



Invasive Species Science Update

Number 5, December 2011

From the Newsletter Editors

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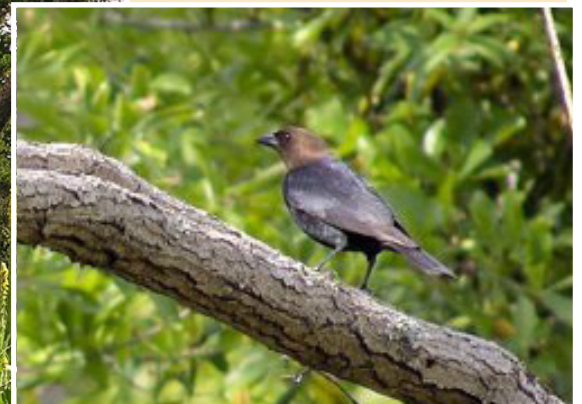
This Issue ...

- ▶ Wildfire's influence on exotic plants
- ▶ Exotic forbs transform Intermountain grasslands
- ▶ Podcast on spider research
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- ▶ Brook trout vs. native cutthroat trout
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Welcome to the fifth issue of the Rocky Mountain Research Station's (RMRS) Invasive Species Science Update. The newsletter is produced by the RMRS Invasive Species Working Group (ISWG), which is a core group of scientists who volunteer to coordinate outreach of RMRS invasive species science to managers and the public. After publishing the past four newsletters, we've concluded that an annual issue will best represent the pace of new science and keep users abreast of the latest research. Subsequent issues will occur each fall. The ISWG also disperses its recent research findings through periodic white papers and our website. The latest white paper, "Rocky Mountain Research Station Invasive Species

Visionary White Paper," is in press and due out soon. It provides an overview of RMRS invasives science coverage and gaps through 2011. We'll distribute it to this mailing list and post it on our website at http://www.rmrs.nau.edu/invasive_species/index.php. All of our products, including all newsletters and publication lists, can be found at this website. We want your feedback on ways to improve this service and encourage anyone who wishes to be an active participant in developing these products to join the ISWG. If you have comments or questions, please contact the ISWG team leader, Dean Pearson, dpearson@fs.fed.us.

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Research Notes

Exotic Plant Response to Wildfire

By: Paula Fornwalt (pfornwalt@fs.fed.us), Research Ecologist, Forest and Woodland Ecosystems Program, Fort Collins, CO

Fire is a key ecological process in forests of the western United States, and it plays critical roles in regulating and sustaining native understory plant communities. But fire can also help establish and spread exotic plant species. Given that the occurrence of fire—both wild and prescribed—has increased in recent decades and is likely to continue to increase in the future, we must develop a thorough understanding of the factors influencing postfire exotic plant response.

In 2002, the Hayman Fire burned across 55,800 ha of *Pinus ponderosa*—*Pseudotsuga menziesii* (ponderosa pine—Douglas-fir) forest in the Colorado Front Range. Also burned in the fire were pre-existing plots that had been surveyed for understory plant composition and cover in 1997. Researchers from Fort Collins, Colorado, seized this opportunity to examine the influence of the Hayman Fire on exotic plants by remeasuring the plots annually from 2003 to 2007. Their results were recently published in the journal *Biological Invasions*.

The researchers found that total exotic richness and cover were highly dependent

on fire severity, with exotics being least stimulated by fire in lightly burned areas, and most stimulated in moderately and severely burned areas. Furthermore, in moderately and severely burned areas, exotic richness and cover generally increased as time since fire passed. However, exotic richness and cover remained low as of 2007, and correlations between native and exotic richness and cover suggest that exotics have not yet interfered with native understory development.

The prefire dataset also provided unique evidence that prefire exotic community composition at both local (i.e., plot) and landscape (i.e., study site) scales strongly influences the postfire exotic community that develops at a given location. The researchers found that regardless of fire severity, the exotic species that were present in a plot before the fire were also largely present in the plot after the fire. Furthermore, most new exotic species in a plot were

present elsewhere in the study site before the fire. However, some new species were truly new invaders that were not found in the prefire surveys. The most notable new invader was cheatgrass (*Bromus tectorum*), which was not found in the plots until 2007, the last year surveys were conducted. Continued monitoring of exotic species is planned for 2012, 10 years post fire, and will provide valuable insight into longer-term patterns of postfire exotic invasion. For more information, see Fornwalt and others (2010), in the Recent Publications section on page 8.



Verbascum thapsus (common mullein), foreground, was the most commonly encountered nonnative plant species following the Hayman Fire.

Podcast Features Spider Research

A podcast produced by the Encyclopedia of Life and Atlantic Public Media features work by Research Ecologist Dean Pearson (Missoula, MT) on the effects of invasive plants on native spiders and food-web interactions. Encyclopedia of Life catalogs information about all species on the planet in a way that is interesting and user friendly. This research was also featured on National Public Radio's "Living on Earth" series. To hear the podcast, visit <http://education.eol.org/podcast/branch-tip-spiders>.



Native *Dictyna* spider webs on plants of the exotic invader, spotted knapweed, at Lee Metcalf National Wildlife Refuge in western Montana.



Native grassland in winter, western Montana. Native forbs have long senesced, leaving only the simple structure of native bunchgrasses.



Invaded grassland in winter, western Montana. The flowering stems of exotic species such as spotted knapweed persist well beyond the growing season, providing ideal structures for native web-building spiders.

The Transformation of Intermountain Grasslands by Exotic Forbs: More Than Meets the Eye

By: Dean Pearson (dpearson@fs.fed.us), Research Ecologist, Yvette Ortega (yortega@fs.fed.us), Ecologist, and Samantha Sears, Biological Technician, Wildlife and Terrestrial Ecosystems Program, Missoula, MT

Intermountain grasslands of the northern Rocky Mountains are being transformed. Exotic forbs like spotted knapweed, leafy spurge, and Dalmatian toadflax have been invading for years and are changing the structure and function of these systems. Although intermountain grasslands are naturally rich in native forbs, the newcomers differ from native forbs in subtle but important ways. A recent study in western Montana by Dean, Yvette, and Samantha showed that dominant exotic forb species tend to put more energy into flowering structures and to flower later than dominant natives, while natives tend to put relatively more energy into vegetative growth and to synchronize vegetative growth and flowering earlier in the season. The researchers found that senescence of flowering stems also differed dramatically, with exotics producing far more persistent flowering structures.

These differences depict a distinct niche separation between the dominant natives and invading exotics, which has important implications for understanding both invasibility of the system and invader impacts. With regard to the invasibility of these systems, the fact that the five species of invaders examined represent five distinct plant families yet exhibit similar plant traits suggests that the success of these species may hinge on their similar ability to exploit an “empty niche” within these communities. If so, these plant traits might be used to predict future invasions. With regard to invader impacts, the distinctive shift in the structure and function of the community indicates an invasion trajectory that predicts changes in community interactions and ecosystem services. For example, later flowering times may affect pollinators, later growing periods may influence how fire interacts with the vegetation, and shifts in the types of biomass produced and decomposition rates may affect nutrient cycling.

The above postulated effects are reasonable but speculated based on research in other systems. However, the researchers did quantify the extensive outcomes of one subtle shift within these communities—those resulting from changes in plant architecture. They found that the larger, more expansive, and more persistent flowering stems

of the exotics allowed populations of native web-building spiders to increase by 80-fold. Additionally, native spiders built larger webs on the exotic substrates that allowed each spider to double its prey captures. The combined effect of increased spider numbers and increased lethality of each spider has allowed spiders in invaded habitats to suppress some prey populations to such an extent that their prey’s prey are released from predation. These results show how even subtle changes caused by invasion can have extensive impacts that transmit through four trophic levels. For more information on this research, see Pearson (2009, 2010) and Pearson and others (in press) listed in the Recent Publications section below. Also check out the following article about a recently released podcast featuring this research.

Roads Trump Restoration Treatments in Their Effects on Noxious Weeds

By: Justin Runyon (jrunyon@fs.fed.us), Research Entomologist, Grassland, Shrubland, and Desert Ecosystems Program, Bozeman, MT

Burning and thinning treatments are being increasingly used in Western forests to manage insects, manage disease, and reduce wildfire hazards. Unfortunately, these tools can trigger the invasion and spread of invasive plants—something that could thwart successful restoration efforts. Land managers need to be aware of this potential unwanted side-effect and need to be armed with the knowledge to best monitor and treat weeds following restoration. However, the effects of these activities on the introduction and spread of invasive plants are not well understood. A recently published, long-term RMRS study at Tenderfoot Experimental Forest in Montana helps shed some light on the issue.

In the study, the occurrence of noxious weeds was monitored in treatment areas (thinned and/or burned), untreated control areas, and along adjacent forest roads from 2001-2009. Interestingly, except for Canada thistle, which invaded slash piles



Forest thinning treatments in the Tenderfoot Experimental Forest in Montana (left; photo by Kevin O'Neill) had little impact on noxious weeds. Instead, forest roads (right; photo by Justin Runyon) were the key factor influencing the distribution of noxious weeds in this forest.

in some treated areas, noxious weeds were confined to roadsides and did not colonize treatments. This highlights the importance of roads for weed distribution and spread, and it suggests that roadways should be considered when evaluating the potential for invasion of exotic plants following restoration treatments. In this forest, weed control along adjacent roads and in heavily disturbed areas such as slash piles may be a cost-effective and efficient tactic to limit exotic plant invasion.

Many questions remain and more research is needed on this topic. For example, the Montana forest studied here is relatively weed-free and it is unclear if these findings can be extended to more heavily invaded forests or forests containing other weed species. It is clear that monitoring invasive plants, within treated areas and along roads, should be a component of forest restoration. For more information, see Birdsall and others (2011), listed in the Recent Publications section on page 8.

Exotic Brook Trout Displace Cutthroat Trout in the West

By: Kevin S. McKelvey (kmckelvey@fs.fed.us), Research Ecologist, Wildlife and Terrestrial Ecosystems Program, and Michael K. Young (mkyoung@fs.fed.us), Research Fisheries Biologist, Air, Water, and Aquatic Environments Program, Missoula, MT

Freshwater aquatic fauna are among our most endangered nationwide. Although the reasons for endangerment are many, few systems are as heavily impacted by nonnative invasive species. Indeed, many iconic invaders are aquatic: zebra and quagga mussels, Asian carp, and Eurasian water milfoil, to name a few. Many of these species have been introduced in ways similar to the primary pathways for terrestrial organisms, either as stowaways as part of international commerce, escapees from farms,



Native westslope cutthroat trout (top) and a nonnative brook trout (bottom), captured from Bostwick Creek, a tributary to the Gallatin River near Bozeman, MT. Brook trout are implicated in the loss of cutthroat trout populations throughout the Rocky Mountains.

or releases by the pet trade or pet owners. However, to a much greater extent, freshwater ecosystems have been subject to intentional and repeated introductions of exotic species. For the most part, with

notable exceptions such as the disastrous introduction of opossum shrimp *Mysis diluviana* in lakes of the northern Rockies, these intentional introductions involve species of fish.

Research Notes cont.

In small, coldwater streams in the inland West, the primary invasive fish species is the brook trout *Salvelinus fontinalis*, which is native to eastern North America. Brook trout were widely stocked in streams in this region beginning in the late 1800s. Historically, these streams contained various subspecies of cutthroat trout *Oncorhynchus clarkii*, but cutthroat trout are now absent from much of this area. For example, in central Montana, where westslope cutthroat trout *O. c. lewisi* were first identified by Lewis and Clark, this subspecies occupies perhaps 5% of its historical range, primarily in small streams above fish barriers. It has been replaced in large rivers by rainbow trout *O. mykiss* (which was stocked from Pacific coastal waters) and brown trout

Salmo trutta (which originates from Europe), and in small streams by brook trout. In western Montana and Idaho, however, westslope cutthroat trout are much more widespread; they appear to occupy over 50% of their historical range. Although brook trout are present in some waters, they are thought to be much more limited in their distribution. “Thought” is intentional here: little sampling of headwater streams has been done.

In 2008, researchers from Missoula, Montana, began an extensive survey of western Montana and northern Idaho streams to document the distribution of all species of fish and amphibians on Forest Service lands. We sampled using intensive, single-pass electrofishing in over 1,000 reaches of nearly 400 streams. Many of these reaches were in the extreme headwaters of over 200 streams. These sites were located near the

upstreammost extent of the distribution of fish, locations that are generally regarded to have pristine habitats that lack exotic species.

Preliminary results suggest a disturbing pattern. Westslope cutthroat trout seem much less widely distributed than was assumed during a recent (2005) assessment of their range. Moreover, brook trout are present in about half of the small streams in western Montana and northern Idaho, and in about a quarter of all headwaters sites. In streams containing both species, brook trout usually (and often dramatically) outnumber westslope cutthroat trout. In a substantial number of streams, as in central Montana, brook trout have completely replaced westslope cutthroat trout. This study will yield many insights into the impacts of exotic brook trout on native fish of the region.

Treating Downy Brome with Herbicide and Seeding With Native Shrubs

By: Suzanne Owen (smowen@fs.fed.us), Chemist, and Carolyn Sieg (csieg@fs.fed.us), Research Plant Ecologist, Forest and Woodland Ecosystems Program, Flagstaff, AZ

Downy brome or cheatgrass (*Bromus tectorum* L.) is one of the most invasive and widespread exotic plants in North America. Downy brome can reduce soil nutrient availability, alter native plant community composition, and increase fire frequencies. The effectiveness of Plateau® imazapic herbicide in reducing downy brome cover has been variable, and there is uncertainty about the impacts of imazapic on native species. Researchers from Flagstaff, Arizona, recently published

an article in *Invasive Plant Science and Management* that investigated if treatments of imazapic and/or seeding with native shrubs were effective in rehabilitating shrublands highly invaded by downy brome on the Kaibab National Forest in northern Arizona. Researchers also determined the effects of imazapic on different growth stages of both downy brome and three native shrub species in the greenhouse.

A one-time application of imazapic combined with seeding shrubs was only slightly effective in rehabilitating areas with high downy brome and thatch cover, and resulted in short-term impacts to nontarget species. In the field, seeding shrubs did not significantly increase shrub density, although imazapic herbicide reduced downy brome cover and nontarget forb cover by 20-25% and altered plant community composition the first

year post-treatment. Imazapic was lethal to downy brome at all growth stages in the greenhouse and reduced shrub germination by 50 to 80%, but older shrub seedlings were more tolerant of the herbicide. These results highlight the need to treat downy brome infestations before they become too large. Removing thatch before treating with imazapic, although likely lethal to the native shrubs in this study, could increase the effectiveness of imazapic. Because imazapic can alter native plant communities, managers should consider the unintended consequences of this herbicide and the consideration of other strategies for downy brome control, such as seeding native plant barriers and using herbicides that selectively reduce downy brome seed viability. For more information, see Owen and others (2011), listed in the Recent Publications section on page 8.



Imazapic herbicide application to downy brome-invaded shrubland. The herbicide was mixed with an inert blue dye for visibility.

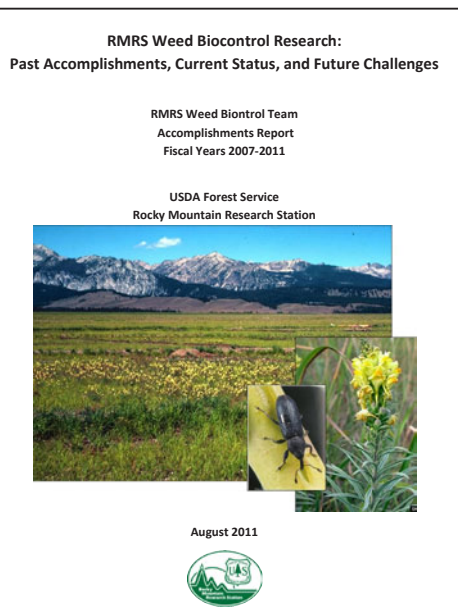


Greenhouse experiment showing downy brome that was treated with the herbicide, imazapic (left), and water as a control (right).

RMRS Biocontrol Team Releases Accomplishments Report

By: Deborah Finch (dfinch@fs.fed.us), Grassland, Shrubland, and Desert Ecosystems Program Manager, Albuquerque, NM

The Station's biocontrol researchers have prepared a five-year accomplishments report (FY07-11) to showcase their work titled "RMRS Weed Biocontrol Research: Past Accomplishments, Current Status, and Future Challenges." Weed biocontrol scientists conduct research to help stem the invasion of exotic invasive plants in the Interior West. The report highlights an emphasis on the publication of first-rate science in respected peer-reviewed outlets (44 publications), and second, and perhaps more importantly, an emphasis on the timely provision of weed biocontrol application information and tools to managers on the ground (e.g., 25 additional publications in outlets aimed at managers). The research products and technology transfer activities are outlined in the report by the following scientists: George Markin (retired volunteer), Research Entomologists **Justin Runyon** and **Sharlene Sing**, Bozeman; Supervisory Ecologist **Jack Butler**, Rapid City; Research Ecologist **Dean Pearson** and Ecologist **Yvette Ortega**, Missoula; Research Ecologist **Susan Meyer**, Provo; and Research Plant Ecologist **Rosemary Pendleton**, Albuquerque. See the full report at <http://www.fs.fed.us/rmrs/docs/home/weed-biocontrol-accomplishments.pdf>.



Other News

Preventing Forest Pest Infestations

The Don't Move Firewood campaign is a multimedia outreach effort seeking to educate the public about the threat of moving forest pests on firewood. Invasive forest pests such as the Asian longhorned beetle and emerald ash borer are well documented to disperse and cause new infestations on contaminated firewood being moved by the public, and native insects such as the mountain pine beetle can also be spread to new uninfested areas by cut wood. By using a wide range of federal, state, and local partners, the Don't Move Firewood campaign has



The Golden-spotted oak borer caused significant mortality to oaks in California when it spread from its natural range (Mexico and Arizona), possibly in contaminated firewood. Photo courtesy of Mike Lewis, Center for Invasive Species Research, Bugwood.org

grown from a small program (initially funded in 2008 by the USFS Northeastern Area, with help from a private foundation) into a nationwide campaign that has working relationships in more than half of the states. In 2012, Don't Move Firewood anticipates being an integral part of the Interior West's firewood outreach program, as well as producing multiple products on request for the USFS Pacific Southwest Research Station and the USFS Southeastern Area. The parent organization of Don't Move Firewood is The Nature Conservancy's Forest Health Protection Program, a national initiative addressing threats to North American ecosystems. For more information on Don't Move Firewood, please visit <http://www.DontMoveFirewood.org>.

New Invasive Species Resource

The science organization, CABI, recently released a beta version of The Invasive Species Compendium, an online, open access resource featuring detailed information on the world's invasive plants and animals—their taxonomy, biology, distribution, impacts, and management. The website currently covers over 1,500 species, and includes over 1,000 full text articles and 70,000 abstracts linked to the species accounts. For more information, visit <http://www.cabi.org/Default.aspx?site=170&page=4127>.



TWS Joins the National Environmental Coalition on Invasive Species

The Wildlife Society (TWS) became an official member of the National Environmental Coalition on Invasive Species (NECIS) in September 2011. Established in 2003, the National Environmental Coalition on Invasive Species (NECIS) is a national partnership of several major environmental organizations that provides a united expert and scientific voice on invasive species policy. Its leaders include scientists, lawyers, activists, and advocates with many years of experience on invasives policy. TWS, a professional scientific and educational association dedicated to excellence in wildlife stewardship through science and education, brings expertise on invasive plant and animal issues and looks forward to contributing to this coalition.

Ask the Expert



Q: Does the spread of Eurasian collared-doves pose a threat to native species?

Submitted by Nick DeCesare, PhD candidate, University of Montana, Missoula, MT

Answered by Yvette Ortega, RMRS Ecologist with a background in avian ecology and invasive species research (yortega@fs.fed.us); Wildlife and Terrestrial Ecosystems Program

A: The Eurasian collared-dove (*Streptopelia decaocto*) has invaded North America at a record pace. In 1982, this species arrived in Florida and has since rapidly spread to places as far as Montana and Alaska. The invasiveness of this species has raised concern over its potential impacts on native species, particularly related species such as the mourning dove. To date, little research has been done to address this question directly, but basic information on the life history and ecology of collared and native doves offers some insight. Both collared-doves and native doves feed primarily on seed and grain. However, the collared-dove is restricted to agricultural, suburban, and urban areas, where it takes advantage of artificial food sources such as bird feeders and cultivated fields. Because these food sources tend to be abundant in human-influenced habitats, the exotic dove is unlikely to compete significantly with native doves for food. However, in landscapes where trees used for nesting substrates are limited, collared-doves could reduce availability of nest sites for native doves. In addition, collared-doves could spread diseases to native birds given their ever-increasing abundance and their tendency to concentrate at feeding and roost sites. For example, collared-doves are a carrier for West Nile virus and may therefore contribute to the proliferation of this virus. Research is needed to examine the potential pathways of impact for this newly invasive bird.

Please submit your “Ask the Expert” questions to Dean Pearson (dpearson@fs.fed.us).



Eurasian collared-dove,
courtesy of Joy Voila,
Northeastern University,
Bugwood.org.

Upcoming Events:

Montana Weed Control Association 54th Conference,
January 11-13, 2012,
Great Falls, MT
(<http://www.mtweed.org/mwca-conference-information/>)

Society for Range Management 65th Annual Conference,
January 29-February 3, 2012,
Spokane, WA
(<http://www.rangelands.org/events/>)

Idaho Weed Conference,
February 1-2, 2012,
Boise, ID
(<http://idahoweedcontrol.org/weedconference.html/>)

2012 Weed Science Society of America Annual Meeting,
February 6-9, 2012,
Big Island, HI
(<http://www.wssa.net/>)

Society for Conservation Biology North American Congress,
July 15-18, 2012,
Oakland, CA
(<http://www.scbnacongress.org/>)

96th Ecological Society of America Annual Meeting,
August 5-10, 2012,
Portland, OR
(<http://www.esa.org/portland/>)

Recent Publications

Beckstead, J., S. E. Meyer, B. M. Connolly, M. B. Huck, and L. E. Street. 2010. **Cheatgrass facilitates spillover of a seed bank pathogen onto native grass species.** *Journal of Ecology* 98:168-177.

Beckstead, J., L. K. Street, S. E. Meyer, and P. S. Allen. 2011. **Fire effects on the cheatgrass seed bank pathogen *Pyrenophora semeniperda*.** *Rangeland Ecology and Management* 64:148-157.

Birdsall, J., and G. Markin. 2010. **Biological Control of Yellow Starthistle (*Centaurea solstitialis*) in the Salmon River Canyon of Idaho.** *Invasive Plant Science and Management* 3:462-469.

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Coop, J. D., R. T. Massatti, and A. W. Schoettle. 2010. **Subalpine vegetation pattern three decades after stand-replacing fire: Effects of landscape context and topography on plant community composition, tree regeneration, and diversity.** *Journal of Vegetation Science* 21:472-487.

Fornwalt, P. J., M. R. Kaufmann, and T. J. Stohlgren. 2010. **Impacts of mixed severity wildfire on exotic plants in the Colorado Front Range.** *Biological Invasions* 12:2683-2695.

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Kim, M.-S., N. B. Klopfenstein, and G. I. McDonald. 2010. **Effects of forest management practices and environment on occurrence of *Armillaria* species.** *Journal Korean Forestry Society* 99:251-257.

Kim, M.-S., and N. B. Klopfenstein. 2011. **Molecular identification of *Armillaria gallica* from the Niobrara Valley Preserve in Nebraska.** *Journal of Phytopathology* 159: 69-71.

Kim, M.-S., J. W. Hanna, and N. B. Klopfenstein. 2010. **First report of an *Armillaria* root disease pathogen, *Armillaria gallica*, associated with several new hosts in Hawaii.** *Plant Disease* 94:1503.

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Lee, J. C., S. M. Hamud, J.F. Negrón, J. J. Witcosky, and S. J. Seybold. 2010. **Semiochemical-mediated flight strategies of two invasive elm bark beetles: A potential factor in competitive displacement.** *Environmental Entomology* 39:642-652.

Markin, G. P., and C. J. Horning. 2010. **Discovery of a gall-forming midge, *Asphondylia pilosa* Kieffer (Diptera: Cecidomyiidae), on Scotch broom (*Cytisus scoparius* (L.) Link) (Fabaceae).** *Journal of the Kansas Entomological Society* 83:260-263.

Maron, J. L., D. E. Pearson, S. M. Hovick, and W. P. Carson. 2010. **Funding needed for assessments of weed biological control.** *Frontiers in Ecology and the Environment* 8:122-123.

Mazzola, M. B., J. C. Chambers, R. R. Blank, D. A. Pyke, E. W. Schupp, K. G. Allcock, P. S. Doescher, and R. S. Nowak. 2010. **Effects of resource availability and propagule supply on native species recruitment in sagebrush ecosystems invaded by *Bromus tectorum*.** *Biological Invasions* 13:513-526.

McGlone, C. M., C. H. Sieg, and T.E. Kolb. 2011. **Invasion resistance and persistence: established plants win, even with disturbance and high propagule pressure.** *Biological Invasions* 13:291-304.

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Publications available on the RMRS Invasive Species Website: http://www.rmrs.nau.edu/invasive_species/publications.php

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