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Invasive Species Science Update

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From the Editors

This newsletter is designed to keep managers and other users up-to-date with recently completed and ongoing research by RMRS scientists, as well as to highlight breaking news related to invasive species issues. The newsletter is produced by the RMRS Invasive Species Working Group (ISWG), a core group of scientists who volunteer to disseminate RMRS invasive species science to managers and the public through this newsletter, the website, and periodic white papers. All of our products, including past issues of the newsletters and lists of publications, can be found online at: http://www.fs.fed.us/rm/invasive-species/.

In this issue, we highlight the importance of early detection and rapid response as applied to new invader incidents for meadow hawkweed, medusahead, and rush skeletonweed. Exotic plants are now a common theme in many ecosystems throughout the United States, including in places established specifically to protect native species and communities. Although the exact number of plants introduced into the United States is unknown, published estimates range from 4,000 to 5,000 species. Fortunately, only a small proportion of species identified as exotic appear to adversely impact native species, communities, and ecosystems. However, the larger portion of exotic species that are currently considered benign represents a pool of potentially damaging species should environmental conditions shift in their favor, as via climate change. The Early Detection section of this newsletter highlights the need to be ever vigilant regarding entry of new species, even those that appear benign.

USDA Forest Service—RMRS

Meadow hawkweed infestation (photo credit: Linda Wilson, University of Idaho, Bugwood.org).

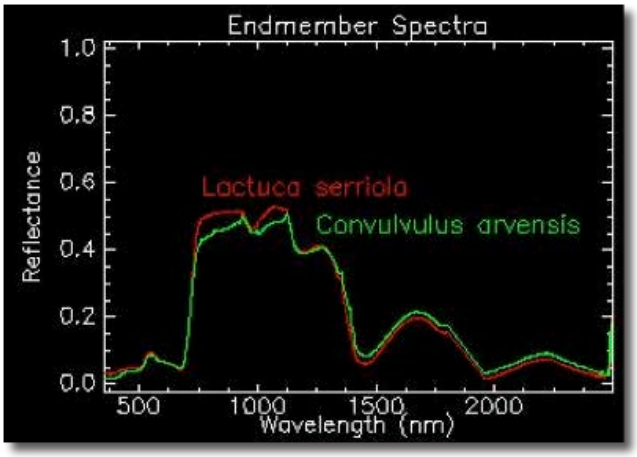
Black-capped chickadee (photo credit: K. Zeiber Nature Photographs).

Research Notes

A Spectral Library of Native and Invasive Species from a Post-Fire Environment

By Sarah Lewis-Scholes (sarahlewis@fs.fed.us), Andrew Hudak (ahudak@fs.fed.us), and Pete Robichaud (probichaud@fs.fed.us), Forestry Sciences Laboratory, Moscow, Idaho

Managers were very concerned about weed spread following the 2005 School Fire that burned 50,000 acres of state, private and Umatilla National Forest lands in southeast Washington. Non-native plants, including invasive and noxious species, often increase after fire following reductions in native plant and tree canopy cover and density. Remote sensing is often used after wildfires to monitor and map changes in soil and vegetation conditions. Toward improving this tool, RMRS and University of Idaho researchers conducted a pilot study to collect unique plant "spectral reflectance signatures" that can be combined with high-resolution remote imagery in order to track weed spread. Penelope Morgan and Leigh Lentile collected these detailed signatures for more than 70 species, including 11 classified as noxious in the state of Washington. The goal was to use the reflectance signatures, or "endmembers," together with high-resolution, Quickbird satellite imagery to map weed spread after the fire. Over the course of six summers of field sampling, however, non-native species were found at low cover (maximum 2% plot cover) in fewer than 20% of the high severity burn plots and were absent altogether in unburned plots. The lack of substantial weed cover following this particular fire kept researchers from detecting these plants using collected signatures in the remotely sensed imagery. However, the library of compiled reflectance spectra data can be used by other managers and scientists for similar remote sensing image analyses on other fires, particularly when paired with high-resolution, hyperspectral imagery that has many more channels than Quickbird. The spectral library may be accessed at: https://www.frames.gov/partner-sites/assessing-burn-severity/spectral/spectral-library-eastern-washington/.



The reflectance spectra of prickly lettuce in red and field bindweed in green. Each plant species has a unique spectral signature.

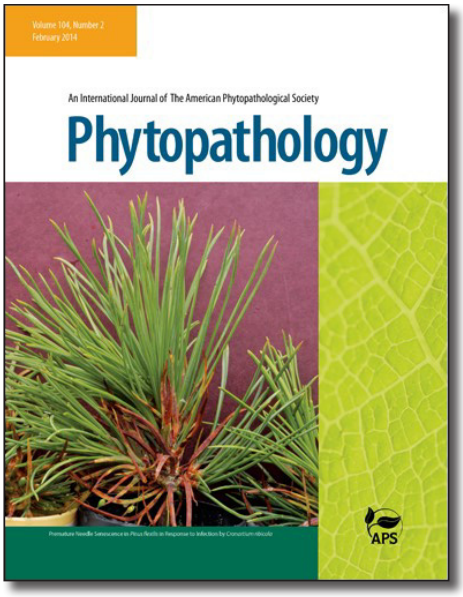
Right: Sarah Lewis-Scholes samples the reflectance spectra of prickly lettuce (*Lactuca serriola*), which is non-native to eastern Washington.

Bottom: Collecting the unique reflectance spectra of field bindweed (*Convolvulus arvensis*), a Class C noxious weed in eastern Washington.

Disease Resistance Gene Discovered in Limber Pine

By: Anna Schoettle (aschoettle@fs.fed.us), RMRS Forestry Sciences Laboratory, Fort Collins, Colorado

Limber pine (*Pinus flexilis*) is being threatened by the lethal non-native disease white pine blister rust, increasing bark beetle pressure, and climate change in mountain environments. Tree line ecosystems dominated by limber pine are ecologically valuable for watershed protection and diversity. Consequently, limber pine is of conservation concern in the southern Rocky Mountains. In a recent publication in the journal Phytopathology, Forest Service researchers report on the first of a series of studies using seed lots from individual seed trees (genetic families) to examine complete resistance to white pine blister rust and its inheritance in limber pine. The researchers report that 14% of the 105 tested limber pine seed lots show segregation of a disease-free trait consistent with inheritance by a single dominant gene, which they name "Cr4." Limber pine seedlings with the dominant resistant allele Cr4 remain disease-free after artificial inoculation with the white pine blister rust fungus. The average frequency of the Cr4 allele across healthy and recently invaded populations in the southern Rocky Mountains was unexpectedly high (5.0%; ranging from 0 to 13.9%). This research suggests that Cr4 is not a product of a recent mutation and may confer other adaptive benefits against other abiotic or biotic stress factors. For more information on this research, see Schoettle and others (2014) in the Recent Publications section.



Cover of the February 2014 issue of *Phytopathology*. Depicted in the cover image: premature senescence of infected needles is an early indication of this genetic resistance.

Genetic Diversity and Population Structure of Sickleweed (*Falcaria vulgaris*)

By: Jack Butler (jackbutler@fs.fed.us), RMRS Forest & Grassland Research Laboratory, Rapid City, South Dakota

Genetic analysis of recently introduced plants can provide valuable insight into their potential to be invasive and assist in developing management strategies. In this study, students and faculty at South Dakota State University collaborated with RMRS scientists to use chloroplast and nuclear DNA markers to (1) study the genetic diversity and structure of upper Midwest United States populations of sickleweed, and (2) determine whether sickleweed populations in the United States were established from a single or multiple introductions. Results of the study indicated a positive correlation between genetic diversity (higher number of alleles and higher observed and expected heterozygosity) and population size. Several studies have shown that high genetic diversity is a characteristic of many invasive plant populations. Further analyses showed three distinct genetic clusters that are distributed without any geographic pattern, suggesting multiple introductions of sickleweed in the northern Great Plains. Overall, the study indicates multiple introductions and gene flow in sickleweed populations of the upper Midwest, probably as a result of human mediated propagule dispersal, that have now resulted in higher genetic diversity. The ability of sickleweed populations to expand vegetatively by root sprouting can foster rapid selection of such adapted genotypes. Evolutionary changes that have occurred in sickleweed since its establishment and expansion could be used to prioritize management strategies that reduce gene flow among genetic clusters or chlorotypes. For more information see Piya and Nepal (2013) and Piya and others (2014) in the Recent Publications section.

Heavy infestation of sickleweed on the Fort Pierre National Grasslands (South Dakota).

Graduate student Sarbottam Piya (left) studies the genetic diversity of sickleweed, an exotic plant species recently introduced into the Northern Great Plains (photo credit: Madav Nepal).

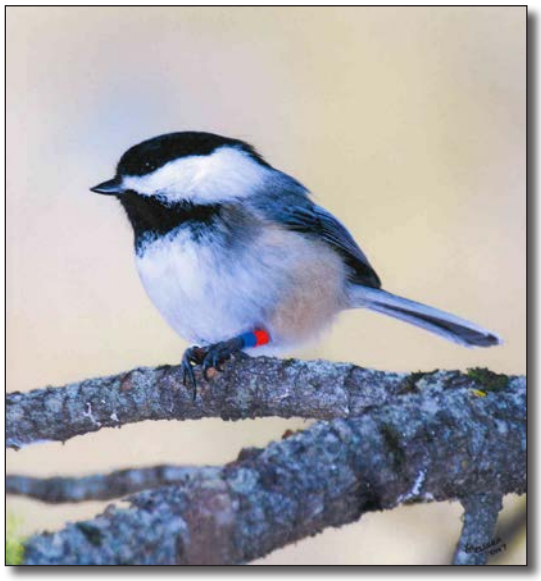
The coarsely toothed leaf is responsible for giving sickleweed its common name.

Who Gets the Novel Resource Prize?

By: Yvette Ortega (yortega@fs.fed.us) and Dean Pearson (dpearson@fs.fed.us), RMRS Forestry Sciences Laboratory, Missoula, Montana

Exotic species are infamous for their strong negative effects on native species, but less appreciated is the fact that such invaders can also have strong positive effects. For example, exotic organisms can provide a novel food resource—one that is often superabundant—thereby subsidizing native populations and potentially triggering effects that ripple through the community. However, predicting which native species will successfully exploit exotic resources remains a challenge. RMRS researchers Dean Pearson and Yvette Ortega and University of Montana researchers Leigh Greenwood and Ray Callaway studied the foraging behavior of black-capped (*Poecile atricapillus*) and mountain (*P. gambeli*) chickadees in western Montana to compare the degree to which these closely related species exploited larvae of gall flies (*Urophora* sp.), exotic biological control insects overwintering within the seedheads of the invasive forb spotted knapweed (*Centaurea stoebe*). Chickadees typically forage within tree or shrub cover, whereas knapweed and hence gall flies thrive in open grassland away from cover. The researchers found that black-capped chickadees were much more likely than mountain chickadees to forage for gall fly larvae. Black-capped chickadees strategically minimized time spent in open habitats by flying out from cover to retrieve knapweed seedheads and immediately returning to cover to extract the larvae. Black-capped chickadees also employed an atypical hovering technique nearly twice as often as their sister species did, particularly when foraging away from cover. Via this hovering technique, birds were able to gather knapweed seedheads from erect plants rather than searching for seedheads on the ground. These shifts in foraging behavior allowed black-capped chickadees to exploit gall fly larvae to a much greater degree than mountain chickadees while minimizing exposure to a high-risk habitat, an outcome with potentially important community-wide consequences. Behavioral flexibility has been used to predict which species will become successful invaders. This new study suggests that behavioral flexibility may also be used to predict how native species will respond to invasions, particularly the availability of exotic food resources. For more information on this research, see Ortega and others (2014) in the Recent Publications section.

Study co-author Leigh Greenwood with mountain chickadee (photo credit: Leigh Greenwood).



Black-capped chickadee showing color bands used to track individuals (photo credit: K. Zeiber Nature Photographs).

Early Detection

First Report of Medusahead Wildrye Grass (*Taeniatherum caput-medusae*) in Montana

By: Bryce Christiaens (bryce@missoulaeduplace.org), Missoula County Weed District Manager, and Doug Dupuis (dougd@cskt.org), Confederated Salish and Kootenai Tribes Range Specialist

In late 2013, Medusahead wildrye grass (*Taeniatherum caput-medusae*) was found in Montana for the first time in one confirmed location on the Flathead Reservation. This highly invasive annual grass has successfully invaded about 2.5 million acres of the Intermountain West. Medusahead has high silica content, which is slow to decay, leading to the creation of dense layers of thatch. As it invades an area, the thatch it generates inhibits the seeds of other species from establishing while its seeds continue to flourish within the dense litter layer. In this way, medusahead is able to outcompete not only desirable vegetation but also the likes of cheatgrass, another problematic invader of the West. Another concern is that medusahead has little to no forage value for wildlife or livestock because its seed heads are armored with stiff awns that can injure the eyes and mouths of grazing animals. If medusahead is allowed to establish and spread in Montana, it may degrade wildlife and livestock habitat while altering fire regimes, as it has done in California, Colorado, Nevada, Oregon, and Utah, where it is listed as a noxious weed. In 2014, the Confederated Salish and Kootenai Tribes; Montana Conservation Corp.; U.S. Fish and Wildlife Service; and Weed Districts in Sanders, Missoula, and Lake County partnered to map the roughly 1500 acres that encompass the current medusahead infestation. The affected area was subsequently treated with an aerial application of the

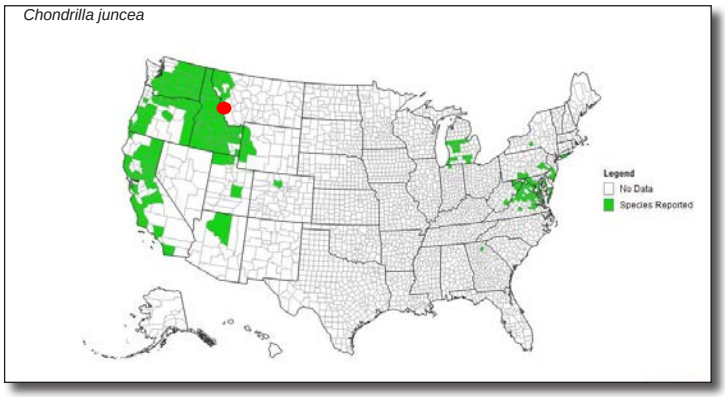
Patch of medusahead wildrye grass and close-up of seedhead (Photo credit: Kelsey Miller, Lake County Weed District).

herbicide Imazapic as a first step aimed at controlling the infestation. Managers plan to seed a vegetative buffer strip along the outer edge of the infestation to inhibit spread, and are implementing an outreach and education program to encourage awareness of medusahead and preventative measures against invasion. Future plans toward eventual eradication include ongoing chemical, biological, and cultural treatments, as guided by research and monitoring programs.

Rapid Response to a New Infestation of Rush Skeletonweed (*Chondrilla juncea* L.) in Ravalli County, Montana

By: Gil Gale, Biologist, Bitterroot National Forest

Rush skeletonweed (*Chondrilla juncea* L.) was detected on a private ranch by the ranch manager in southern Ravalli County, Montana, in the fall of 2014. This weed species is also known in northwestern Montana (where successful containment has occurred), and has previously been found and eradicated at small sites in west-central areas of the state. It is designated as a Priority 1B noxious weed by the state of Montana, with management goals of eradication or containment as well as education. Rush skeletonweed has infested large areas in Idaho, Washington, and Oregon, and the seeds are wind-dispersed, so this species poses a very high risk to grassland and shrubland habitats in western Montana. The new infestation represents a serious eastward expansion into these habitats, so rapid response was critical. The response was organized by Kellieann Morris, Ravalli County Weed District, and Gil Gale, Bitterroot National Forest. An emergency grant was received from the Montana Noxious Weed Trust Fund for survey and treatment work. The work was completed from October 21 to November 16, 2014. The ranch owner also contributed $60,000 toward the effort. More than 6500 acres of the ranch and nearby lands were surveyed on foot, by ATV, and from helicopter. Seven patches were found, ranging in size from 0.25 to 6 acres in size, and 23 individual plants were found. Plants were collected by cutting, pulling, and bagging the fruiting stems (102 bags) to reduce seed dispersal, and all patches were treated with herbicide. The bags were destroyed in a new incinerator that was acquired by the weed district. Additional surveys and treatments are planned for 2015.

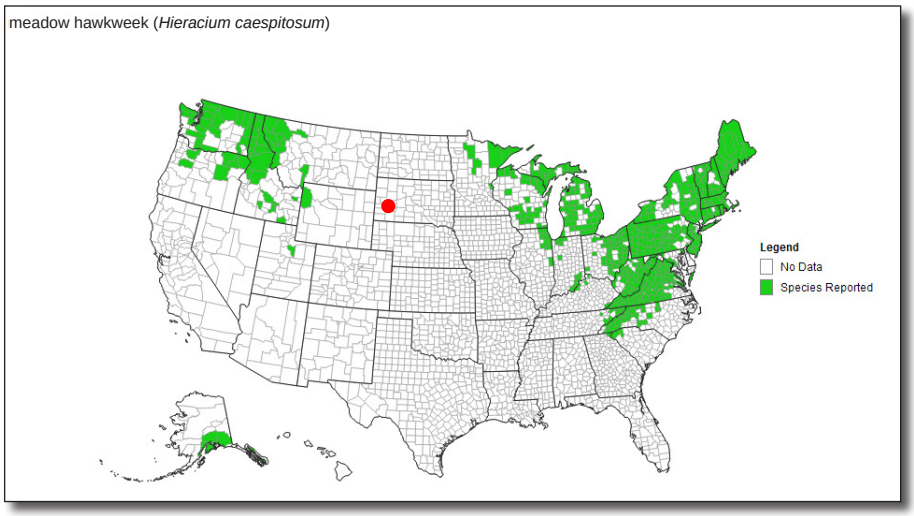


Rush skeletonweed (left, center) and distribution map (right) (EDDMapS. 2015. Early Detection & Distribution Mapping System. The University of Georgia—Center for Invasive Species and Ecosystem Health. Available: http://www.eddmaps.org/ [April 14, 2015].).

First Report of Meadow Hawkweed (*Hieracium caespitosum*) in South Dakota

By: Brian E. Dickerson (bedickerson@fs.fed.us), RMRS Forest and Grassland Research Laboratory, Rapid City, South Dakota

During the 2014 field season, RMRS staff at the Rapid City Forest and Grassland Research Laboratory discovered a non-native plant species new to the Black Hills and, quite possibly, new to the U.S. central plains states. A native of Europe, meadow hawkweed (*Hieracium caespitosum*, Dumort.) was introduced in the eastern United States as an ornamental in 1828. Since then, it has expanded its range considerably in the midwestern and northeastern United States. It was first recorded in the Pacific Northwest in 1969, leaving a considerable gap in the central and southwestern portions of the United States. Meadow hawkweed is listed as a noxious weed in Idaho, Montana, Oregon, and Washington. It is a perennial with fibrous roots and short to long rhizomes. The plant is conspicuously hairy on the leaves and stems and produces a milky juice when broken. Stems are 2 to 9 dm in height and leaves are mostly basal. Each stem produces a flat topped compact terminal cluster of 5 to 30 yellow flowers. It has been reported to establish as low, moderate, or dense patches in upland forest openings, mountain meadows, permanent pastures, and abandoned farmland. Populations in Montana and Idaho are described as recent and as rapidly spreading, where dense populations often displace native species. Because it is generally considered a weak competitor, growing on poor soils in its native range, management of meadow hawkweed in its new range often involves the integration of herbicides and fertilization. Dr. John Wallace, University of Idaho, reported excellent success in controlling meadow hawkweed using the herbicide Clopyralid. The sudden discovery of a small population of this invader in the Black Hills National Forest of western South Dakota may represent a considerable range expansion in a relatively short period of time. The Black Hills is an uplifted island of ponderosa pine and spruce forest surrounded by a sea of mixed grass prairie and the nearest known populations of meadow hawkweed are quite distant both spatially and ecologically (see map). The small population found in the Black Hills occurred in one of a series of permanent, 1000-m^2 monitoring plots in an area that was logged in 2007. The plots were evaluated for non-native plants pre-harvest, 3 years post-harvest, and then again 7 years post-harvest (in 2014). No other populations of meadow hawkweed were found on this timber sale, which was hand-pulled, or on any of the other five timber sales that were evaluated in 2014. However, field biologists in the Black Hills region are now alert to the potential of a serious invader that could threaten the ecological integrity of this unique forest. To read more about meadow hawkweed, see the following references:



Current distribution of meadow hawkweed in the United States (green) and recent range expansion in South Dakota (red dot) (EDDMapS. 2015. Early Detection & Distribution Mapping System. The University of Georgia—Center for Invasive Species and Ecosystem Health. Available: http://www.eddmaps.org/. [April 2, 2015].).

Stone, Katherine R. 2011. *Hieracium caespitosum*. In: Fire Effects Information System [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/.

Wallace, J.M., T.S. Prather, and L.M. Wilson. 2010. Plant community response to integrated management of meadow hawkweed (*Hieracium caespitosum*) in the Pacific Northwest. Invasive Plant Science and Management 3:268-275.

Wilson, L.M., J. Fehrer, S. Brautigam, and G. Grosskopf. 2006. A new invasive hawkweed, *Hieracium glomeratum* (Lactuceae, Asteraceae), in the Pacific Northwest. Canadian Journal of Botany 84:133-142.

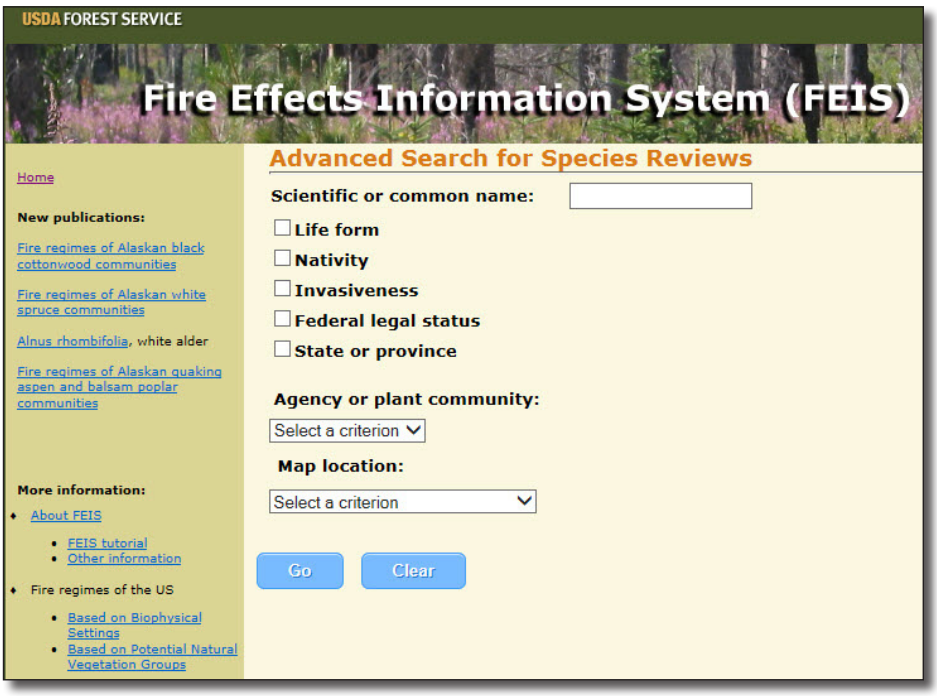
Meadow hawkweed (*Hieracium caespitosum*) (left) showing hairy basal leaves and stem (middle) and the habitat in which it was found (right).

Other News

Invasive Plants in the Fire Effects Information System

By: Kris Zouhar (kzouhar@fs.fed.us), RMRS Fire Sciences Laboratory, Missoula, Montana

With the growing body of literature on invasive plants, land managers and planners may struggle to keep up with the scientific literature on species of concern. The Fire Effects Information System (FEIS, http://www.feis-crs.org/beta/) offers syntheses of the literature on ecology and fire for 182 plant species considered invasive in North America. FEIS syntheses integrate information on autecology, community ecology, and fire relationships, including effects of fire on invasive plants, the effects of plant invasions on fuel characteristics and fire regimes, and the use of fire to control invasives. These syntheses are much more than lists or summaries of articles; they provide a logically sound, thoroughly documented narrative based on information from the scientific literature and managers, organized and presented so readers can identify potential applications to their management issues. A new FEIS user interface and a new collection of literature reviews, called Fire Regime Syntheses, will make additional fire regime information accessible for all FEIS Species Reviews. The new user interface also has new search capabilities that enable users to find FEIS literature reviews by location, life form, plant community, nativity, invasiveness, and/or Federal legal status.



Advanced Search Page, Fire Effects Information System.

FS and NPS Partnership to Conserve Mountain Top Ecosystems from the Invasive Pathogen that Caused White Pine Blister Rust

By: Anna Schoettle (aschoettle@fs.fed.us), RMRS Forestry Sciences Laboratory, Fort Collins, Colorado

Interagency collaboration between the USDA Forest Service and the National Park Service, using available tools and methods that are compatible with land use designations, has led to the development of a wide variety of programs to conserve and promote self-sustaining five-needle pine ecosystems in the presence of white pine blister rust. Interagency collaboration provides the science foundation in developing conservation strategies for high elevation five-needle pine ecosystems. These interagency programs include sampling frameworks, in situ and ex situ gene conservation; demographic, regeneration, and forest health assessments; developing rust resistant populations; and restoration plantings and trials. The scientific knowledge generated from this work reduces the uncertainty in projecting outcomes of interventions or inactivity to improve trade-off analyses as managers assess their options. The information can also feed into economic analyses and inform the public. Depending on the intensity of impact by white pine blister rust, efforts are focused on developing restoration activities in declining landscapes (Restoration Strategy) and/or proactive interventions in threatened ecosystems to mitigate future impacts (Proactive Strategy). Restoration treatments can slow impacts and rebuild impacted populations, while proactive interventions can help prepare the landscape for invasion to mitigate the severity of future impacts. The goal of both approaches is to conserve the species and promote self-sustaining five-needle pine ecosystems in the presence of white pine blister rust. For more information on this research, see Schoettle and others (2013) in the Recent Publications section.

National Park Service and RMRS employees collecting limber pine seed cones in Rocky Mountain National Park for rust resistance testing and gene conservation.

IUFRO Joint Conference of Five-Needle Pines, Rusts of Forest Trees, and Genomics Groups

By: Anna Schoettle (aschoettle@fs.fed.us), RMRS Forestry Sciences Laboratory, Fort Collins, Colorado

World-wide experts in genetics and genomics of five-needle pines and rusts of forest trees convened in Fort Collins June 15-20, 2014, for their first joint conference to share cutting edge methods and emerging technologies to sustain healthy forest ecosystems. This is the first joint conference of the International Union of Forest Research Organizations (IUFRO) 2.02.15 Genetics of Five-Needle Pines working group, IUFRO 7.02.05 Rusts of Forest Trees working group, and the genomics working group Strobusphere. Anna Schoettle, a Deputy Coordinator for the IUFRO Five-Needle Pine working group, co-organized the conference with Richard Sniezko, Richard Hamelin, and David Neale and served as the local coordinator with help from Kelly Burns and others. The conference included two days of presentations and four field trips (southern Wyoming, Rocky Mountain National Park, Mt. Goliath Research Natural Area, and ARS National Center for Genetic Resources Preservation) to learn about current forest conditions, ongoing research, and conservation of pines as they are challenged by the non-native invasive white pine blister rust. The field trips also included visits to limber pine and Rocky Mountain bristlecone pine forests. The 106 attendees included representatives from 16 countries, 17 U.S. states and 4 Canadian provinces; students, active researchers and professionals, and retired experts participated. Financial contributions by numerous USFS entities, BLM, American Forests, Whitebark Pine Ecosystem Foundation, Sierra Pacific Industries, and IUFRO helped make the conference a success.

Anna Schoettle delivers a presentation on the ecology and genetics of Rocky Mountain bristlecone pine (*Pinus aristata*) at the Mt. Goliath Research Natural Area during a conference field trip (photo credit: Richard Sniezko).

Montana Governor Steve Bullock Signs Executive Order to Combat Invasive Species

Press Release, Office of the Governor, State of Montana, December 4, 2014

Governor Steve Bullock was joined by sportsmen, conservationists, and land managers as he signed an executive order improving and streamlining Montana's efforts to tackle the threat of invasive species in the state. The order establishes the Montana Invasive Species Council (MISC) to serve as the overarching council to combat invasive species in the state—both aquatic and terrestrial. "Montanans cherish our outdoor recreation and spaces, and those spaces play a crucial role in our state's vibrant economy. It is imperative that we do everything we can to protect Montana from the threat of invasive species that disrupt our land, water, and native species," Bullock said. "None of us want another knapweed spreading across Montana."

The MISC will be tasked with:

(1) providing recommendations, direction, and planning for combating infestations of invasive species throughout the state, while preventing the introduction of others;
(2) fostering cooperation, communication, and coordinated approaches that support international, Federal, regional, state, local, and tribal initiatives for the prevention, early detection, and control of invasive species;
(3) serving as a non-partisan forum that would achieve a science-based interdisciplinary and comprehensive understanding of the current status, trends, and potential threats of invasive species in Montana;
(4) identifying priorities for prevention and control of invasive species in Montana;
(5) recommending and taking measures that will encourage prevention, early detection, and control of harmful invasive species in Montana;
(6) championing priority invasive species issues identified by stakeholders to best protect the state; and
(7) advising and working with agency personnel, local efforts, and the scientific community to implement program priorities.

The MISC will be made up of 21 members, including representatives from tribal governments, county weed districts, the Montana State University extensions, conservation districts, conservation organizations, private land owners, natural resource groups, private industry, and representatives from state and Federal stakeholder agencies.

Learning to Live With Cheatgrass: Giving Up or a Necessary Paradigm Shift?—A Viewpoint

By: Stan Kitchen (skitchen@fs.fed.us), RMRS Shrub Sciences Laboratory, Provo, Utah

Cheatgrass demonstrating its ability to establish in the toughest of environments (right), and its ability to dominate a native plant community (bottom).

Bromus tectorum, cheatgrass, downy brome, downy chess, early chess, drooping brome, June grass, bronco grass, 100-day grass, Mormon oats, military grass; each name reveals a distinct perspective of this North American immigrant. Before 1492, distribution included northern Africa, Europe, and central Asia. Cheatgrass expanded during the last 12,000 years in concert with the domestication and herding of livestock and with cultivated agriculture. Cheatgrass was first observed in North America in Pennsylvania around 1790. It is thought to have first arrived in contaminated grain or perhaps as packing material protecting a precious family heirloom. The earliest record for the West was nearly 100 years later in 1883 from the state of Washington. By about 1930, it had spread to all 50 states (with the possible exception of Florida); and today, its New World range includes all Canadian provinces, parts of northern Mexico, and temperate South America, even as its Old World range continues to expand. Highly successful newcomers, such as cheatgrass, should be viewed as permanent additions to North American flora. Researchers, land owners and managers, and policy makers would do well to acknowledge the new realities created by introduced species and focus efforts on: (1) limiting new introductions, (2) assessing the variability of impacts across affected ecosystems, and (3) developing reasonable expectations and practices for mitigating effects while preserving core ecosystem functionality. For more on Stan's article, see Kitchen (2014) in the Recent Publications section.

Awards

Sharlene Sing, Forestry Sciences Laboratory, Bozeman, Montana

Research Entomologist Sharlene Sing recently received the 2013 National Forest System Invasive Species Program Award for Excellence in Invasive Species Partnership Development from the Washington Office. This national award recognizes a Forest Service individual or office demonstrating outstanding, dedicated leadership in the development of partnerships to address invasive species threatening the National Forest System. Sharlene's partnership work in supporting invasive plant management experts, resource managers, and other scientists on a wide variety of issues related to the ecology and management of invasive plants, with particular emphasis on implementation, safety, and assessment of classical biological control of exotic weeds, earned her this award. Her work ranges from developing and disseminating technology transfer products and activities, such as leading instructional workshops and demonstrating field methods, to co-authoring informational brochures and handbooks on various weed species and their management. Her ongoing informal consultations with National Forest System personnel as well as other Federal, state, and private partners on invasive weed related issues allow for participation in extensive field tours assessing the suitability of sites to biological control, providing data for planning documents, and co-writing competitive grant proposals.

Jeanne Chambers, Forestry Sciences Laboratory

Research Ecologist Jeanne Chambers recently received the 2014 Distinguished Restorationist award from the Great Basin Chapter of the Society for Restoration Ecology. Jeanne received the award during the Society for Ecological Restoration's Regional Conference in Redmond, Oregon, last month. The award recognizes Jeanne for her sustained career achievement in restoration ecology and management. Beginning as a Range Conservationist for the BLM in Idaho, Jeanne has spent most of her career in her current position, studying riparian, rangeland, and alpine systems throughout the West. She has a distinguished publication record in basic and applied science and has synthesized scientific information in a way that has informed the trajectory of science and science-management partnerships on the topics of annual weed ecology; sagebrush-steppe restoration; ecosystem resistance and resilience; and riparian ecology, restoration, and management. She is an influential advocate for Great Basin ecosystems, a regional leader in the partnership of science and management, and a key contributor to regional collaborative programs. These programs include the Sagebrush Steppe Treatment Evaluation Project, the Great Basin Landscape Conservation Cooperative, the Great Basin Fire Science Delivery Project, the Great Basin Research and Management Partnership, and the Great Basin Consortium.

Recent Publications

Connolly, B.; Pearson, D.E.; Mack, R.N. 2014. **Effect of native generalist granivores on exotic plant invasiveness and habitat invasibility.** Ecology. 95: 1759–1769.

Kitchen, S.G. 2014. **Learning to live with cheatgrass: giving up or a necessary paradigm shift.** Rangelands. 36: 32–36.

Maron, J.L.; Auge, H.; Korell, L.; Pearson, D.E.; Hensen, I.; Suding, K.N.; Stein, C. 2014. **Staged invasions across disparate grasslands: effects of seed provenance, consumers, and disturbance on productivity and species richness.** Ecology Letters. 17: 499–507.

Ortega, Y.K.; Benson, A.; Greene, E. 2014. **Invasive plant erodes local song diversity in a migratory songbird.** Ecology. 95: 458–465.

Ortega, Y.K.; Greenwood, L.; Callaway, R.M.; Pearson, D.E. 2014. **Differential response of congeneric consumers to an exotic food resource: who gets the novel resource prize?** Biological Invasions. 16: 1757–1767.

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