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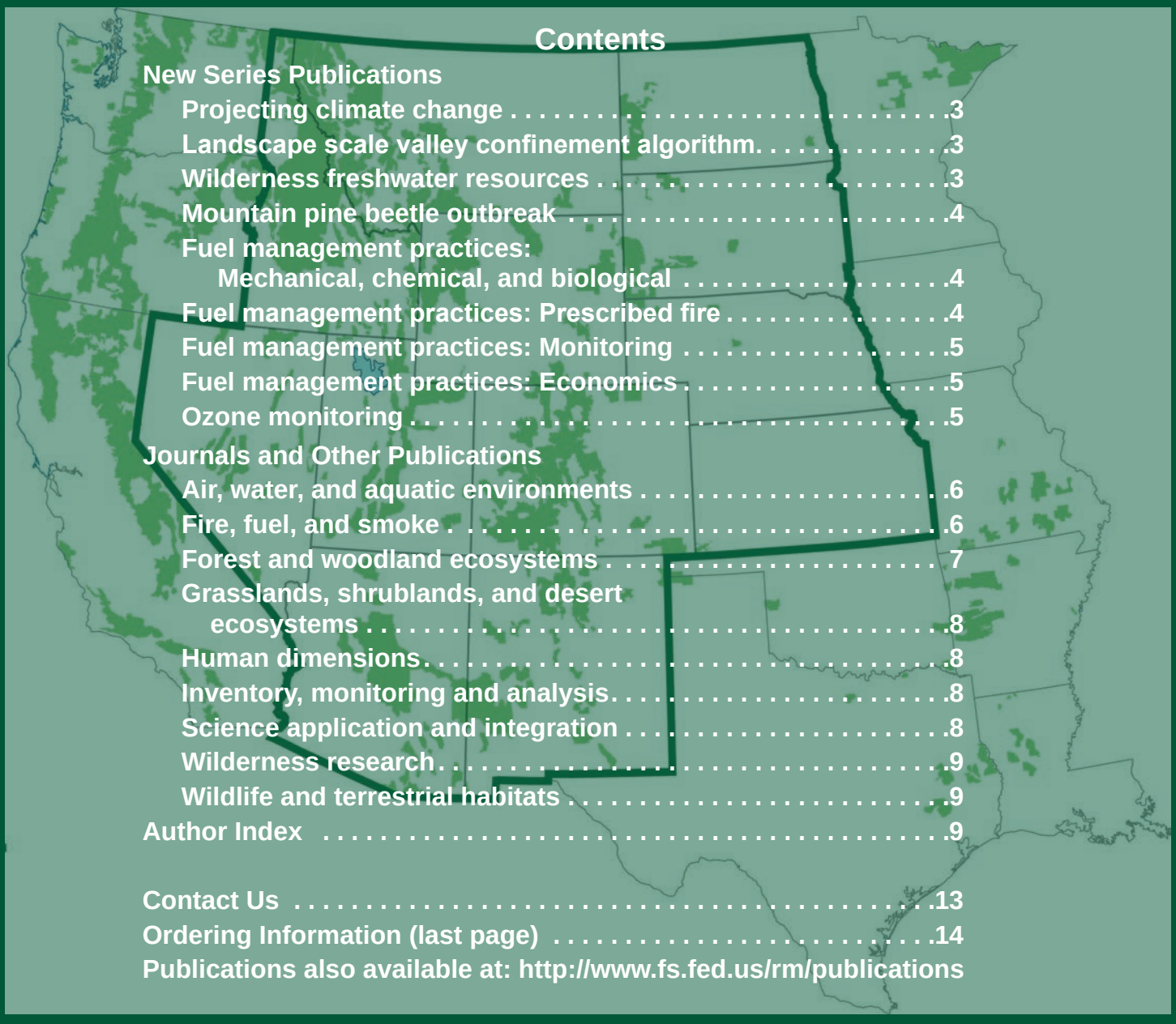
Rocky Mountain Research Station

New Publications

April to June 2014



Contents

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.

To order a publication, please see the last page.

New RMRS Series Publications

Projecting climate change

Order 7

Projecting climate change in the United States: A technical document supporting the Forest Service RPA 2010 Assessment. Joyce, Linda A.; Price, David T.; Coulson, David P.; McKenney, Daniel W.; Siltanen, R. Martin; Papadopol, Pia; Lawrence, Kevin. 2014. Gen. Tech. Rep. RMRS-GTR-320. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 85 p.

This report describes the development of the historical and projected climate data set. Climate projections, along with projections for population dynamics, economic growth, and land use change in the United States, comprise the RPA scenarios and are used in the RPA Assessment to project future renewable resource conditions 50 years into the future. The climate variables are monthly total precipitation, monthly mean daily maximum air temperature, and monthly mean daily minimum air temperature. Downscaled climate data were developed for the period 2001-2100 at the 5-arcminute grid scale for the conterminous United States. The scenarios used here from the IPCC Special Report on Emissions Scenarios are A1B, A2, and B2. These projection data and the change factor data are available through the U.S. Forest Service data archive website (http://www.fs.usda.gov/rds/archive/).

Online: http://www.fs.fed.us/rm/pubs/rmrs_gtr320.html.

Landscape scale valley confinement algorithm

Order 8

A landscape scale valley confinement algorithm: Delineating unconfined valley bottoms for geomorphic, aquatic, and riparian applications. Nagel, David E.; Buffington, John M.; Parkes, Sharon L.; Wenger, Seth; Goode, Jaime R. 2014. Gen. Tech. Rep. RMRS-GTR-321. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 42 p.

This report describes a GIS program called the Valley Confinement Algorithm (VCA), which identifies unconfined valleys in montane landscapes. The algorithm uses nationally available digital elevation models (DEMs) at 10-30 m resolution to generate results at subbasin scales (8 digit hydrologic unit). User-defined parameters allow results to be tailored to specific applications and landscapes. Field data were sampled to verify geomorphic characteristics of valley types identified by the program, and a detailed accuracy assessment was conducted to quantify the reliability of the algorithm output.

Online: http://www.fs.fed.us/rm/pubs/rmrs_gtr321.html.

Wilderness freshwater resources

Online only

Freshwater resources in designated wilderness areas of the United States: A state-of-knowledge review. Johnson, Adam N.; Spildie, David R. 2014. Gen. Tech. Rep. RMRS-GTR-324. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 32 p. **NOTE**: This is available only online. No paper copy will be printed.

The report discusses several important topics and themes relating to freshwater resources originating in wilderness areas, including surface water quality and quantity; groundwater resources; water uses and benefits; ecosystem services and water valuation mechanisms; potential climate change impacts; water-related legislation; and case studies and maps. Case studies highlight the societal benefits that may be obtained from water derived from designated wilderness areas. A GIS mapping analysis of several regions provides a qualitative view of the value of water draining wilderness areas by illustrating the physical proximity of high-quality resources to populous regions.

Online: http://www.fs.fed.us/rm/pubs/rmrs_gtr324.html.

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Mountain pine beetle outbreak

Order 9

Future Forests Webinar Series, webinar proceedings and summary: Ongoing research and management responses to the mountain pine beetle outbreak. Matonis, M.; Hubbard, R.; Gebert, K.; Hahn, B.; Miller, S.; Regan, C. 2014. Proceedings RMRS-P-70. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 80 p.

The Future Forest Webinar Series facilitated dialogue between scientists and managers about the challenges and opportunities created by the mountain pine beetle (MPB) epidemic. The series consisted of six webinars from October 2011 to December 2012 and were facilitated by the USFS Rocky Mountain Research Station, the Northern and Rocky Mountain Regions, and the Colorado Forest Restoration Institute. Topics included: potential fire risk and behavior, current and future vegetation conditions, wildlife habitats and populations, social and economic considerations, ecosystem- and watershed-level changes, and management responses. These proceedings represent a snapshot of relevant scientific and management concerns related to this epidemic.

Online: http://www.fs.fed.us/rm/pubs/rmrs_p070.html.

Fuel management practices: Mechanical, chemical, and biological

Order 10

A comprehensive guide to fuel management practices for dry mixed conifer forests in the northwestern United States: Mechanical, chemical, and biological fuel treatment methods. Jain, Theresa B.; Battaglia, Mike A.; Han, Han-Sup; Graham, Russell T.; Keyes, Christopher R.; Fried, Jeremy S.; Sandquist, Jonathan E. 2014. Res. Note RMRS-RN-61. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Several mechanical approaches to managing vegetation fuels hold promise when applied to the dry mixed conifer forests in the western United States. These are most useful to treat surface, ladder, and crown fuels. There are a variety of techniques to remove or alter all kinds of plant biomass (live, dead, or decomposed) that affect forest resilience. It is important for managers to understand when and where each technique will best accomplish management objectives. This summary addresses three fuel treatment approaches: mechanical, herbicides, and targeted grazing.

Online: http://www.fs.fed.us/rm/pubs/rmrs_rn061.html.

Fuel management practices: Prescribed fire

Order 11

A comprehensive guide to fuel management practices for dry mixed conifer forests in the northwestern United States: Prescribed fire. Jain, Theresa B.; Battaglia, Mike A.; Han, Han-Sup; Graham, Russell T.; Keyes, Christopher R.; Fried, Jeremy S.; Sandquist, Jonathan E. 2014. Res. Note RMRS-RN-62. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Fire has had a profound historical role in shaping dry mixed conifer forests in the western United States. However, the uncertainty and complexity of prescribed fires raises the question "Is fire always the best option for treating fuels?" To mitigate the uncertainty, there are several steps fire managers execute before conducting a prescribed fire. Experienced fire practitioners combine science, decision support tools (e.g., fire behavior models), and monitoring with their own experience and knowledge to reduce the risks of prescribed fire.

Online: http://www.fs.fed.us/rm/pubs/rmrs_rn062.html.

To order a publication, please see the last page.

Fuel management practices: Monitoring

Order 12

A comprehensive guide to fuel management practices for dry mixed conifer forests in the northwestern United States: Monitoring. Jain, Theresa B.; Battaglia, Mike A.; Han, Han-Sup; Graham, Russell T.; Keyes, Christopher R.; Fried, Jeremy S.; Sandquist, Jonathan E. 2014. Res. Note RMRS-RN-63. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Short- and medium-term evaluation of how fuel treatments are working is the only way to know if the hundreds of activities on the ground are adding up to the goals of more resilient landscapes and increased safety of people and property. Monitoring is a critical resource for decision makers who design fuels management programs; however, it is an often neglected part of the fuel management cycle.

Online: http://www.fs.fed.us/rm/pubs/rmrs_rn063.html.

Fuel management practices: Economics

Order 13

A comprehensive guide to fuel management practices for dry mixed conifer forests in the northwestern United States: Inventory and model-based economic analysis of mechanical fuel treatments. Jain, Theresa B.; Battaglia, Mike A.; Han, Han-Sup; Graham, Russell T.; Keyes, Christopher R.; Fried, Jeremy S.; Sandquist, Jonathan E. 2014. Res. Note RMRS-RN-64. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Implementing fuel treatments in every place where it could be beneficial to do so is impractical and not cost effective under any plausible specification of objectives. Only some of the many possible kinds of treatments will be effective in any particular stand and there are some stands that seem to defy effective treatment. In many more, effective treatment costs far more than the value of treatment benefits. Understanding the scope of the fuel management challenges in these forests is the first step towards identifying fuel treatment approaches that are likely to be both effective and economically feasible.

Online: http://www.fs.fed.us/rm/pubs/rmrs_rn064.html.

Ozone monitoring

Order 14

Ozone monitoring at remote sites using low-power instrumentation. Korfmacher, John L.; Musselman, Robert C. 2014. Res. Note RMRS-RN-65. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 7 p.

Collection of non-urban ambient ozone data at regional or larger scales is cost- and labor-intensive. Collection efforts are often further complicated by difficulty of access to data collection sites, the need for climate-controlled facilities to house instrumentation, and a requirement for a connection to utility-grade (grid) power. Regional ozone is more often studied via modeling. Although nitrite-based passive samplers may be used to estimate seasonal and longer-term exposure levels and trends, these samplers are easily contaminated, are sometimes inaccurate, and provide an ozone value that represents accumulation over the entire sample period, ignoring the dynamics of the exposure during that time period. Estimates of other ozone metrics used for regulatory compliance are not possible without continuous ozone data. More detailed knowledge of the daily and longer-term patterns of ozone exposure is vital to evaluating the impact of this pollutant on plant tissues.

Online: http://www.fs.fed.us/rm/pubs/rmrs_rn065.html.

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

A blocking primer increases specificity in environmental DNA detection of bull trout (*Salvelinus confluentus*). Wilcox, T.M.; Schwartz, M.K.; McKelvey, K.S.; Young, M.K.; Lowe, W.H. 2014. Conservation Genetics Resources. 6: 283–284.

Chapter 7: Forests. Joyce, Linda; Running, Steven W.; Breshears, David D.; Dale, Virginia H.; Malmsheimer, Robert W.; Sampson, R. Neil; Sohngen, Brent; Woodall, Christopher W. 2014. In: Melillo, J.M.; Richmond, T.C.; Yohe, G.W., eds. Climate change impacts in the United States: The third national climate assessment. Washington, DC: U.S. global Change Research Program: 175-194. doi:10.7930/J0Z60KZC.

Climate change and forest values. Wear, David N.; Joyce, Linda A.; Butler, Brett J.; Gaither, Cassandra Johnson; Nowak, David J.; Stewart, Susan J.; 2014. In: Peterson, David L.; Vose, James M.; Patel-Weynand, Toral, eds. Climate change and United States Forests. Advances in Global Change Research. 57: 93-112.

Distance, flow, and PCR inhibition: eDNA dynamics in two headwater streams. Jane, S.F.; Wilcox, T.M.; McKelvey, K.S.; Young, M.K.; Schwartz, M.K.; Lowe, W.H.; Letcher, B.H.; Whiteley, A.R. 2014. Molecular Ecology Resources. doi: 10.1111/1755-0998.12285.

Evidence of climate-induced range contractions in bull trout *Salvelinus confluentus* in a Rocky Mountain watershed, U.S.A. Eby, L.A.; Helmy, O.; Holsinger, L.M.; Young, M.K. 2014. PLoS ONE. 9(6): e98812. doi:10.1371/journal.pone.0098812.

Exposure of U.S. National Parks to land use and climate change 1900-2100. Hansen, Andrew J.; Piekielek, Nathan; Davis, Cory; Haas, Jessica; Theobald, David M.; Gross, John E.; Monahan, William B.; Olliff, Tom; Running, Steven W. 2014. Ecological Applications. 24(3): 484-502. Online: http://www.treesearch.fs.fed.us/pubs/45736.

Influence of large wood on channel morphology and sediment storage in headwater mountain streams, Fraser Experimental Forest, Colorado. Ryan, Sandra E.; Bishop, Erica L.; Daniels, Michael J. 2014. Geomorphology. 217: 73-88.

The missing mountain water: Slower westerlies decrease orographic enhancement in the Pacific Northwest USA. Luce, C.H.; Abatzoglou, J.T.; Holden, Z.A. 2013. Science. 342: 1360-1364. Online: http://www.treesearch.fs.fed.us/pubs/45750.

Ozone in remote areas of the Southern Rocky Mountains. Musselman, Robert C.; Korfmacher, John L. 2014. Atmospheric Environment. 82: 383-390. Online: http://www.treesearch.fs.fed.us/pubs/45786.

Patch size but not short-term isolation influences occurrence of westslope cutthroat trout above human-made barriers. Peterson, D.P.; Rieman, B.E.; Horan, D.L.; Young, M.K. 2014. Ecology of Freshwater Fish. doi: 10.1111/eff.12108.

Relative effects of climate change and wildfires on stream temperatures: A simulation modeling approach in a Rocky Mountain watershed. Holsinger, L.; Keane, R.; Isaak, D.; Eby, L.; Young, M. 2014. Climatic Change. 124(1-2):191-206. doi: 10.1007/s10584-014-1092-5.

Sensitivity of summer stream temperatures to climate variability in the Pacific Northwest. Luce, Charles; Staab, Brian; Kramer, Marc; Wenger, Seth; Isaak, Dan; McConnell, Callie. 2014. Water Resources Research. doi: 10.1002/2013WR014329. Online: http://www.treesearch.fs.fed.us/pubs/45784.

A tree-ring based reconstruction of Logan River streamflow, northern Utah. Allen, Eric B.; Rittenour, Tammy M.; DeRose, R. Justin; Bekker, Matthew F.; Kjelgren, Roger; Buckley, Brendan M. 2013. Water Resources Research. 49: 1-10. Online: http://www.treesearch.fs.fed.us/pubs/45749.

Fire, fuel, and smoke

Comparing three sampling techniques to estimate down dead woody surface fuel biomass. Keane, R.E.; Gray, K. 2013. International Journal of Wildland Fire. 22:1093-1107. Online: http://www.publish.csiro.au/?act=view_file&file_id=WF13038.pdf.

Fire activity and severity in the Western US vary along proxy gradients representing fuel amount and fuel moisture. Parks, S.A.; Parisien, M.-A.; Miller, C.; Dobrowski, S.Z. 2014. PloS ONE 9:e99699.

New and revised fire effects tools for fire management. Keane, Robert E.; Dillon, Greg; Drury, Stacy; Innes, Robin; Morgan, Penny; Lutes, Duncan; Prichard, Susan J.; Smith, Jane; Strand, Eva. 2014. Fire Management Today. 73(3): 37-47.

The role of wildfire, prescribed fire, and mountain pine beetle infestations on the population dynamics of black-backed woodpeckers in the Black Hills, South Dakota. Rota, Christopher T.; Millspaugh, Joshua J.; Rumble, Mark A.; Lehman, Chad P.; Kesler, Dylan C. 2014. PLoS ONE. 9(4): e94700. Online: http://www.plosone.org/article/fetchObject.action?uri=info%3Adoi%2F10.1371%2Fjournal.pone.0094700&representation=PDF.

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Forest and woodland ecosystems

Applied chemical ecology of the mountain pine beetle. Progar, Robert A.; Gillette, Nancy; Fettig, Christopher J.; Hrinkevich, Kathryn. 2014. Forest Science. 60(3): 414-433. Online: http://www.treesearch.fs.fed.us/pubs/46026.

Containers. Landis, Thomas D.; Luna, Tara; Dumroese, R. Kasten. 2014. In: Wilkinson, Kim M.; Landis, Thomas D.; Haase, Diane L.; Daley, Brian F.; Dumroese, R. Kasten, eds. Tropical nursery manual: A guide to starting and operating a nursery for native and traditional plants. Agric. Handb. 732. Washington, DC: U.S. Department of Agriculture, Forest Service: 123-140. Online: http://www.geographicconsulting.com/wp-content/uploads/2014/05/7.-Containers.pdf.

Cultural practices for prevention and control of mountain pine beetle infestations. Fettig, Christopher J.; Gibson, Kenneth E.; Munson, A. Steven; Negrón, Jose F. 2014. Forest Science. 60(3): 450-463. Online: http://www.treesearch.fs.fed.us/pubs/44855.

Ecological consequences of mountain pine beetle outbreaks for wildlife in western North American forests. Saab, Victoria A.; Latif, Quresh S.; Rowland, Mary M.; Johnson, Tracey N.; Chalfoun, Anna D.; Buskirk, Steven W.; Heyward, Joslin E.; Dresser, Matthew A. 2014. Forest Science. 60(3): 539-559. Online: http://www.treesearch.fs.fed.us/pubs/46027.

Establishing the science foundation to sustain high-elevation five-needle pine forests threatened by novel interacting stresses in four western National Parks. Schoettle, A.W.; Connor, J.; Mack, J.; Pineda Bovin, P.; Beck, J.; Baker, G.M.; Sniezko, R.A.; Burns, K.S. 2013. George Wright Forum. 30 (3): 302-312. Online: http://www.georgewright.org/303schoettle.pdf.

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Understorey plant community dynamics following a large, mixed severity wildfire in a *Pinus ponderosa–Pseudotsuga menziesii* forest, Colorado, USA. Fornwalt, Paula J.; Kaufmann, Merrill R. 2014. Journal of Vegetation Science. 25: 805-818.

White pine blister rust resistance in limber pine: Evidence for a major gene. Schoettle, A.W.; Sniezko, R.A.; Kegley, A.; Burns, K.S. 2014. Phytopathology. 104:163-173. Online: http://www.treesearch.fs.fed.us/pubs/44228.

Grasslands, shrublands, and desert ecosystems

Himalayan origin and evolution of *Myricaria* (Tamaricaeae) in the Neogene. Zhang, Ming-Li; Meng, Hong-Hu; Zhang, Hong-Xiang; Vyacheslav, Byalt V.; Sanderson, Stewart C. 2014. PLos ONE. 9(6): e97582. Online: http://www.plosone.org/article/fetchObject.action?uri=info%3Adoi%2F10.1371%2Fjournal.pone.0097582&representation=PDF.

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Resilience to stress and disturbance, and resistance to *Bromus tectorum* L. invasion in cold desert shrublands of western North America. Chambers, Jeanne C.; Bradley, Bethany A.; Brown, Cynthia S.; D'Antonio, Carla; Germino, Matthew J.; Grace, James B.; Hardegree, Stuart P.; Miller, Richard F.; Pyke, David A. 2014. Ecosystems. 17(2): 360-375.

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Human dimensions

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Inventory, monitoring, and analysis

Properties of Endogenous Post-Stratified Estimation using remote sensing data. Tipton, John; Opsomer, Jean; Moisen, Gretchen. 2013. Remote Sensing of Environment. 139: 130-137. Online: http://www.treesearch.fs.fed.us/pubs/45752.

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Genotyping-by-sequencing for *Populus* population genomics: An assessment of genome sampling patterns and filtering

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Wilderness research

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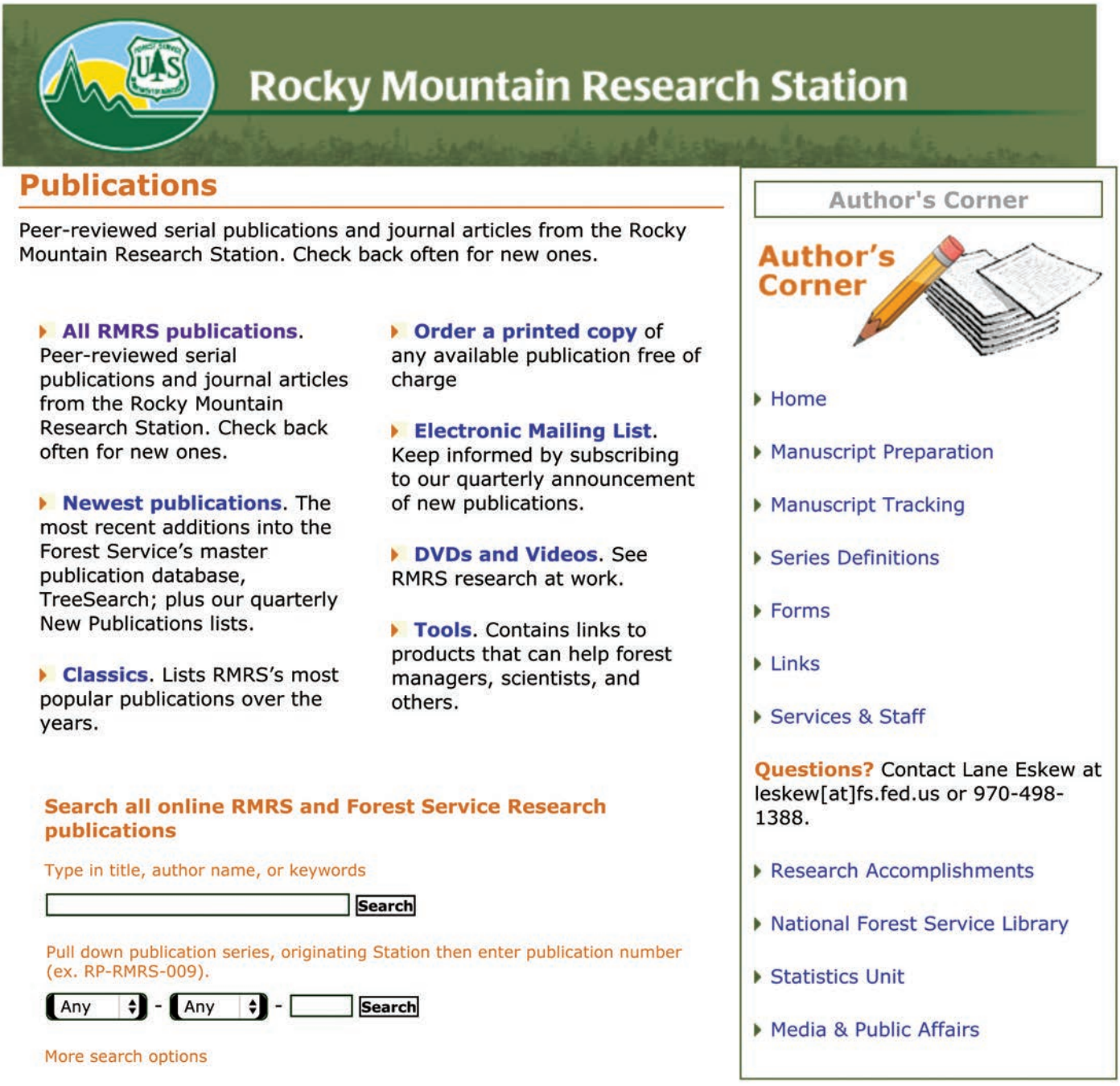

Science Program Areas

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. Contack 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.

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 Colin Hardy, Program Manager, for more information: 406-329-4978.

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 Tom Crow, Program Manager, for more information: 970-498-1378.

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 Cindy Swanson, Program Manager for more information: 406-329-3388.

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 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.

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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