Rocky Mountain Research Station

New Publications

April to June 2013

Integrated Science Working for You


Air, Water, and Aquatic Environments


Fire, Fuel, and Smoke


Forest and Woodland Ecosystems


Grasslands, Shrublands, and Desert Ecosystems


Human Dimensions


Inventory, Monitoring, and Analysis


Science Application and Integration


Wildlife and Terrestrial Habitats

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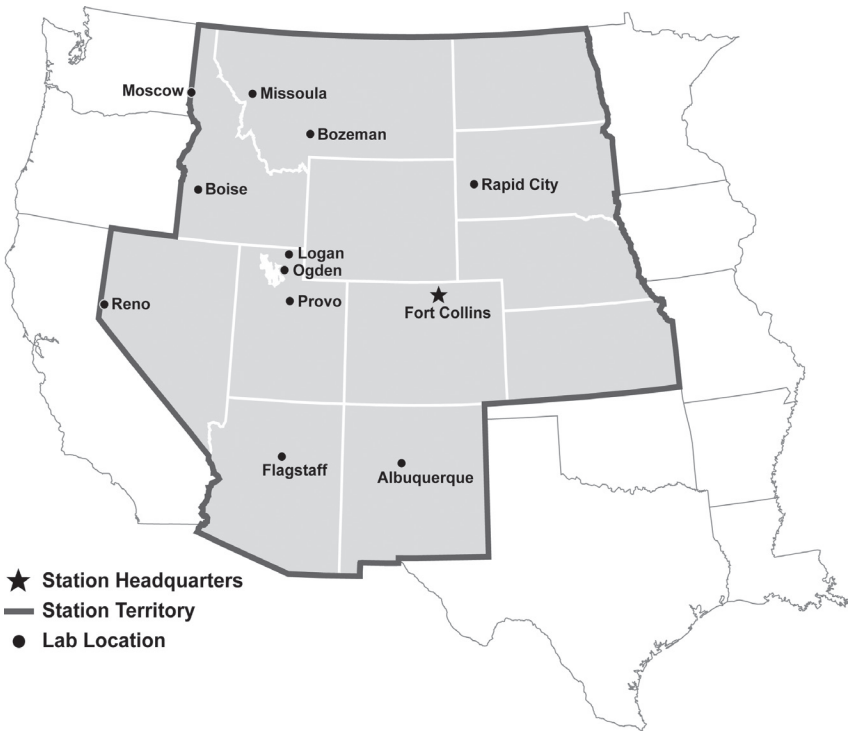
The Rocky Mountain Research Station



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.

To order a publication, please see inside back cover.

New RMRS Series Publications

Wetland and riparian ecosystems

Online only

Historical range of variation assessment for wetland and riparian ecosystems, U.S. Forest Service Rocky Mountain Region. Gage, Edward; Cooper, David J. 2013. Gen. Tech. Rep. RMRS-GTR-286WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 239 p.

This document provides an overview of historical range of variation concepts and explores their application to wetland and riparian ecosystems in the US Forest Service Rocky Mountain Region (Region 2), which includes National Forests and National Grasslands occurring in the states of Colorado, Wyoming, Nebraska, Kansas, and South Dakota. For each of five ecosystem types - riparian areas, fens, wet meadows, salt flats, and marshes - we review key structural and functional characteristics including geomorphic setting, principal ecological drivers, classification, and dominant vegetation. In addition, we discuss anthropogenic factors known to influence the abundance or condition of each main wetland type.

Online: http://www.fs.fed.us/rm/pubs/rmrs_gtr286.html.

Measuring water and sediment discharge

Order 34

Measuring water and sediment discharge from a road plot with a settling basin and tipping bucket. Black, Thomas A.; Luce, Charles H. 2013. Gen. Tech. Rep. RMRS-GTR-287. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 38 p.

A simple empirical method quantifies water and sediment production from a forest road surface, and is well suited for calibration and validation of road sediment models. To apply this quantitative method, the hydrologic technician installs bordered plots on existing typical road segments and measures coarse sediment production in a settling tank. When a tipping bucket gauge and a flow splitting device are added to the installation, both coarse and fine sediment can be collected along with a continuous discharge record. Included in this report is the design of a simple and inexpensive tipping bucket system and the procedures for measuring plot discharge up to 60 gal (227 L) per minute.

Online: http://www.fs.fed.us/rm/pubs/rmrs_gtr287.html.

Wildfires and risk management

Online only

Decision making for wildfires: A guide for applying a risk management process at the incident level. Taber, Mary A.; Elenz, Lisa M.; Langowski, Paul G. 2013. Gen. Tech. Rep. RMRS-GTR-298WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 59 p.

This publication focuses on the thought processes and considerations surrounding a risk management process for decision making on wildfires. The publication introduces a six element risk management cycle designed to encourage sound risk-informed decision making in accordance with Federal wildland fire policy, although the process is equally applicable to non-Federal fire managers and partners. The process describes the assessment and control of identified risks, the analysis of benefits and costs, and the risk decision at multiple scales. Decision makers can apply principles from this publication to specific decision documentation structures such as the Wildland Fire Decision Support System (WFDSS) or other wildland fire decision documentation systems.

Online: http://www.fs.fed.us/rm/pubs/rmrs_gtr298.html.

Wilderness campsites: Changing conditions

Order 35

Changing conditions on wilderness campsites: Seven case studies of trends over 13 to 32 years. Cole, David N. 2013. Gen. Tech. Rep. RMRS-GTR-300. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 99 p.

This report brings together seven case studies of trends in the number and condition of wilderness campsites over periods ranging from 13 to 32 years. Case examples come from five mountainous wilderness areas in the western United States: Sequoia-Kings Canyon Wilderness in California, the Eagle Cap Wilderness in Oregon, the Frank Church-River of No Return Wilderness in Idaho and the Selway-Bitterroot and Lee Metcalf Wilderness in Montana, as well as Grand Canyon National Park in Arizona and Caney Creek Wilderness in Arkansas. Campsite impacts have recently plateaued or declined in most wildernesses in this compilation. In the most extreme cases, campsite improvement reflects (1) successful implementation of a use concentration or containment strategy, and (2) an active wilderness ranger program, involving obliteration of unnecessary or poorly located campsites and maintenance and cleaning of established campsites.

Online: http://www.fs.fed.us/rm/pubs/rmrs_gtr300.html.

Climate change and Southwest species vulnerability

Order 36

Vulnerability of species to climate change in the Southwest: Threatened, endangered, and at-risk species at Fort Huachuca, Arizona. Bagne, Karen E.; Finch, Deborah M. 2013. Gen. Tech. Rep. RMRS-GTR-302. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 183 p.

The response of species to climate change is uncertain and will be the outcome of complex interactions and processes. Nevertheless, a simple flexible strategy is needed to help integrate climate change into management planning and actions. This assessment uses SAVS, a vulnerability scoring tool based on ecological principles, to rank individual species of interest within the Fort Huachuca region according to predicted climate change responses and associated population declines balanced with responses expected to incur resilience or population increases. Specific areas of vulnerability, research needs, and management implications are identified for each species. Several critical management areas can mitigate negative impacts to benefit multiple species, including fire and fuels, invasive species, natural and artificial waters, and landscape-scale planning. Management planning should be in place that will assist species impacted by extreme events such as prolonged drought, severe wildfires, and intense flooding. The assessment process was also used to identify areas where climate change may present opportunities, as opposed to challenges, for management of TER-S.

Online: http://www.fs.fed.us/rm/pubs/rmrs_gtr302.html.

Great Basin Experimental Range

Online only

Great Basin Experimental Range: Annotated bibliography. McArthur, E. Durant; Richardson, Bryce A.; Kitchen, Stanley G. 2013. Gen. Tech. Rep. GTR-305WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 97 p.

This annotated bibliography documents the research that has been conducted on the Great Basin Experimental Range. One hundred and ninety-one works are included and indexed by date, type of publication, subject matter, and author; categories include: Community Ecology, Disturbance (Grazing) Ecology, Fire Ecology, Historical and Site Descriptions, Livestock Management, Mammal Ecology, Methodology, Plant Autoecology, Plant Physiology, Plant Taxonomy or Status, Range Ecology and Range Management, Research Needs Assessment, Revegetation and Restoration Ecology, Site Evaluation and Species Performance, Soil Biology and Ecology, and Watershed Ecology.

Online: http://www.fs.fed.us/rm/pubs/rmrs_gtr305.html.

To order a publication, please see inside back cover.

Burnup model: Predicted fuel consumption

Online only

Predicted fuel consumption in the Burnup model: Sensitivity to four user inputs. Lutes, D. C. 2013. Res. Note RMRS-RN-51WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 11 p.

Fuelbeds consist of a number of combustible components that are consumed during a fire, including duff, litter, vegetation (herbs, shrub, foliage, and branches) and down dead woody material (DWM). Combustion of DWM during a fire has a well-documented role in determining fire effects and fire behavior impacts such as emissions (Sandberg and others 2002), vegetative changes (Brown and Smith 2000), soil heating (Neary and others 2005), and fire intensity (Pyne and others 1996). Inventory programs and research studies, such as Brown and See 1981, note that on forested sites in the United States DWM is often the second most abundant fuel component by mass (after duff), so an accurate prediction of DWM consumption is important for determining fire effects and fire behavior.

Online: http://www.fs.fed.us/rm/pubs/rmrs_rn051.html.

Comparison of Kalman filters

Order 37

Comparison of Kalman filters in combining panel data from the annual inventory system of the South Korea National Forest Inventory. Lam, Tzeng Yih; Czaplewski, Raymond L.; Yim, Jong Su; Lee, Kyeong Hak; Kim, Sung Ho; Kim, Rae Hyun. 2013. Res. Note RMRS-RN-52. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 15 p.

National Forest Inventories (NFIs) serve a primary purpose of providing crucial information for formulating national forest policy, environmental planning and reporting to international processes (Tomppo and others 2010). Pressure for timely and reliable forestry statistics urges countries to put a NFI in place or to consider alternative designs. Some countries, for example, USA and Finland, moved from a periodic inventory design to an annual inventory design (Lawrence and others 2010) with the Swedish NFI being one of the earliest examples of the transition (Matérn 1960, Ranneby and others 1987). An annual inventory systematically subdivides a plot network, with equal proportion, into a number of panels equal to the length of measurement cycle (Reams and others 2005). A measurement cycle is typically five or ten years. Panels are measured successively on an annual basis. Remeasurement starts in the next cycle once all panels are visited. Thus, an annual inventory is expected to meet the demand for continually updated information.

Online: http://www.fs.fed.us/rm/pubs/rmrs_rn052.html.

FIA panel data analysis

Online only

Model-based time-series analysis of FIA panel data absent re-measurements. Czaplewski, Raymond L.; Thompson, Mike T. 2013. Res. Pap. RMRS-RP-102WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 13 p.

An epidemic of lodgepole pine (*Pinus contorta*) mortality from the mountain pine beetle (*Dendroctonus ponderosae*) has swept across the Interior West. Aerial surveys monitor the areal extent of the epidemic, but only Forest Inventory and Analysis (FIA) field data support a detailed assessment at the tree level. Dynamics of the lodgepole pine population occur at a more rapid rate than the FIA 10-year re-measurement cycle. A model-based approach links population-level estimates from each annual FIA panel estimate. A simple multivariate model predicts the statewide rates of annual change among live uninfected trees, live infected trees, mortality trees, and standing dead trees. A multivariate weighted sum of panel estimates and model predictions of the same attributes improve estimates for each year. Biological structure incorporated into the model improves logical consistency among the various categories of tree-level estimates and smooths annual fluctuations caused by random sampling error. We present concepts in simple terms and illustrate results with FIA data from 2002 to 2008.

Online: http://www.fs.fed.us/rm/pubs/rmrs_rp102.html.

Fire severity and fuel treatments

Online only

Fuel treatments and fire severity: A meta-analysis. Martinson, Erik J.; Omi, Philip N. 2013. Res. Pap. RMRS-RP-103WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 38 p.

We employed meta-analysis and information theory to synthesize findings reported in the literature on the effects of fuel treatments on subsequent fire intensity and severity. Data were compiled from 19 publications that reported observed fire responses from 62 treated versus untreated contrasts. Effect sizes varied widely and the most informative grouping of studies distinguished three vegetation types and three types of fuel treatment. The resultant meta-analytic model is highly significant ($p<0.001$) and explains 78% of the variability in reported observations of fuel treatment effectiveness. Our synthesis highlights several considerations that both support and inform the current fuels management paradigm.

Online: http://www.fs.fed.us/rm/pubs/rmrs_rp103.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

Applying online WEPP to assess forest watershed hydrology. Dun, S.; Wu, J.Q.; Elliot, W.J.; Frankenberger, J.R.; Flanagan, D.C.; McCool, D.K. 2013. Transactions of the ASABE. 56(2): 581-590. Online: http://www.treesearch.fs.fed.us/pubs/43832.

Carbon dioxide exchange rates from short- and long-hydroperiod Everglades freshwater marsh. Jimenez, K.L.; Starr, G.; Staudhammer, C.L.; Schedlbauer, J.L.; Loescher, H.W.; Malone, S.L.; Oberbauer, S.F. 2012. Journal of Geophysical Research. 117: G04009. Online: http://www.treesearch.fs.fed.us/pubs/43649.

Current research issues related to post-wildfire runoff and erosion processes. Moody, John A.; Shakesby, Richard A.; Robichaud, Peter R.; Cannon, Susan H.; Martin, Deborah A. 2013. Earth-Science Reviews. 122: 10-37. Online: http://www.treesearch.fs.fed.us/pubs/43826.

DNA barcoding at riverscape scales: Assessing biodiversity among fishes of the genus Cottus (Teleostei) in northern Rocky Mountain streams. Young, Michael K.; McKelvey, Kevin S.; Pilgrim, Kristine L.; Schwartz, Michael K. 2013. Molecular Ecology. doi: 10.1111/1755-0998.12091. Online: http://www.treesearch.fs.fed.us/pubs/43346.

Ecosystem resilience despite large-scale altered hydroclimatic conditions. Campos, Guillermo E. Ponce; Moran, M. Susan; Huete, Alfredo; Zhang, Yongguang; Bresloff, Cynthia; Huxman, Travis E.; Eamus, Derek; Bosch, David D.; Buda, Anthony R.; Gunter, Stacey A.; Scalley, Tamara Heartsill; Kitchen, Stanley G.; McClaran, Mitchel P.; McNab, W. Henry; Montoya, Diane S.; Morgan, Jack A.; Peters, Debra P.C.; Sadler, E. John; Seyfried, Mark S.; Starks, Patrick J. 2013. Nature. 494: 349-353. Online: http://www.treesearch.fs.fed.us/pubs/43187.

Effects of simulated drought on the carbon balance of Everglades short-hydroperiod marsh. Malone, Sparkle L.; Starr, Gregory; Staudhammer, Christina L.; Ryan, Michael G. 2013. Global Change Biology. doi: 10.1111/gcb.12211. Online: http://www.treesearch.fs.fed.us/pubs/43813.

Erosion processes and prediction with WEPP technology in forests in the northwestern U.S. Elliot, W.J. 2013. Transactions of the ASABE. 56(2): 563-579. Online: http://www.treesearch.fs.fed.us/pubs/43831.

An evaluation of the hydrologic relevance of lateral flow in snow at hillslope and catchment scales. Eiriksson, David; Whitson, Michael; Luce, Charles H.; Marshall, Hans Peter; Bradford, John; Benner, Shawn G.; Black, Thomas; Hetrick, Hank; McNamara, James P. 2013. Hydrological Process. 27: 640-654. Online: http://www.treesearch.fs.fed.us/pubs/42781.

Fuel moisture influences on fire-altered carbon in masticated fuels: An experimental study. Brewer, Nolan W.; Smith, Alistair M.S.; Hatten, Jeffery A.; Higuera, Philip E.; Hudak, Andrew T.; Ottmar, Roger D.; Tinkham, Wade T. 2013. Journal of Geophysical Research: Biogeosciences. 118: 30-40.

Geospatial application of the Water Erosion Prediction Project (WEPP) model. Flanagan, D.C.; Frankenberger, J.R.; Cochrane, T.A.; Renschler, C.S.; Elliot, W.J. 2013. Transactions of the ASABE. 56(2): 591-601. Online: http://www.treesearch.fs.fed.us/pubs/43830.

An instrument to measure turbulent eddy fluxes in the atmosphere of Mars. Rafkin, S.; Banfield, D.; Dissly, R.; Silver, J.; Stanton, A.; Wilkinson, E.; Massman, W.; Ham, J. 2012.

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In: International Workshop on Instrumentation for Planetary Missions (IPM-2012). Greenbelt, MD: NASA Goddard Space Flight Center. Online: http://www.treesearch.fs.fed.us/pubs/43503.

Modifying WEPP to improve streamflow simulation in a Pacific Northwest watershed. Srivastava, A.; Dobre, M.; Wu, J.Q.; Elliot, W.J.; Bruner, E.A.; Dun, S.; Brooks, E.S.; Miller, I.S. 2013. Transactions of the ASABE. 56(2): 603-611. Online: http://www.treesearch.fs.fed.us/pubs/43824.

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Fire, fuel, and smoke

A comparison of producer gas, biochar, and activated carbon from two distributed scale thermochemical conversion systems used to process forest biomass. Anderson, Nathaniel; Jones, J. Greg; Page-Dumroese, Deborah; McCollum, Daniel; Baker, Stephen; Loeffler, Daniel; Chung, Woodam. 2013. Energies. 6: 164-183. Online: http://www.treesearch.fs.fed.us/pubs/42789.

Long-term (13-year) effects of repeated prescribed fires on stand structure and tree regeneration in mixed-oak forests. Hutchinson, Todd F.; Yaussy, Daniel A.; Long, Robert P.; Rebbeck, Joanne; Sutherland, Elaine Kennedy. 2012. Forest Ecology and Management. 286: 87-100. Online: http://www.treesearch.fs.fed.us/pubs/42167.

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Forest and woodland ecosystems

Area-wide application of verbenone-releasing flakes reduces mortality of whitebark pine *Pinus albicaulis* caused by the mountain pine beetle *Dendroctonus ponderosae*. Gillette, Nancy E.; Hansen, E. Matthew; Mehmel, Constance J.; Mori, Sylvia R.; Webster, Jeffrey N.; Erbilgin, Nadir; Wood, David L. 2012. Agricultural and Forest Entomology. doi: 10.1111/j.1461-9563.2012.00577.x. Online: http://www.treesearch.fs.fed.us/pubs/41790.

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Integrating regeneration, genetic resistance, and timing of intervention for the long-term sustainability of ecosystems challenged by non-native pests: a novel proactive approach. Schoettle, A.W.; Klutsch, J.G.; Sniezko, R.A. 2012. In: Sniezko, R.A.; Yanchuk, A.D.; Kliejunas, J.T.; Palmieri, K.M.; Alexander, J.M.; Frankel, S.J., tech. coords. Proceedings of the Fourth International Workshop on the Genetics of Host-Parasite Interactions in Forestry: Disease and Insect Resistance in Forest Trees. Gen. Tech. Rep. PSW-GTR-240. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. p. 112-123. Online: http://www.treesearch.fs.fed.us/pubs/42527

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A tale of two single mountain alpine endemics: *Packera franciscana* and *Erigeron mancus*. Fowler, James F.; Sieg, Carolyn H.; Casavant, Brian M.; Hite, Addie E. 2012. Calochortiana. 1: 110-114. Online: http://www.treesearch.fs.fed.us/pubs/43450.

Grasslands, shrublands, and desert ecosystems

Annual brome control using a native fungal seed pathogen. Meyer, Susan E.; Clement, Suzette; Becksteac, Julie, inventors. 2013. Gonzaga University and U.S. Department of Agriculture, assignees. 2013 Feb 7. U.S. patent publication no. US 2013/0035231 A1. 23 p. Online: http://www.treesearch.fs.fed.us/pubs/43772.

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Boiled, tumbled, burned, and heated: Seed scarification techniques for Munro's globemallow appropriate for large-scale application. Kildisheva, Olga A.; Dumroese, R. Kasten; Davis,

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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.

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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