United States Department of Agriculture

Rocky Mountain Research Station

New Publications

October–December 2017

CONTENTS

NEW SERIES PUBLICATIONS

The National Riparian Core Protocol 3
Fens and their rare plants in the Beartooth Mountains, Shoshone National Forest, Wyoming 3
Doing more with the core: Proceedings of the 2017 Forest Inventory and Analysis (FIA) Science Stakeholder Meeting 4
New Mexico's forest resources, 2008–2014 4
Probability of infestation and extent of mortality models for mountain pine beetle in lodgepole pine foresots in Colorado 5

JOURNALS AND OTHER PUBLICATIONS

Air, water and aquatic environments 6
Fire, fuel and smoke 6
Forest and woodland ecosystems 7
Grasslands, shrublands and desert ecosystems 8
Human dimensions 9
Inventory and monitoring 10
Science application and communication 10
Wildlife and terrestrial habitats 10

CONTACT US 12

ORDERING INFORMATION 12

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The Rocky Mountain Research Station

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 more than 400 permanent full-time employees, including about 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 Bureau of Land Management 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. These 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 Publication Series

The National Riparian Core Protocol

Online only

The National Riparian Core Protocol: A riparian vegetation monitoring protocol for wadeable streams of the conterminous United States. Merritt, David M.; Manning, Mary E.; Hough-Snee, Nate, eds. 2017. Gen. Tech. Rep. RMRS-GTR-367. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 37 p.

Riparian areas are hotspots of biological diversity that may serve as high quality habitat for fish and wildlife. The National Riparian Core Protocol (NRCP) provides tools and methods to assist natural resource professionals in sampling riparian vegetation and physical characteristics along wadeable streams. Guidance is provided for collecting basic information on riparian vegetation composition and physical structure in fluvial riparian ecosystems. The NRCP provides a foundation to assess the characteristics and condition of channels and riparian vegetation at a single point in time or in response to changes in land- and water-use activities, including restoration, or natural processes through time.

https://www.fs.usda.gov/treesearch/pubs/55365

Fens and their rare plants in the Beartooth Mountains, Shoshone National Forest, Wyoming

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Fens and their rare plants in the Beartooth Mountains, Shoshone National Forest, Wyoming. Heidel, Bonnie; Fertig, Walter; Mellmann-Brown, Sabine; Houston, Kent E.; Dwire, Kathleen A. 2017. Gen. Tech. Rep. RMRS-GTR-369. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 110 p.

This report summarizes the studies on Beartooth fens from 1962 to 2009, which have contributed to current knowledge of rare plant distributions and biodiversity conservation. The study area is the Wyoming portion of the Beartooth Mountains in the Middle Rocky Mountains. Here, we profile 18 fens that occur over the range of elevations, settings, geomorphic landforms, and vegetation. The wetland flora from these 18 fens is composed of 58 families, 156 genera, and 336 vascular plant species—more than 10 percent of the known Wyoming flora. We discuss 32 rare vascular plant species and 1 bryophyte species associated with Beartooth fens and their State and regional significance. Information compiled in this report increases understanding of Beartooth fens, provides a basis for future research and comparisons with mountain fens elsewhere in Wyoming and the Rocky Mountains, and contributes to conservation of fen resources and services.

https://www.fs.usda.gov/treesearch/pubs/55247

New RMRS Publication Series

Doing more with the core: Proceedings of the 2017 Forest Inventory and Analysis science stakeholder meeting

Online only

Doing more with the core: Proceedings of the 2017 Forest Inventory and Analysis (FIA) Science Stakeholder Meeting; 2017 October 24-26; Park City, UT. Healey, Sean P.; Berrett, Vicki M., comps. 2017. Proc. RMRS-P-75. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 56 p.

An FIA Science Stakeholder Meeting was held October 24-26th, 2017, to bring key FIA personnel together with important partners and peers. The theme for this meeting, "Doing More with the Core," targeted innovation around how FIA analyzes, augments, and delivers information derived from its central data collection operations. Meeting topics included: 1) maximizing the value of the "annual" sample design adopted by the Program approximately 15 years ago; 2) developing better delivery tools that meet client needs and that take advantage of ever-expanding options for data visualization and communication; 3) assuring data continuity that supports a variety of land manager needs; 4) integrating more powerful and efficient monitoring technologies and statistical techniques into established analysis lines; and 5) supporting FIA's expansion in areas targeted by the most recent Farm Bill. This proceedings document includes details from selected papers presented at the meeting.

https://www.fs.usda.gov/treesearch/pubs/55248

New Mexico's forest resources, 2008–2014

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New Mexico's forest resources, 2008–2014. Goeking, Sara A.; Menlove, Jim. 2017. Resour. Bull. RMRS-RB-24. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 68 p.

Abstract

This report presents a summary of the most recent inventory of New Mexico's forests based on field data collected between 2008 and 2014. The results presented here summarize a complete cycle of New Mexico's forest inventory, or 10 years' worth of data collection. The report includes descriptive highlights and tables of area, numbers of trees, biomass, volume, growth, mortality, and removals. Most results are organized by forest type or forest-type group, species group, diameter class, or owner group. The State's most abundant forest type is pinyon/juniper woodland, which covers more than 10 million acres. Pinyon/juniper woodlands combined with juniper woodlands cover a total of 13.5 million acres, or more than half of New Mexico's forest land area. Gambel oak is the most abundant tree species by number of trees, followed by common pinyon. Ponderosa pine makes up about one-quarter of the State's total tree volume and biomass, and thus is the most abundant tree species in terms of volume and biomass.

https://www.fs.usda.gov/treesearch/pubs/55293

New RMRS Publication Series

Probability of infestaton and extent of mortality models for mountain pine beetle in lodgepole pine forests in Colorado

Online only

Probability of infestation and extent of mortality models for mountain pine beetle in lodgepole pine forests in Colorado. Negron, Jose F.; Klutsch, Jennifer G. 2017. Res. Note RMRS-RN-77. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 13 p.

The mountain pine beetle, *Dendroctonus ponderosae* Hopkins, is a significant agent of tree mortality in lodgepole pine (*Pinus contorta* Dougl. ex Loud.) forests throughout western North America. We use data from a network of plots established in 2006-2007 on the Sulphur Ranger District of the Arapaho and Roosevelt National Forests to develop simple probability of infestation and extent of mortality models using classification and regression trees, respectively. A classification tree indicated that when live lodgepole pine basal area was equal to or greater than 59.3 ft2/acre pre-outbreak, the probability of infestation increased. A second classification tree added lodgepole pine mean diameter as a second splitting variable. The rate of correct classification for both models was greater than 0.79. These simple models use readily available data from forest inventories and can be used to identify stands, based on forest stand conditions, where mountain pine beetle is more likely to occur and the potential extent of lodgepole pine tree mortality should an outbreak occur.

https://www.fs.usda.gov/treesearch/pubs/55502

Journals and Other Publications

Online links are provided if available. For the general public, some links may hit a pay wall. Please accept our apologies for any inconvenience.

Air, water and aquatic environments

Decline of the world's saline lakes. Wurtsbaugh, Wayne A.; Miller, Craig; DeRose, R. Justin; [et al.]. 2017. Nature Geoscience. doi: 10.1038/ngeo3052. https://www.fs.usda.gov/treesearch/pubs/55579.

Modeling streamflow in asnow-dominated forest watershed using the Water Erosion Prediction Project (WEPP) model. Srivastava, A.; Wu, J.Q.; Elliot, W.J.; [et al.]. 2017. Transactions of the ASABE. 60(4): 1171–1187. https://www.fs.usda.gov/treesearch/pubs/55585.

Monthly paleostreamflow reconstruction from annual tree-ring chronologies. Stagge, J.H.; Rosenberg, D.E.; DeRose, R.J.; [et al.]. 2018. Journal of Hydrology 557: 791–804. https://www.fs.usda.gov/treesearch/pubs/55581.

The NorWeST summer stream temperature model and scenarios for the western U.S.: A crowd-sourced database and new geospatial tools foster a user community and predict broad climate warming of rivers and streams. Isaak, Daniel J.; Nagel, David E.; Luce, Charles H.; Wollrab, Sherry P.; Chandler, Gwynne L.; Horan, Dona L.; Parkes-Payne, Sharon; [et al.]. 2017. Water Resources Research. 53: 9181–9205. https://www.fs.usda.gov/treesearch/pubs/55586.

Post-disturbance sediment recovery: Implications for watershed resilience. Rathburn, Sara L.; Shahverdian, Scott M.; Ryan, Sandra E. 2017. Geomorphology. doi: 10.1016/j.geomorph.2017.08.039. https://www.fs.usda.gov/treesearch/pubs/55035.

Fire, fuel and smoke

Adapting to wildfire: Moving beyond homeowner risk perceptions to taking action. Champ, Patricia. 2017. In: Laney, Kara N.A century of wildland fire research: Contributions to long-term approaches for wildland fire management: Proceedings of a workshop. Washington, DC: The National Academies Press: 67–72. https://www.fs.usda.gov/treesearch/pubs/55047.

Analog-based fire regime and vegetationshifts in mountainousregionsofthewestern US. Parks, Sean A.; Holsinger, Lisa M.; Miller, Carol; [et al.]. 2017. Ecography. 40: 001-011. https://www.fs.usda.gov/treesearch/pubs/55029.

Effect of particle aging on chemical characteristics, smoldering, and fire behavior in mixed-conifer masticated fuel. Sikkink, Pamela G.; Jain, Theresa B.; Heinsch, Faith Ann; Keane, Robert E.; Butler, Bret; [et al.]. 2017. Forest Ecology and Management. 405: 150–165. https://www.fs.usda.gov/treesearch/pubs/55027.

A model-based framework to evaluate alternative wildfire suppression strategies. Riley, Karin L.; Thompson, Matthew P.; Scott, Joe H.; Gilbertson-Day, Julie W. 2018. Resources. 7(1): 4. https://www.fs.usda.gov/treesearch/pubs/55575.

Modeling fuel treatment leverage: Encounter rates, risk reduction, and suppression cost impacts. Thompson, Matthew P.; Riley, Karin L.; Haas, Jessica R.; [et al.] 2017. Forests. 8(12): 469. https://www.fs.usda.gov/treesearch/pubs/55535.

Predicting post-fire tree mortality for 12 western US conifers using the First-Order Fire Effects Model (FOFEM). Hood, Sharon; Lutes, Duncan. 2017. Fire Ecology. 13(2): 66–84. https://www.fs.usda.gov/treesearch/pubs/55050.

Returning fire to the land: Celebrating traditional knowledge and fire. Lake, Frank K.; Wright, Vita; Morgan, Penelope; [et al.]. 2017. Journal of Forestry. 115(5): 343-353. https://www.fs.usda.gov/treesearch/pubs/54392.

Spatial patterns of ponderosa pine regeneration in high-severity burn patches. Owen, Suzanne M.; Sieg, Carolyn H.; Iniguez, Jose M.; Baggett, L. Scott.; Fornwalt, Paula J.; Battaglia, Michael A.; [et al.]. 2017. Forest Ecology and Management. 405: 134–149. https://www.fs.usda.gov/treesearch/pubs/55012.

Journals and Other Publications

Online links are provided if available. For the general public, some links may hit a pay wall. Please accept our apologies for any inconvenience.

Systems thinking and wildland fire management. Thompson, Matthew P.; Dunn, Christopher J.; Calkin, David E. 2017. In: Proceedings of the 60th Annual Meeting of the ISSS-2016; Boulder, CO. International Society for the Systems Sciences. 17 p. http://journals.isss.org/index.php/proceedings60th/ article/view/2906. https://www.fs.usda.gov/treesearch/pubs/55036.

ThinTool: A spreadsheet model to evaluate fuel reduction thinning cost, net energy output, and nutrient impacts. Han, Sang-Kyun; Han, Han-Sup; Elliot, William J.; Edward M. Bilek. 2017. Forest Science. 63(1): 118–127. https://www.fs.usda.gov/treesearch/pubs/55584.

Where you stand depends on where you sit: Qualitative inquiry into notions of fire adaptation. Brenkert-Smith, Hannah; Meldrum, James R.; Champ, Patricia A.; Barth, Christopher M. 2017. Ecology and Society. 22(3): 7. https://www.fs.usda.gov/treesearch/pubs/55046.

Wildfire risk reduction in the United States: Leadership staff perceptions of local fire department roles and responsibilities. Madsen,RachelS.;Haynes,HyltonJ.G.; McCaffrey,Sarah M. 2018. International Journal of Disaster Risk Reduction. 27: 451–458. https://www.fs.usda.gov/treesearch/pubs/55591.

Forest and woodland ecosystems

The current status of the distribution range of the western pine beetle, *Dendroctonus brevicomis* (Curculionidae: Solytinae) in northern Mexico. Valerio-Mendoza, O.; Armendariz-Toledano, F.; Negrón, José F.; [et al.]. 2017. Journal of Insect Science. 17(5): 92. https://www.fs.usda.gov/ treesearch/pubs/55037.

Draft genome sequence of the fungus associated with oak-wilt mortality in South Korea, *Raffaelea quercus-mongolicae* KACC44405. Jeon, Jongbum; Kim, Ki-Tae; Klopfenstein, Ned B.; [et al.]. 2017. Genome Announcements. 5: e00797-17. https://www.fs.usda.gov/treesearch/pubs/55031.

Effects of climate change on forest vegetation in the northern Rockies [Chapter 5]. Keane, Robert E.; Jain, Terrie B.; Holsinger, Lisa M.; [et al.]. 2018. In: Halofsky Jessica; Peterson David L., eds. Climate Change and Rocky Mountain Ecosystems. Advances in Global Change Research. Vol. 63. Cham, Switzerland: Springer Nature: 59–95. https://www.fs.usda.gov/treesearch/pubs/55073.

Estimating aboveground treebiomass forbeetle-killed lodgepole pine in the Rocky Mountains of northern Colorado. Chung, Woodam; Evangelista, Paul; Anderson, Nathaniel; [et al.]. 2017. Forest Science. 63(4): 413-419. https://www.fs.usda.gov/treesearch/pubs/55043.

Eucalypt powdery mildew caused by *Podosphaera pannosa* in Brazil. Fonseca, Natalia R.; Guimaraes, Lucio M.S.; Klopfenstein, Ned B.; [et al.]. 2017. Topical Plant Pathology. 42: 261–271. https://www.fs.usda.gov/treesearch/pubs/55030.

Fires following bark beetles: Factors controlling severity and disturbance interactions in ponderosa pine. Sieg, Carolyn H.; Linn, Rodman R.; Pimont, Francois; [et al.]. 2017. Fire Ecology: 13(3): 1–23. https://www.fs.usda.gov/treesearch/pubs/55576.

A framework for evaluating forest restoration alternatives and their outcomes, over time, to inform monitoring: Bioregional inventory originated simulation under management. Fried, Jeremy S.; Jain, Theresa B.; Loreno, Sara; [et al.]. 2017. In: Keyser, C.E.; Keyser, T.L., eds. Proceedings of the 2017 Forest Vegetation Simulator (FVS) Virtual e-Conference. E-Gen. Tech. Rep. SRS-224. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station: 40–50. https://www.fs.usda.gov/treesearch/pubs/55072.

Heterogeneity in preferences for woody biomass energy in the US Mountain West. Campbell, Robert M.; Venn, Tyron J.; Anderson, Nathaniel M. 2018. Ecological Economics. 145: 27–37. https://www.fs.usda.gov/treesearch/pubs/55044.

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Online links are provided if available. For the general public, some links may hit a pay wall. Please accept our apologies for any inconvenience.

Individual tree detection from Unmanned Aerial Vehicle (UAV) derived canopy height model in an open canopy mixed conifer forest. Mohan, Midhun; Silva, Carlos Alberto; Hudak, Andrew Thomas; [et al.]. 2017. Forests. 8: 340. https://www.fs.usda.gov/treesearch/pubs/55069.

Negligible impacts of biomass removal on Douglas-fir growth 29 years after outplanting in the northern Rocky Mountains. Jang, Woongsoon; Keyes, Christopher R.; Page-Dumroese, Deborah S. 2018. Biomass and Bioenergy. 108: 236–243. https://www.fs.usda.gov/treesearch/pubs/55569.

Predicting stem total and assortment volumes in an industrial *Pinus taeda* L. forest plantation using airborne laser scanning data and random forest. Silva, Carlos Alberto; Klauberg, Carine; Hudak, Andrew Thomas; [et al.]. 2017. Forests. 8: 254. https://www.fs.usda.gov/treesearch/pubs/55071.

Prediction of forest canopy and surface fuels from lidar and satellite time series data in a bark beetle-affected forest. Bright, Benjamin C.; Hudak, Andrew T.; Meddens, Arjan J. H.; [et al.]. 2017. Forests: 8(9): 322. https://www.fs.usda.gov/treesearch/pubs/55045.

Restoration oftemperate savannas and woodlands [Chapter 11]. Hanberry, Brice B.; Kabrick, John M.; Jain, Theresa B.; [et al.]. 2017. In: Allison, Stuart K.; Murphy, Stephen D., eds. Routledge Handbook of Ecological and Environmental Restoration. New York, NY: Taylor and Francis Group, Routledge: 142–157. https://www.fs.usda.gov/treesearch/pubs/55048.

Short-term effects of reduced-impact logging on *Copaifera* spp. (Fabaceae) regeneration in eastern Amazon. Klauberg, Carine; Vidal, Edson; Hudak, Andrew Thomas; [et al.]. 2017. Forests. 8: 257. https://www.fs.usda.gov/treesearch/pubs/55067.

Spatial patterns of ponderosa pine regeneration in high-severity burn patches. Owen, Suzanne M.; Sieg, Carolyn H.; Iniguez, Jose M.; Baggett, L. Scott.; Fornwalt, Paula J.; Battaglia, Michael A.; [et al.]. 2017. Forest Ecology and Management. 405: 134–149. https://www.fs.usda.gov/treesearch/pubs/55012.

Tribal lands provide forest management laboratory for mainstream university students. Hoagland, Serra J.; Miller, Ronald; Waring, Kristen M.; Carroll, Orlando. 2017. Journal of Forestry. 115(5): 484-490. https://fs.usda.gov/treesearch/pubs/53803.

Variables associated with the occurrence of Ips beetles, red turpentine beetle and wood borers in live and dead ponderosa pines with post-fire injury. Negrón, José F.; McMillin, Joel; Sieg, Carolyn H.; Fowler, James F.; [et al.]. 2016. Agricultural and Forest Entomology. 18: 313–326. doi: 10.1111/afe.12163. https://www.fs.usda.gov/treesearch/pubs/52313.

Grasslands, shrublands and desert ecosystems

Effects of climate change on rangeland vegetation in the northern Rockies [Chapter 6]. Reeves, Matt C.; Manning, Mary E.; DiBenedetto, Jeff P.; [et al.] 2018. In: Halofsky Jessica; Peterson David L., eds. Climate Change and Rocky Mountain Ecosystems. Advances in Global Change Research. Vol. 63. Cham, Switzerland: Springer Nature: 97–114. https://www.fs.usda.gov/treesearch/pubs/55028.

Floral orientation in Eulychnia acida, an arborescent cactus of the Atacama Desert, and implications for cacti globally. Warren, S.D.; Aguilera, L.E.; Baggett, L.S.; [et al.]. 2017. Ecosphere. 8(10): e01937. 10.1002/ecs2.1937. https://www.fs.usda.gov/treesearch/pubs/55386.

Irrigation requirements for seed production of two Eriogonum species in a semiarid environment. Shock, Clinton C.; Shaw, Nancy; Kilkenny, Francies F. 2017. Hortscience. 52(9): 1188–1194. doi: 10.21273/HORTSCI12186-17. https://www.fs.usda.gov/treesearch/pubs/55385.

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Online links are provided if available. For the general public, some links may hit a pay wall. Please accept our apologies for any inconvenience.

Pretreatment tree dominance and conifer removal treatments affect plant succession in sagebrush communities. Williams, Rachel E.; Tausch, Robin J.; Chambers, Jeanne C.; [et al.] 2017. Rangeland Ecology & Management. 70: 759–773. https://www.fs.usda.gov/treesearch/pubs/55384.

Pyriculins A and B, two monosubstituted hex-4-ene-2,3-diols and other phytotoxic metabolites produced by *Pyricularia grisea* isolated from buffelgrass (*Cenchrus ciliaris*). Masi, Marco; Meyer, Susan; Clement, Suzette; [et al.]. 2017. Chirality. 2017: 1–11. https://www.fs.usda.gov/treesearch/pubs/55066.

A review of surface energy balance models for estimating actual evapotranspiration with remote sensing at high spatiotemporal resolution over large extents. McShane, Ryan R.; Driscoll, Katelyn P.; Sando, Roy. 2017. Scientific Investigations Report 2017–5087. Reston, VA: U.S. Geological Survey. 19 p. https://www.fs.usda.gov/treesearch/pubs/55026.

Spectrophotometry of Artemisia tridentata to quantitatively determine subspecies. Richardson, Bryce A.; Boyd, Alicia A.; Tobiasson, Tanner; [et al.]. 2018. Rangeland Ecology and Management. 71: 87–90. https://www.fs.usda.gov/treesearch/pubs/55582.

Human dimensions

Adapting to wildfire: Moving beyond homeowner risk perceptions to taking action. Champ, Patricia. 2017. In: Laney, Kara N. A century of wildland fire research: Contributions to long-term approaches for wildland fire management: Proceedings of a workshop. Washington, DC: The National Academies Press: 67–72. https://www.fs.usda.gov/treesearch/pubs/55047.

Economic and policy factors driving adoption of institutional woody biomass heating systems in the United States. Young, Jesse D.; Anderson, Nathaniel M.; Naughton, Helen T.; [et al.]. 2018. Energy Economics. 69: 456–470. https://www.fs.usda.gov/treesearch/pubs/55570.

Effect of downed trees on harvesting productivity and costs in beetle-killed stands. Kim, Yaejun; Chung, Woodam; Han, Hee; Anderson, Nathaniel M. 2017. Forest Science. 63 (6): 596–605. https://www.fs.usda.gov/treesearch/pubs/55588.

Examining the social acceptability of forest biomass harvesting and utilization from collaborative forest landscape restoration: A case study from western Colorado, USA. Western, Jessica M.; Cheng, Antony S.; Anderson, Nathaniel M.; [et al.]. 2017. Journal of Forestry. 115(6): 530–539. https://www.fs.usda.gov/treesearch/pubs/55589.

A framework for developing safe and effective large-fire response in a new fire management paradigm. Dunn, Christopher J.; Thompson, Matthew P.; Calkin, David E. 2017. Forest Ecology and Management. 404: 184–196. https://www.fs.usda.gov/treesearch/pubs/55034.

Native American student perspectives of challenges in natural resource higher education. Gervais, Breanna K.; Long, Jonathan W.; Hoagland, Serra J.; [et al.]. 2017. Journal of Forestry. 115(5): 491–497. https://www.fs.usda.gov/treesearch/pubs/53943.

Should I stay or should I go now? Or should I wait and see? Influences on wildfire evacuation decisions. McCaffrey, Sarah; Wilson, Robyn; Konar, Avishek. 2017. Risk Analysis. doi: 10.1111/risa.12944. https://www.fs.usda.gov/treesearch/pubs/55590.

Tribal lands provide forest management laboratory for mainstream university students. Hoagland, Serra J.; Miller, Ronald; Waring, Kristen M.; [et al.]. 2017. Journal of Forestry. 115(5): 484-490. https://www.fs.usda.gov/treesearch/pubs/53803.

Vulnerability of grazing and confined livestock in the Northern Great Plains to projected mid- and late-twenty-first century climate. Derner, Justin; Briske, David; Reeves, Matt;

Journals and Other Publications

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[et al.]. 2017. Climatic Change. doi: 10.1007/s10584-017-2029-6. https://www.fs.usda.gov/treesearch/pubs/55014.

Inventory and monitoring

ThinTool: A spreadsheet model to evaluate fuel reduction thinning cost, net energy output, and nutrient impacts. Han, Sang-Kyun; Han, Han-Sup; Elliot, William J.; [et al.]. 2017. Forest Science. 63(1): 118-127. https://www.fs.usda.gov/treesearch/pubs/55584.

Science application and communication

Streamwater nitrogen and forest dynamics following a mountain pine beetle epidemic: Insights from three decades of research at the Fraser Experimental Forest, CO. Rhoades, Chuck. 2017. Science You Can Use (in 5 minutes). (November). Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p. https://www.fs.fed.us/rmrs/sites/default/files/documents/SYCUin5min_StreamwaterNandForestdynamics_Rhoades_Nov2017.pdf.

Where's the beef? Predicting the effects of climate change on cattle production in western U.S. rangelands. Reeves, Matt: Bagne, Karen; Tanaka, John. 2017. Science You Can Use Bulletin. 27(September/October). Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 12 p. https://www.fs.usda.gov/treesearch/pubs/55339.

Wildlife and terrestrial habitats

Characteristics of successful puma kill sites of elk in the Black Hills, South Dakota. Lehman, Chadwick P.; Rota, Christopher T.; Rumble, Mark A.; [et al.]. 2017. Wildlife Biology. doi: 10.2981/wlb.00248. https://www.fs.usda.gov/treesearch/pubs/53674.

eDNA sampling—Not just for fisheries biologists anymore. Schwartz, Michael K.; Penaluna, Brooke E.; Wilcox, Taylor M. 2017. The Wildlife Professional. November/December 2017. http:// wildlife.org/not-just-for-fisheries-biologists-anymore. https:// www.fs.usda.gov/treesearch/pubs/55572.

Hibernating little pocket mice show few seasonal changes in bone properties. Pineda, Noellyn; Owen, Marjorie; Kitchen, Stanley; [et al.]. 2017. The Anatomical Record. doi: 10.1002/ar.23676. https://www.fs.usda.gov/treesearch/pubs/55074.

Hierarchical population structure in greater sage-grouse provides insight into management boundary delineation. Cross, Todd B.; Naugle, David E.; Carlson, John C.; Schwartz, Michael K. 2016. Conservation Genetics. 17: 1417–1433. https://www.fs.usda.gov/treesearch/pubs/52271.

Pumas affect elk dynamics in absence of other large carnivores. Lehman, Chadwick P.; Rota, Christopher T.; Raithel, Jarod D.; [et al.]. 2017. Journal of Wildlife Management. doi: 10.1002/jwmg.21392. https://www.fs.usda.gov/treesearch/pubs/55512.

Sampling scales define occupancy and underlying occupancy-abundance relationships in animals. Steenweg, Robin; Hebblewhite, Mark; Whittington, Jesse; Lukacs, Paul; McKelvey, Kevin. 2018. Ecology. 99(1): 172–183. https://www.fs.usda.gov/treesearch/pubs/55574.

Simulations inform design of regional occupancy-based monitoring for a sparsely distributed, territorial species. Latif, Quresh S.; Ellis, Martha M.; Saab, Victoria A.; [et al.]. 2017. Ecology and Evolution. doi: 10.1002/ece3.3725. https://www.fs.usda.gov/treesearch/pubs/55583.

Science Program Areas

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. Webpage: https://www.fs.fed.us/rmrs/science-program-areas/air-water-and-aquatic-environmentss. Contact Frank McCormick, Program Manager, for more information: 970-498-1175.

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. Webpage: https://www.fs.fed.us/rmrs/science-program-areas/aldo-leopold-wilderness-research-institute. 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. Webpage: https://www.fs.fed.us/rmrs/science-program-areas/fire-fuel-and-smoke. 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. Webpage: https://www.fs.fed.us/rmrs/science-program-areas/forest-and-woodland-ecosystems. 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. Webpage: hhttps://www.fs.fed.us/rmrs/science-program-areas/grassland-shrubland-and-desert-ecosystems. 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. Webpage: https://www.fs.fed.us/rmrs/science-program-areas/human-dimensions Contact David Chapman, Program Manager, for more information: 970-498-1378.

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. Webpage: https://www.fs.fed.us/rmrs/science-program-areas/inventory-and-monitoring. Contact Michael Wilson, Program Manager, for more information: 801-625-5407.

Science Application and Communication

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. Webpage: https://www.fs.fed.us/rmrs/science-program-areas/science-application-and-communication. 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. Webpage: https://www.fs.fed.us/rmrs/science-program-areas/wildlife-and-terrestrial-ecosystems. Contact William Block, Program Manager, for more information: 928-556-2161.

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