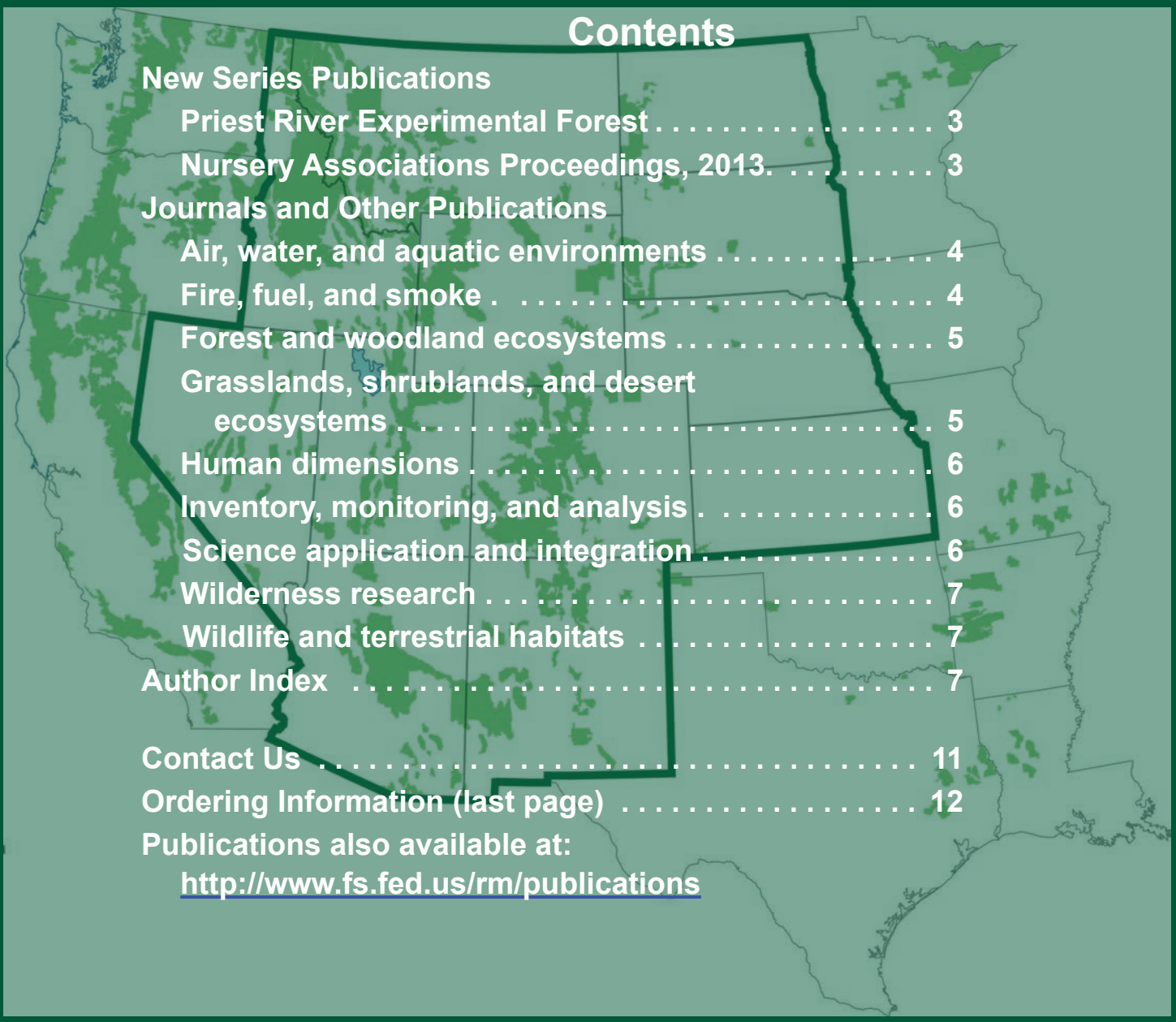
United States Department of Agriculture

Rocky Mountain Research Station

New Publications

January to March 2015



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The Rocky Mountain Research Station

The Rocky Mountain Research Station is one of five regional units that make up the US Forest Service Research and Development organization—the most extensive natural resources research organization in the world. We maintain 14 research locations throughout a 12 state territory encompassing the Great Basin, Southwest, Rocky Mountains and parts of the Great Plains. The Station employs over 400 permanent full-time employees, including roughly 100 research scientists.

Scientists conduct research that spans an area containing 52% of the nation's National Forest System lands (54 National Forests and Grasslands). In the lower 48 states, our territory also includes 55% of the nation's BLM lands; 48% of the designated wildernesses; 37% of National Park Service lands; numerous other public and tribal lands; and 41% of the non-urban/rural private lands.

We administer and conduct ecological research on 14 experimental forests, ranges, and watersheds over the long-term, even centuries, enabling us to learn how forests change as climate and other factors change over time.

We also oversee activities on several hundred research natural areas, a network of ecosystems set aside to conserve biological diversity. The areas represent a wide variety of habitats and ecosystems from alpine ecosystems to lowlands; and from coniferous forests of the Northern Rockies to semiarid deserts of the Southwest and prairie ecosystems of the Great Plains.

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New RMRS Series Publications

Priest River Experimental Forest

Online only

Climate, snowpack, and streamflow of Priest River Experimental Forest, revisited. Tinkham, Wade T.; Denner, Robert; Graham, Russell T. 2015. Gen. Tech. Rep. RMRS-GTR-331. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 49 p. NOTE: This publications is available only online.

The climate record of Priest River Experimental Forest has the potential to provide a century-long history of northern Rocky Mountain forest ecosystems. The record, which began in 1911 with the Benton Flat Nursery control weather station, included observations of temperature, precipitation, humidity, and wind. Later, other observations stations were added to the network and observations were expanded to include snow courses and streamflow measurements. The region contains nearly all of the dominant forest types within the northern Rocky Mountains, from the xeric ponderosa pine forest type, to the highly mesic western red cedar type, with mesic Douglas-fir forests in between. Over the last century, the area has experienced an increase in minimum daily temperatures of 2.8 °F, while no discernable trend can be seen in the maximum temperatures. This observed increase in minimum daily temperature is consistent with changes expected from global warming. The total annual precipitation has not changed over the last century, while the March 1st snowpack at the lower elevations within the catchment has declined by over 30%. Although there is no change in total precipitation, there has been a 33% increase in average annual stream runoff. This change in runoff is attributed to both a shift in streamflow timing, due to earlier snowpack melt, and to large changes in tree species composition following the white pine blister rust epidemic in the 1950s. This unique dataset has the potential to inform managers and researchers about the changes regional climatic water balances may undergo as climate continues to shift.

Online: http://www.fs.fed.us/rm/pubs/rmrs_gtr331.html.

Nursery Associations Proceedings, 2013

Order RMRS-P-72

National Proceedings: Forest and Conservation Nursery Associations - 2013. Wilkinson, K.M.; Haase, D.L.; Pinto, J.R., technical coordinators. 2014. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Proc. RMRS-P-72. 79 p.

These proceedings are a compilation of 14 papers that were presented at the regional meetings of the forest and conservation nursery associations in the United States in 2013. Subject matter for the technical sections included nursery fertilization, black walnut research, exploring the threat of hybrid Phytopthoras (and how to prevent this), management of soils, growing media, and roots in the production of forest and conservation seedlings. This included tree pathology, Methyl Bromide alternatives, mycofiltration technology, photoperiod manipulation, fertilization, root zone heating, evaluating alternative growing media components and conducting effective research in the nursery.

Online: http://www.fs.fed.us/rm/pubs/rmrs_p072.html.

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Journals and Other Publications

Obtain the following publications through university libraries, the publisher, or other outlets. Forest Service employees may request these items from the National Forest Service Library at FSLibrary-DocsFC@fs.fed.us or telephone: (970) 498-1205. We have also provided links to electronic copies when available.

Air, water, and aquatic environments

Aquatic fate of aerially applied hexazinone and terbuthylazine in a New Zealand planted forest. Baillie, Brenda R.; Neary, Daniel G.; Gous, Stefan; Rolando, Carol A. 2015. Journal of Sustainable Watershed Science & Management. 2(1): 118-129. Online: http://www.treesearch.fs.fed.us/pubs/48004.

Assessing the environmental performance of biomass supply chains: Methods, results, challenges and limitations. Schweinle, Jorg; Rodl, Anne; Borjesson, Pal; Neary, Daniel G.; Langeveld, Johannes W.A.; Berndes, Goran; Cowie, Annette; Ahlgren, Serina; Margni, Manuele; Gaudreault, Caroline; Verschuyl, Jake; Wigley, T. Bently; Vice, Kirsten; Titus, Brian. 2015. Task 43. Report 2015:TR01. IEA Bioenergy. 121 p. Online: http://www.treesearch.fs.fed.us/pubs/47802.

Best practices guidelines for managing water in bioenergy feedstock production. Neary, Daniel G. 2015. Task 43. Report 2015:TR02. IEA Bioenergy. 125 p. Online: http://www.treesearch.fs.fed.us/pubs/47801.

The cold-water climate shield: Delineating refugia for preserving salmonid fishes through the 21st century. Isaak, Daniel J.; Young, Michael K.; Nagel, David E.; Horan, Dona L.; Groce, Matthew C. 2015. Global Change Biology. doi: 10.1111/gcb.12879. Supp. material included. Online: http://www.treesearch.fs.fed.us/pubs/47740.

Disturbance legacies of historic tie-drives persistently alter geomorphology and large wood characteristics in headwater streams, southeast Wyoming. Ruffing, Claire M.; Daniels, Melinda D.; Dwire, Kathleen A. 2015. Geomorphology. 231: 1-14. Online: http://www.treesearch.fs.fed.us/pubs/47754.

Downstream effects of stream flow diversion on channel characteristics and riparian vegetation in the Colorado Rocky Mountains, USA. Caskey, Sharon T.; Blaschak, Tyanna S.; Wohl, Ellen; Schnackenberg, Elizabeth; Merritt, David M.; Dwire, Kathleen A. 2014. Earth Surface Processes and Landforms. doi: 10.1002/esp.3651. Online: http://www.treesearch.fs.fed.us/pubs/47750.

Featured collection introduction: Riparian ecosystems and buffers II. Mayer, Paul M.; Dwire, Kathleen A.; Okay, Judith A.; Vidon, Philipe G. 2014. Journal of the American Water Resources Association. 50(3): 529-532. Online: http://www.treesearch.fs.fed.us/pubs/47751.

Genecological approaches to predicting the effects of climate change on plant populations. Kilkenny, Francis F. 2015. Natural Areas Journal. 35(1):152-164. Online: http://www.treesearch.fs.fed.us/pubs/47748.

High-resolution observations of the near-surface wind field over an isolated mountain and in a steep river canyon. Butler, B.W.; Wagenbrenner, N.S.; Forthofer, J.M.; Lamb, B.K.; Shannon, K.S.; Finn, D.; Eckman, R.M.; Clawson, K.; Bradshaw, L.; Sopko, P.; Beard, S.; Jimenez, D.; Wold, C.; Vosburgh, M. 2015. Atmospheric Chemistry and Physics. 15: 3785-3801. Online: http://www.treesearch.fs.fed.us/pubs/47992.

Isotope hydrology and baseflow geochemistry in natural and human-altered watersheds in the Inland Pacific Northwest, USA. Sanchez-Murillo, Ricardo; Brooks, Erin S.; Elliot, William J.; Boll, Jan. 2015. Isotopes in Environmental and Health Studies. doi: 10.1080/10256016.2015.1008468. Online: http://www.treesearch.fs.fed.us/pubs/47848.

Is U.S. climatic diversity well represented within the existing federal protection network? Batllori, Enric; Miller, Carol; Parisien, Marc-Andre; Parks, Sean A.; Moritz, Max A. 2014. Ecological Applications. 24(8): 1898-1907. Online: http://www.treesearch.fs.fed.us/pubs/47945.

A millennium-length reconstruction of Bear River stream flow, Utah. DeRose, R.J.; Bekker, M.F.; Wang, S.-Y.; Buckley, B.M.; Kjelgren, R.K.; Bardsley, T.; Rittenour, T.M.; Allen, E.B. 2015. Journal of Hydrology. doi: 10.1016/j.jhydrol.2015.01.014. Online: http://www.treesearch.fs.fed.us/pubs/47621.

Our relationship with a dynamic landscape: Understanding the 2013 Northern Colorado Flood. Hines, Sarah; Brenkert-Smith, Hannah; Champ, Patty; Joyce, Linda; Robichaud, Pete; Ryan-Burkett, Sandra. 2014. Science You Can Use Bulletin, Issue 10. Fort Collins, CO: Rocky Mountain Research Station. 15 p. Online: http://www.treesearch.fs.fed.us/pubs/47763.

Fire, fuel, and smoke

Are wildfire management resources in the United States efficiently allocated to protect resources at risk? A case study from Montana. O'Donnell, Derek T.; Venna, Tyron J.; Calkin, David E. 2014. Economic Analysis and Policy. 44: 318-332. Online: http://www.treesearch.fs.fed.us/pubs/47920.

A chance-constrained programming model to allocate wildfire initial attack resources for a fire season. Wei, Yu; Bevers, Michael; Belval, Erin; Bird, Benjamin. 2014. Forest Science. 60. doi: http://dx.doi.org/10.5849/forsci.14-112. Online: http://www.treesearch.fs.fed.us/pubs/47944.

Current status and future needs of the BehavePlus Fire Modeling System. Andrews, Patricia L. 2014. International Journal of Wildland Fire. 23: 21-33. Online: http://www.treesearch.fs.fed.us/pubs/47875.

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Development and application of a geospatial wildfire exposure and risk calculation tool. Thompson, Matthew P.; Haas, Jessica R.; Gilbertson-Day, Julie W.; Scott, Joe H.; Langowski, Paul; Bowne, Elise; Calkin, David E. 2015. Environmental Modelling and Software. 63: 61-72. Online: http://www.treesearch.fs.fed.us/pubs/47738.

Development and application of a probabilistic method for wildfire suppression cost modeling. Thompson, Matthew P.; Haas, Jessica R.; Finney, Mark A.; Calkin, David E.; Hand, Michael S.; Browne, Mark J.; Halek, Martin; Short, Karen C.; Grenfell, Isaac C. 2015. Forest Policy and Economics. 50: 249-258. Online: http://www.treesearch.fs.fed.us/pubs/47739.

The influence of parent material on vegetation response 15 years after the Dude Fire, Arizona. Leonard, Jackson M.; Medina, Alvin L.; Neary, Daniel G.; Tecle, Aregai. 2015. Forests. 6: 613-635. Online: http://www.treesearch.fs.fed.us/pubs/47800.

Potential postwildfire debris-flow hazards - a prewildfire evaluation for the Sandia and Manzano Mountains and surrounding areas, central New Mexico. Tillery, Anne C.; Haas, Jessica R.; Miller, Lara W.; Scott, Joe H.; Thompson, Matthew P. 2014. Scientific Investigations Report 2014-5161. Reston, VA: U.S. Geological Survey. 24 p. Online: http://www.treesearch.fs.fed.us/pubs/47737.

Using rainwater harvesting techniques for firefighting in forest plantations. Garcia-Chevesich, P.; Valdes-Pineda, R.; Neary, D.; Pizarro, R. 2015. Journal of Tropical Forest Science. 27(1): 1-2. Online: http://www.treesearch.fs.fed.us/pubs/47799.

Wildland fuel fundamentals and applications. Keane, Robert E. 2015. New York: Springer. 182 p.

Forest and woodland ecosystems

Comparison of riparian and upland forest stand structure and fuel loads in beetle infested watersheds, southern Rocky Mountains. Dwire, Kathleen A.; Hubbard, Robert; Bazan, Roberto. 2015. Forest Ecology and Management. 335: 194-206. Online: http://www.treesearch.fs.fed.us/pubs/47753.

Cytotype differences in radial increment provide novel insight into aspen reproductive ecology and stand dynamics. DeRose, R. Justin; Mock, Karen E.; Long, James N. 2015. Canadian Journal of Forest Research. 45: 1–8. Online: http://www.treesearch.fs.fed.us/pubs/47622.

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Geographically variable response of Dendroctonus ponderosae to winter warming in the western United States. Weed, Aaron S.; Bentz, Barbara J.; Ayres, Matthew P.; Holmes, Thomas P. 2015. Landscape Ecology. doi: 10.1007/s10980-015-0170-z. Online: http://www.treesearch.fs.fed.us/pubs/48000.

Impacts of forest harvest on active carbon and microbial properties of a volcanic ash cap soil in northern Idaho. Page-Dumroese, Deborah S.; Busse, Matt D.; Overby, Steven T.; Gardner, Brian D.; Tirocke, Joanne M. 2015. Open Journal of Soil Science. 5: 11-19. Online: http://www.treesearch.fs.fed.us/pubs/48013.

Recovery of small pile burn scars in conifer forests of the Colorado Front Range. Rhoades, Charles C.; Fornwalt, Paula J.; Paschke, Mark W.; Shanklin, Amber; Jonas, Jayne L. 2015. Forest Ecology and Management. 347: 180-187. Online: http://www.treesearch.fs.fed.us/pubs/47990.

Revisiting disturbance: A new guide for keeping dry mixed conifer forests healthy through fuel management. Miller, Sue; Jain, Theresa; Battaglia, Mike A.; Han, Han-Sup; Graham, Russell T.; Keyes, Christopher R.; Fried, Jeremy S.; Sandquist, Jonathan E. 2014. Science You Can Use Bulletin, Issue 9. Fort Collins, CO: Rocky Mountain Research Station. 12 p. Online: http://www.treesearch.fs.fed.us/pubs/47766.

Simulation of quaking aspen potential fire behavior in Northern Utah, USA. DeRose, R. Justin; Leffler, A. Joshua. 2014. Forests. 5: 3241-3256. Online: http://www.treesearch.fs.fed.us/pubs/47619.

Species composition influences management outcomes following mountain pine beetle in lodgepole pine-dominated forests. Pelz, K.A.; Rhoades, C.C.; Hubbard, R.M.; Battaglia, M.A.; Smith, F.W. 2015. Forest Ecology and Management. 336: 11-20. Online: http://www.treesearch.fs.fed.us/pubs/47835.

Tree physiology and bark beetles. Ryan, Michael G.; Sapes, Gerard; Sala, Anna; Hood, Sharon M. 2015. New Phytologist. 205: 955-957. Online: http://www.treesearch.fs.fed.us/pubs/47849.t

Grasslands, shrublands, and desert ecosystems

Projections of contemporary and future climate niche for Wyoming big sagebrush (*Artemisia tridentata* subsp. *wyomingensis*): A guide for restoration. Still, Shannon M.; Richardson, Bryce A. 2015. Natural Areas Journal. 35(1): 30-43. Online: http://www.treesearch.fs.fed.us/pubs/48015.

Seedling establishment in a masting desert shrub parallels the pattern for forest trees. Meyer, Susan; Pendleton, Burton K. 2015. Acta Oecologica. 65-66(May-June): 1-10. Online: http://www.treesearch.fs.fed.us/pubs/47931.

Spatiotemporal evolution of Calophaca (Fabaceae) reveals multiple dispersals in the Central Asian mountains and adjacent regions. Zhang, Ming-Li; Wen, Zhi-Bin; Fritsch, Peter W.; Sanderson, Stewart C. 2015. PLoS ONE 10(4): e0123228. Online: http://www.treesearch.fs.fed.us/pubs/47993.

Spotlight on 2014 research by the Grassland, Shrubland and Desert Ecosystems Science Program. [multiple authors]. 2015. GSD Update. March. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 14 p. Online: http://www.treesearch.fs.fed.us/pubs/48002. In this issue:

- New research on resilience of sagebrush ecosystems used for improving sage-grouse habitat (Jeanne Chambers)

- Population estimate for black-backed woodpeckers (Mark Rumble)
- Seeding techniques for restoring sagebrush ecosystems following wildfire (Jeffrey Ott)
- Evaluating the resiliency of understory vegetation to timber harvest in ponderosa pine forests (Jack Butler)
- Restoring foarest landscapes (Kasten Dumroese)
- Ensuring quality testing of nursery Stocktypes (Jeremiah Pinto)
- A new look at the race for survival: Cheatgrass biocontrol with "black fingers of death" (Susan Meyer)
- *Mecinus heydenii*: An unexpected appetite for hybrid toadflax (Sharlene Sing)
- Vulnerability to climate change: An assessment of an important restoration sepcies (Francis Kilkenny)
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- Climate regulates mountain big sagebrush recovery after fire (Stanley Kitchen)
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- Climate change impacts on future carbon stores and managemenbt of warm deserts of the United States (Paulette Ford)
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- Reproductive strategies of cacti in the driest desert in the world (Steven Warren)

Tertiary montane origin of the Central Asian flora, evidence inferred from cpDNA sequences of *Atraphasxis* (Polygonaceae). Zhang, Ming-Li; Sanderson, Stewart C.; Sun, Yan-Xia; Byalt, Vyacheslav V.; Hao, Xiao-Li. 2014. Journal of Integrative Plant Biology. 56(12): 1125-1135. Online: http://www.treesearch.fs.fed.us/pubs/47941.

Toadflax stem miners and gallers: The original weed whackers. Matonis, Megan; Sing, Sharlene E.; Ward, Sarah; Turner, Marie F. S.; Weaver, David; Tosevski, Ivo; Gassmann, Andre; Bouchard, Patrice. 2014. Science You Can Use Bulletin, Issue 11. Fort Collins, CO: Rocky Mountain Research Station. 10 p. Online: http://www.treesearch.fs.fed.us/pubs/47765.

Human dimensions

Categorizing the social context of the wildland urban interface: Adaptive capacity for wildfire and community "archetypes." Paveglio, Tavis B.; Moseley, Cassandra; Carroll, Matthew S.; Williams, Daniel R.; Davis, Emily Jane; Fischer, A. Paige. 2015. Forest Science. 60: http://dx.doi.org/10.5849/forsci.14-036. Online: http://www.treesearch.fs.fed.us/pubs/48014.

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Systematic temporal patterns in the relationship between housing development and forest bird biodiversity. Pidgeon, Anna M.; Flather, Curtis H.; Radeloff, Volker C.; Lepczyk, Christopher A.; Keuler, Nicholas S.; Wood, Eric M.; Stewart, Susan I.; Hammer, Roger B. 2014. Conservation Biology. 28(5): 1291-1301. Online: http://www.treesearch.fs.fed.us/pubs/47858.

Inventory, monitoring, and analysis

Developing strategies to initialize landscape-scale vegetation maps from FIA data to enhance resolution of individual species-size cohort representation in the landscape disturbance model SIMPPLLE. Muller, Jacob John. 2014. Missoula, MT: University of Montana. Thesis. Online: http://www.treesearch.fs.fed.us/pubs/48012.

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Biomass and fire dynamics in a temperate forest-grassland mosaic: Integrating multi-species herbivory, climate, and fire with the FireBGCv2/GrazeBGC system. Riggs, R.A.; Keane, R.E.; Cimon, N.; Cook, R.; Holsinger, L.; Cook, J.; DelCurto, T.; Baggett, L.S.; Justice, D.; Powell, D.; Vavra, M.; Naylor, B. 2015. Ecological Modelling. 296: 57-78. Online: http://www.treesearch.fs.fed.us/pubs/47844.

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Niche versus neutrality: A dynamical analysis. Kalyuzhny, Michael; Seri, Efrat; Chocron, Rachel; Flather, Curtis H.; Kadmon, Ronen; Shnerb, Nadav M. 2014. The American

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Spatially-explicit estimation of Wright's neighborhood size in continuous populations. Shirk, Andrew J.; Cushman, Samuel A. 2014. Frontiers in Ecology and Evolution. 2: 62. doi: 10.3389/fevo.2014.00062. Online: http://www.treesearch.fs.fed.us/pubs/48001.

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Wilderness research

The USGS Northern Rocky Mountain Science Center. Corn, Paul Stephen; Soileau, Suzanna C. 2014. International Journal of Wilderness. 20(3): 33-34. Online: http://www.treesearch.fs.fed.us/pubs/47946.

Wildlife and terrestrial habitats

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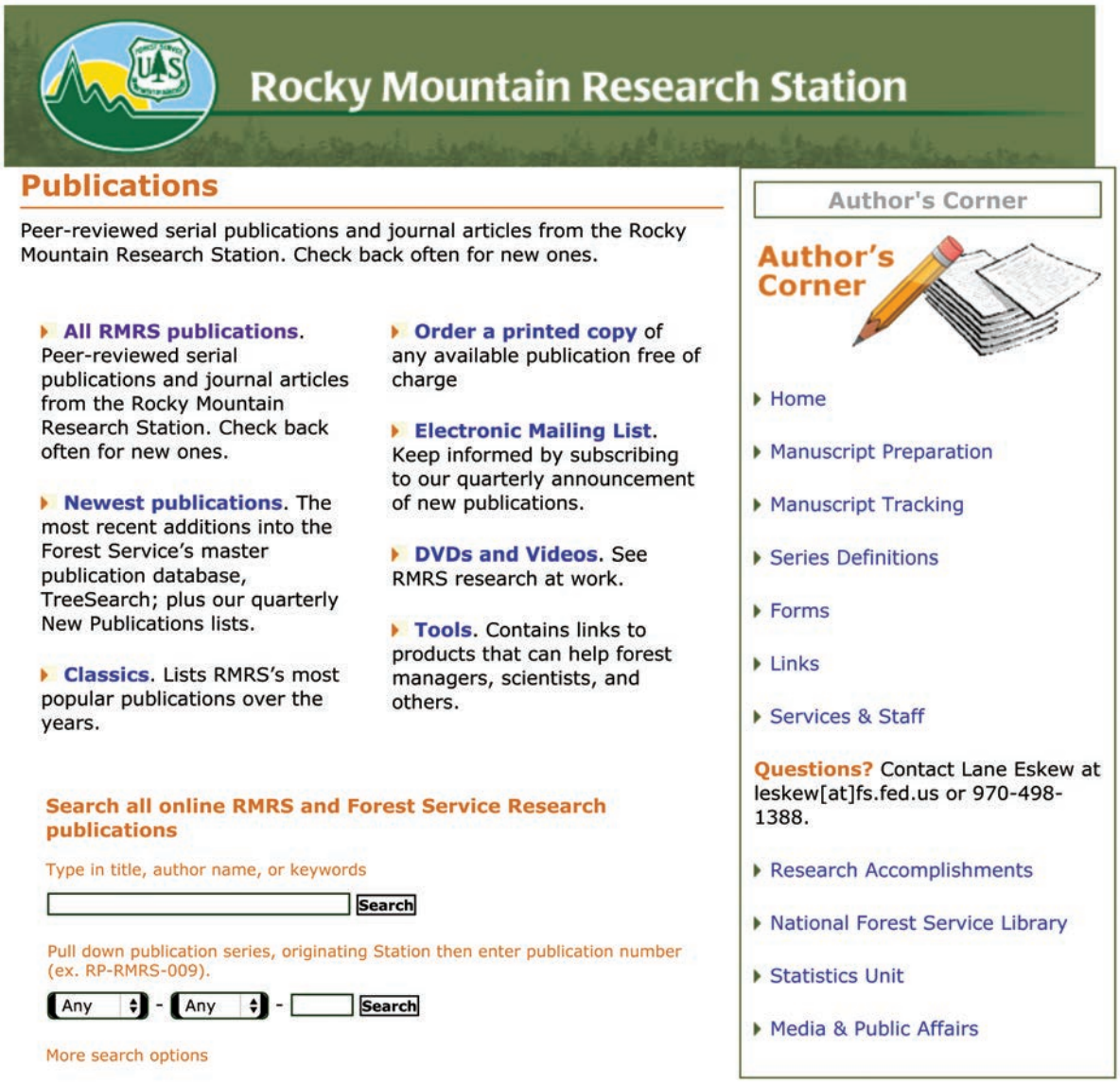

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Science Program Areas

The Rocky Mountain Research Station is evolving from a Station with 30 research work units (including ecosystem management units and national programs) to a comprehensive programmatic structure consisting of eight Science Program areas and several Research, Development and Applications programs. Descriptions of the Science Program areas follow below.

Air, Water and Aquatic Environments

Air quality, water availability, water quality, and aquatic habitats are critical issues within the rapidly changing Western United States. The Air, Water and Aquatic Environments program is committed to the development of knowledge and science applications related to air and water quality, as well as the habitat quality, distribution, diversity, and persistence of fish and other aquatic species. Website: http://www.fs.fed.us/rm/boise/awae_home.shtml. Contact Frank McCormick, Program Manager, for more information: 208-373-4351.

Aldo Leopold Wilderness Research Institute

The Aldo Leopold Wilderness Research Institute aims to provide scientific leadership by bringing diverse groups of scientists and managers together to develop and use the knowledge needed to assure wilderness ecosystems and values endure for generations to come. Website: http://leopold.wilderness.net. Contact Susan Fox, Program Director, for more information: 406-542-4193.

Fire, Fuel and Smoke

The Fire, Fuel and Smoke program works to improve the safety and effectiveness of fire management through the creation and dissemination of basic fire science knowledge. The program investigates the impacts of fires on the environment by means of fundamental and applied research for understanding and predicting fire behavior, its effects on ecosystems, and its emissions into the atmosphere. Website: http://www.firelab.org. Contact Bret Butler, Acting Program Manager, for more information: 406-329-4801.

Forest and Woodland Ecosystems

Forests and woodlands are increasingly being impacted by large scale urbanization and human developments, uncharacteristically large and severe wildfires, insect and disease outbreaks, exotic species invasions, and drought, and interactions of multiple stressors at local, landscape, and regional scales. The Forest and Woodland Ecosystems program acquires, develops, and delivers the scientific knowledge for sustaining and restoring forests and woodlands landscape health, biodiversity, productivity, and ecosystem processes. Website: http://www.fs.fed.us/rmrs/research/programs/forest-woodlands-ecosystem/. Contact Alison Hill, Program Manager, for more information: 928-556-2105.

Grassland, Shrubland and Desert Ecosystems

Disruptions by large-scale clearing for agriculture, water diversions, extensive grazing, changes in the native fauna, the advent of alien weeds, altered fire regimes, and increases in human-caused insect and disease epidemics have contributed to produce areas that are in unsuitable condition. The Grassland, Shrubland and Desert Ecosystems program addresses the biology, use, management, and restoration of these grass and shrublands. Website: http://www.fs.fed.us/rmrs/research/programs/grassland-shrubland-desert/. Contact Debbie Finch, Program Manager, for more information: 505-724-3671.

Human Dimensions

The Human Dimensions program provides social and economic science based innovation to human societies as they develop a sustainable relationship with their environment. Major issues confronting societies across the globe such as global climate change, energy, fire, water, and ecosystem services all have important social-economic dimensions that will be explored and addressed by this program. Website: http://www.fs.fed.us/rmrs/research/programs/social-economics-decision/. Contact Dan Williams, Acting Program Manager, for more information: 970-498-2561.

Inventory, Monitoring and Analysis

The Inventory, Monitoring and Analysis program provides the resource data, analysis, and tools needed to effectively identify current status and trends, management options and impacts, and threats and impacts of fire, insects, disease, and other natural processes. Website: http://www.fs.fed.us/rm/ogden/. Contact Michael Wilson, Program Manager, for more information: 801-625-5407.

Science Application and Integration

The Science Application and Integration program is a knowledge transfer unit that provides leadership for the integration and use of scientific information in natural resource planning and management across the Interior West. Website: http://www.fs.fed.us/rm/science-application-integration/. Contact Jan Engert, Assistant Station Director, for more information: 970-498-1377.

Wildlife and Terrestrial Ecosystems

The Wildlife and Terrestrial Ecosystems program is engaged in sustaining species and ecosystems of concern through studies of ecological interactions within and between plant, aquatic, and terrestrial animal communities; understanding public use effects through studies elucidating social and economic values associated with consumptive and non-consumptive uses of fish and wildlife; managing terrestrial and aquatic habitats; and evaluating outcomes of land and water uses and natural disturbances. Website: http://www.rmrs.nau.edu/wildlife/. Contact William Block, Program Manager, for more information: 928-556-2161.

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