USDA
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Rocky Mountain Research Station

New Publications

January–March 2018

CONTENTS

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The Rocky Mountain Research Station

The Rocky Mountain Research Station is one of five regional units that make up the U.S. 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 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.

New RMRS Publication Series

The Rothermel surface fire spread model and associated developments: A comprehensive explanation

Limited paper copies are available from RMRS Distribution: rmrspubrequest@fs.fed.us

The Rothermel surface fire spread model and associated developments: A comprehensive explanation. Andrews, Patricia L. 2018. Gen. Tech. Rep. RMRS-GTR-371. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 121 p.

The Rothermel surface fire spread model, with some adjustments by Frank A. Albini in 1976, has been used in fire and fuels management systems since 1972. Fuel models are often used to define fuel input parameters. Dynamic fuel models use equations for live fuel curing. Models have been developed for the effect of cross-slope wind and for fire spread in directions other than head fire. Equations for the Rothermel model and associated models are presented for easy reference. The influence of input variables on results is examined. While the spread model is used in the U.S. National Fire Danger Rating System (NFDRS), there are significant differences. The NFDRS equations and fuel models are given. This paper is intended to serve as a reference for those interested in the foundation of wildland fire modeling. System developers will benefit from equations from various sources being in one document. Developers of custom fuel models will find information on the impact of fuel parameters on rate of spread calculations.

https://www.fs.usda.gov/treesearch/pubs/55928

Fire patterns in piñon and juniper land cover types in the semiarid western United States from 1984 through 2013

Limited paper copies are available from RMRS Distribution: rmrspubrequest@fs.fed.us

Fire patterns in piñon and juniper land cover types in the semiarid western United States from 1984 through 2013. Board, David I.; Chambers, Jeanne C.; Miller, Richard F.; Weisberg, Peter J. 2018. RMRS-GTR-372. Fort Collins, CO: U.S Department of Agriculture, Forest Service, Rocky Mountain Research Station. 57 p.

We evaluated spatio-temporal patterns of fire in piñon and juniper land cover types from the National Gap Analysis Program using Monitoring Trends in Burn Severity (MTBS 2016) data (1984 through 2013) for Northern and Southern Intermountain and Central and Southern Rocky Mountain geographic regions. We examined differences in total area burned, fire rotation, fire size, fire number, and fire season among: (1) the four geographic regions; (2) the EPA level III ecoregions that occur within each geographic region; and (3) the piñon and juniper land cover types (woodlands, savannas, and shrublands) and other land cover types that occur within each geographic region and level III ecoregion. Careful monitoring of longer term trends in fire activity and the interacting effects of invasive annual grasses, bark beetles, and climate change is needed to access the dynamics of piñon and juniper land cover types and evaluate the efficacy of management treatments in piñon and juniper land cover types.

https://www.fs.usda.gov/treesearch/pubs/55663

New RMRS Publication Series

Climate change vulnerability and adaptation in the Northern Rocky Mountains, Part 1

Limited paper copies are available from RMRS Distribution: rmrspubrequest@fs.fed.us

Climate change vulnerability and adaptation in the Northern Rocky Mountains. Halofsky, Jessica E.; Peterson, David L.; Dante-Wood, S. Karen; Hoang, Linh; Ho, Joanne J.; Joyce, Linda A., eds. 2018. Gen. Tech. Rep. RMRS-GTR-374. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Part 1. pp. 1–273.

The Northern Rockies Adaptation Partnership (NRAP) identified climate change issues relevant to resource management in the Northern Rockies (USA) region, and developed solutions intended to minimize negative effects of climate change and facilitate transition of diverse ecosystems to a warmer climate. U.S. Forest Service scientists, resource managers, and stakeholders worked together over 2 years to conduct a state-of-science climate change vulnerability assessment and develop adaptation options for national forests and national parks in the Northern Rockies region. The vulnerability assessment emphasized key resource areas for local ecosystems and communities. Part 1 covers the biogeographic, cultural, and historical setting; historical and projected climate; effects of climate change on showpack, glaciers, and water resources; climate vulnerability of native cold-water salmonids; and effects of climate change on forest vegetation. Resource managers used the assessment to develop a detailed list of ways to address climate change vulnerabilities through management actions.

https://www.fs.usda.gov/treesearch/pubs/55974

Climate change vulnerability and adaptation in the Northern Rocky Mountains, Part 2

Limited paper copies are available from RMRS Distribution: rmrspubrequest@fs.fed.us

Climate change vulnerability and adaptation in the Northern Rocky Mountains. Halofsky, Jessica E.; Peterson, David L.; Dante-Wood, S. Karen; Hoang, Linh; Ho, Joanne J.; Joyce, Linda A., eds. 2018. Gen. Tech. Rep. RMRS-GTR-374. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Part 2. pp. 275–475.

The Northern Rockies Adaptation Partnership (NRAP) identified climate change issues relevant to resource management in the Northern Rockies (USA) region, and developed solutions intended to minimize negative effects of climate change and facilitate transition of diverse ecosystems to a warmer climate. U.S. Forest Service scientists, resource managers, and stakeholders worked together over 2 years to conduct a state-of-science climate change vulnerability assessment and develop adaptation options for national forests and national parks in the Northern Rockies region. The vulnerability assessment emphasized key resource areas for local ecosystems and communities. Part 2 covers the effects of climate change on rangeland vegetation, effects of climate change on ecological disturbance; climate change and wildlife; effects of climate change on recreation; effects of climate change on ecosystem services; and the effects of climae change on cultural resources. Resource managers used the assessment to develop a detailed list of ways to address climate change vulnerabilities through management actions.

https://www.fs.usda.gov/treesearch/pubs/55975

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

Data Descriptor: TerraClimate, a high-resolution global dataset of monthly climate and climatic water balance from 1958–2015. Abatzoglou, John T.; Dobrowski, Solomon Z.; Parks, Sean A.; Hegewisch, Katherine C. 2018. Scientific Data. 5: 170191. https://www.fs.usda.gov/treesearch/pubs/55896.

Delineating climate refugia for native aquatic species with big crowd-sourced databases. Isaak, Daniel; Young, Michael. 2017. Mountain Views. December 2017: 3–6. https://www.fs.usda.gov/treesearch/pubs/56036.

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

Fine-scale characteristics of fluvial bull trout redds and adjacent sites in Rapid River, Idaho, 1993-2007. Guzevich, John W.; Thurow, Russell F. 2017. Northwest Science. 91(2): 198-213. https://www.fs.usda.gov/treesearch/pubs/54340.

Proof of concept for the use of macroinvertebrates as indicators of polychlorinated biphenyls (PCB) contamination in Lake Hartwell. Lazorchak, J.M.; Griffith, M.B.; McCormick, F.; [et al.]. 2018. Environmental Toxicology and Chemistry. 34(6): 1277–1282. https://www.fs.usda.gov/treesearch/pubs/56033.

The role of wild and scenic rivers in the conservation of aquatic biodiversity. Rothlisberger, John D.; Scalley, Tamara Heartsill; Thurow, Russell F. 2017. International Journal of Wilderness. 23(2): 49-63, 72. https://www.fs.usda.gov/treesearch/pubs/56037.

Fire, fuel and smoke

Advancing dendrochronological studies of fire in the United States. Harley, Grant L.; Heyerdahl, Emily K.; Sutherland, Elaine Kennedy; [et al.]. 2018. Fire. 1: 11. https://www.fs.usda.gov/treesearch/pubs/56028.

Fine-scale spatial climate variation and drought mediate the likelihood of reburning. Parks, Sean A.; Parisien, Marc-Andre; Miller, Carol; Holsinger, Lisa M.; Baggett, Larry Scott. 2018. Ecological Applications, 28(2): 573–586. https://www.fs.usda.gov/treesearch/pubs/55897.

Mixed-severity fire fosters heterogeneous spatial patterns of conifer regeneration in a dry conifer forest. Malone, Sparkle L.; Fornwalt, Paula J.; Battaglia, Mike A.; Chambers, Marin E.; Iniguez, Jose M.; Sieg, Carolyn H. 2018. Forests. 9: 45. https://www.fs.usda.gov/treesearch/pubs/55858.

Modeling crop residue burning experiments to evaluate smoke emissions and plume transport. Zhou, Luxi; Urbanski, Shawn P.; Wong, David C.; [et al.]. 2018. Science of the Total Environment. 627: 523-533. https://www.fs.usda.gov/treesearch/pubs/56006.

Overstory structure and surface cover dynamics in the decade following the Hayman Fire, Colorado. Fornwalt, Paula J.; Stevens-Rumann, Camille S.; Collins, Byron J. 2018. Forests. 9: 152. https://www.fs.usda.gov/treesearch/pubs/55859.

Spatial optimization of operationally relevant large fire confine and point protection strategies: Model development and test cases. Yu, W.; Thompson, M.P.; Haas, J.R.; [et al.]. 2018. Canadian Journal of Forest Research. 48: 1–14. dx.doi.org/10.1139/cjfr-2017-0271. https://www.fs.usda.gov/treesearch/pubs/55936.

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.

Uncertainties in predicting debris flow hazards following wildfire [Chapter 19]. Hyde, Kevin D.; Riley, Karin; Stoof, Cathelijne. 2017. In: Riley, Karin; Webley, Peter; Thompson, Matthew, eds. Natural hazard uncertainty assessment: Modeling and decision support; Geophysical Monograph 223. John Wiley and Sons, Inc.: 287–299. https://www.fs.usda.gov/treesearch/pubs/55937.

Forest and woodland ecosystems

Anisohydric water use behavior links growing season evaporative demand to ring-width increment in conifers from summer-dry environments. Voelker, Steve L.; DeRose, R. Justin; Bekker, Matthew F.; [et al.]. 2018. Trees. doi: 10.1007/s00468-018-1668-1. https://www.fs.usda.gov/treesearch/pubs/55860.

Back to the Future: Building resilience in Colorado Front Range forests using research findings and a new guide for restoration of ponderosa and dry-mixed conifer landscapes. Miller, Sue; Addington, Rob; Battaglia, Mike; [et al.]. 2018. Science You Can Use Bulletin. Issue 28. Fort Collins, CO: Rocky Mountain Research Station. 15 p. https://www.fs.usda.gov/treesearch/pubs/55651.

Bark beetles as agents of change in social-ecological systems. Morris, Jesse L; DeRose, R. Justin; Mattor, Katherine M; [et al.]. 2018. Frontiers in Ecology and the Environment. 16(S1): S34-S43. https://doi.org/10.1002/fee.1754. https://www.fs.usda.gov/treesearch/pubs/55620.

Conifer radial growth response to recent seasonal warming and drought from the southwestern USA. Turettner, Charles; Anderegg, William R.L.; Shaw, John D.; [et al.]. 2018. Forest Ecology and Management. doi.org/10.1016/j.foreco.2018.01.044. https://www.fs.usda.gov/treesearch/pubs/56005.

The future of subalpine forests in the Southern Rocky Mountains: Trajectories for *Pinus aristata* genetic lineages. Malone, Sparkle L.; Schoettle, Anna W.; Coop, Jonathan D. 2018. PLoS ONE. 13(3): e0193481. https://www.fs.usda.gov/treesearch/pubs/55935.

Idaho forest growth response to post-thinning energy biomass removal and complementary soil amendments. Sherman, Lauren A.; Page-Dumroese, Deborah S.; Coleman, Mark D. 2018. GCB Bioenergy. 10: 246–261. https://www.fs.usda.gov/treesearch/pubs/55515.

Overlapping bark beetle outbreaks, salvage logging and wildfire restructure a lodgepole pine ecosystem. Rhoades, Charles C.; Pelz, Kristen A.; Fornwalt, Paula J.; [et al.]. 2018. Forests. 9(3): Article 101. https://www.fs.usda.gov/treesearch/pubs/56038.

Optimizing biomass feedstock logistics for forest residue processing and transportation on a tree-shaped road network. Han, Hee; Chung, Woodam; Wells, Lucas; Anderson, Nathaniel. 2018. Forests. 9: 121. https://www.fs.usda.gov/treesearch/pubs/55857.

Paleo-event data standards for dendrochronology. Sutherland, Elaine Kennedy; Brewer, P.; Gross, W. 2017. Past Global Changes Magazine. 25(3): 163. https://www.fs.usda.gov/treesearch/pubs/55934.

***Pinus albicaulis* Engelm. (whitebark pine) in mixed-species stands throughout its US range: Broad-scale indicators of extent and recent decline**. Goeking, Sara A.; Izlar, Deborah Kay. 2018. Forests. 9(3): article 131. doi:10.3390/f9030131. https://www.fs.usda.gov/treesearch/pubs/55862.

The role of hybridization during ecological divergence of southwestern white pine (*Pinus strobiformis*) and limber

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.

pine (*P. flexilis*). Menon, M.; Schoettle, A. W.; Cushman, S. A.; [et al.]. 2018. Molecular Ecology 27: 1245–1260. https://www.fs.usda.gov/treesearch/pubs/56026.

Structure and composition of historical longleaf pine ecosystems in Mississippi, USA. Hanberry, Brice B.; Coursey, Keith; Kush, John S. 2018. Human Ecology. https://www.fs.usda.gov/treesearch/pubs/56032.

Using organic amendments to restore soil physical and chemical properties of a mine site in northeastern Oregon, USA. Page-Dumroese, D. S.; Ott, M. R.; Strawn, D. G.; Tirocke, J. M. 2018. Applied Engineering in Agriculture. 34(1): 43–55. https://www.fs.usda.gov/treesearch/pubs/55863.

Where buffalo and cattle meet: Modelling interspecific contact risk using cumulative resistant kernels. Kaszta, Zaneta; Cushman, Samuel A.; Sillero-Zubiri, Claudio; Wolff, Eleonore; Marino, Jorgelina. 2018. Ecography. 41: 1–11. https://www.fs.usda.gov/treesearch/pubs/55932.

Grasslands, shrublands and desert ecosystems

GSD Update: Year in review: Spotlight on 2017 research by the Grassland, Shrubland and Desert Ecosystems Science Program. April 2018. Finch, Deborah M., ed. 2018. Albuquerque, NM: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 17 p. https://www.fs.usda.gov/treesearch/pubs/56002.

Recognizing loss of open forest ecosystems by tree densification and land use intensification in the Midwestern USA. Hanberry, Brice B.; Abrams, Marc D. 2018. Regional Environmental Change. doi.org/10.1007/s10113-018-1299-5. https://www.fs.usda.gov/treesearch/pubs/56031.

Semiochemicals to enhance herbivory by *Diorhabda carinulata* aggregations in saltcedar (*Tamarix* spp.) infestations. Gaffke, A.M.; Sing, S.E; Dudley, T.L.; [et al.]. 2018. Pest Management Science. doi 10.1002/ps.4848. https://www.fs.usda.gov/treesearch/pubs/56030.

Human dimensions

Cost and performance tradeoffs between mail and internet survey modes in a nonmarket valuation study. Campbell, Robert M.; Venn, Tyron, J.; Anderson, Nathaniel M. 2018. Journal of Environmental Management. 210: 316–327. https://www.fs.usda.gov/treesearch/pubs/55670.

Implications for U.S. trade and nonindigenous species risk resulting from increased economic integration of the Asia-Pacific region. Countryman, A.M.; Warziniack, T.; Grey, E. 2018. Society & Natural Resources. doi: 10.1080/08941920.2018.1447713. https://www.fs.usda.gov/treesearch/pubs/56027.

Spacing conservation practice: Place-making, social learning, and adaptive governance in natural resource management [Chapter 15]. Williams, Daniel R. 2018. In: Marsden, Terry, ed. The SAGE Handbook of Nature, Three Volume Set. London, UK: SAGE Publishing. p. 285-303 (Volume 1). https://www.fs.usda.gov/treesearch/pubs/56029.

Technoeconomic and policy drivers of project performance for bioenergy alternatives using biomass from beetle-killed trees. Campbell, Robert M.; Anderson, Nathaniel M.; Daugaard, Daren E.; [et al.]. 2018. Energies. 11(2): 293. https://www.fs.usda.gov/treesearch/pubs/55669.

Wild apple growth and climate change in southeast Kazakhstan. Panyushkina, Irina P.; Lynch, Ann M.; O'Connor,

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.

Christopher D.; [et al.]. 2017. Forests. 8: 406. https://www.fs.usda.gov/treesearch/pubs/55933.

Inventory and monitoring

Global patterns of drought recovery. Schwalm, Christopher R.; Anderegg, William R.L.; Shaw, John D.; [et al.]. 2017. Nature. 548: 202–205. https://www.fs.usda.gov/treesearch/pubs/56004.

Painting a picture across the landscape with ModelMap. Cooke, B.; Freeman, E.; Moisen, G.; Frescino, T. 2017. Science You Can Use Bulletin. Issue 26. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 9 p. https://www.fs.usda.gov/treesearch/pubs/54761.

Science application and communication

Back to the Future: Building resilience in Colorado Front Range forests using research findings and a new guide for restoration of ponderosa and dry-mixed conifer landscapes. Miller, Sue; Addington, Rob; Battaglia, Mike; [et al.]. 2018. Science You Can Use Bulletin. Issue 28. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 15 p. https://www.fs.usda.gov/treesearch/pubs/55651.

Wildlife and terrestrial habitats

Conflicting perspectives on spotted owls, wildfire, and forest restoration. Ganey, Joseph L.; Wan, Ho Yi; Cushman, Samuel A.; [et al.]. 2017. Fire Ecology. 13(3). 146–165. https://www.fs.usda.gov/treesearch/pubs/55673.

DNA from hairs left at depredated greater sage-grouse nests to detect mammalian nest predators. Kirol, Christopher P.; Pilgrim, Kristine L.; Sutphin, Andrew L.; [et al.]. 2018. Using Wildlife Society Bulletin. doi: 10.1002/wsb.853. https://www.fs.usda.gov/treesearch/pubs/55864.

Molecular detection of northern leatherside chub (*Lepidomeda copei*) DNA in environmental samples. Dysthe, Joseph C.; Young, Michael K.; McKelvey, Kevin S.; Schwartz, Michael K.; [et al.]. 2018. Western North American Naturalist. 78: 92–99. https://www.fs.usda.gov/treesearch/pubs/56003.

Repurposing environmental DNA samples—Detecting the western pearlshell (*Margaritifera falcata*) as a proof of concept. Dysthe, Joseph C.; Carim, Kellie J.; Young, Michael K.; McKelvey, Kevin S.; Mock, Karen E.; Schwartz, Michael K. [et al.].2018. Ecology and Evolution. 8: 2659–2670. https://www.fs.usda.gov/treesearch/pubs/55666.

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 Michael Schwartz, Program Manager, for more information: 406-542-4161.

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