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The Rocky Mountain Research Station is one of seven regional units that make up the U.S. Forest Service Research and Development organization.

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 percent of the nation’s National Forest System lands (54 national forests and grasslands). In the lower 48 States, our territory also includes 55 percent of the nation’s Bureau of Land Management lands; 48 percent of the designated wildernesses; 37 percent of National Park Service lands; numerous other public and tribal lands; and 41 percent 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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This report provides a multiscale approach for assessing the geomorphic sensitivity of streams and ecological resilience of riparian ecosystems, including meadows, in upland watersheds of the Great Basin to disturbances and management actions. Part I describes the key concepts needed to understand geomorphic sensitivity, ecological resilience, and ecological integrity. The watershed characteristics and components that influence sensitivity and resilience to disturbance are discussed, including the geomorphic characteristics of the stream channels and vegetation characteristics of the riparian ecosystems. A categorization of watershed sensitivity and resilience is provided to evaluate the past and likely future responses of the watersheds to disturbances and determine appropriate management strategies. Part II contains the information and protocols needed to categorize stream reaches and watersheds according to their relative sensitivity and resilience and evaluate their ecological integrity. The assessment involves collecting data on (1) watershed characteristics, (2) stream channel geomorphic and hydrologic characteristics, (3) riparian and meadow ecosystem vegetation characteristics, and (4) disturbance types and magnitudes. The assessments of watershed sensitivity and resilience are intended to provide the basis for prioritizing areas for conservation and restoration activities and determining the most effective strategies. The target audience is managers and stakeholders interested in assessing and adaptively managing Great Basin stream systems and riparian and meadow ecosystems.

Keywords: geomorphic sensitivity; ecological resilience; ecological integrity; Great Basin; watersheds; stream channels; riparian ecosystems; meadows; conservation; restoration; adaptive management

Online: https://www.fs.usda.gov/treesearch/pubs/63511

For centuries, humans occupied and altered California Park, a unique high-elevation rangeland in northwestern Colorado. The area’s rich biodiversity attracted Native American hunters and successive European-American cattlemen, sheepherders, homesteaders, and recreationists. All of these groups influenced the area’s plant and animal composition and diversity, but heavy cattle and sheep grazing from the 1870s into the 1940s had a drastic and lasting impact on California Park. The area became part of the National Forest System in 1905 and since then the U.S. Department of Agriculture, Forest Service has managed livestock, hunting, and forest resources. Early accounts of California Park create a complex picture of the historical vegetation; some describe the landscape as a meadow supporting a variety of wildlife and surrounded by forest, and others refer to shrubland habitats. This report documents land-use change, management decisions, and subsequent ecosystem change in California Park since the late 1800s. Much of the report is based on a recent interview with a lifelong resident of the area, a retired Forest Service range manager. Other local primary and secondary historical sources supplement material from this interview. This chronology of land use helps to explain how present-day conditions developed and can inform management decisions. In recent years, the Forest Service has focused its management on sustaining native vegetation and wildlife and reversing upland and riparian degradation caused by humans. Despite land managers’ efforts, however, widespread invasive plants and soil limitations remain significant obstacles to maintaining desired vegetation composition within California Park. Knowledge about land-use change in California Park can assist restoration efforts in upland landscapes to favor ground-nesting birds and ungulates, and along stream corridors to enhance native trout and boreal toad populations.

**Keywords:** oral history; ecological restoration; rangeland management; sagebrush steppe; herbicide treatment; sage-grouse habitat; land-use change; northwest Colorado; Medicine Bow-Routt National Forest

**Online:** https://www.fs.usda.gov/treesearch/pubs/63490
Suppression of most wildland fire ignitions has defined fire management in the United States since 1935. These past suppression activities, along with climate change impacts and other factors, have resulted in longer fire seasons and increased frequency of large fires in many forest ecosystems across the western United States, thus resulting in a fire management crisis. But suppression has not been the default approach in a few large wilderness areas of the U.S. Northern Rocky Mountains: the Selway-Bitterroot Wilderness, the Bob Marshall Wilderness Complex, and the Frank Church-River of No Return Wilderness. Instead, wildland fire has been managed over the last four decades to play a more natural role in these ecosystems. The fire management approach in these wilderness areas provides an excellent, and relatively rare, case study of wildland fire managed for resource benefit. This report recounts historically important fires managed in these wilderness areas and analyzes the development of wilderness fire management in the Northern Rockies from the pioneering days in the 1970s to the present. An improved understanding of this history, including the challenges overcome and lessons learned by managers in this region, could help inform fire management policies and decisions across the Nation.

**Keywords:** Northern Rockies; wilderness fire; Selway-Bitterroot Wilderness; Bob Marshall Wilderness Complex; Frank Church-River of No Return Wilderness; fire management

**Online:** [https://www.fs.usda.gov/treesearch/pubs/63491](https://www.fs.usda.gov/treesearch/pubs/63491)

This report traces the flow of Montana’s 2018 timber harvest through the primary wood-using industries; provides a description of the structure, capacity, and condition of Montana’s primary forest products industry; and quantifies volumes and uses of wood fiber. Historical wood products industry changes are discussed, as well as changes in harvest, production, employment, and sales objectives.

Keywords: timber harvest; timber processors; forest economics; mill residue; wood utilization

Online: https://www.fs.usda.gov/treesearch/pubs/63512


Wildfire affects many types of communities and is a particular concern for communities in the wildland urban interface (WUI), such as Chalk Creek in Chaffee County. The core intent of this project was to provide evidence to support Colorado State Forest Service (CSFS) Salida Field Office’s wildfire mitigation and education program. This report analyzes existing wildfire risk data collected in late 2017 through 2019 and pairs it with social data collected in the summer of 2019, in order to better understand Chalk Creek residents’ knowledge, experiences, and perceptions about wildfire risk. This greater understanding will help CSFS focus its programs and outreach and ultimately promote increased mitigation and reduced wildfire risk in Chalk Creek

Keywords: WiRē (wildfire research center); partner; risk assessment; survey data; wildland urban interface; social science; mitigation; wildfire risk; community; homeowner; social science

Online: https://www.fs.usda.gov/treesearch/pubs/63542

Land management and fire management goals are increasingly framed in terms of resilience, in part due to the combined impacts of climate change, land-use change, and legacies of land management. Implicit in this framing is the recognition that resilience to wildfire involves both ecological and social dimensions. Discussions surrounding resilience often do not explicitly articulate what resources should or must be resilient to wildfire, and seldom do they make explicit for whom resilience is important. Land managers need to understand and identify which resources their communities want to be resilient to wildfire before they can outline specific actions that could be taken to support resilience for those resources. We detail an approach for bringing together land and resource managers, community institutions, and other stakeholders—those people for whom resilience is important—to achieve these objectives. We describe a series of exercises used for a workshop but present them here in a more generic form that could be adapted to a variety of landscapes, audiences, and formats.

Keywords: collaboration; community engagement; environmental evaluation; mutual learning; translational ecology; wildfire management

Online: https://www.fs.usda.gov/treesearch/pubs/63651
External publications written by our scientists and cooperators and grouped by our Science Program Areas. For more information on our Science Program Areas, please visit our web site: www.fs.usda.gov/rmrs/science-program-areas/.

**Journals and Other Publications**


**Air, Water and Aquatic Environments**


**Fire, Fuel and Smoke**

Alcasena, Fermin; Ager, Alan; Le Page, Yannick; Bessa, Paulo; Loureiro, Carlos; Oliveira, Tiago. 2021. Assessing wildfire exposure to communities and protected areas in Portugal. Fire. 4: 82.


**Forest and Woodland Ecosystems**


Bayham, Jude; Belval, Erin J.; Thompson, Matthew P.; Dunn, Christopher; Stonesifer, Crystal S.; Calkin, David E. 2020. Weather, risk, and resource orders on large wildland fires in the western US. Forests. 11: 169.


Torres, Hugo; Pacheco, Abilio Pereira; Claro, Joao; Salis, Michele; Thompson, Matthew P.; Stonesifer, Crystal S.; Diana, Gavino; Cocco, Silvio. 2018. Flexible design of a helipad network for forest firefighting helicopters, applied to the case of Sardinia [Chapter 7]. In: Viegas, Domingos Xavier, ed. Advances in Forest Fire Research 2018. Coimbra, Portugal: University of Coimbra, ADAI/CEIF. https://doi.org/10.14195/978-989-26-16-506_158.

Evans, Margaret E. K.; DeRose, R. Justin; Stefan Klesse; Girardin, Martin P.; Heilman, Kelly A.; Alexander, M. Ross; Arsenault, Andre; Babst, Flurin; Bouchard, Mathieu; Cahoon, Sean M. P.; Campbell, Elizabeth M.; Dietze, Michael; Duchesne, Louis; Frank, David C.; Giebink, Courtney L.; Gomez-Guerrero, Armando; Garcia, Genaro Gutierrez; Hogg, Edward H.; Metsaranta, Juha; Ols, Clementine; Rayback, Shelly A.; Reid, Anya; Ricker, Martin; Schaberg, Paul G.; Shaw, John D.; Sullivan, Patrick F.; Gaytan, Sergio Armando Villela. 2021. Adding tree rings to North America’s National Forest Inventories: An essential tool to guide drawdown of atmospheric CO2. BioScience. https://doi.org/10.1093/biosci/biab119.

Maintaining Resilient Dryland Ecosystems


Wilderness (Aldo Leopold Wilderness Research Institute)


Qian, Qian; Wang, Junbang; Zhang, Xiujuan; Wang, Shaoqiang; Li, Yingnian; Wang, Qinxue; Watson, Alan E.; Zhao, Xinquan. 2022. Improving herders’ income through alpine grassland husbandry on Qinghai-Tibetan Plateau. Land Use Policy. 113: 105896.

Wildlife and Terrestrial Ecosystems

Hwang, Mei-Hsiu; Ditmer, Mark A.; Teo, Shu-De; Wong, Siew Te; Garshelis, David L. 2021. Sun bears use 14-year-old previously logged forest more than primary forest in Sabah, Malaysia. Ecosphere. 12(10): e03769.

Young, Michael K.; Smith, Rebecca; Pilgrim, Kristine L.; Schwartz, Michael K. 2021. Molecular species delimitation refines the taxonomy of native and nonnative physinine snails in North America. Scientific Reports. 11: 21739.
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