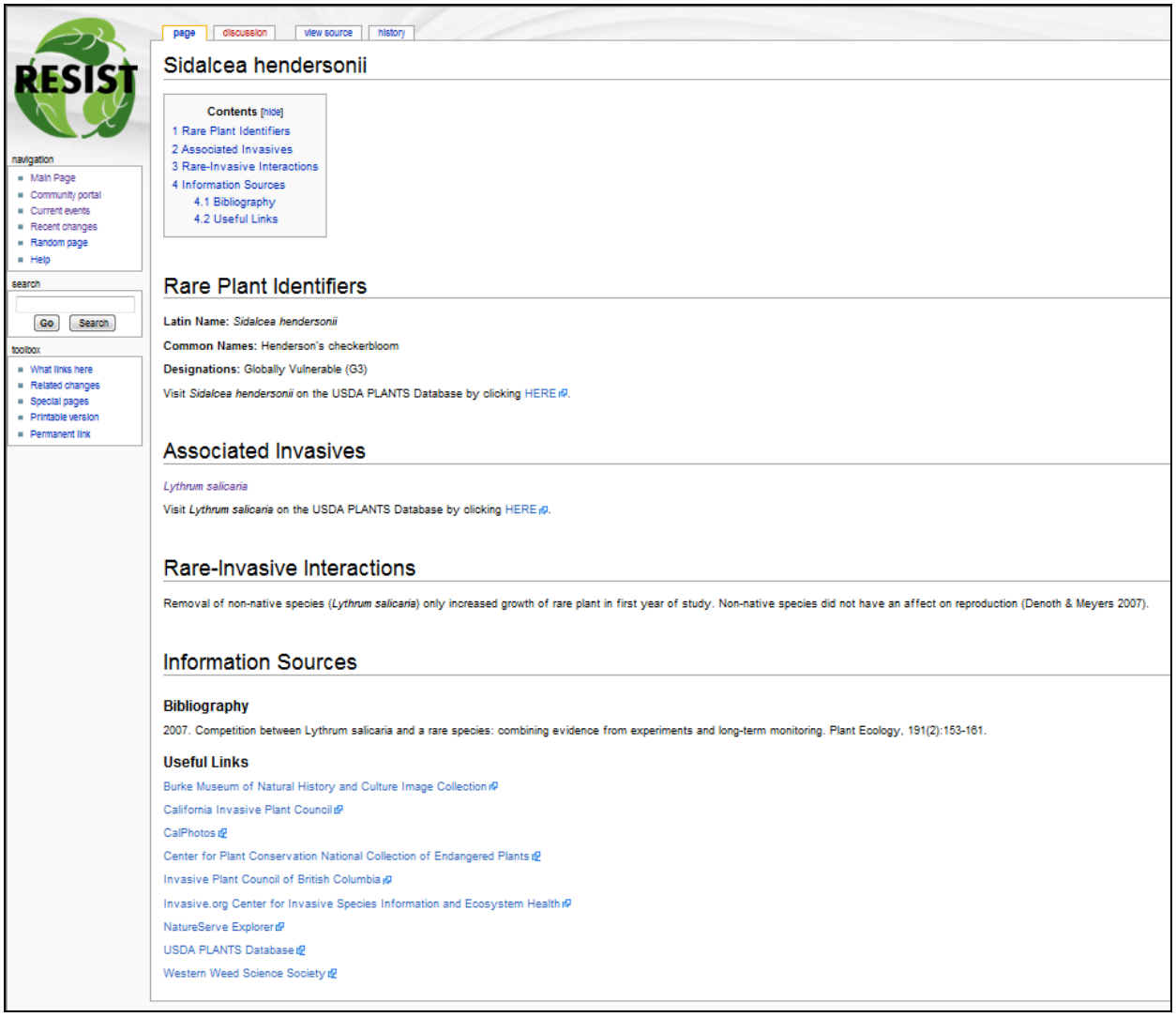
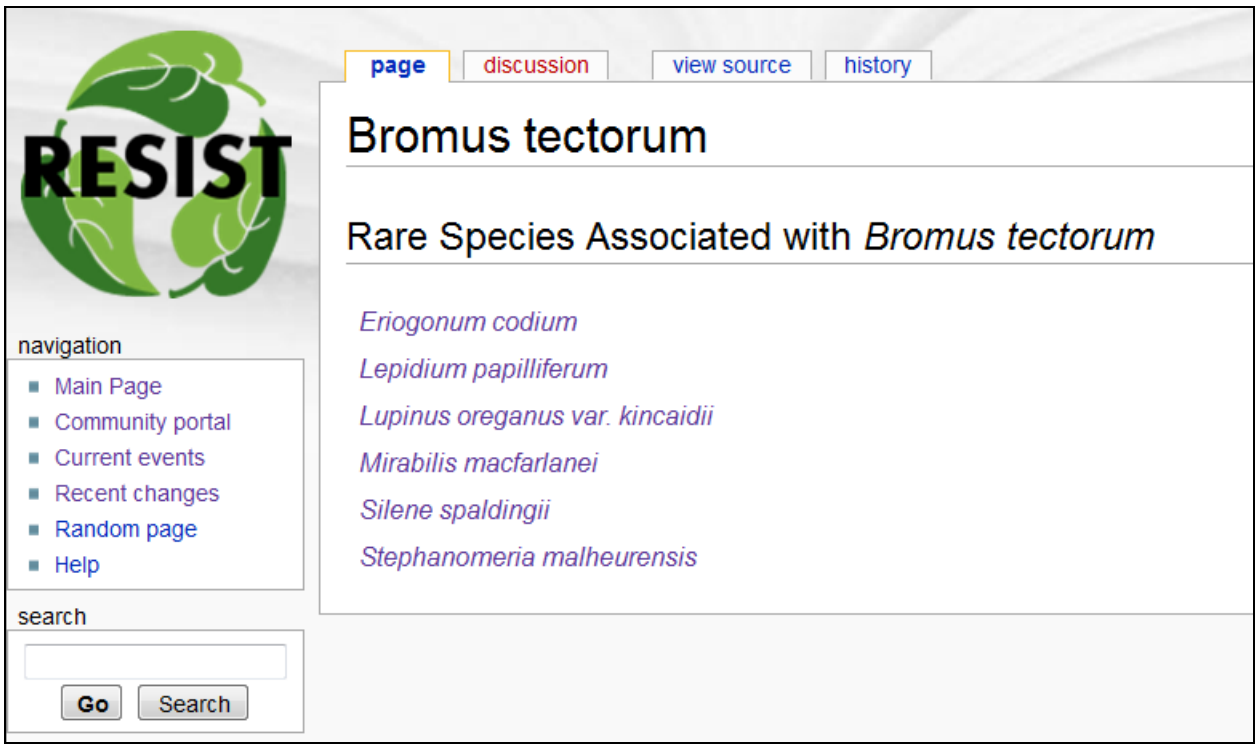


Figure 9. Example of RESIST Website Invasive Species Page.



TABLES

Table 1. Responses to the question, "What threat/s do the exotic species pose to the T&E species?" Respondents were allowed to select more than one answer. 144 respondents answered this question.

Threats	Count	Percent
Competition for light	110	76%
Competition for water	112	78%
Competition for space	132	92%
Competition for nutrients	107	74%
Competition for pollinators	44	31%
Increases thatch	58	40%
Increases fire risk	68	47%
Disease vector	16	11%
Consumption by exotic animals	1	1%
Allelopathy	4	3%
Habitat alteration	5	3%
Changes soil chemistry or characteristics	5	3%
Other	11	8%
Decreases fire risk	2	1%

Table 2. Responses to the question, "What impacts have you observed exotic species having on T&E species?" Respondents were allowed to select more than one answer. 138 respondents answered this question.

Impacts	Count	Percent
No impact	16	12%
Reduced plant size	37	27%
Reduced flowering and/or reproduction	48	35%
Reduced population size	99	72%
Hybridization and genetic swamping	15	11%
Extirpation	34	25%
Other (please specify)	21	15%

Table 3. Summary of six Institute for Applied Ecology reports that include information on concurrence of non-native species and rare, threatened or endangered plant species.

Study Species	Reference	Study Overview	Results
Erigeron decumbens (Willamette daisy)	Thorpe (2007)	Description of associated vegetation at two Willamette daisy populations (Oxbow West & Vinci) in West Eugene Wetlands	Both sites had over 50% cover of introduced species, representing 12 – 32 introduced species • Oxbow West = 70% • Vinci = 68%
Erigeron decumbens (Willamette daisy)	Thorpe and Kaye (2007)	Monitoring effects of burning and mowing every-other year on Willamette daisy. Treatments initiated in 2002.	Treated plots had fewer Willamette daisy plants than control plots, however, there was still an increase in plants in the treated plots. Mowing increased crown cover and reproductive output compared to burn treatments. There appeared to be an increase in cover of the exotic *Anthoxathum oderatum* (sweet vernalgrass) in burned plots, but this was not quantified.
Multiple species	Blakely-Smith and Kaye (2005)	Baseline monitoring of six BLM sensitive species in Upper Willamette Resource Area, Eugene District.	Four species, *Horkelia congesta* ssp. *congesta, Lathyrus holochlorus, Sidalcea campestris,* and *Sisyrinchium hitchcokii* had observed invasive threats. Two species, *Agrostis howellii* and *Romanzoffia thompsonii* did not.
Eucephalis vialis (Wayside aster)	Thorpe, Martin and Kaye (2007)	Includes long-term dataset of associated vegetation (2002 – 2007) (Salem District).	12 invasive species occur in close proximity to *E. vialis*. *Eucephalis* increased in cover by 2.6% between 2002 – 2007. *Cytisus scoparius* increased 5x during same time period. Most invasive grasses and forbs occurred in trace amounts (< 0.5%) over all years
Calochortus greenei (Greene's mariposa lily)	Menke and Kaye (2007)	Changes in plant community at 3 sites with varying intensities of grazing (Medford District).	Sites with low to moderate grazing intensity had low, stable cover of non-native species. High intensity grazing population had lower native species abundance. *Taeniatherum caput-medusae* was dominant species

Table 3, continued. Summary of six Institute for Applied Ecology reports that include information on concurrence of non-native species and rare, threatened or endangered plant species.

Study Species	Reference	Study Overview	Results
Lupinus sulphurus ssp. *kincaidii* (Kincaid's lupine)	Menke and Kaye (2003)	Baseline monitoring of several populations in the Roseburg District.	Although non-native species were rare within *Lupinus* patches, several species commonly occurred near populations, including *Cytisus scoparius*, *Rubus discolor*, *Leucanthemum vulgare*, and *Cynosurus echinatus*.
	Thorpe and Kaye (2007)	Effect of control techniques on Kincaid's lupine and Himalayan blackberry (Eugene District).	Treatments increased lupine cover and # of inflorescences, Burning > Mowing 2x > Mowing 1x Treatments decreased blackberry cover; burning and mowing 2 x reduced cover up to 25%.

Table 4. Summary of *Plagiobothrys hirtus* research conducted by Oregon Department of Agriculture for BLM Roseburg District (Silvernail et al. 2007).

Site	Management techniques	Monitoring	Results
Soggy Bottoms	• Late season mowing (2001) • Control burn (2003) • No grazing	• Set up stakes around perimeter of area occupied by *P. hirtus* • Annual census (2003 – 2007) • Measure reproductive traits for subset of 30 plants • Photoplots set up in burned and unburned habitat, photographed at regular intervals throughout growing season (2004-2007)	• Population decline: 1869 (2004) to 37 (2007) • Factors for decline? o Altered hydrology after fire o Competition from exotic weeds (pennyroyal) • Burn improved reproductive capacity four-fold
Westgate	• Late season mowing (2001) • No grazing	• Set up stakes around perimeter of area occupied by *P. hirtus* • Annual census (2003-2007) • Measure reproductive traits for subset of 30 plants	• Population decline: 2005, 2006 • Population increase: 2673 (2006) to 13,590 (2007) • Factors for increase? o Natural variability o Response to management • Reproductive capacity only slightly higher during same timeframe

Table 5. List of invasive species present in at least four Western Oregon BLM districts.

Scientific Name	Common Name	# Districts
Centaurea debeauxii (C. pratensis)	meadow knapweed	6
Cirsium arvense	Canada thistle	6
Cirsium vulgare	bull thistle	6
Conium maculatum	poison hemlock	6
Convolvulus arvensis	field bindweed	6
Cytisus scoparius	Scotch broom, Scot's broom	6
Dactylis glomerata	orchardgrass	6
Daucus carota	wild carrot	6
Dipsacus fullonum (sylvestris)	common teasel, Fuller's teasel	6
Hypericum perforatum	St.Johnswort, Klamath Weed	6
Melilotus oficinalis, M. alba	yellow sweetclover, white sweetclover	6
Phalaris arundinacea	reed canarygrass	6
Plantago lanceolata	narrowleaf plantain	6
Senecio jacobaea	tansy ragwort	6
Solanum dulcamara	climbing nightshade	6
Verbascum thapsus	common mullein	6
Arctium minus	lesser burrdock	5
Brassica rapa	field mustard	5
Bromus tectorum	cheatgrass	5
Centaurea diffusa	diffuse knapweed	5
Centaurea solstitialis	yellow starthistle	5
Cichorium intybus	chicory	5
Digitalis purpurea	purple foxglove	5
Elymus repens (=Agropyron repens)	quackgrass	5
Hedera helix	English ivy	5
Hypochaeris radicata	hairy catsear	5
Lactuca serriola	prickly lettuce	5
Lathyrus latifolius	perennial pea	5
Leucanthemum vulgare	oxeye daisy	5
Lotus corniculatus	birdfoot deervetch	5
Polygonum cuspidatum	Japanese knotweed	5
Ranunculus repens	creeping buttercup	5
Rubus laciniatus	cutleaf blackberry	5
Taeniatherum caput-medusae	medusahead rye	5
Bromus rigidus	ripgut brome	4
Carduus nutans	musk thistle	4

Table 5, cont. List of invasive species present in at least four Western Oregon BLM districts.

Scientific Name	Common Name	# Districts
Centaurea stoebe (= C. biebersteinii) (C. maculata misapplied)	spotted knapweed	4
Cynosurus cristatus	crested dog's-tail grass	4
Cynosurus echinatus	bristly dog's-tail	4
Foeniculum vulgare	sweet fennel	4
Genista monspessulana	French broom	4
Geranium robertianum	stinky bob	4
Holcus lanatus	common velvet-grass	4
Iris pseudacorus	Yellow flag	4
Lythrum salicaria	purple loosestrife	4
Rubus armeniacus (= discolor)	Himalayan blackberry	4
Sonchus asper	prickly sowthistle	4
Tanacetum vulgare	common tansy	4
Ulex europaeus	gorse	4
Vinca major	bigleaf periwinkle	4

Table 6. Proportion of Bureau sensitive species sites with documented presence of at least one non-native weed on Roseburg District. Number of unknown reports refers to those which did not have any associated vegetation listed.

Species[1]	Total # Reports	# Weed	# No Weed	# Unknown	% Weed
Adiantum jordanii	1	0	1	0	0.0%
Arabis koehleri var. *koehleri*	4	2	2	0	50.0%
Eucephalis vialis	15	6	9	0	40.0%
Bensoniella oregona	1	0	1	0	0.0%
Calochortus coxii	9	2	2	5	22.2%
Calochortus umpquaensis	8	1	4	3	12.5%
Carex gynodynama	1	0	1	0	0.0%
Carex serratodens	1	1	0	0	100.0%
Cicendia quadrangularis	1	1	0	0	100.0%
Cimicifuga elata	6	0	4	2	0.0%
Limanthes gracilis ssp. *gracilis*	4	0	3	1	0.0%
Pellaea andromedifolia	11	7	4	0	63.6%
Perideridia erythrorhiza	7	7	0	0	100.0%
Polystichum californicum	4	0	4	0	0.0%
Ramanzoffa thompsonii	9	2	6	1	22.2%
Sisyrinchium hitchcockii	2	2	0	0	100.0%
Wolffia borealis	1	0	0	1	0.0%

[1]Data unavailable for *Plagiobothrys hirtus* and *Horkelia congesta* ssp. *congesta*

Table 7. Non-native weeds present in Bureau sensitive species sites on BLM Roseburg District. Highlighted species are on the district's noxious weed list.

	Arabis koehleri var. koehleri	*Eucephalis vialis*	*Calochortus coxii*	*Calochortus umpquaensis*	*Carex serratodens*	*Cicendia quadrangularis*	*Pellaea andromedifolia*	*Perideridia erythrorhiza*	*Ramanzoffia thompsonii*	*Sisyrinchium hitchcockii*
Aira caryophylea	--	1	--	--	--	1	--	--	--	1
Aphanes arvensis	--	--	--	--	--	--	--	--	2	--
Avena fatua	--	--	--	--	--	--	--	1	--	--
Bellis perennis	--	--	--	--	--	--	--	1	--	1
Briza minor	--	--	--	--	--	1	--	--	--	1
Bromus mollis	--	--	--	--	--	--	--	1	--	--
Bromus rigidus	--	--	--	--	--	--	1	--	--	--
Cirsium vulgare	--	--	--	--	--	--	--	1	--	--
Centarium umbellatum	--	--	--	--	--	--	--	2	--	--
Cynosurus cristatus	--	--	--	--	--	--	--	2	--	--
Cynosurus echinatus	1	2	1	1	--	--	6	3	--	--
Dactylis glomerata	--	1	--	--	--	--	--	1	--	--
Draba verna	1	--	--	--	--	--	1	--	--	--
Erodium cicutarium	--	--	--	--	--	--	2	--	--	--
Holcus lanatus	--	1	--	--	--	--	--	4	--	1
Hypericum perforatum	--	1	--	--	--	--	2	2	--	--
Hypochaeris radicata	1	1	--	--	--	--	--	1	--	1
Lathyrus latifolius	--	1	--	--	--	--	--	--	--	--
Linum bienne	--	--	--	1	--	--	--	1	--	--
Lolium multiforum	--	--	--	--	1	--	--	2	--	--
Lotus corniculatus	--	1	--		--	--	--	--	--	--
Luzula campestris	--	1	1	--	--	--	--	--	--	--
Mentha pulegium	--	--	--	--	--	--	--	2	--	2
Poa pratensis	--	--	--	--	1	--	--	--	--	--
Rosa eglanteria	--	--	--	--	--	--	--	1	--	--
Rubus discolor	--	--	--	--	--	--	1	1	--	--
Taenaitherum caput-medusae	--	--	--	--	--	--	1	4	--	--
Vulpia myuros	--	--	--	--	--	--	1	--	--	--

Table 8. List of noxious weed species found on BLM Roseburg District.

Family	Species	Common Name	Code
Apiaceae	*Conium maculatum*	Poison-hemlock	COMA2
Araliaceae	*Hedera helix*	English ivy	HEHE
Asteraceae	*Carduus pycnocephalus*	Italian plumeless thistle	CAPY2
Asteraceae	*Carduus tenuiflorus*	Winged plumeless thistle	CATE2
Asteraceae	*Carthamus lanatus*	Wooly distaff thistle	CALA20
Asteraceae	*Centaurea diffusa*	Diffuse knapweed	CEDI3
Asteraceae	*Centaurea melitensis*	Tocalote, Malta starthistle	CEME2
Asteraceae	*Centaurea pratensis*	Meadow knapweed	CEPR2
Asteraceae	*Centaurea solstitalis*	Yellow starthistle	CESO3
Asteraceae	*Chondrilla juncea*	Skeleton-weed	CHJU
Asteraceae	*Cirsium arvense*	Canadian thistle	CIAR4
Asteraceae	*Cirsium vulgare*	Bull thistle	CIVU
Asteraceae	*Erechtites minima*	Coastal burnweed	ERMI6
Asteraceae	*Senecio jacobea*	Stinking willie	SEJA
Asteraceae	*Silybum marianum*	Blessed milk thistle	SIMA3
Clusiaceae	*Hypericum perforatum*	Common St. Johnswort	HYPE
Convolvulaceae	*Convolvulus arvensis*	Field bindweed	COAR4
Fabaceae	*Cytisus scoparius*	Scot's broom	CYSC4
Fabaceae	*Cytisus striatus*	Portugese broom	CYST7
Fabaceae	*Genista monspessulana*	French broom	GEMO2
Fabaceae	*Spartium junceum*	Spanish broom	SPJU2
Fabaceae	*Ulex europaeus*	Gorse	ULEU
Lamiaceae	*Mentha pulegium*	Pennyroyal	MEPU
Lythraceae	*Lythrum salicaria*	Purple loosestrife	LYSA2
Malvaceae	*Abutilon theophrasti*	Velvetleaf	ABTH

Table 8, cont.. List of noxious weed species found on BLM Roseburg District.

Family	Species	Common Name	Code
Poaceae	*Taeniatherum caput-medusae*	Medusahead	TACA8
Polygonaceae	*Polygonum cuspidatum*	Japanese knotweed	POCU6
Rosaceae	*Crataegus monogyna*	One-seed hawthorn	CRMO3
Rosaceae	*Potentilla recta*	Sulfur cinquefoil	PORE5
Rosaceae	*Rubus discolor*	Himalayan blackberry	RUDI2

Table 9. Non-native weeds present in *Lupinus sulphureus* ssp. *kincaidii* sites on Roseburg District based on a 2003 study conducted by the Institute for Applied Ecology. Highlighted species are on the district's noxious weed list.

Species	Sites								
	Loose Laces-1	Loose Laces-2	Loose Laces-3	Loose Laces-4	Letitia Creek	Callahan Meadows	China Ditch-1	China Ditch-2	China Ditch-3
Bromus rigidus	--	--	--	--	--	x	--	--	--
Cynosurus echinatus	--	--	--	--	--	x	x	x	x
Cytisus scoparius	--	--	--	--	--	--	x	--	x
Daucus carrota	x	--	x	--	--	--	--	--	--
Geranium molle	--	--	--	--	--	x	--	--	--
Hypericum perforatum	--	--	x	--	--	--	x	--	x
Hypochaeris radicata	--	--	x	--	--	--	--	--	x
Linum perenne	--	--	--	--	--	--	x	x	x
Lolium arundinaceum	x	--	--	--	--	--	--	--	--
Poa pratensis	--	--	--	--	--	x	--	--	--
Rubus discolor	--	--	--	--	--	--	x	x	--
Sherardia arvensis	--	--	--	--	--	x	--	--	--
Torilis arvensis	--	--	--	--	--	x	--	--	--
Trifolium dubius	--	--	--	--	--	--	x	--	x
Trifolium subterraneum	--	--	--	--	--	x	--	--	--
Vicia sativa	--	--	--	--	--	--	--	x	--
Total	**2**	**0**	**3**	**0**	**0**	**7**	**6**	**4**	**6**

APPENDIX

A. RESIST SURVEY

RESIST survey

1. Introduction

Thank you for participating in our RESIST (Rare and Endangered Species and Invasive Species Threats) survey.

We are only looking for responses about T&E plant species

The Institute for Applied Ecology is conducting this survey to determine:

1. the extent to which rare, threatened, and endangered plant species are impacted by exotic plant species,

2. the nature of impacts of exotic species on listed species,

3. the methods that are currently being used to control exotic species in habitat occupied by listed species, and

4. what information and/or tools are needed for land managers.

We estimate that it will take about 5 minutes to complete this survey.

RESIST survey

2. Background information

Please tell us a little about you.

1. Who do you work for?

2. In which state or province is the land you manage?

RESIST survey

3. Listed species information

For the use of this survey, we are defining "T&E species" as any species that fits within one of the following categories:
Species listed by the Endangered Species Act (including candidate, threatened, and endangered)
State listed species (including candidate, threatened, and endangered)
Agency listed species (including BLM Bureau Sensitive and USFS Special Status)
Species listed under the Species At Risk Act (SARA)
Species listed under the Heritage Program

*** 3. do you manage T&E species?**

- yes
- no

4. How many T&E species do you manage?

RESIST survey

4. Exotic species information

For the purpose of this survey, we are defining "exotic species" as any species that has been introduced and includes species that may be called nonnative, exotic, and invasive.

*** 5. Do you manage exotic species?**

6. How many exotic species do you manage?

*** 7. Do any of the exotic species occur in T&E species habitat?**

8. What threat/s do the exotic species pose to the T&E species? (you may select more than one answer)

- ☐ competition for light
- ☐ competition for water
- ☐ competition for space
- ☐ competition for nutrients
- ☐ competition for pollinators
- ☐ increases thatch
- ☐ increases fire risk
- ☐ disease vector
- ☐ Other (please specify)

9. What impacts have you observed exotic species having on T&E species? (you may select more than one answer)

- ☐ No impact
- ☐ Reduced plant size
- ☐ Reduced flowering and/or reproduction
- ☐ Reduced population size
- ☐ Hybridization and genetic swamping
- ☐ Extirpation
- ☐ Other (please specify)

RESIST survey

5. for extirpated species

We are especially interested in obtaining specific examples of when an invasive species has caused the extirpation of a native species. Please provide species name below.

10. What was the listed species that was extirpated?

11. Which invasive species caused the extirpation?

RESIST survey

6. control information

12. What methods have you used to control invasive species that occur within listed species habitat (you may select more than one).

	Check if you have used this method	Check if this method has been effective
mowing	☐	☐
herbicides	☐	☐
burning	☐	☐
biocontrol	☐	☐
hand-pulling	☐	☐
raking	☐	☐
none	☐	☐

*** 13. Are herbicides available to you as a tool?**

14. If you are not able to use herbicides, why not? (you may select more than one answer)

- ☐ endangered species
- ☐ agency-wide restrictions
- ☐ negative public attitude
- ☐ nothing available for current needs (label restrictions)
- ☐ Other (please specify)

*** 15. To what degree do each of the following limit management of exotic species in T&E habitat?**

	high	moderate	low	no effect	N/A
funding	○	○	○	○	○
agency support	○	○	○	○	○
knowledge of control	○	○	○	○	○
efficacy of control	○	○	○	○	○
limitations to use of herbicide	○	○	○	○	○
limitations to use of fire	○	○	○	○	○
scale of problem	○	○	○	○	○

RESIST survey

16. Which of the following is your top concern limiting the management of exotic species in T&E species habitat?

- ○ funding
- ○ agency support
- ○ knowledge of control
- ○ efficacy of control
- ○ limitations to use of herbicide
- ○ limitations to use of fire
- ○ scale of problem

17. Is there any other information on the interactions of listed and exotic species that you would like to share with us?

RESIST survey

7. Closing and contact

18. If you would be willing to answer more detailed questions about the interactions of listed and exotic species, please let us know how best to contact you.

Name:

agency/affiliation:

Street/PO Box:

City:

State:

Zip code:

Phone number:

Alternate phone number:

e-mail:

Thank you for taking part of our survey. If you have any questions about the survey or the Institute for Applied Ecology, please visit our website, www.appliedeco.org or e-mail Andrea S. Thorpe, PhD at andrea@appliedeco.org

B. COMPLETED "RARE AND INVASIVE SPECIES INTERACTIONS" FORMS FOR SITES VISITED IN THE ROSEBURG DISTRICT BLM IN 2009.

Date:	07/08/2009

Rare and Invasive Species Interactions

For each rare species site, please document presence of invasive species and degree to which they comingle with the rare species. For example, if an invasive species is present at the site, but is not within the population boundaries of the rare species, it would receive a "none", though be marked as present. Include comments such as observed impacts to rare species (e.g. increased thatch, reduced light).

General Information			
Completed by?	**Andrea Thorpe**	**Organization:**	**Institute for Applied Ecology**
Native plant:	**Calochortus umpquaensis**	**BLM status:**	**Oregon Endangered**
Site Name: (County)	**078; T26S, R3W, Sec 27**	**District:**	**Roseburg**
Other site disturbances?	**none**		
Invasive Information			
Invasive species:	Taeniatherum caput-medusae	**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments: CAUM not observed			
Invasive species:	Rubus armeniacus	**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments: CAUM not observed			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			

Date:	07/08/2009

Rare and Invasive Species Interactions

For each rare species site, please document presence of invasive species and degree to which they comingle with the rare species. For example, if an invasive species is present at the site, but is not within the population boundaries of the rare species, it would receive a "none", though be marked as present. Include comments such as observed impacts to rare species (e.g. increased thatch, reduced light).

General Information			
Completed by?	**Andrea Thorpe**	**Organization:**	**Institute for Applied Ecology**
Native plant:	**Calochortus umpquaensis**	**BLM status:**	**Oregon Endangered**
Site Name: (County)	**Callahan Meadows**	**District:**	**Roseburg**
Other site disturbances?	**none**		

Invasive Information			
Invasive species:	Taeniatherum caput-medusae, Bromus hordeacus, Cynosurus echinatus	**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments: CAUM not observed, but grasses common throughout			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			

Date:	5/12/2009

Rare and Invasive Species Interactions

For each rare species site, please document presence of invasive species and degree to which they comingle with the rare species. For example, if an invasive species is present at the site, but is not within the population boundaries of the rare species, it would receive a "none", though be marked as present. Include comments such as observed impacts to rare species (e.g. increased thatch, reduced light).

General Information			
Completed by?	**Andrea Thorpe**	**Organization:**	**Institute for Applied Ecology**
Native plant:	**Lupinus sulphureus ssp. kincaidii**	**BLM status:**	**UWFS Threatened**
Site Name: (County)	**Callahan Meadows**	**District:**	**Roseburg**
Other site disturbances?	**none**		
Invasive Information			
Invasive species:	Cynosourus echinitus, Bromus hodeaceus, Bromus rigidus, Poa pratensis	**Degree of commingling:**	Complete
Approx. cover of invasive or number of plants:		Total cover of all annual grasses 15-20%	
Comments: Some thatch from annual grasses			
Invasive species:	Rumex crispus	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:		<1%	
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			

Date:	5/12/2009

Rare and Invasive Species Interactions

For each rare species site, please document presence of invasive species and degree to which they comingle with the rare species. For example, if an invasive species is present at the site, but is not within the population boundaries of the rare species, it would receive a "none", though be marked as present. Include comments such as observed impacts to rare species (e.g. increased thatch, reduced light).

General Information			
Completed by?	**Andrea Thorpe**	**Organization:**	**Institute for Applied Ecology**
Native plant:	**Lupinus sulphureus ssp. kincaidii**	**BLM status:**	**UWFS Threatened**
Site Name: (County)	**China Ditch, sub-pop 1 & 2**	**District:**	**Roseburg**
Other site disturbances?	**none**		

Invasive Information			
Invasive species:	Bromus hordeaceus, Aira caryophyllea, Cynosurs echinatus	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	<5%		
Comments: most annual grasses on cut-bank edge next to road, some mixing with LUSUKI			
Invasive species:	Centaurea pratensis	**Degree of commingling:**	None
Approx. cover of invasive or number of plants:	5-10 individuals		
Comments: At site, though not within LUSUKI population.			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			

Date:	5/12/2009

Rare and Invasive Species Interactions

For each rare species site, please document presence of invasive species and degree to which they comingle with the rare species. For example, if an invasive species is present at the site, but is not within the population boundaries of the rare species, it would receive a "none", though be marked as present. Include comments such as observed impacts to rare species (e.g. increased thatch, reduced light).

General Information			
Completed by?	**Andrea Thorpe**	**Organization:**	**Institute for Applied Ecology**
Native plant:	**Lupinus sulphureus ssp. kincaidii**	**BLM status:**	**UWFS Threatened**
Site Name: (County)	**China Ditch, Sub-pop 3**	**District:**	**Roseburg**
Other site disturbances?	**none**		
Invasive Information			
Invasive species:	Cynosourus echinitus, Bromus hodeaceus,	**Degree of commingling:**	None
Approx. cover of invasive or number of plants:	Total cover of all annual grasses ~75%		
Comments: On road adjacent to population			
Invasive species:	Cytisus scoparius	**Degree of commingling:**	None
Approx. cover of invasive or number of plants:	<1%		
Comments: On cut bank, though not intermingled with plants			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			

Date:	5/12/2009

Rare and Invasive Species Interactions

For each rare species site, please document presence of invasive species and degree to which they comingle with the rare species. For example, if an invasive species is present at the site, but is not within the population boundaries of the rare species, it would receive a "none", though be marked as present. Include comments such as observed impacts to rare species (e.g. increased thatch, reduced light).

General Information			
Completed by?	**Andrea Thorpe**	**Organization:**	**Institute for Applied Ecology**
Native plant:	**Lupinus sulphureus ssp. kincaidii**	**BLM status:**	**UWFS Threatened**
Site Name: (County)	**Dickerson Heights**	**District:**	**Roseburg**
Other site disturbances?	**none**		
Invasive Information			
Invasive species:	Cynosurus echinatus	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	1%		
Comments:			
Invasive species:	Rubus armeniacus	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	5%		
Comments:	on roadside/cut bank		
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			

Date:	5/12/2009

Rare and Invasive Species Interactions

For each rare species site, please document presence of invasive species and degree to which they comingle with the rare species. For example, if an invasive species is present at the site, but is not within the population boundaries of the rare species, it would receive a "none", though be marked as present. Include comments such as observed impacts to rare species (e.g. increased thatch, reduced light).

General Information			
Completed by?	**Andrea Thorpe**	**Organization:**	**Institute for Applied Ecology**
Native plant:	**Lupinus sulphureus ssp. kincaidii**	**BLM status:**	**UWFS Threatened**
Site Name: (County)	**Letitia Creek, sub-population 1**	**District:**	**Roseburg**
Other site disturbances?	**none**		
Invasive Information			
Invasive species:	Rubus armeniacus	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	5%		
Comments:			
Invasive species:	annual grasses	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	<1%		
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			

Date:	5/12/2009

Rare and Invasive Species Interactions

For each rare species site, please document presence of invasive species and degree to which they comingle with the rare species. For example, if an invasive species is present at the site, but is not within the population boundaries of the rare species, it would receive a "none", though be marked as present. Include comments such as observed impacts to rare species (e.g. increased thatch, reduced light).

General Information			
Completed by?	**Andrea Thorpe**	**Organization:**	**Institute for Applied Ecology**
Native plant:	**Lupinus sulphureus ssp. kincaidii**	**BLM status:**	**UWFS Threatened**
Site Name: (County)	**Letitia Creek 2**	**District:**	**Roseburg**
Other site disturbances?	**none**		
Invasive Information			
Invasive species:	Cirsium vulgare	**Degree of commingling:**	None
Approx. cover of invasive or number of plants:	7-10 rosettes		
Comments:	on cut bank adjacent to and below population		
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			

Date:	5/12/2009

Rare and Invasive Species Interactions

For each rare species site, please document presence of invasive species and degree to which they comingle with the rare species. For example, if an invasive species is present at the site, but is not within the population boundaries of the rare species, it would receive a "none", though be marked as present. Include comments such as observed impacts to rare species (e.g. increased thatch, reduced light).

General Information			
Completed by?	**Andrea Thorpe**	**Organization:**	**Institute for Applied Ecology**
Native plant:	**Lupinus sulphureus ssp. kincaidii**	**BLM status:**	**UWFS Threatened**
Site Name: (County)	**Loose Laces sub-pop 1**	**District:**	**Roseburg**
Other site disturbances?	**none**		
Invasive Information			
Invasive species:	Bromus rigidus	**Degree of commingling:**	None
Approx. cover of invasive or number of plants:	<5%		
Comments:	at edge of population		
Invasive species:	Cirsium arvense	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	2 rosettes		
Comments:			
Invasive species:	Bromus spp.	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	5-10% over entire site, <2%/m2		
Comments:			
Invasive species:	Rubus armeniacus	**Degree of commingling:**	Complete
Approx. cover of invasive or number of plants:	5-10%		
Comments:	short where growing with LUSUKI, but taller elsewhere		
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			

Date:	5/12/2009

Rare and Invasive Species Interactions

For each rare species site, please document presence of invasive species and degree to which they comingle with the rare species. For example, if an invasive species is present at the site, but is not within the population boundaries of the rare species, it would receive a "none", though be marked as present. Include comments such as observed impacts to rare species (e.g. increased thatch, reduced light).

General Information			
Completed by?	**Andrea Thorpe**	**Organization:**	**Institute for Applied Ecology**
Native plant:	**Lupinus sulphureus ssp. kincaidii**	**BLM status:**	**UWFS Threatened**
Site Name: (County)	**Loose Laces sub-pop 2**	**District:**	**Roseburg**
Other site disturbances?	**none**		
Invasive Information			
Invasive species:	Rubus armeniacus	**Degree of commingling:**	Complete
Approx. cover of invasive or number of plants:	<5%		
Comments:			
Invasive species:	Festuca arundinaceae (Schedonorus phoenix)	**Degree of commingling:**	Complete
Approx. cover of invasive or number of plants:	<5%		
Comments:			
Invasive species:	Bromus spp.	**Degree of commingling:**	Complete
Approx. cover of invasive or number of plants:	<5%		
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			

Date:	5/12/2009

Rare and Invasive Species Interactions

For each rare species site, please document presence of invasive species and degree to which they comingle with the rare species. For example, if an invasive species is present at the site, but is not within the population boundaries of the rare species, it would receive a "none", though be marked as present. Include comments such as observed impacts to rare species (e.g. increased thatch, reduced light).

General Information			
Completed by?	**Andrea Thorpe**	**Organization:**	**Institute for Applied Ecology**
Native plant:	**Lupinus sulphureus ssp. kincaidii**	**BLM status:**	**UWFS Threatened**
Site Name: (County)	**Loose Laces sub-pop 3**	**District:**	**Roseburg**
Other site disturbances?	**none**		
Invasive Information			
Invasive species:	Bromus hordeaceus	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	<5%		
Comments: through-out population			
Invasive species:	Cytisus scoparius	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	~1m x 1m		
Comments: ~1m tall, seeding			
Invasive species:	Hypericum perforatum	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	3m x 1m total		
Comments: pathcily distributed throug-out			
Invasive species:	Rubus armeniacus	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	1m x 1m		
Comments:			
Invasive species:	Cirsium arvense	**Degree of commingling:**	Complete
Approx. cover of invasive or number of plants:			
Invasive species:	Dactylis spp.	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	<2%		
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			

Date:	5/12/2009

Rare and Invasive Species Interactions

For each rare species site, please document presence of invasive species and degree to which they comingle with the rare species. For example, if an invasive species is present at the site, but is not within the population boundaries of the rare species, it would receive a "none", though be marked as present. Include comments such as observed impacts to rare species (e.g. increased thatch, reduced light).

General Information			
Completed by?	**Andrea Thorpe**	**Organization:**	**Institute for Applied Ecology**
Native plant:	**Lupinus sulphureus ssp. kincaidii**	**BLM status:**	**UWFS Threatened**
Site Name: (County)	**Loose Laces sub-pop 4**	**District:**	**Roseburg**
Other site disturbances?	**none**		
Invasive Information			
Invasive species:	Rubus armeniacus	**Degree of commingling:**	Complete
Approx. cover of invasive or number of plants:	<5%		
Comments:			
Invasive species:	Bromus spp.	**Degree of commingling:**	Complete
Approx. cover of invasive or number of plants:	<5%		
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			

Date:	5/12/2009

Rare and Invasive Species Interactions

For each rare species site, please document presence of invasive species and degree to which they comingle with the rare species. For example, if an invasive species is present at the site, but is not within the population boundaries of the rare species, it would receive a "none", though be marked as present. Include comments such as observed impacts to rare species (e.g. increased thatch, reduced light).

General Information			
Completed by?	**Andrea Thorpe**	**Organization:**	**Institute for Applied Ecology**
Native plant:	**Lupinus sulphureus ssp. kincaidii**	**BLM status:**	**UWFS Threatened**
Site Name: (County)	**Stouts Creek, roadside**	**District:**	**Roseburg**
Other site disturbances?	**none**		
Invasive Information			
Invasive species:	Bromus hordeaceus, B. mollis, B. tectorum, Dactylis glomerata	**Degree of commingling:**	None
Approx. cover of invasive or number of plants:	>80%		
Comments:	where grasses are most dense, there is no LUSUKI		
Invasive species:	Cirsium spp	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	<2%		
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			

Date:	5/12/2009

Rare and Invasive Species Interactions

For each rare species site, please document presence of invasive species and degree to which they comingle with the rare species. For example, if an invasive species is present at the site, but is not within the population boundaries of the rare species, it would receive a "none", though be marked as present. Include comments such as observed impacts to rare species (e.g. increased thatch, reduced light).

General Information			
Completed by?	**Andrea Thorpe**	**Organization:**	**Institute for Applied Ecology**
Native plant:	**Lupinus sulphureus ssp. kincaidii**	**BLM status:**	**UWFS Threatened**
Site Name: (County)	**Stouts Creek, sub-pop 1**	**District:**	**Roseburg**
Other site disturbances?	**none**		
Invasive Information			
Invasive species:	Bromus hordeaceus, B. rigidus, B. tectorum, Aira caryophyllea, Cynosorus echinatus, Dactylis glomerata, Allopecurus	**Degree of commingling:**	Complete
Approx. cover of invasive or number of plants:	>30%		
Comments: remnant thatch			
Invasive species:	Rubus armeniacus	**Degree of commingling:**	Complete
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:	3m x total		
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			

Date:	5/12/2009

Rare and Invasive Species Interactions

For each rare species site, please document presence of invasive species and degree to which they comingle with the rare species. For example, if an invasive species is present at the site, but is not within the population boundaries of the rare species, it would receive a "none", though be marked as present. Include comments such as observed impacts to rare species (e.g. increased thatch, reduced light).

General Information			
Completed by?	**Andrea Thorpe**	**Organization:**	**Institute for Applied Ecology**
Native plant:	**Lupinus sulphureus ssp. kincaidii**	**BLM status:**	**UWFS Threatened**
Site Name: (County)	**Stouts Creek, sub-pop 2**	**District:**	**Roseburg**
Other site disturbances?	**none**		
Invasive Information			
Invasive species:	Bromus hordeaceus, B. mollis, B. tectorum, Dactylis glomerata	**Degree of commingling:**	Complete
Approx. cover of invasive or number of plants:	25%		
Comments:	where grasses are most dense, there is no LUSUKI; remnant thatch		
Invasive species:	Rubus armeniacus	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	10%		
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			

Date:	07/20/2009

Rare and Invasive Species Interactions

For each rare species site, please document presence of invasive species and degree to which they comingle with the rare species. For example, if an invasive species is present at the site, but is not within the population boundaries of the rare species, it would receive a "none", though be marked as present. Include comments such as observed impacts to rare species (e.g. increased thatch, reduced light).

General Information			
Completed by?	**Andrea Thorpe**	**Organization:**	**Institute for Applied Ecology**
Native plant:	**Perideridia erythrorhiza**	**BLM status:**	**Federal Species of Concern**
Site Name: (County)	**OR100_0218, 002**	**District:**	**Roseburg**
Other site disturbances?	**none**		
Invasive Information			
Invasive species:	Rubus discolor	**Degree of commingling:**	None
Approx. cover of invasive or number of plants:			
Comments: On edge of meadow, could invade into PEER population			
Invasive species:	Mentha pulugium	**Degree of commingling:**	Complete
Approx. cover of invasive or number of plants:	5% over entire area		
Comments: Mentha thick in places			
Invasive species:	Holcus lanatus, Cynosurus echinatus	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	10-20%		
Comments: thatch thicker as move south down drainage			
Invasive species:	Silybum marianum	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	2-5%		
Comments:			
Invasive species:	Hypericum perforatum	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	<1%		
Invasive species:	Senecio jacobaea	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	low		
Comments: Plants mainly on edge of meadow			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			

Date:	07/20/2009

Rare and Invasive Species Interactions

For each rare species site, please document presence of invasive species and degree to which they comingle with the rare species. For example, if an invasive species is present at the site, but is not within the population boundaries of the rare species, it would receive a "none", though be marked as present. Include comments such as observed impacts to rare species (e.g. increased thatch, reduced light).

General Information			
Completed by?	**Andrea Thorpe**	**Organization:**	**Institute for Applied Ecology**
Native plant:	**Perideridia erythrorhiza**	**BLM status:**	**Federal Species of Concern**
Site Name: (County)	**OR100_0218, 005 and Site 0130 (roadside)**	**District:**	**Roseburg**
Other site disturbances?	**none**		
Invasive Information			
Invasive species:	Mentha pulugium	**Degree of commingling:**	None
Approx. cover of invasive or number of plants:			
Comments: PEER tends to be in shade of oaks; MEPU tends to be in open			
Invasive species:	RUDI	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:			
Comments: more common closer to road			
Invasive species:	Taeniatherum caput-medusae, Holcus lanatus, Cynosurus echinatus	**Degree of commingling:**	Complete
Approx. cover of invasive or number of plants:	>80%		
Comments: grass cover increases closer to road			
Invasive species:	Silybum marianum	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	2-5%		
Comments:			
Invasive species:	Hypericum perforatum	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	<1%		
Invasive species:	Senecio jacobaea	**Degree of commingling:**	Partial
Approx. cover of invasive or number of plants:	low		
Comments: Plants mainly on edge of meadow			
Invasive species:		**Degree of commingling:**	--
Approx. cover of invasive or number of plants:			
Comments:			

C. LIST OF RARE SPECIES CURRENTLY INCLUDED IN THE RESIST WEBSITE

Abronia umbellata ssp. breviflora
Abutilon parishii
Abutilon sandwicense
Acaena ssp.
Adiantum viridimontanum
Aeschynomene virginica
Agrostis howellii
Alectryon macrococcus
Alsinidendron trinerve
Amorpha herbacea var. crenulata
Amsinckia grandiflora
Arabis fecunda
Arabis serotina
Astragalus applegatei
Astragalus eremiticus
Astragalus lentiginosus var. micans
Astragalus robbinsii
Bonamia ovalifolia
Brighamia insignis
Calochortus coxii
Calochortus greenei
Calochortus umpquaensis
Calycadenia villosa
Canavalia molokaiensis
Castilleja levisecta
Chamaesyce deltoidea ssp. deltoidea
Chionochloa ssp.
Cicendia quadrangularis
Cirsium vinaceum
Colubrina oppositifolia
Cordylanthus maritimus ssp. maritimus
Crataegus harbisonii
Cucurbita okeechobeensis
Delissea rhytidosperma
Digitaria pauciflora
Dudleya nesiotica
Eriastrum densifolium ssp. sanctorum
Erigeron decumbens
Eriogonum codium
Eriogonum ovalifolium var. williamsiae
Eucephalus vialis
Euphorbia haeleeleana
Fritillaria gentneri
Galactia smallii
Gardenia mannii
Gaura neomexicana ssp. coloradensis
Hedeoma diffusa
Hedyotis st.-johnii
Helianthus paradoxus
Hibiscadelphus distans
Hibiscadelphus hualalaiensis
Hibiscadelphus woodii
Hibiscus brackenridgei ssp. brackenridgei
Horkelia congesta ssp. congesta
Isodendrion pyrifolium
Jacquemontia reclinata
Kokia drynarioides
Kokia kauaiensis
Lathyrus holochlorus
Leavenworthia aurea var. texana
Lepidium papilliferum
Lesquerella tuplashensis
Lilium pardalinum ssp. pitkinense
Lipochaeta lobata var. leptophylla
Lomatium cookii
Lupinus oreganus var. kincaidii
Marsilea villosa
Mespilus canescens
Mimulus ringens var. colpophilus
Mirabilis macfarlanei
Nothocestrum breviflorum
Oenothera deltoides ssp. howellii
Pachycladon cheesemanii
Pellaea andromedifolia
Perideridia erythrorhiza
Phacelia argentea
Pimella spicata
Plagiobothrys hirtus
Platanthera leucophaea
Poa mannii
Pritchardia viscosa
Puccinellia howellii
Romanzoffia thompsonii
Sabatia kennedyana
Schoenoplectus hallii
Scirpus longii
Sericocarpus rigidus
Sesbania tomentosa
Sidalcea campestris
Sidalcea cusickii
Sidalcea hendersonii
Silene perlmanii
Silene regia
Silene spaldingii
Sisyrinchium hitchcockii
Solidago shortii
Spiraea virginiana
Stephanomeria malheurensis
Tetramolopium lepidotum ssp. lepidotum
Trifolium thompsonii
Viola chamissoniana ssp. chamissoniana
Zanthoxylum dipetalum var. tomentosum

D. LIST OF INVASIVE SPECIES CURRENTLY INCLUDED IN THE RESIST WEBSITE

Ageratum conyzoides
Agrostis capillaris
Aira caryophyllea
Aleurites moluccana
Alliaria petiolata
Ammophila arenaria
Anthoxanthum odoratum
Arundo donax
Bauhinia variegata
Brachypodium sylvaticum
Bromus diandrus
Bromus hordeaceus
Bromus inermis
Bromus tectorum
Centaurea diffusa
Centaurea nigrescens
Centaurea solstitialis
Centaurea stoebe ssp. micranthos
Ceratocephala testiculata
Chrysanthemoides monilifera subsp. rotundata
Cirsium arvense
Cirsium vulgare
Cordyline fruticosa
Coronilla varia
Cupaniopsis anacardioides
Cynanchum rossicum
Cynosurus echinatus
Cytisus scoparius
Dipsacus fullonum
Distichlis spicata
Erigeron karvinskianus
Frangula alnus
Grevillea robusta
Hieracium pilosella
Hypericum perforatum
Hypochaeris radicata
Kalanchoe pinnata
Lantana camara
Lathyrus polyphyllus
Lepidium latifolium
Leucaena leucocephala
Leucanthemum vulgare
Linaria dalmatica
Lolium perenne
Lonicera japonica
Lonicera maackii
Lotus corniculatus
Lythrum salicaria
Melaleuca quinquenervia
Melinis minutiflora
Mentha pulegium
Microstegium vimineum
Morella faya
Neyraudia reynaudiana
Parapholis incurva
Paspalum conjugatum
Passiflora ligularis
Passiflora suberosa
Passiflora tripartita var. mollissima
Pennisetum ciliare
Pennisetum clandestinum
Pennisetum setaceum
Phalaris arundinacea
Phragmites australis
Pluchea carolinensis
Poa bulbosa
Poa pratensis
Polygonum cuspidatum
Polypogon monspeliensis
Prosopis pallida
Pseudotsuga menziesii
Psidium cattleianum
Psidium guajava
Pyrus communis
Rhamnus cathartica
Rosa bracteata
Rosa multiflora
Rubus argutus
Rubus armeniacus
Rubus laciniatus
Rubus rosifolius
Salsola tragus
Schedonorus phoenix
Schinus terebinthifolius
Setaria parviflora
Silybum marianum
Spiraea japonica
Sporobolus indicus
Stachytarpheta australis
Symphoricarpos albus
Taeniatherum caput-medusae
Tamarix ramosissima
Toxicodendron diversilobum
Triumfetta semitriloba
Urochloa maxima
Vulpia myuros