



# Rocky Mountain Research Station

# New Publications

April–June 2020

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# Rocky Mountain Research Station

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.

## Contact us

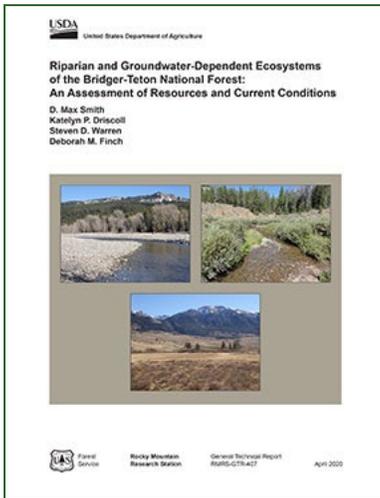
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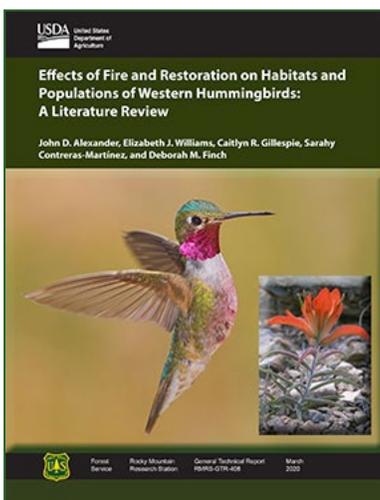


Smith, D. Max; Driscoll, Katelyn P.; Warren, Steven D.; Finch, Deborah M. 2020. [Riparian and groundwater-dependent ecosystems of the Bridger-Teton National Forest: An assessment of resources and current conditions](#). Gen. Tech. Rep. RMRS-GTR-407. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 204 p.

This assessment was conducted to provide information on the current conditions of riparian and groundwater-dependent ecosystems in relation to their natural range of variation on the Bridger-Teton National Forest. We summarized dominant riparian community types that are present on the Forest and described riparian fish and wildlife habitat. We used peer-reviewed literature, data from the Forest and other partners, and site visits to evaluate the status of five key ecosystem characteristics: (1) surface water and groundwater fluctuations, (2) water quality, (3) channel and floodplain dynamics, (4) composition and structure of riparian vegetation, and (5) composition of groundwater-dependent ecosystems. [MORE](#)

**Keywords:** forest plan, key ecosystem characteristics, riparian vegetation, flow regime, channel morphology, floodplain, Wyoming, Greater Yellowstone Ecosystem

Online: [www.fs.usda.gov/treesearch/pubs/59872](http://www.fs.usda.gov/treesearch/pubs/59872)

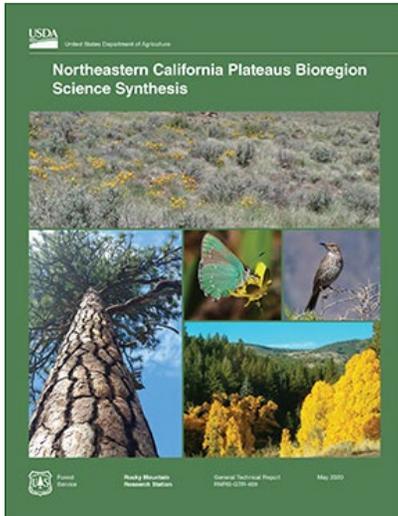


Alexander, J. D.; Williams, E. J.; Gillespie, C. R.; Contreras-Martínez, S.; Finch, D. M. 2020. [Effects of restoration and fire on habitats and populations of western hummingbirds: A literature review](#). Gen. Tech. Rep. RMRS-GTR-408. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 64 p.

To inform future restoration efforts, we reviewed the known effects of fire and habitat management and restoration on hummingbirds in four key habitat types in North America. We examined seven species that most commonly occur west of the Rocky Mountains: Rufous (*Selasphorus rufus*), Calliope (*Selasphorus calliope*), Broad-tailed (*Selasphorus platycercus*), Costa's (*Calypte costae*), Black-chinned (*Archilochus alexandri*), Anna's (*Calypte anna*), and Allen's (*Selasphorus sasin*). Our review found that most western hummingbird species respond positively to wild or prescribed fire in forested and chaparral habitats of the western United States, although some hummingbird occurrence declines following fire, possibly due to the loss of preferred nesting habitat in mature forests. [MORE](#)

**Keywords:** hummingbirds, fire, prescribed fire, restoration, climate change

Online: [www.fs.usda.gov/treesearch/pubs/59664](http://www.fs.usda.gov/treesearch/pubs/59664)



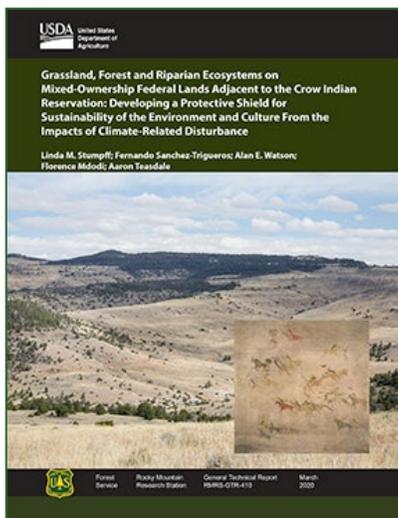
Dumroese, R.K.; Moser, W.K., eds. 2020. [Northeastern California plateaus bioregion science synthesis](#). Gen. Tech. Rep. RMRS-GTR-409. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 210 p.

The Northeastern California Plateaus Bioregion Science Synthesis reviews literature relevant to the ecology and management of the Great Basin ecosystems and dry pine forests of the Lassen and Modoc National Forests. Critical factors on these national forests are reduced water availability - expected to become more challenging as levels and patterns of precipitation and temperature change under climate variability - coupled with a high proportion of rangeland and open woodland whose vegetation community is influenced by grazing of livestock and wild animal populations. Conifer encroachment of rangelands and the densification of woodlands, a result of fire suppression, impact wildlife communities that rely on open woodlands and other habitats characterized by having overstories of low density. [MORE](#)

**Keywords:** hummingbirds, fire, prescribed fire, restoration, climate change

Online: [www.fs.usda.gov/treesearch/pubs/60158](http://www.fs.usda.gov/treesearch/pubs/60158)

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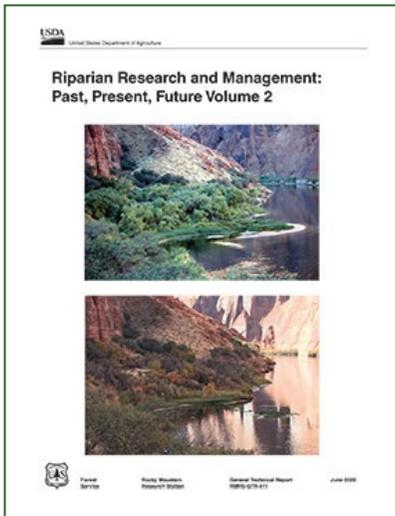


Stumpff, Linda M.; Sanchez-Trigueros, Fernando; Watson, Alan E.; Mdoti, Florence; Teasdale, Aaron. [Grassland, forest and riparian ecosystems on mixed-ownership federal lands adjacent to the Crow Indian Reservation: Developing a protective shield for sustainability of the environment and culture from the impacts of climate-related disturbance](#). Gen. Tech. Rep. RMRS-GTR-410. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 84 p.

Between 2016 and 2018, the USDA Forest Service, Rocky Mountain Research Station's Aldo Leopold Wilderness Research Institute hosted a team of scholars to reflect on how Federal agencies can best prescribe restoration for conditions associated with climate change-induced disturbance to protect sustainability in mixed-ownership lands, with a focus on the Upper Missouri River Basin. Phase 1 of this project was a review of natural resources and current threats to these resources on mixed-ownership lands adjacent to the Crow Indian Reservation in Montana and Wyoming, USA. Phase 2 was aimed at designing and explaining a model of adaptive environmental management (the Protective Shield Framework), based on Indigenous principles to increase resilience, to bolster resistance to climate- and human-related disturbance on fire-adapted ecosystems, and to implement restoration from such impacts in sustainable ways. [MORE](#)

**Keywords** sustainability, Indigenous knowledge, traditional knowledge, phenological knowledge, wilderness study areas, wild horses, invasive species, Great Plains, Crow Tribe

Online: [www.fs.usda.gov/treesearch/pubs/59871](http://www.fs.usda.gov/treesearch/pubs/59871)

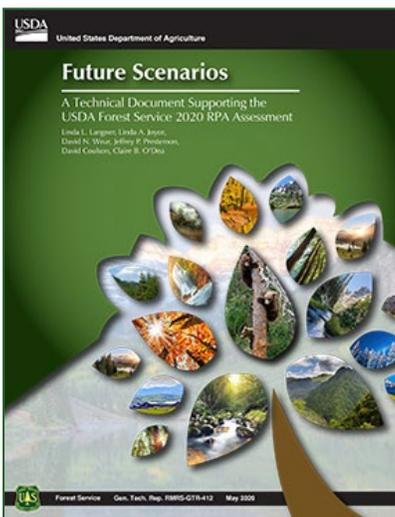


Carothers, Steven W.; Johnson, R. Roy; Finch, Deborah M.; Kingsley, Kenneth J.; Hamre, Robert H., tech. eds. 2020. [Riparian research and management: Past, present, future: Volume 2](#). Gen. Tech. Rep. RMRS-GTR-411. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 268 p.

In the Preface to [volume 1](#), we discuss the development of riparian ecology as one of the newest of ecological fields that gained significant momentum in the 1950s and 1960s as part of the general “riparian movement” in the United States. The field expanded rapidly throughout the latter half of the 1900s. Volume 2 involves more than two dozen authors - most with decades of experience - who expand upon riparian and other topics introduced in [volume 1](#). Two important recent developments are global climate change and impacts of introduced tamarisk leaf beetles (*Diorhabda* spp.) in the American West. Other chapters in volume 2 that provide current information evaluate the losses of riparian habitat, including “extirpation” of a large number of mesquite bosques (woodlands) in the Southwest; the restoration of riparian ecosystems damaged by anthropogenic activities; the importance of a watershed; and the importance of riparian ecosystems to recreation. [MORE](#)

**Keywords:** Keywords: riparian, ecosystem, ecology, riparian processes, riparian losses, restoration, aquatic, arid, semiarid, upland, freshwater, groundwater, hydrology, watershed, tamarisk, tamarisk leaf beetles (*Diorhabda* spp.)

Online: [www.fs.usda.gov/treearch/pubs/60500](http://www.fs.usda.gov/treearch/pubs/60500)

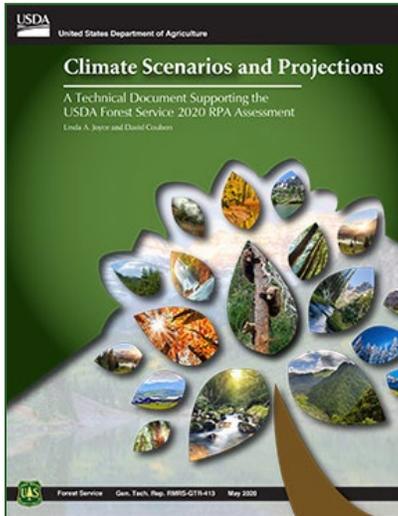


Langner, Linda L.; Joyce, Linda A.; Wear, David N.; Prestemon, Jeffrey P.; Coulson, David; O’Dea, Claire B. 2020. [Future scenarios: A technical document supporting the USDA Forest Service 2020 RPA Assessment](#). Gen. Tech. Rep. RMRS-GTR-412. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 34 p. <https://doi.org/10.2737/RMRS-GTR-412>.

The Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) mandates a periodic assessment of the conditions and trends of the Nation’s renewable resources on forests and rangelands. The 2020 RPA Assessment will evaluate the future of the Nation’s renewable natural resources through 2070. This publication describes the process used to select a set of four integrated scenarios to represent a plausible span of socioeconomic and climate futures that underpin the natural resource analyses. These four scenarios, and their associated assumptions about population change, economic growth, and climate change, are also described in this document. [MORE](#)

**Keywords:** RPA Assessment, scenarios, Representative Concentration Pathways, Shared Socioeconomic Pathways

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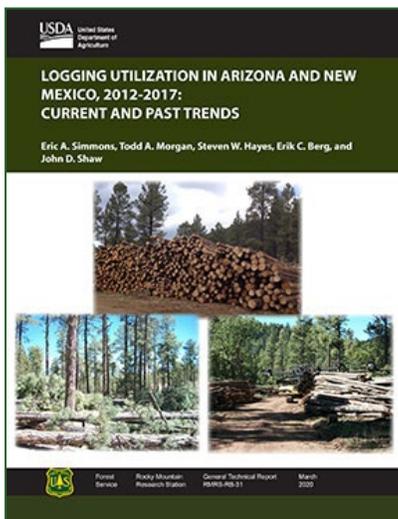


Joyce, Linda A.; Coulson, David. 2020. [Climate scenarios and projections: A technical document supporting the USDA Forest Service 2020 RPA Assessment](#). Gen. Tech. Rep. RMRS-GTR-413. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 85 p. doi: 10.2737/RMRS-GTR-413.

The 2020 RPA Assessment includes climate change as a driver affecting natural resources on forests and rangelands in the United States. This publication describes the process used to select the scenarios, climate models, and climate projections that will be used to project renewable resource conditions 50 years into the future. Downscaled climate data selected are the MACAv2-METDATA developed by Abatzoglou and others at the University of Idaho. The dataset covers the conterminous United States at a grid size of approximately 4 km (1/24 degree) on a side. The two selected scenarios are the Representative Concentration Pathways (RCPs) 4.5 and 8.5. [MORE](#)

**Keywords:** selection process, climate model evaluation, mid-century, RCP 4.5, RCP 8.5

Online: [www.fs.usda.gov/treearch/pubs/60113](http://www.fs.usda.gov/treearch/pubs/60113)



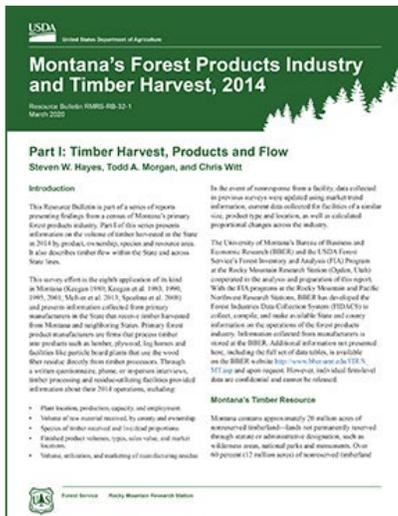
Simmons, Eric A.; Morgan, Todd A.; Hayes, Steven W.; Berg, Erik C.; Shaw, John D. 2020. [Logging utilization in Arizona and New Mexico, 2012-2017: Current and past trends](#). Resour. Bull. RMRS-RB-31. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 24 p.

A study of commercial timber-harvesting sites in Arizona and New Mexico was conducted from 2012 to 2017 to estimate growing-stock removals, characterize current tree utilization and logging operations, and assist with estimating the amount of woody biomass left on-site after harvesting. Fifty-four sample logging sites were selected within major geographic regions proportional to regional five-year timber harvests. [MORE](#)

**Keywords:** forest inventory, growing-stock removals, logging residue, removals factors, timber harvest

Online: [www.fs.usda.gov/treearch/pubs/59941](http://www.fs.usda.gov/treearch/pubs/59941)

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Hayes, Steven W.; Morgan, Todd A.; Witt, Chris. 2020. Montana’s forest products industry and timber harvest, 2014: [Part I: Timber Harvest, Products and Flow](#). Resour. Bull. RMRS-RB-32-1. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 8 p.

Hayes, Steven W.; Morgan, Todd A.; Witt, Chris. 2020. Montana’s forest products industry and timber harvest, 2014: [Part II: Industry sectors, capacity and outputs](#). Resour. Bull. RMRS-RB-32-2. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 8 p.

Marcille, Kate C.; McIver, Chelsea P.; Hayes, Steven W.; Morgan, Todd A.; Witt, Chris. 2020. Montana’s forest products industry and timber harvest, 2014: [Part III: Sales, employment and economic contribution](#). Resour. Bull. RMRS-RB-32-3. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 8 p.

McIver, Chelsea P. 2020. Montana’s forest products industry and timber harvest, 2014: [Part IV: Supplemental Tables](#). Resour. Bull. RMRS-RB-32-4. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 16 p.

These Resource Bulletins are part of a series of reports presenting findings from a census of Montana’s primary forest products industry. Part I of this series presents information on the volume of timber harvested in the State in 2014 by product, ownership, species and resource area. It also describes timber flow within the State and across State lines. Part II of the series presents information on the forest products sectors that processed timber and mill residue into finished products in 2014. Part III of the series presents information on sales value and employment associated with primary wood products manufacturing, the economic contribution of forest products manufacturing in the State, and an analysis of the broader forest industry and how it has changed over time. All dollar figures included have been adjusted for inflation to constant 2014 dollars, unless otherwise noted. Part IV is the Supplemental Tables.

**Keywords:** Montana forest products industry, timber resources, timber harvest, timber flow

Online - Part I: [www.fs.usda.gov/treearch/pubs/59982](http://www.fs.usda.gov/treearch/pubs/59982)

Online - Part II: [www.fs.usda.gov/treearch/pubs/59983](http://www.fs.usda.gov/treearch/pubs/59983)

Online - Part III: [www.fs.usda.gov/treearch/pubs/59984](http://www.fs.usda.gov/treearch/pubs/59984)

Online - Part IV: [www.fs.usda.gov/treearch/pubs/59985](http://www.fs.usda.gov/treearch/pubs/59985)

## Journals and Other Publications

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/](http://www.fs.usda.gov/rmrs/science-program-areas/).

### Air, Water and Aquatic Environments

- Avera, Bethany N.; Rhoades, Charles C.; Calderon, Francisco; Cotrufo, M. Francesca. 2020. [Soil C storage following salvage logging and residue management in bark beetle-infested lodgepole pine forests](#). *Forest Ecology and Management*. 472: 118251.
- Cartwright, Jennifer M.; Dwire, Kathleen A.; Freed, Zach; Hammer, Samantha J.; McLaughlin, Blair; Misztal, Louise W.; Schenk, Edward R.; Spence, John R.; Springer, Abraham E.; Stevens, Lawrence E. 2020. [Oases of the future? Springs as potential hydrologic refugia in drying climates](#). *Frontiers in Ecology and the Environment*. 18(5): 245-253.
- Chow, Alex T.; Tsai, Kuo-Pei; Fegel, Timothy S.; Pierson, Derek N.; Rhoades, Charles C. 2019. [Lasting effects of wildfire on disinfection by-product formation in forest catchments](#). *Journal of Environmental Quality*. 48: 1826-1834.
- Pallud, Celine; Rhoades, Charles C.; Schneider, Linden; Dwivedi, Pranjal; Borch, Thomas. 2020. [Temperature-induced iron \(III\) reduction results in decreased dissolved organic carbon export in subalpine wetland soils, Colorado, USA](#). *Geochimica et Cosmochimica Acta*. 280: 148-160.
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- Robichaud, Peter R.; Lewis, Sarah A.; Wagenbrenner, Joseph W.; Brown, Robert E.; Pierson, Fredrick B. 2020. [Quantifying long-term post-fire sediment delivery and erosion mitigation effectiveness](#). *Earth Surface Processes and Landforms*. 45: 771-782.

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- Cansler, C. Alina; Hood, Sharon M.; van Mantgem, Phillip J.; Varner, J. Morgan, et. al. 2020. [The Fire and Tree Mortality Database, for empirical modeling of individual tree mortality after fire](#). *Scientific Data*. 7: 194.

- Haynes, Katharine; Short, Karen; Xanthopoulos, Gavriil; Viegas, Domingos; Ribeiro, Luis Mario; Bianchi, Raphael. 2020. [Wildfires and WUI fire fatalities](#). In: Manzello, Samuel L., ed. Encyclopedia of Wildfires and Wildland-Urban Interface (WUI) Fires. Cham, Switzerland: Springer. 16 p.
- Page, Wesley G.; Butler, Bret W. 2019 [Assessing wildland firefighter entrapment](#). Fire Management Today. 77(3): 16-19.
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- Bentz, Barbara J.; Bonello, Pierluigi.; Delb, Bright, Benjamin C.; Hudak, Andrew T.; Egan, Joel M.; Jorgensen, Carl L.; Rex, Franciel E.; Hicke, Jeffrey A.; Meddens, Arjan J. H. 2020. [Using satellite imagery to evaluate bark beetle-caused tree mortality reported in aerial surveys in a mixed conifer forest in northern Idaho, USA](#). Forests. 11: 529.
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- Bright, Benjamin C.; Hudak, Andrew T.; Meddens, Arjan J. H.; Egan, Joel M.; Jorgensen, Carl L. 2020. [Mapping multiple insect outbreaks across large regions annually using Landsat time series data](#). Remote Sensing. 12: 1655.
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- Crotteau, Justin S.; Keyes, Christopher R. 2020. [Restoration treatments improve overstory tree resistance attributes and growth in a ponderosa pine/Douglas-fir forest](#). *Forests*. 11: 574.
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- Crotteau, Justin S.; McClellan, Michael H.; De Santo, Toni L.; Spores, Sheila R.; Barnard, Jeffrey C. 2020. [Sharing the load to develop young-growth silviculture for forage and biodiversity in southeast Alaska](#). In: Pile, Lauren S.; Deal, Robert L.; Dey, Daniel C.; Gwaze, David; Kabrick, John M.; Palik, Brian J.; Schuler, Thomas M., comps. *Forest Management - Research Partnerships: Proceedings of the 2019 National Silviculture Workshop*; 2019 May 21-23; Bemidji, MN. Gen. Tech. Rep. NRS-P-193. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. p. 170-192.
- Crotteau, Justin S.; Rue-Johns, Annelise Z.; Barnard, Jeffrey C. 2019. [Effects on understory biomass and forage 8-10 years after precommercial thinning of Sitka spruce-western hemlock stands in southeast Alaska](#). *Canadian Journal of Forest Research*. 32(4): 215-225.
- Fan, Z.; Moser, W. K.; Crosby, M. K.; Yu, W.; Zhang, Y.; Hansen, M. H.; Fan, S. X. 2018. [County-scale mapping of the invasion stage and invasiveness of major nonnative invasive plants in the Upper Midwest forestlands, USA](#). *Mathematical and Computational Forestry and Natural-Resource Sciences*. 10(2): 68-79.
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