

Resistance of the soil microbial community to land-surface disturbances of high-intensity winter grazing and wildfire

www.nrfirescience.org/resource/22722

Common land-surface disturbances in rangelands with potential to influence the resistance and resilience of the ecosystem include livestock grazing and fire. The impact of these land-use disturbances on the soil microbial community is important to understand because the soil microbial community provides and supports many ecosystem...

Author(s): Jacob Comer, Lora Perkins

Year Published: 2021

Type: Document

Book or Chapter or Journal Article

Hillslope sediment fence catch efficiencies and particle sorting for post-fire rain storms

www.nrfirescience.org/resource/22625

Hillslope erosion has often been monitored with sediment fences, but these can underestimate sediment yields due to overtopping of runoff and associated sediment. We modified four sediment fences to collect and measure the runoff and sediment that overtopped the fence in addition to the sediment deposited behind the fence. Specific...

Author(s): Codie Wilson, Stephanie Kampf, Joseph W. Wagenbrenner, Lee H. MacDonald, Hunter Gleason

Year Published: 2021

Type: Document

Book or Chapter or Journal Article

Practical postfire sagebrush shrub restoration techniques

www.nrfirescience.org/resource/22598

Wildfire is increasing in frequency and size in the western United States with climate change and invasive species such as cheatgrass. This increase is also causing an increase in the need for restoration techniques, especially in low-elevation, arid shrublands. Sagebrush shrublands are home to the threatened Gunnison sage-grouse...

Author(s): Madeline N. Grant-Hoffman, Heidi L. Plank

Year Published: 2021

Type: Document

Book or Chapter or Journal Article

The propagule doesn't fall far from the tree, especially after short?interval, high?severity fire

www.nrfirescience.org/resource/22555

Subalpine forests that historically burned every 100–300 yr are expected to burn more frequently as climate warms, perhaps before trees reach reproductive maturity or produce a serotinous seedbank. Tree regeneration after short?interval (<30?yr) high?severity fire will increasingly rely on seed dispersal from unburned...

Author(s): Nathan S. Gill, Tyler J. Hoecker, Monica G. Turner

Year Published: 2021

Type: Document

Book or Chapter or Journal Article

Tracking rates of post-fire conifer regeneration distinct from deciduous vegetation recovery across the western USA

www.nrfirescience.org/resource/22956

Post?fire shifts in vegetation composition will have broad ecological impacts. However, information characterizing post?fire recovery patterns and their drivers are lacking over large spatial extents. In this

analysis we used Landsat imagery collected when snow cover (SCS) was present, in combination with growing season (GS)...

Author(s): Melanie K. Vanderhoof, Todd J. Hawbaker, Andrea Ku, Kyle E. Merriam, Erin Berryman, Megan E. Cattau

Year Published: 2021

Type: Document

Book or Chapter or Journal Article

Undesirable outcomes in seasonally dry forests

www.nrfirescience.org/resource/22872

We appreciate Hutto's call to promote positive ecological outcomes by recognizing diverse forest fire ecologies. Nevertheless, we continue to argue that restoration treatments are appropriate in the approximately 17 million ha of forest in the western US that historically burned every 40 years or less (Rollins 2009). Given ongoing...

Author(s): Scott L. Stephens, Anthony L. Westerling, Matthew D. Hurteau, M. Zachariah Perry, Courtney Schultz, Sally Thompson

Year Published: 2021

Type: Document

Book or Chapter or Journal Article

Seeing the Big Picture: Long Term Studies at Lick Creek Demonstrate How Fuel Treatments Impact a Changing Forest

www.nrfirescience.org/resource/22670

A long-term study at Lick Creek demonstrates how fuel treatments in dry forests provide benefits beyond mitigating the chance of a high-severity fire.

Author(s): Nehalem C. Clark

Year Published: 2021

Type: Document

Research Brief or Fact Sheet

Effectiveness of post-fire salvage logging stream buffer management for hillslope erosion in the U.S. Inland Northwest Mountains

www.nrfirescience.org/resource/22610

Active wildfire seasons in the western U.S. warrant the evaluation of post-fire forest management strategies. Ground-based salvage logging is often used to recover economic loss of burned timber. In unburned forests, ground-based logging often follows best management practices by leaving undisturbed areas near streams called...

Author(s): Peter R. Robichaud, Edwin D. Bone, Sarah A. Lewis, Erin S. Brooks, Robert E. Brown

Year Published: 2021

Type: Document

Book or Chapter or Journal Article

Native and non-native understory vegetation responses to restoration treatments in a dry conifer forest over 23 years

www.nrfirescience.org/resource/22564

Restoration of fire-prone forests is a common practice intended to increase resilience to wildfire, drought, and bark beetles. However, the long-term effects of restoration treatments on understory species, particularly non-native species, are poorly understood. We investigated long-term (23 years) effects of restoration treatments...

Author(s): Woongsoon Jang, Justin S. Crotteau, Yvette K. Ortega, Sharon M. Hood, Christopher R. Keyes, Dean E. Pearson, Duncan C. Lutes, Anna Sala

Year Published: 2021
Type: Document
Book or Chapter or Journal Article

Understanding the effect of fire on vegetation composition and gross primary production in a semi-arid shrubland ecosystem using the Ecosystem Demography (EDv2.2) model

www.nrfirescience.org/resource/22963

Wildfires in sagebrush (*Artemisia* spp.)-dominated semi-arid ecosystems in the western United States have increased dramatically in frequency and severity in the last few decades. Severe wildfires often lead to the loss of native sagebrush communities and change the biogeochemical conditions which make it difficult for sagebrush to...

Author(s): Karun Pandit, Hamid Dashti, Andrew T. Hudak, Nancy F. Glenn, Alejandro N. Flores, Douglas J. Shinneman

Year Published: 2021

Type: Document

Book or Chapter or Journal Article

Fire controls annual bromes in northern Great Plains grasslands—Up to a point

www.nrfirescience.org/resource/22951

Concern about the impacts of two invasive annual brome grasses (cheatgrass and Japanese brome, *Bromus tectorum* L. and *B. japonicus* Thunb. ex Murray) on the mixed-grass prairie of North America's northern Great Plains (NGP) is growing. Cheatgrass is well known west of the NGP, where replacement of fire-intolerant, native sagebrush...

Author(s): Amy J. Symstad, Deborah A. Buhl, Daniel J. Swanson

Year Published: 2021

Type: Document

Book or Chapter or Journal Article

Tracking rates of postfire conifer regeneration vs. deciduous vegetation recovery across the western United States

www.nrfirescience.org/resource/22869

Postfire shifts in vegetation composition will have broad ecological impacts. However, information characterizing postfire recovery patterns and their drivers are lacking over large spatial extents. In this analysis, we used Landsat imagery collected when snow cover (SCS) was present, in combination with growing season (GS) imagery...

Author(s): Melanie K. Vanderhoof, Todd J. Hawbaker, Andrea Ku, Kyle E. Merriam, Erin Berryman, Megan E. Cattau

Year Published: 2021

Type: Document

Book or Chapter or Journal Article

Fire-catalyzed vegetation shifts in ponderosa pine and Douglas-fir forests of the western United States

www.nrfirescience.org/resource/22333

Increased wildfire activity combined with warm and dry post-fire conditions may undermine the mechanisms maintaining forest resilience to wildfires, potentially causing ecosystem transitions, or fire-catalyzed vegetation shifts. Stand-replacing fire is especially likely to catalyze vegetation shifts expected from climate change, by...

Author(s): Kimberley T. Davis, Philip E. Higuera, Solomon Z. Dobrowski, Sean A. Parks, John T. Abatzoglou, Monica T. Rother, Thomas T. Veblen

Year Published: 2020

Type: Document
Book or Chapter or Journal Article

Fire legacies, heterogeneity, and the importance of mixed-severity fire in ponderosa pine savannas

www.nrfirescience.org/resource/20917

Globally, savanna ecosystems are shifting outside of “safe operating spaces” due to removal of their primary self-reinforcing feedback—fire—and subsequent erosion of disturbance legacies. Restoring savannas will require reinstating fire feedbacks. But knowledge gaps in the nature of historic fire regimes and how mechanisms...

Author(s): Caleb P. Roberts, Victoria M. Donovan, Sarah M. Nodskov, Emma C. Keele, Craig D. Allen, David A. Wedin, Dirac Twidwell

Year Published: 2020

Type: Document
Book or Chapter or Journal Article

Fire and land cover change in the Palouse Prairie–forest ecotone, Washington and Idaho, USA

www.nrfirescience.org/resource/22094

Background: Prairie-forest ecotones are ecologically important for biodiversity and ecological processes. While these ecotones cover small areas, their sharp gradients in land cover promote rich ecological interaction and high conservation value. Our objective was to understand how historical and current fire occurrences and human...

Author(s): Penelope Morgan, Emily K. Heyerdahl, Eva K. Strand, Stephen C. Bunting, James P. Riser, John T. Abatzoglou, Max W. Nielsen-Pincus, Mara Johnson

Year Published: 2020

Type: Document
Book or Chapter or Journal Article

Resilience to large, 'catastrophic' wildfires in North America's grassland biome

www.nrfirescience.org/resource/21643

Wildfires are ecosystem-level drivers of structure and function in many vegetated biomes. While numerous studies have emphasized the benefits of fire to ecosystems, large wildfires have also been associated with the loss of ecosystem services and shifts in vegetation abundance. The size and number of wildfires are increasing...

Author(s): Victoria M. Donovan, Dirac Twidwell, Daniel R. Uden, Tsegaye Tadesse, Brian D. Wardlow, Christine H. Bielski, Matthew O. Jones, Brady W. Allred, David E. Naugle, Craig R. Allen

Year Published: 2020

Type: Document
Book or Chapter or Journal Article

Invasive grasses: A new perfect storm for forested ecosystems?

www.nrfirescience.org/resource/21179

Exotic grasses are a widespread set of invasive species that are notable for their ability to significantly alter key aspects of ecosystem function. Understanding the role and importance of these invaders in forested landscapes has been limited but is now rising, as grasses from Eurasia and Africa continue to spread through...

Author(s): Becky K. Kerns, Claire Tortorelli, Michelle A. Day, Ty Nietupski, Ana M. G. Barros, John Kim, Meg A. Krawchuk

Year Published: 2020

Type: Document
Book or Chapter or Journal Article

Evaluating post-wildfire logging-slash cover treatment to reduce hillslope erosion after salvage logging using ground measurements and remote sensing

www.nrfirescience.org/resource/22322

Continuing long and extensive wildfire seasons in the Western US emphasize the need for better understanding of wildfire impacts including post-fire management scenarios. Advancements in our understanding of post-fire hillslope erosion and watershed response such as flooding, sediment yield, and debris flows have recently received...

Author(s): Peter R. Robichaud, Sarah A. Lewis, Robert E. Brown, Edwin D. Bone, Erin S. Brooks

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Fine-scale fire patterns mediate forest structure in frequent-fire ecosystems

www.nrfirescience.org/resource/21601

In frequent-fire forests, wildland fire acts as a self-regulating process creating forest structures that consist of a fine-grained mosaic of isolated trees, tree groups of various sizes, and non-treed openings. Though the self-regulation of forest structure through repeated fires is acknowledged, few studies have...

Author(s): Scott M. Ritter, Chad M. Hoffman, Michael A. Battaglia, Camille Stevens-Rumann, William E. Mell

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Variable thinning and prescribed fire influence tree mortality and growth during and after a severe drought

www.nrfirescience.org/resource/22011

California's high density, fire-excluded forests experienced an extreme drought accompanied by warmer than normal temperatures from 2012 to 2015, resulting in the deaths of millions of trees. We examined tree mortality and growth of mixed-conifer stands that had been experimentally treated between 2011 and 2013 with two different...

Author(s): Eric E. Knapp, Alexis Bernal, Jeffrey M. Kane, Christopher J. Fettig, Malcolm P. North

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Remote sensing of vegetation conditions after post-fire mulch treatments

www.nrfirescience.org/resource/21164

Wildfires are becoming more prevalent and are impacting forests, watersheds and important resources. Hydrologic and geomorphic processes following wildfires can include erosion flooding, and degraded water quality. To mitigate these secondary impacts, post-fire restoration treatments can be applied to a burned area to stabilize the...

Author(s): Viet D. Vo, Alicia M. Kinoshita

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

A climatic dipole drives short- and long-term patterns of postfire forest recovery in the western United States

www.nrfirescience.org/resource/22299

Researchers are increasingly examining patterns and drivers of postfire forest recovery amid growing concern that climate change and intensifying fires will trigger ecosystem transformations. Diminished seed availability and postfire drought have emerged as key constraints on conifer recruitment. However, the spatial and temporal...

Author(s): Caitlin E. Littlefield, Solomon Z. Dobrowski, John T. Abatzoglou, Sean A. Parks, Kimberley T. Davis

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Identifying opportunities for the use of broadcast prescribed fire on Colorado's Front Range

www.nrfirescience.org/resource/20791

Increasing the pace and scale of fuel treatments to protect social and ecological values from severe wildfire is a major initiative of numerous land management agencies, organizations, and collaborative groups throughout the western United States, including the Colorado Front Range. Broadcast prescribed fire is a relatively low-cost...

Author(s): Rob Addington, Brian G. Tavernia, Michael D. Caggiano, Matthew P. Thompson, Jason D. Lawhon, John S. Sanderson

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Restoration applications of resource objective wildfires in western US forests: a status of knowledge review

www.nrfirescience.org/resource/21580

Background: Frequent-fire forests of the western United States have undergone remarkable changes in structure, composition, and function due to historical exclusion of naturally occurring fire. Mechanized tree thinning to reduce forest density and fuel loads tends to be expensive and cannot be effectively implemented across all...

Author(s): David W. Huffman, John Paul Roccaforte, Judith D. Springer, Joseph E. Crouse

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Strong Legacy Effects of Prior Burn Severity on Forest Resilience to a High-Severity Fire

www.nrfirescience.org/resource/21927

Legacy effects from one disturbance may influence successional pathways by amplifying or buffering forest regeneration after the next disturbance. We assessed vegetation and tree regeneration in non-serotinous Sierra lodgepole pine (*Pinus contorta* var. *murrayana*) stands after a 1984 wildfire which burned with variable severity and...

Author(s): Lucas B. Harris, Stacy Drury, Alan H. Taylor

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Small-scale water deficits after wildfires create long-lasting ecological impacts

www.nrfirescience.org/resource/21078

Ecological droughts are deficits in soil-water availability that induce threshold-like ecosystem responses, such as causing altered or degraded plant-community conditions, which can be exceedingly difficult to reverse. However, 'ecological drought' can be difficult to define, let alone to quantify,

especially at spatial and...

Author(s): Rory O'Connor, Matthew J. Germino, David M Barnard, Caitlin M. Andrews, John Bradford, David S. Pilliod, Robert S. Arkle, Robert K. Shriver

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Predicting forest recovery following high-severity fire - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/22241

Novel combinations of fire regime and forest type are emerging in areas affected by climate change, fire exclusion, and other stressors. Species interactions following wildfire in these areas are not well understood. In Sierra Nevada mixed conifer forests, large patches of stand-replacing fire were once rare but are becoming...

Author(s): Carmen L. Tubbesing, Scott L. Stephens

Year Published: 2020

Type: Document

Technical Report or White Paper

Forest stand and site characteristics influence fuel consumption in repeat prescribed burns

www.nrfirescience.org/resource/20777

Prescribed fire is a vital tool for mitigating wildfire hazard and restoring ecosystems in many western North American forest types. However, there can be considerable variability in fuel consumption from prescribed burns, which affects both hazard mitigation and emissions. In the present study, data from replicated, repeat-entry...

Author(s): Jacob I. Levine, Brandon M. Collins, Robert A. York, Daniel E. Foster, Danny L. Fry, Scott L. Stephens

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Open forest ecosystems: An excluded state

www.nrfirescience.org/resource/21450

Once dominant but now largely excluded from eastern North America, open forests of savannas to woodlands occupy the ecosystem gradient between grasslands and closed forests. These fire-maintained systems differ in structure, processes, and species from closed canopy, succession-driven forests that currently dominate this region. In...

Author(s): Brice B. Hanberry, Don C. Bragg, Heather D. Alexander

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Fire and land cover change in the Palouse Prairie-forest ecotone, Washington and Idaho, USA

www.nrfirescience.org/resource/21830

Background: Prairie-forest ecotones are ecologically important for biodiversity and ecological processes. While these ecotones cover small areas, their sharp gradients in land cover promote rich ecological interaction and high conservation value. Our objective was to understand how historical and current fire occurrences and human...

Author(s): Penelope Morgan, Emily K. Heyerdahl, Eva K. Strand, Stephen C. Bunting, James P. Riser, John T. Abatzoglou, Max W. Nielsen-Pincus, Mara Johnson

Year Published: 2020

Type: Document
Book or Chapter or Journal Article

Assessing post-wildfire conifer regeneration: Validation of a non-destructive seedling aging method

www.nrfirescience.org/resource/22237

Determining the age of natural conifer regeneration following wildfires is crucial to understanding ecological trajectories and predicting post-fire effects in conifer forests. However, traditional methods of determining seedling age via growth ring counts requires killing desirable seedlings, while the validity of non-destructive...

Author(s): Eva K. Strand, Darcy H. Hammond

Year Published: 2020

Type: Document

Technical Report or White Paper

Restoration of Sagebrush in Crested Wheatgrass Communities: Longer-Term Evaluation in Northern Great Basin

www.nrfirescience.org/resource/20743

Crested wheatgrass (*Agropyron cristatum* [L] Gaertm. and *Agropyron desertorum* [Fisch.] Schult.), an introduced bunchgrass, has been seeded on millions of hectares of sagebrush steppe. It can establish near-monocultures; therefore, reestablishing native vegetation in these communities is often a restoration goal. Efforts to restore...

Author(s): Kirk W. Davies, Chad S. Boyd, Jonathan D. Bates, Erik P. Hamerlynck, Stella M. Copeland

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Forest restoration treatments in a ponderosa pine forest enhance physiological activity and growth under climatic stress

www.nrfirescience.org/resource/21446

As the climate warms, drought will increasingly occur under elevated temperatures, placing forest ecosystems at growing risk of extensive dieback and mortality. In some cases, increases in tree density following early 20th-century fire suppression may exacerbate this risk. Treatments designed to restore historical stand structure...

Author(s): Alan J. Tepley, Sharon M. Hood, Christopher R. Keyes, Anna Sala

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Landscape evaluations and prescriptions for post-fire landscapes - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/22540

Wildfires are modifying the structure and composition of forests at rates that far exceed mechanical thinning and prescribed fire treatments. We responded to this by analyzing recent wildfires to understand drivers of fire-severity and post-fire vegetation development, with an emphasis on how pre- and post-fire management and prior...

Author(s): Andrew J. Larson, C. Alina Cansler, Van R. Kane, Derek J. Churchill, Paul F. Hessburg, James A. Lutz, Nicholas A. Povak

Year Published: 2020

Type: Document

Technical Report or White Paper

Long-Term Effects of Fuels Treatments, Overstory Structure, and Wildfire on Tree Regeneration in Dry Forests of Central Washington

www.nrfirescience.org/resource/21771

The long-term effectiveness of dry-forest fuels treatments (restoration thinning and prescribed burning) depends, in part, on the pace at which trees regenerate and recruit into the overstory. Knowledge of the factors that shape post-treatment regeneration and growth is limited by the short timeframes and simple disturbance...

Author(s): Allison K. Rossman, Jonathan D. Bakker, David W. Peterson, Charles B. Halpern

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Effects of restoration and fire on habitats and populations of western hummingbirds: A literature review

www.nrfirescience.org/resource/21030

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 (...)

Author(s): John D. Alexander, Elizabeth Williams, Caitlyn R. Gillespie, Sarahy Contreras-Martínez, Deborah M. Finch

Year Published: 2020

Type: Document

Technical Report or White Paper

Goal setting and Indigenous fire management: a holistic perspective

www.nrfirescience.org/resource/22219

...

Author(s): William Nikolakis, Emma Roberts, Ngaio Hotte, Russell Myers Ross

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Variable forest structure and fire reconstructed across historical ponderosa pine and mixed conifer landscapes of the San Juan Mountains, Colorado

www.nrfirescience.org/resource/20677

Late-1800s land surveys were used to reconstruct historical forest structure and fire over more than 235,000 ha in ponderosa pine and mixed conifer landscapes of the San Juan Mountains, Colorado, to further understand differences among regional mountain ranges and help guide landscape-scale restoration and management. Historically,...

Author(s): William L. Baker

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

How do plant communities differ between fire refugia and firegenerated early?seral vegetation?

www.nrfirescience.org/resource/22495

Aims: Wildfires in dry forest ecosystems in western North America are producing fire effects that are more severe than historical estimates, raising concerns about the resilience of these landscapes to

contemporary disturbances. Despite increasing fire activity, relatively little is known about the structure and composition of fire...

Author(s): William M. Downing, Meg A. Krawchuk, Jonathan D. Coop, Garrett W. Meigs, Sandra L. Haire, Ryan B. Walker, Ellen Whitman, Geneva W. Chong, Carol Miller, Claire Tortorelli

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Fuel treatment effectiveness in the context of landform, vegetation, and large, wind-driven wildfires

www.nrfirescience.org/resource/20996

Large wildfires (>50,000 ha) are becoming increasingly common in semi-arid landscapes of the western United States. Although fuel reduction treatments are used to mitigate potential wildfire effects, they can be overwhelmed in wind-driven wildfire events with extreme fire behavior. We evaluated drivers of fire severity and...

Author(s): Susan J. Prichard, Nicholas A. Povak, Maureen C. Kennedy, David W. Peterson

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

A changing climate is snuffing out post-fire recovery in montane forests

www.nrfirescience.org/resource/22110

Aim: Climate warming is increasing fire activity in many of Earth's forested ecosystems. Because fire is a catalyst for change, investigation of post-fire vegetation response is critical to understanding the potential for future conversions from forest to non-forest vegetation types. We characterized the influences of climate...

Author(s): Kyle Rodman, Thomas T. Veblen, Michael A. Battaglia, Marin Chambers, Paula J. Fornwalt, Zachary A. Holden, Thomas E. Kolb, Jessica R. Ouzts, Monica T. Rother

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Fire and climate change: conserving seasonally dry forests is still possible

www.nrfirescience.org/resource/21761

The destructive wildfires that occurred recently in the western US starkly foreshadow the possible future of forest ecosystems and human communities in the region. With increases in the area burned by severe wildfire in seasonally dry forests expected to result from climate change, judicious, science-based fire and restoration...

Author(s): Scott L. Stephens, Anthony L. Westerling, Matthew D. Hurteau, M. Zachariah Peery, Courtney Schultz, Sally Thompson

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Changing wildfire, changing forests: the effects of climate change on fire regimes and vegetation in the Pacific Northwest, USA

www.nrfirescience.org/resource/20655

Background: Wildfires in the Pacific Northwest (Washington, Oregon, Idaho, and western Montana, USA) have been immense in recent years, capturing the attention of resource managers, fire scientists, and the general public. This paper synthesizes understanding of the potential effects of changing climate and fire regimes on Pacific...

Author(s): Jessica E. Halofsky, David L. Peterson, Brian J. Harvey
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Topographic position amplifies consequences of short-interval stand-replacing fires on postfire tree establishment in subalpine conifer forests

www.nrfirescience.org/resource/22389

Stand-replacing fires burned at 100 to 300-year intervals for millennia in subalpine conifer forests of western North America, but forests are burning more frequently as climate warms. Postfire tree regeneration is reduced when young forests reburn before recovering from previous fires or when drought occurs during postfire years....

Author(s): Tyler J. Hoecker, Winslow D. Hansen, Monica G. Turner
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Pyrogenic carbon generation from fire and forest restoration treatments

www.nrfirescience.org/resource/20950

Pyrogenic carbon (PyC) is a chemically stable form of carbon (C) generated during fire events and is one of the few legacies of fire recorded in soil; however, the significance of this material as a form of C storage in forest ecosystems has received only limited scientific attention, and currently relatively little is known...

Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Vegetative and Edaphic Responses in a Northern Mixed Conifer Forest Three Decades after Harvest and Fire: Implications for Managing Regeneration and Carbon and Nitrogen Pools

www.nrfirescience.org/resource/22107

Research Highlights: This experiment compares a range of combinations of harvest, prescribed fire, and wildfire. Leveraging a 30-year-old forest management-driven experiment, we explored the recovery of woody species composition, regeneration of the charismatic forest tree species *Larix occidentalis* Nutt., and vegetation and soil...

Author(s): R. Kasten Dumroese, Martin F. Jurgensen, Deborah S. Page-Dumroese
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Fire and land cover change in the Palouse Prairie–forest ecotone, Washington and Idaho, USA

www.nrfirescience.org/resource/22381

Background: Prairie-forest ecotones are ecologically important for biodiversity and ecological processes. While these ecotones cover small areas, their sharp gradients in land cover promote rich ecological interaction and high conservation value. Our objective was to understand how historical and current fire occurrences and human...

Author(s): Penelope Morgan, Emily K. Heyerdahl, Eva K. Strand, Stephen C. Bunting, James P. Riser, John T. Abatzoglou, Max W. Nielsen-Pincus, Mara Johnson
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Vegetation dynamics following compound disturbance in a dry pine forest: fuel treatment then bark beetle outbreak

www.nrfirescience.org/resource/20918

In the western United States, restoration of forests with historically frequent, low-severity fire regimes often includes fuel reduction that reestablish open, early-seral conditions while reducing fuel continuity and loading. Between 2001 and 2016, fuel reduction (e.g., thinning, prescribed burning, etc.) was implemented on...

Author(s): Justin S. Crotteau, Christopher R. Keyes, Sharon M. Hood, Andrew J. Larson

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Topography and fire legacies drive variable post-fire juvenile conifer regeneration in eastern Oregon, USA

www.nrfirescience.org/resource/22099

Increasingly frequent large wildfires in the western US raise questions about the effects of climate and site-level factors on forest ecosystem resilience. This study presents findings from seedling and sapling surveys conducted across 179 sites 15–21 years post-fire in eastern Oregon's Blue Mountain ecoregion. We found wide...

Author(s): Angela Boag, Mark J. Ducey, Michael W. Palace, Joel Hartter

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Fuel treatment longevity in ponderosa pine-dominated forest 24 years after cutting and prescribed burning

www.nrfirescience.org/resource/21655

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Author(s): Sharon M. Hood, Christopher R. Keyes, Katelynn J. Bowen, Duncan C. Lutes, Carl A. Seielstad

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

How do plant communities differ between fire refugia and firegenerated early-seral vegetation?

www.nrfirescience.org/resource/22332

Aims: Wildfires in dry forest ecosystems in western North America are producing fire effects that are more severe than historical estimates, raising concerns about the resilience of these landscapes to contemporary disturbances. Despite increasing fire activity, relatively little is known about the structure and composition of fire...

Author(s): William M. Downing, Meg A. Krawchuk, Jonathan D. Coop, Garrett W. Meigs, Sandra L. Haire, Ryan B. Walker, Ellen Whitman, Geneva W. Chong, Carol Miller, Claire Tortorelli

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Long-Term Post-Fire Vegetation Recovery

www.nrfirescience.org/resource/20896

Many large fires have burned in recent decades across western North America, and this trend is projected to continue as conditions become warmer and drier. Recovery processes have been studied

more thoroughly 1-2 years post fire than in the longer term. Fuel and fire managers need better information on long-term post-fire ecosystem...

Author(s): Andrew T. Hudak, Leda N. Kobziar, Karen L. Riley

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

The Biggest Bang for the Buck: Cost-Effective Vegetation Treatment Outcomes Across Drylands of the Western USA

www.nrfirescience.org/resource/21607

Restoration and rehabilitation treatments that manipulate vegetation can be expensive to implement but are infrequently evaluated to determine whether spending more improves intended outcomes. We assessed commonly implemented vegetation treatments and costs relative to their outcomes across sagebrush shrublands and pinyon-juniper...

Author(s): Seth Munson, Ethan O. Yackulic, Lucas S. Bair, Stella M. Copeland, Kevin L. Gunnell

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Simulating the Effectiveness of Improvement Cuts and Commercial Thinning to Enhance Fire Resistance in West Coast Dry Mixed Conifer Forests

www.nrfirescience.org/resource/21176

Nine multipurpose silvicultural treatments, formulated as a synthesis of recently implemented prescriptions offered by forest managers, were simulated to evaluate their effectiveness at enhancing fire resistance. The Forest Vegetation Simulator was applied, within the BioSum Framework, on over 3,000 Forest Inventory and Analysis...

Author(s): Theresa B. Jain, Jeremy S. Fried, Sara Loreno

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Post-fire growth of seeded and planted big sagebrush - strategic designs for restoring Greater Sage-grouse nesting habitat

www.nrfirescience.org/resource/22320

Wildfires change plant community structure and impact wildlife habitat and population dynamics. Recent wildfire-induced losses of big sagebrush (*Artemisia tridentata*) in North American shrublands are outpacing natural recovery and leading to substantial losses in habitat for sagebrush-obligate species such as Greater Sage-grouse...

Author(s): David A. Pyke, Robert K. Shriver, Robert S. Arkle, David S. Pilliod, Cameron L. Aldridge, Peter S. Coates, Matthew J. Germino, Julie A. Heinrichs, Mark A. Ricca, Scott E. Shaff

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Effects of two emergency stabilization treatments on main soil properties four years after application in a severely burnt area

www.nrfirescience.org/resource/20814

In NW of the Iberian Peninsula, the incidence of anthropogenic fires is very high and, due to the climatologic and topographical conditions, burnt soils are prone to high erosion risks. In recent years several environmental management techniques (BAER: burnt area emergency response) have been applied after some wildfires, but there...

Author(s): María Fernandez-Fernandez, Serafín J. González-Prieto
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Fuel treatment effectiveness in the context of landform, vegetation, and large, wind-driven wildfires

www.nrfirescience.org/resource/21599

Large wildfires (>50,000 ha) are becoming increasingly common in semi-arid landscapes of the western United States. Although fuel reduction treatments are used to mitigate potential wildfire effects, they can be overwhelmed in wind-driven wildfire events with extreme fire behavior. We evaluated drivers of fire severity and...

Author(s): Susan J. Prichard, Nicholas A. Povak, Maureen C. Kennedy, David W. Peterson
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Response of planted sagebrush seedlings to cattle grazing applied to decrease fire probability

www.nrfirescience.org/resource/21960

Restoration of non-sprouting shrubs after wildfire is increasingly becoming a management priority. In the western U.S., Wyoming big sagebrush (*Artemisia tridentata* Nutt. ssp. *wyomingensis* Beetle & Young) restoration is a high priority, but sagebrush establishment from seed is sporadic. In contrast, planting seedlings often...

Author(s): Kirk W. Davies, Jonathan D. Bates, Chad S. Boyd
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Modelling the effect of accelerated forest management on long-term wildfire activity

www.nrfirescience.org/resource/21079

We integrated a widely used forest growth and management model, the Forest Vegetation Simulator, with the FSim large wildfire simulator to study how management policies affected future wildfire over 50 years on a 1.3 million ha study area comprised of a US national forest and adjacent lands. The model leverages decades of research...

Author(s): Alan A. Ager, Ana M. G. Barros, Rachel M. Houtman, Robert C. Seli, Michelle A. Day
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Exploring seedling-based aspen (*Populus tremuloides*) restoration near range limits in the Intermountain West, USA

www.nrfirescience.org/resource/22247

With the effects of climate change expected to intensify over the coming century, land managers will require more proactive and novel approaches to conserve and restore threatened ecosystems. In the US Intermountain West, quaking aspen (*Populus tremuloides* Michx.) is a foundation species of considerable conservation interest...

Author(s): Alexander A. Howe, Simon M. Landhäusser, Owen T. Burney, James N. Long, Randall D. Violett, Karen Mock
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Post-fire regeneration of endangered limber pine (*Pinus flexilis*) at the northern extent of its range

www.nrfirescience.org/resource/20787

Limber pine (*Pinus flexilis*), an understudied tree species important to montane and subalpine ecosystems, is listed as endangered in Alberta. Dispersal of seeds to newly disturbed, open areas by Clark's nutcracker (*Nucifraga columbiana*) is expected to facilitate post-disturbance establishment of limber pine. Prescribed burning has...

Author(s): Denyse A. Dawe, Vernon S. Peters, Michael D. Flannigan

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Development of post-fire vegetation response-ability model in grassland mountainous ecosystem using GIS and remote sensing

www.nrfirescience.org/resource/21458

The mountainous grassland ecosystem in Golden Gate National Park (South Africa) has post-fire ecological resilience. However, vegetation species composition and structure can alter when the ecosystem continually has uncontrolled fires. This study developed a vegetation response-ability model by integrating environmental factors (...)

Author(s): Efosa G. Adagbasa, Samuel A. Adelabu, Tom W. Okello

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Content analysis of resilience in forest fire science and management

www.nrfirescience.org/resource/21057

To better understand the implications of the word resilience for western forest and fire management, this study explores its emerging use in a large body of policy and management documents produced between 1980 and 2016. We performed a computer-aided content analysis on 1487 scientific journal articles and 139 western U.S. Forest...

Author(s): Owen A. Selles, Adena R. Rissman

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Impact of unburned remnant sagebrush versus outplants on post-fire landscape rehabilitation - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/22238

Nearly half of the vast sagebrush steppe in the western United States has lost many or nearly all native plant species, largely due to the interaction of invasive species and increased wildfire. Re-establishing sagebrush, a keystone component of these ecosystems, has become a management focus in recent decades using aerial broadcast...

Author(s): Cara Applestein, T. Trevor Caughlin, Matthew J. Germino

Year Published: 2020

Type: Document

Technical Report or White Paper

Protected area stewardship in the Anthropocene: integrating science, law, and ethics to evaluate proposals for ecological restoration in wilderness

www.nrfirescience.org/resource/20756

ePDFPDF PDF ?Tools ?Share Abstract Every year, the four federal agencies that manage designated wilderness in the United States receive proposals to implement small? and large?scale ecological restorations within the National Wilderness Preservation System. The combination of climate change with other landscape stressors is...

Author(s): Peter Landres, Beth Hahn, Eric Biber, Daniel T. Spencer

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Effects of fire on grassland soils and water: A review

www.nrfirescience.org/resource/21447

Grasslands occur on all of the continents. They collectively constitute the largest ecosystem in the world, making up 40.5% of the terrestrial land area, excluding Greenland and Antarctica. Grasslands are not entirely natural because they have formed and developed under natural and anthropogenic pressures. Their importance now is to...

Author(s): Daniel G. Neary, Jackson M. Leonard

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Elucidating and disseminating the role of fire mosses in post-fire ecosystem recovery - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/22544

The extent of severely burned landscapes are increasing in the Western US due to climate change and altered forest states. Directly after a wildfire, managers implement techniques to stabilize soils or harvest merchantable timber. Collaborating with land managers from the Colville National Forest in Northeastern Washington we built...

Author(s): Henry S. Grover, Matthew A. Bowker

Year Published: 2020

Type: Document

Technical Report or White Paper

Effect of a wildfire and of post-fire restoration actions in the organic matter structure in soil fractions

www.nrfirescience.org/resource/21792

The impact of wildfires and of restoration actions on soil organic matter (SOM) content and structure was studied in a soil under pine (*Pinus pinea*) from Doñana National Park (SW Spain). Samples were collected from burnt areas before (B) and after post-fire restoration (BR) and compared with an unburnt (UB) site. Analytical...

Author(s): Nicasio T. Jiménez-Morillo, Gonzalo Almendros, José M. de la Rosa, Antonio Jordán, Lorena M. Zavala, Arturo J. P. Granged, José A. González-Pérez

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Burn weather and three-dimensional fuel structure determine post-fire tree mortality

www.nrfirescience.org/resource/23037

Context: Post-fire tree mortality is a spatially structured process driven by interacting factors across multiple scales. However, empirical models of fire-caused tree mortality are generally not spatially explicit, do not differentiate among scales, and do not differentiate immediate from delayed mortality.

Objectives: We aimed to...

Author(s): Sean M.A. Jeronimo, James A. Lutz, Van R. Kane, Andrew J. Larson, Jerry F. Franklin

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Tackling Idaho's Cheatgrass Challenge: A Call-to-Action to Reduce Cheatgrass and Other Invasive Annual Grasses in Sagebrush Country

www.nrfirescience.org/resource/21035

Cheatgrass and other invasive annual grasses, such as medusahead and ventenata, are taking over America's sagebrush rangelands, increasing wildfire size and frequency, reducing forage productivity, and threatening wildlife habitat and rural economies. Efforts to control invasive annual grasses are too often done reactively where...

Year Published: 2020

Type: Document

Management or Planning Document

Effects of post-fire management on vegetation and fuels following successive wildfires in mixed conifer forests - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/22235

In the face of changing climatic regimes and increases in extreme fire events, many western forests are poised to burn, not only once but multiple times, sometimes in short succession. As such, land managers have limited opportunities to effectively alter post-fire vegetation and fuels to make them more resilient to future...

Author(s): Michelle Coppoletta, Brandon M. Collins, Scott H. Markwith, Kyle E. Merriam

Year Published: 2020

Type: Document

Technical Report or White Paper

Resiliency of native mixed-grass rangelands and crested wheatgrass pasture lands to spring wildfire

www.nrfirescience.org/resource/20707

Previous research has suggested that prescribed fire will become more necessary in the northern Great Plains of the United States as woody encroachment and invasive plant species cover increase. Prescribed fire will likely become a more frequent management strategy to mimic natural processes in grasslands-a combination of fire and...

Author(s): Katherine C. Kral-O'Brien, Kevin K. Sedivec, Benjamin A. Geaumont, Amanda L. Gearhart

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Vegetative and edaphic responses in a northern mixed conifer forest three decades after harvest and fire: Implications for regeneration and carbon and nitrogen pools

www.nrfirescience.org/resource/22505

Research Highlights: This experiment compares a range of combinations of harvest, prescribed fire, and wildfire. Leveraging a 30-year-old forest management-driven experiment, we explored the recovery of woody species composition, regeneration of the charismatic forest tree species *Larix occidentalis* Nutt., and vegetation and soil...

Author(s): R. Kasten Dumroese, Martin F. Jurgensen, Deborah S. Page-Dumroese

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Wildfire severity and postfire salvage harvest effects on long-term forest regeneration

www.nrfirescience.org/resource/21764

Following a wildfire, regeneration to forest can take decades to centuries and is no longer assured in many western U.S. environments given escalating wildfire severity and warming trends. After large fire years, managers prioritize where to allocate scarce planting resources, often with limited information on the factors that drive...

Author(s): Nicholas A. Povak, Derek J. Churchill, C. Alina Cansler, Paul F. Hessburg, Van R. Kane, Jonathan T. Kane, James A. Lutz, Andrew J. Larson

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Wildfire recovery as a “hot moment” for creating fire-adapted communities

www.nrfirescience.org/resource/21002

Recent decades have witnessed an escalation in the social, economic, and ecological impacts of wildfires worldwide. Wildfire losses stem from the complex interplay of social and ecological forces at multiple scales, including global climate change, regional wildfire regimes altered by human activities, and locally managed wildland-...

Author(s): Ronald L. Schumann, Miranda H. Mockrin, Alexandra D. Syphard, Joshua Whittaker, Owen F. Price, Cassandra Johnson-Gaither, Christopher T. Emrich, Van Butsic

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Resources for Postfire Response: Empowering Land Managers with New After Fire Toolkit

www.nrfirescience.org/resource/22202

To improve access and understanding of postfire resources, scientists with the Rocky Mountain Research Station and its partners have drawn on years of science/management collaboration to compile an online resource called the After Fire Toolkit and Information site. The After Fire Toolkit, which can be found at www.fs.usda.gov/rmrs/...

Author(s): Brian Cooke

Year Published: 2020

Type: Document

Research Brief or Fact Sheet

Ponderosa pine mortality in the Bob Marshall Wilderness after successive fires over 14 years

www.nrfirescience.org/resource/20676

Fire exclusion since the 1930s across western U.S. landscapes has greatly altered fire regimes and fuel conditions. After a lightning-caused fire swept through the center of the Bob Marshall Wilderness Area in 2003, researchers initiated a comprehensive study along the South Fork of the Flathead River. This study assessed the post-...

Author(s): Sarah Flanary, Robert E. Keane

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Sagebrush rangelands and greater sage-grouse in Northeastern California [Chapter 4.3]

www.nrfirescience.org/resource/22489

Sagebrush (*Artemisia* species) habitat, an intricate, species-rich mosaic of different sagebrush species and a remarkably diverse assemblage of grasses, forbs, and other shrubs, once covered about 170 million acres (69 million ha) across the Western United States (fig. 4.3.1). Noss et al. (1995) note that sagebrush habitat is an...

Author(s): R. Kasten Dumroese

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Ecosystem scale evapotranspiration and CO₂ exchange in a burned and unburned peatland: implications for the ecohydrological resilience of carbon stocks to wildfire

www.nrfirescience.org/resource/20969

Boreal peatlands represent a significant global store of soil carbon, which are subject to increasing natural and anthropogenic disturbance. Wildfire is the single largest disturbance to boreal forest and wetlands annually. Critical to the long-term carbon storage function in peatlands is the (re?) establishment of a near?...

Author(s): Matthew Q. Morison, Richard M. Petrone, Sophie L. Wilkinson, A. Green, James M.

Waddington

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Fine-scale fire patterns mediate forest structure in frequent-fire ecosystems

www.nrfirescience.org/resource/22108

In frequent-fire forests, wildland fire acts as a self-regulating process creating forest structures that consist of a fine-grained mosaic of isolated trees, tree groups of various sizes, and non-treed openings. Though the self-regulation of forest structure through repeated fires is acknowledged, few studies have...

Author(s): Scott M. Ritter, Chad M. Hoffman, Michael A. Battaglia, Camille Stevens-Rumann, William E. Mell

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Post-fire tree regeneration (or lack thereof) can change ecosystems

www.nrfirescience.org/resource/20639

This review is focused on tree seedling regeneration for several reasons. First, a high mortality event, like a high-severity wildfire, kills the mature trees needed to maintain forest cover. When fire-caused mortality is minimal, we are less concerned about tree regeneration, but a high severity fire creates the need for tree...

Author(s): Camille Stevens-Rumann, Penelope Morgan, Kimberley T. Davis, Kerry Kemp, Jarod Blades

Year Published: 2020

Type: Document

Synthesis

Persistent effects of fire severity on ponderosa pine regeneration niches and seedling growth

www.nrfirescience.org/resource/22387

Several recent studies have documented how fire severity affects the density and spatial patterns of tree regeneration in western North American ponderosa pine forests. However, less is known about the effects of fire severity on fine-scale tree regeneration niche attributes such as understory plant composition and cover, surface...

Author(s): Suzanne M. Owen, Carolyn Hull Sieg, Peter Z. Fule, Catherine A. Gehring, L. Scott Baggett, Jose M. Iniguez, Paula J. Fornwalt, Michael A. Battaglia
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Rethinking fire?adapted species in an altered fire regime

www.nrfirescience.org/resource/20919

Novel combinations of fire regime and forest type are emerging in areas affected by climate change, fire exclusion, and other stressors. Species interactions following wildfire in these areas are not well understood. In Sierra Nevada mixed-conifer forests, large patches of stand-replacing fire were once rare but are becoming...

Author(s): Carmen L. Tubbesing, Robert A. York, Scott L. Stephens, John J. Battles
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Climatic Controls on Post-fire Ponderosa Pine and Douglas-fir Regeneration and Growth

www.nrfirescience.org/resource/22100

Climate change is causing increased wildfire activity across the western US and creating post-fire conditions that are warmer and drier than they were in the past. Scientists and managers are concerned with the potential for post-fire tree recruitment failures in dry mixed-conifer forests. Tree seedlings are more sensitive to...

Author(s): Kimberley T. Davis, Lacey Hankin
Year Published: 2020
Type: Document
Research Brief or Fact Sheet

Can wildland fire management alter 21st-century subalpine fire patterns and forests in Grand Teton National Park?

www.nrfirescience.org/resource/21728

In subalpine forests of the western United States that historically experienced infrequent, high-severity fire, whether fire management can shape 21st-century fire regimes and forest dynamics to meet natural resource objectives is not known. Managed wildfire use (i.e., allowing lightning-ignited fires to burn when risk is low...

Author(s): Winslow D. Hansen, Diane Abendroth, Werner Rammer, Rupert Seidl, Monica G. Turner
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

What drives ponderosa pine regeneration following wildfire in the western United States?

www.nrfirescience.org/resource/20620

Ponderosa pine (*Pinus ponderosa* Lawson & C. Lawson) is a prominent tree species in forests of the western United States. Wildfire activity in ponderosa pine dominated or co-dominated forests has increased dramatically in recent decades, with these recent wildfires often burning in an uncharacteristic manner due to past land...

Author(s): Julie E. Korb, Paula J. Fornwalt, Camille Stevens-Rumann
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Climate and disturbance influence self-sustaining stand dynamics of aspen (*Populus tremuloides*) near its range margin

www.nrfirescience.org/resource/21230

Species that are primarily seral may form stable (self-sustaining) communities under certain disturbance regimes or environmental conditions, yet such populations may also be particularly vulnerable to ecological change. Aspen (*Populus* spp.) are generally considered seral throughout the Northern Hemisphere, including P...

Author(s): Douglas J. Shinneman, Susan K. McIlroy

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

What drives ponderosa pine regeneration following wildfire in the western United States?

www.nrfirescience.org/resource/20241

Ponderosa pine (*Pinus ponderosa* Lawson & C. Lawson) is a prominent tree species in forests of the western United States. Wildfire activity in ponderosa pine dominated or co-dominated forests has increased dramatically in recent decades, with these recent wildfires often burning in an uncharacteristic manner due to past land...

Author(s): Julie E. Korb, Paula J. Fornwalt, Camille Stevens-Rumann

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Guidelines for aspen restoration in Utah with applicability to the Intermountain West

www.nrfirescience.org/resource/19550

As highly productive and biologically diverse communities, healthy quaking aspen (*Populus tremuloides*; hereafter aspen) forests provide a wide range of ecosystem services across western North America. Western aspen decline during the last century has been attributed to several causes and their interactions, including altered fire...

Author(s): Stanley G. Kitchen, Patrick N. Behrens, Sherel Goodrich, Ashley Green, John Guyon, Mary H. O'Brien, David Tart

Year Published: 2019

Type: Document

Technical Report or White Paper

High fire disturbance in forests leads to longer recovery, but varies by forest type

www.nrfirescience.org/resource/20584

Across the world, millions of hectares of forest are burned by wildfires each year. Satellite remote sensing, particularly when used in time series, can describe complex disturbance-recovery processes, but is underutilized by ecologists. This study examines whether a greater disturbance magnitude equates to a longer recovery...

Author(s): Samuel Hislop, Simon D. Jones, Mariela Soto-Berelov, Andrew K. Skidmore, Andrew Haywood, Trung H. Nguyen

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

How big is enough? Vegetation structure impacts effective fuel treatment width and forest resiliency

www.nrfirescience.org/resource/19052

Fuel treatments are designed with multiple management goals, including improving suppression capacity and restoring the historical structure of dry forests. Fuelbreaks are a class of fuel treatment that remove fuels within a wide strip of land, with an overarching objective to reduce fire behavior and provide safe access for...

Author(s): Maureen C. Kennedy, Morris C. Johnson, Kendra Fallon, Deborah Mayer

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Rethinking resilience to wildfire

www.nrfirescience.org/resource/19928

Record-breaking fire seasons are becoming increasingly common worldwide, and large wildfires are having extraordinary impacts on people and property, despite years of investments to support social–ecological resilience to wildfires. This has prompted new calls for land management and policy reforms as current land and fire...

Author(s): Dave McWethy, Tania L. Schoennagel, Philip E. Higuera, Meg A. Krawchuk, Brian J. Harvey, Elizabeth C. Metcalf, Courtney Schultz, Carol Miller, Alexander L. Metcalf, Brian Buma, Arika Virapongse, Judith C. Kulig, Richard C. Stedman, Zakary Ratajczak, Cara R. Nelson, Crystal A. Kolden

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Use of landscape simulation modeling to quantify resilience for ecological applications

www.nrfirescience.org/resource/20184

Goals of fostering ecological resilience are increasingly used to guide U.S. public land management in the context of anthropogenic climate change and increasing landscape disturbances. There are, however, few operational means of assessing the resilience of a landscape or ecosystem. We present a method to evaluate resilience using...

Author(s): Robert E. Keane, Rachel A. Loehman, Lisa M. Holsinger, Donald A. Falk, Philip E. Higuera, Sharon M. Hood, Paul F. Hessburg

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Post-fire vegetation communities in western Colorado

www.nrfirescience.org/resource/20877

Wildfire is a cause of disturbance on public lands, and post-fire treatments often include broadcast seeding of native and non-native seeds. We collected vegetation data from an area burned by a wildfire in western Colorado in 2012 and, where available, compared pre- and post-fire data. We sought to determine how dominant plant...

Author(s): M Nikki Grant-Hoffman, James Dollerschell

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Past tree influence and prescribed fire exert strong controls on reassembly of mountain grasslands after tree removal

www.nrfirescience.org/resource/19484

Woody?plant encroachment represents a global threat to grasslands. Although the causes and consequences of this regime shift have received substantial attention, the processes that constrain reassembly of the grassland state remain poorly understood. We experimentally tested two potentially

important controls on reassembly, the...

Author(s): Charles B. Halpern, Joseph A. Antos, Shan Kothari, Annette M. Olson

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Resilience of a ponderosa pine plantation to a backfiring operation during a mid-summer wildfire

www.nrfirescience.org/resource/20544

The Mill Fire, which burned in north-western California during the summer of 2012, provided a unique research opportunity when firefighters implemented a backfiring operation to limit wildfire growth. This backfire was ignited and burned through research plots from a long-term study designed to determine the effects of tree density...

Author(s): Jainwei Zhang, Kaelyn A. Finley, Eric E. Knapp

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Origins of abrupt change? Postfire subalpine conifer regeneration declines nonlinearly with warming and drying

www.nrfirescience.org/resource/19044

Robust tree regeneration following high-severity wildfire is key to the resilience of subalpine and boreal forests, and 21st century climate could initiate abrupt change in forests if postfire temperature and soil moisture become less suitable for tree seedling establishment. Using two widespread conifer species, lodgepole pine (...)

Author(s): Winslow D. Hansen, Monica G. Turner

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Landscape and organismal factors affecting sagebrush-seedling transplant survival after megafire restoration

www.nrfirescience.org/resource/19921

Larger and more frequent disturbances are motivating efforts to accelerate recovery of foundational perennial species by focusing efforts into establishing island patches to sustain keystone species and facilitate recovery of the surrounding plant community. Evaluating the variability in abiotic and biotic factors that contribute to...

Author(s): Bill E. Davidson, Matthew J. Germino, Bryce A. Richardson, David M Barnard

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Impacts of successive wildfire on soil hydraulic properties: implications for debris flow hazards and system resilience

www.nrfirescience.org/resource/20177

Climate and land use changes have led to recent increases in fire size, severity, and/or frequency in many different geographic regions and ecozones. Most post-wildfire geomorphology studies focus on the impact of a single wildfire but changing wildfire regimes underscore the need to quantify the effects of repeated disturbance by...

Author(s): Luke A. McGuire, Ann M. Youberg

Year Published: 2019

Type: Document
Book or Chapter or Journal Article

Integrating anthropogenic factors into regional-scale species distribution models - a novel application in the imperiled sagebrush biome

www.nrfirescience.org/resource/20486

Species distribution models (SDMs) that rely on regional-scale environmental variables will play a key role in forecasting species occurrence in the face of climate change. However, in the Anthropocene, a number of local-scale anthropogenic variables, including wildfire history, land-use change, invasive species, and...

Author(s): Juan M. Requena-Mullor, Kaitlin C. Maguire, Douglas J. Shinneman, T. Trevor Caughlin

Year Published: 2019

Type: Document
Book or Chapter or Journal Article

Fire regime and ecosystem responses: adaptive forest management in a changing world (Part 2)

www.nrfirescience.org/resource/19869

Fire is an ecological factor in ecosystems around the world, made increasingly more critical by unprecedented shifts in climate and human population pressure. The knowledge gradually acquired on the subject is needed to improve fire behaviour understanding and to enhance fire management decision-making. This issue (Volume 28, issue...

Author(s): Daniel Moya, Giacomo Certini, Peter Z. Fule

Year Published: 2019

Type: Document
Book or Chapter or Journal Article

A physiological understanding of organismal responses to fire

www.nrfirescience.org/resource/19390

Devastation of both natural and human habitats due to wildfires is becoming an increasingly prevalent global issue. Fire-adapted and fire-prone regions, such as California and parts of Australia, are experiencing more frequent and increasingly destructive wildfires, accompanied by longer wildfire seasons. Further, wildfires are...

Author(s): Clare Stawski, Anna C. Doty

Year Published: 2019

Type: Document
Book or Chapter or Journal Article

Is fire “for the birds”? How two rare species influence fire management across the US

www.nrfirescience.org/resource/20165

The US Endangered Species Act has enabled species conservation but has differentially impacted fire management and rare bird conservation in the southern and western US. In the South, prescribed fire and restoration-based forest thinning are commonly used to conserve the endangered red-cockaded woodpecker (*Picoides borealis*; RCW...

Author(s): Scott L. Stephens, Leda N. Kobziar, Brandon M. Collins, Raymond J. Davis, Peter Z. Fule, William L. Gaines, Joseph L. Ganey, James M. Guldin, Paul F. Hessburg, J. Kevin Hiers, Serra Hoagland, John J. Keane, Ronald E. Masters, Ann E. McKellar, Warren G. Montague, Malcolm P. North, Thomas A. Spies

Year Published: 2019

Type: Document
Book or Chapter or Journal Article

Event-based integrated assessment of environmental variables and wildfire severity through Sentinel-2 data

www.nrfirescience.org/resource/20478

To optimize suppression, restoration, and prevention plans against wildfire, postfire assessment is a key input. Since little research has been carried out on applying Sentinel-2 imagery through an integrated approach to evaluate how environmental parameters affect fire severity, this work aims to fill this gap. A set of large...

Author(s): Juan Picos, Laura Alonso, Guillermo Bastos, Julia Armesto

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

The consequences of soil heating for prescribed fire use and fire restoration in the South - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/19729

Soil heating resulting from prescribed burning in the southern US has potential immediate and long-term impacts. Where fire is being restored to long-unburned sites, the duration and depth of soil heating may be substantial, affecting seed banks, soil carbon cycling, and root and rhizosphere systems with often severe repercussions...

Author(s): Leda N. Kobziar, J. Morgan Varner, Jesse K. Kreye, Michael G. Andreu, David R. Godwin

Year Published: 2019

Type: Document

Technical Report or White Paper

Peatland vegetation change and establishment of re-introduced Sphagnum moss after prescribed burning

www.nrfirescience.org/resource/19377

Fire, including prescribed burning, is common on peatlands globally and can affect vegetation, including peat-forming Sphagnum mosses, and affect ecosystem services. We monitored vegetation in different burn-age categories at three UK peatland sites over a 19-month period. Half of the plots had Sphagnum fragments added and their...

Author(s): Alice Noble, Sheila M. Palmer, David J. Glaves, Alistair Crowle, Joseph Holden

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Is fire “for the birds”? How two rare species influence fire management across the US

www.nrfirescience.org/resource/20125

The US Endangered Species Act has enabled species conservation but has differentially impacted fire management and rare bird conservation in the southern and western US. In the South, prescribed fire and restoration-based forest thinning are commonly used to conserve the endangered red-cockaded woodpecker (*Picoides borealis*; RCW...

Author(s): Scott L. Stephens, Leda N. Kobziar, Brandon M. Collins, Raymond J. Davis, Peter Z. Fule, William L. Gaines, Joseph L. Ganey, James M. Guldin, Paul F. Hessburg, J. Kevin Hiers, Serra Hoagland, John J. Keane, Ronald E. Masters, Ann E. McKellar, Warren G. Montague, Malcolm P.

North, Thomas A. Spies

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Impacts of growing?season climate on tree growth and post?fire regeneration in ponderosa pine and Douglas?fir forests

www.nrfirescience.org/resource/23032

We studied the impacts of climate variability on low?elevation forests in the U.S. northern Rocky Mountains by quantifying how post?fire tree regeneration and radial growth varied with growing?season climate. We reconstructed post?fire regeneration and radial growth rates of *Pinus ponderosa* and *Pseudotsuga menziesii* at 33...

Author(s): Lacey Hankin

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Post-fire management impact on natural forest regeneration through altered microsite conditions

www.nrfirescience.org/resource/20419

High severity stand-replacing wildfires can deeply affect forest ecosystems whose composition includes plant species lacking fire-related traits and specific adaptations. Land managers and policymakers need to be aware of the importance of properly managing these ecosystems, adopting post-disturbance interventions designed to reach...

Author(s): Enrico Marcolin, Raffaella Marzano, Alessandro Vitali, Matteo Garbarino, Emanuele Lingua

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Relationship between soil burn severity in forest fires measured in situ and through spectral indices of remote detection

www.nrfirescience.org/resource/19657

Forest fires in Galicia have become a serious environmental problem over the years. This is especially the case in the Pontevedra region, where in October 2017 large fires (>500 hectares) burned more than 15,000 Ha. In addition to the area burned being of relevance, it is also very important to know quickly and accurately the...

Author(s): Jose Antonio Sobrino, Rafael Llorens, Cristina Fernández, José M. Fernández-Alonso, José A. Vega

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Understanding ecological contexts for active reforestation following wildfires

www.nrfirescience.org/resource/19314

To forestall loss of ecological values associated with forests, land managers need to consider where and when to prioritize active reforestation following major disturbance events. To aid this decision-making process, we summarize recent research findings pertaining to the Sierra Nevada region of California, USA to identify contexts...

Author(s): Angela M. White, Jonathan Long

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Coupling wildfire spread and erosion models to quantify post-fire erosion before and after fuel treatments

www.nrfirescience.org/resource/20106

Wildfires are known to change post-fire watershed conditions such that hillslopes can become prone to increased erosion and sediment delivery. In this work, we coupled wildfire spread and erosion prediction modelling to assess the benefits of fuel reduction treatments in preventing soil runoff. The study was conducted in a 68,000-ha...

Author(s): Michele Salis, Liliana Del Giudice, Peter R. Robichaud, Alan A. Ager, Annalisa Canu, Pierpaolo Duce, Grazia Pellizzaro, Andrea Ventura, Fermin Alcasena-Urdiroz, Donatella Spano, Bachisio Arca

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Potential for post-fire recovery of Greater Sage-grouse habitat

www.nrfirescience.org/resource/20401

In the western United States, fire has become a significant concern in the management of big sagebrush (*Artemisia tridentata* Nutt.) ecosystems. This is due to large-scale increases in cover of the fire-prone invasive annual cheatgrass (*Bromus tectorum* L.) and, concurrently, concerns about declining quantity and quality of...

Author(s): Corinna Riginos, Thomas A. Monaco, Kari E. Veblen, Kevin L. Gunnell, Eric Thacker, David K. Dahlgren, Terry A. Messmer

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Alternative stable equilibria and critical thresholds created by fire regimes and plant responses in a fire-prone community

www.nrfirescience.org/resource/18816

Wildfire is a dominant disturbance in many ecosystems, and fire frequency and intensity are being altered as climates change. Through effects on mortality and regeneration, fire affects plant community composition, species richness, and carbon cycling. In some regions, changes to fire regimes could result in critical, non-...

Author(s): Adam D. Miller, Jonathan R. Thompson, Alan J. Tepley, Kristina J. Anderson-Teixeira

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

An assessment of fire refugia importance criteria ranked by land managers

www.nrfirescience.org/resource/19643

There is evidence that forest resiliency is declining in the western US due to recent increases in both areas burned by wildfire and the number of large fires. Fire refugia may increase forest resiliency; however, for land managers to incorporate fire refugia into their management plans, methods need to be developed to identify and...

Author(s): Anthony Martinez, Arjan J. H. Meddens, Crystal A. Kolden, Andrew T. Hudak

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Wildfire as a catalyst for hydrologic and geomorphic change

www.nrfirescience.org/resource/21241

Wildfire has been a constant presence on the Earth since at least the Silurian period, and is a landscape-scale catalyst that results in a step-change perturbation for hydrologic systems, which ripples across burned terrain, shaping the geomorphic legacy of watersheds. Specifically, wildfire alters

two key landscape properties: (1)...
Author(s): Francis K. Rengers
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Special Issue "Ecology and Restoration of Whitebark Pine"

www.nrfirescience.org/resource/20059

Whitebark pine (*Pinus albicaulis*) forests have been declining throughout their range in Western North America from the combined effects of mountain pine beetle (*Dendroctonus ponderosae*) outbreaks, fire exclusion policies, and the exotic disease white pine blister rust. Projected warming and drying trends in climate may exacerbate...

Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Contributions of fire refugia to resilient ponderosa pine and dry mixed-conifer forest landscapes

www.nrfirescience.org/resource/20352

Altered fire regimes can drive major and enduring compositional shifts or losses of forest ecosystems. In western North America, ponderosa pine and dry mixed-conifer forest types appear increasingly vulnerable to uncharacteristically extensive, high-severity wildfire. However, unburned or only lightly impacted forest stands that...

Author(s): Jonathan D. Coop, Timothy J. DeLory, William M. Downing, Sandra L. Haire, Meg A. Krawchuk, Carol Miller, Marc-Andre Parisien, Ryan B. Walker
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Tamm Review: Seedling-based ecology, management, and restoration in aspen (*Populus tremuloides*)

www.nrfirescience.org/resource/18788

Quaking or trembling aspen (*Populus tremuloides* Michx.) is a foundational tree species, which is native, common, and broadly distributed in North America. The ecology of aspen has been extensively studied throughout its range, but both research and forest management practices have focused primarily on its ability to regenerate...

Author(s): Simon M. Landhäusser, Bradley D. Pinno, Karen Mock
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Post-fire recruitment of Great Basin big sagebrush species: spatial and temporal controls along regional gradients of soil temperature and moisture - JFSP Final Report

www.nrfirescience.org/resource/19622

In sagebrush-dominated shrublands of western North America, warmer temperatures coupled with annual grass invasions are increasing the frequency and extent of wildfires. Postfire sagebrush recovery rates are unpredictable and many recent fires have resulted in the apparent loss of sagebrush habitat, resulting in a pressing need to...

Author(s): Alexandra K. Urza, Peter J. Weisberg, Jeanne C. Chambers, Stanley G. Kitchen, Bruce A. Roundy
Year Published: 2019
Type: Document

Book or Chapter or Journal Article

Short-interval fire erodes the resilience of subalpine lodgepole pine forests

www.nrfirescience.org/resource/21729

Subalpine forests in the northern Rocky Mountains have been resilient to stand-replacing fires that historically burned at 100- to 300-year intervals. Fire intervals are projected to decline drastically as climate warms, and forests that reburn before recovering from previous fire may lose their ability to rebound. We studied recent...

Author(s): Monica G. Turner, Kristin H. Braziunas, Winslow D. Hansen, Brian J. Harvey

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Climate, environment, and disturbance history govern resilience of western North American forests

www.nrfirescience.org/resource/20622

Before the advent of intensive forest management and fire suppression, western North American forests exhibited a naturally occurring resistance and resilience to wildfires and other disturbances. Resilience, which encompasses resistance, reflects the amount of disruption an ecosystem can withstand before its structure or...

Author(s): Paul F. Hessburg, Carol Miller, Sean A. Parks, Nicholas A. Povak, Alan H. Taylor, Philip E. Higuera, Susan J. Prichard, Malcolm P. North, Brandon M. Collins, Matthew D. Hurteau, Andrew J. Larson, Craig D. Allen, Scott L. Stephens, Hiram Rivera-Huerta, Camille Stevens-Rumann, Lori D. Daniels, Ze'ev Gedalof, Robert W. Gray, Van R. Kane, Derek J. Churchill, R. Keala Hagmann, Thomas A. Spies, C. Alina Cansler, R. Travis Belote, Thomas T. Veblen, Michael A. Battaglia, Chad M. Hoffman, Carl N. Skinner, Hugh Safford, R. Brion Salter

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Soil characteristics are associated with gradients of big sagebrush canopy structure after disturbance

www.nrfirescience.org/resource/21231

Reestablishing shrub canopy cover after disturbance in semi-arid ecosystems, such as sagebrush steppe, is essential to provide wildlife habitat and restore ecosystem functioning. While several studies have explored the effects of landscape and climate factors on the success or failure of sagebrush seeding, the influence of soil...

Author(s): David M Barnard, Matthew J. Germino, Robert S. Arkle, John Bradford, Michael C. Duniway, David S. Pilliod, David A. Pyke, Robert K. Shriver, Justin L. Welty

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Survival of Whitebark Pine Seedlings Grown from Direct Seeding: Implications for Regeneration and Restoration under Climate Change

www.nrfirescience.org/resource/20004

Whitebark pine populations are declining nearly range-wide, primarily from the exotic fungal pathogen that causes white pine blister rust (WPBR). Climate change is expected to exacerbate these declines by decreasing climatically suitable areas. Planting WPBR-resistant seedlings is a key restoration action, but it is costly, time...

Author(s): Elizabeth R. Pansing, Diana F. Tomback

Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Long-Term Vegetation Recovery and Invasive Annual Suppression in Native and Introduced Postfire Seeding Treatments

www.nrfirescience.org/resource/20244

Seed mixes used for postfire seeding in the Great Basin are often selected on the basis of short-term rehabilitation objectives, such as ability to rapidly establish and suppress invasive exotic annuals (e.g., cheatgrass, *Bromus tectorum* L.). Longer-term considerations are also important, including whether seeded plants persist,...

Author(s): Jeffrey E. Ott, Francis F. Kilkenny, Daniel D. Summers, Tyler W. Thompson

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Fuel dynamics after reintroduced fire in an old-growth Sierra Nevada mixed-conifer forest

www.nrfirescience.org/resource/19612

Background: Surface fuel loadings are some of the most important factors contributing to fire intensity and fire spread. In old-growth forests where fire has been long excluded, surface fuel loadings can be high and can include woody debris >100 cm in diameter. We assessed surface fuel loadings in a long-unburned old-growth mixed-...

Author(s): C. Alina Cansler, Mark E. Swanson, Tucker J. Furniss, Andrew J. Larson, James A. Lutz

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Post-fire wood mulch for reducing erosion potential increases tree seedlings with few impacts on understory plants and soil nitrogen

www.nrfirescience.org/resource/20585

Following high-severity wildfire, application of mulch on the soil surface is commonly used to stabilize slopes and limit soil erosion potential, protecting ecosystem values at risk. Despite the widespread use of mulch, relatively little is known about its effects on ecosystem recovery and soil processes important for plant re-...

Author(s): Jayne L. Jonas, Erin Berryman, Brett Wolk, Penelope Morgan, Peter R. Robichaud

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Near-future forest vulnerability to drought and fire varies across the western United States

www.nrfirescience.org/resource/19196

Recent prolonged droughts and catastrophic wildfires in the western United States have raised concerns about the potential for forest mortality to impact forest structure, forest ecosystem services, and the economic vitality of communities in the coming decades. We used the Community Land Model (CLM) to determine forest...

Author(s): Polly C. Buotte, Samuel Levis, Beverly E. Law, Tara W. Hudiburg, David E. Rupp, Jeffrey J. Kent

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Phenology patterns indicate recovery trajectories of ponderosa pine forests after high-severity fires

www.nrfirescience.org/resource/21202

Post-fire recovery trajectories in ponderosa pine (*Pinus ponderosa* Laws.) forests of the southwestern United States are increasingly shifting away from pre-burn vegetation communities. This study investigated whether phenological metrics derived from a multi-decade remotely sensed imagery time-series could differentiate among grass...

Author(s): Jessica J. Walker, Christopher E. Souldard

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Post-fire wood mulch for reducing erosion potential increases tree seedlings with few impacts on understory plants and soil nitrogen

www.nrfirescience.org/resource/20215

Following high-severity wildfire, application of mulch on the soil surface is commonly used to stabilize slopes and limit soil erosion potential, protecting ecosystem values at risk. Despite the widespread use of mulch, relatively little is known about its effects on ecosystem recovery and soil processes important for plant re...

Author(s): Jayne L. Jonas, Erin Berryman, Brett Wolk, Penelope Morgan, Peter R. Robichaud

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Science framework for conservation and restoration of the sagebrush biome: Linking the Department of the Interior's Integrated Rangeland Fire Management Strategy to long-term strategic conservation actions. Part 2. Management applications

www.nrfirescience.org/resource/19523

The Science Framework is intended to link the Department of the Interior's Integrated Rangeland Fire Management Strategy with long-term strategic conservation and restoration actions in the sagebrush biome. The focus is on sagebrush (*Artemisia* spp.) ecosystems and sagebrush dependent species with an emphasis on Greater sage-grouse...

Author(s): Michele R. Crist, Jeanne C. Chambers, Susan L. Phillips, Karen L. Prentice, Lief A. Wiechman

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Post-fire tree regeneration and fuels across the Northern Rockies following large wildfires: science meta-analyses, scenarios and manager workshops: Final Report to Joint Fire Science

www.nrfirescience.org/resource/20545

As more of the western US burns in large wildfires it is critical to managers and scientists to understand how these landscapes recovery post-fire. Tree regeneration in high severity burned landscapes determines if and how these landscapes become forested again, while changes in fuels structure influences how these landscapes may...

Author(s): Penelope Morgan, Camille Stevens-Rumann, Kerry Kemp, Jarod Blades

Year Published: 2019

Type: Document

Technical Report or White Paper

Could restoration of a landscape to a pre-European historical vegetation condition reduce burn probability?

www.nrfirescience.org/resource/19046

Montane regions throughout western North America have experienced increases in forest canopy closure and forest encroachment into grasslands over the past century; this has been attributed to climate change and fire suppression/exclusion. These changes threaten ecological values and potentially increase probabilities of intense...

Author(s): Christopher A. Stockdale, Neal McLoughlin, Michael D. Flannigan, Ellen Macdonald

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Stable or seral? Fire-driven alternative states in aspen forests of western North America

www.nrfirescience.org/resource/19924

As important centres for biological diversity, aspen forests are essential to the function and aesthetics of montane ecosystems in western North America. Aspen stands are maintained by a nuanced relationship with wildfire, although in recent decades aspen mortality has increased. The need to understand the baseline environmental...

Author(s): Jesse L. Morris, R. Justin DeRose, Thomas Brussel, Simon C. Brewer, Andrea R. Brunelle, James N. Long

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Resilience and fire management in the Anthropocene

www.nrfirescience.org/resource/20183

Fire management around the world is now undergoing extensive review, with a move toward fire management plans that maintain biodiversity and other ecosystems services, while at the same time mitigating the negative impacts to people and property. There is also increasing recognition of the historical and anthropogenic dimensions...

Author(s): Lindsey Gillson, Cathy L. Whitlock, Glynis Humphrey

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Integrating subjective and objective dimensions of resilience in fire-prone landscapes

www.nrfirescience.org/resource/19464

Resilience has become a common goal for science-based natural resource management, particularly in the context of changing climate and disturbance regimes. Integrating varying perspectives and definitions of resilience is a complex and often unrecognized challenge to applying resilience concepts to social-ecological systems (SEs)...

Author(s): Philip E. Higuera, Alexander L. Metcalf, Carol Miller, Brian Buma, Dave McWethy, Elizabeth C. Metcalf, Zak Ratjczak, Cara R. Nelson, Brian C. Chaffin, Richard C. Stedman, Sarah M. McCaffrey, Tania L. Schoennagel, Brian J. Harvey, Sharon M. Hood, Courtney Schultz, Anne E. Black, Dave Campbell, Julia H. Haggerty, Robert E. Keane, Meg A. Krawchuk, Judith C. Kulig, Rebekah Rafferty, Arika Virapongse

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Potential for post-fire recovery of Greater Sage-grouse habitat

www.nrfirescience.org/resource/20487

In the western United States, fire has become a significant concern in the management of big sagebrush (*Artemisia tridentata* Nutt.) ecosystems. This is due to large-scale increases in cover of the fire-prone invasive annual cheatgrass (*Bromus tectorum* L.) and, concurrently, concerns about declining quantity and quality of...

Author(s): Corinna Riginos, Thomas A. Monaco, Kari E. Veblen, Kevin L. Gunnell, Eric Thacker, David K. Dahlgren, Terry A. Messmer

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Can't see the random forest for the decision trees: selecting predictive models for restoration ecology

www.nrfirescience.org/resource/18952

Improving predictions of restoration outcomes is increasingly important to resource managers for accountability and adaptive management, yet there is limited guidance for selecting a predictive model from the multitude available. The goal of this paper was to identify an optimal predictive framework for restoration ecology using...

Author(s): David M Barnard, Matthew J. Germino, David S. Pilliod, Robert S. Arkle, Cara Applestein, Bill E. Davidson, Matthew R. Fisk

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Evaluating ecological resilience across wildfire suppression levels under climate and fuel treatment scenarios using landscape simulation modelling

www.nrfirescience.org/resource/19870

Continued suppression of wildfires may allow more biomass to accumulate to foster even more intense fires. Enlightened fire management involves explicitly determining concurrent levels of suppression, wildland fire use (allowing some fires to burn) and fuel treatments to manage landscapes for ecological resilience. This study used...

Author(s): Robert E. Keane, Kathy L. Gray, Brett Davis, Lisa M. Holsinger, Rachel A. Loehman

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Evidence of effectiveness in the Cohesive Strategy: measuring and improving wildfire response

www.nrfirescience.org/resource/19437

The United States' National Cohesive Wildfire Management Strategy aims to achieve greater social and ecological resilience to wildfire. It also raises the question: cohesive for whom and for what purpose? In this article, we address the wildfire response goal and what a cohesive response means. Namely, we define a cohesive response...

Author(s): Toddi A. Steelman, Branda Nowell

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Transient population dynamics impede restoration and may promote ecosystem transformation after disturbance

www.nrfirescience.org/resource/20172

The apparent failure of ecosystems to recover from increasingly widespread disturbance is a global

concern. Despite growing focus on factors inhibiting resilience and restoration, we still know very little about how demographic and population processes influence recovery. Using inverse and forward demographic modelling of 531 post...

Author(s): Robert K. Shriver, Caitlin M. Andrews, Robert S. Arkle, David M Barnard, Michael C. Duniway, Matthew J. Germino, David S. Pilliod, David A. Pyke, Justin L. Welty, John Bradford

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Post-fire soil erosion mitigation at the scale of swales using forest logging residues at a reduced application rate

www.nrfirescience.org/resource/20482

Mulching with forest residues has proved to be highly effective in reducing post-fire soil losses at the plot scale. However, its effectiveness has not been quantified at the application rates that are typically used in operational post-fire land management (2-3 Mg ha⁻¹ using straw), as well as at scales larger than 100 m²....

Author(s): Sergio A. Prats, Oscar González-Pelayo, Flávio C. Silva, K. J. Bokhorst, J. E. M. Baartman, Jan J. Keizer

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Operationalizing resilience and resistance concepts to address invasive grass-fire cycles

www.nrfirescience.org/resource/19846

Plant invasions can affect fuel characteristics, fire behavior, and fire regimes resulting in invasive plant-fire cycles and alternative, self-perpetuating states that can be difficult, if not impossible, to reverse. Concepts related to general resilience to disturbance and resistance to invasive plants provide the basis for...

Author(s): Jeanne C. Chambers, Matthew L. Brooks, Matthew J. Germino, Jeremy D. Maestas, David Board, Matthew O. Jones, Brady W. Allred

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Effect of moss crusts on mitigation of post-fire soil erosion

www.nrfirescience.org/resource/19387

Mosses and wildfires are ubiquitous occurrences. Their correlation has been assessed in few studies. Mosses have been pointed as pioneer species in post-fire environments. However, reasons for moss crusting in post-wildfire soils and their ecosystem role in preventing soil erosion have not been quantitatively assessed. Moss crusts...

Author(s): Flávio C. Silva, Diana C.S. Vieira, Els van der Spek, J. Jacob Keizer

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

How Much Forest Persists Through Fire? High-Resolution Mapping of Tree Cover to Characterize the Abundance and Spatial Pattern of Fire Refugia Across Mosaics of Burn Severity

www.nrfirescience.org/resource/20148

Wildfires in forest ecosystems produce landscape mosaics that include relatively unaffected areas, termed fire refugia. These patches of persistent forest cover can support fire-sensitive species and the

biotic legacies important for post-fire forest recovery, yet little is known about their abundance and distribution within fire...

Author(s): Ryan B. Walker, Jonathan D. Coop, William M. Downing, Meg A. Krawchuk, Sparkle L. Malone, Garrett W. Meigs

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Looking to the future: key points for sustainable management of northern Great Plains grasslands

www.nrfirescience.org/resource/20475

The grasslands of the northern Great Plains (NGP) region of North America are considered endangered ecosystems and priority conservation areas yet have great ecological and economic importance. Grasslands in the NGP are no longer self-regulating adaptive systems. The challenges to these grasslands are widespread and serious (e.g....

Author(s): Lora Perkins, Marissa A. Ahlering, Diane L. Larson

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Historical patterns of fire severity and forest structure and composition in a landscape structured by frequent large fires: Pumice Plateau ecoregion, Oregon, USA

www.nrfirescience.org/resource/19358

Context: Lack of quantitative observations of extent, frequency, and severity of large historical fires constrains awareness of departure of contemporary conditions from those that demonstrated resistance and resilience to frequent fire and recurring drought. Objectives: Compare historical and contemporary fire and forest...

Author(s): R. Keala Hagmann, Andrew G. Merschel, Matthew J. Reilly

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Group Resilience: The Place and Meaning of Relational Pauses

www.nrfirescience.org/resource/21265

Recent scholarship on resilience has shed light on the processes by which organizations absorb strain and maintain functioning in the face of adversity. These theories, however, often focus on the operational impacts of adversity without accounting for the strain it puts on organizational members and their abilities to work...

Author(s): Michelle Barton, William A. Kahn

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Lick Creek Demonstration-Research Forest: 25-Year Fire and Cutting Effects on Vegetation & Fuels - JFSP Final Report

www.nrfirescience.org/resource/20112

Fuels reduction treatments are common in ponderosa pine ecosystems of the interior western United States, but the long-term effects on many key ecosystem attributes remain poorly understood, including: tree growth and mortality; forest fuel loads; understory vegetation diversity and composition; production and distribution of...

Author(s): Christopher R. Keyes, Sharon M. Hood, Anna Sala, Duncan C. Lutes

Year Published: 2019
Type: Document
Technical Report or White Paper

Pre-fire vegetation drives post-fire outcomes in sagebrush ecosystems: evidence from field and remote sensing data

www.nrfirescience.org/resource/20404

Understanding the factors that influence vegetation responses to disturbance is important because vegetation is the foundation of food resources, wildlife habitat, and ecosystem properties and processes. We integrated vegetation cover data derived from field plots and remotely sensed Landsat images in two focal areas over a 37-yr...

Author(s): Brittany S. Barker, David S. Pilliod, Matthew Rigge, Collin Homer

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Seed Availability Does Not Ensure Regeneration in Northern Ecosystems of the Endangered Limber Pine

www.nrfirescience.org/resource/18865

When biotic interactions such as disease alter both the seed production capacity of stands, and seedling survivorship, the relative importance of seed availability versus substrate specificity may alter future regeneration opportunities for plant populations. Background and Objectives: We investigated the importance of disease...

Author(s): Vernon S. Peters, Darcy R. Visscher

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

The survival of Pinus ponderosa saplings subjected to increasing levels of fire behavior and impacts on post-fire growth

www.nrfirescience.org/resource/19648

Improved predictions of tree species mortality and growth metrics following fires are important to assess fire impacts on forest succession, and ultimately forest growth and yield. Recent studies have shown that North American conifers exhibit a 'toxicological dose-response' relationship between fire behavior and the resultant...

Author(s): Wade D. Steady, Raquel Partelli Feltrin, Daniel M. Johnson, Aaron M. Sparks, Crystal A. Kolden, Alan F. Talhelm, James A. Lutz, Luigi Boschetti, Andrew T. Hudak, Andrew S. Nelson, Alistair M. S. Smith

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Vegetation succession in an old-growth ponderosa pine forest following structural restoration with fire: implications for retreatment and maintenance - JFSP Final Report

www.nrfirescience.org/resource/19272

Stand changes brought on by fire exclusion have contributed to reduced resilience to wildfire in ponderosa pine forests throughout the western US. Growing recognition of how structural attributes influence resilience has led to interest in restoring more heterogeneous conditions once common in these forests, but key information...

Author(s): Eric E. Knapp, Alan H. Taylor, Michelle Coppoletta, Natalie Pawlikowski

Year Published: 2019

Type: Document
Technical Report or White Paper

Drivers of lodgepole pine recruitment across a gradient of bark beetle outbreak and wildfire in British Columbia

www.nrfirescience.org/resource/20390

Seedbanks are essential for forest resilience, and disturbance interactions could potentially modify seedbank availability, subsequent forest regeneration patterns, and successional trajectories. Regional mountain pine beetle outbreaks have altered forest structure and seedbanks in fire prone-landscapes across western North America...

Author(s): Anna C. Talucci, Kenneth P. Lertzman, Meg A. Krawchuk

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Climate will increasingly determine post-fire tree regeneration success in low-elevation forests, Northern Rockies, USA

www.nrfirescience.org/resource/18803

Climate change is expected to cause widespread shifts in the distribution and abundance of plant species through direct impacts on mortality, regeneration, and survival. At landscape scales, climate impacts will be strongly mediated by disturbances, such as wildfire, which catalyze shifts in species distributions through widespread...

Author(s): Kerry Kemp, Philip E. Higuera, Penelope Morgan, John T. Abatzoglou

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

How stakeholders structure their collaborations to anticipate and tackle the threat of mountain pine beetle in the Jasper–Hinton (Alberta, Canada) area

www.nrfirescience.org/resource/19628

The resilience of resource-based communities facing natural disturbances partly depends on the capacity of a wide diversity of stakeholders to share their expertise, articulate their efforts, and develop solutions that are both effective and equitable. Structural methods from network theory can be used to measure how efficiently and...

Author(s): Rodolphe Gonzalès, Lael Parrott

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Taking the pulse of debris flows: Extracting debris-flow dynamics from good vibrations in southern California and central Colorado

www.nrfirescience.org/resource/21234

The destructive nature of debris flows makes it difficult to quantify flow dynamics with direct instrumentation. For this reason, seismic sensors placed safely away from the flow path are often used to identify the timing and speed of debris flows. While seismic sensors have proven to be a valuable tool for event detection and early...

Author(s): A. Michel, Jason W. Kean, Joel B. Smith, Kate E. Allstadt, Jeffrey A. Coe

Year Published: 2019

Type: Document

Conference Proceedings

Seeding native species increases resistance to annual grass invasion following prescribed burning of semiarid woodlands

www.nrfirescience.org/resource/20049

Exotic grass invasions are often facilitated by disturbances, which provide opportunities for invasion by releasing pulses of resources available to invaders. Where disturbances such as prescribed fire are used as a management tool, there is a pressing need to identify ecosystem attributes associated with susceptibility to...

Author(s): Alexandra K. Urza, Peter J. Weisberg, Jeanne C. Chambers, David Board, Samuel W. Flake
Year Published: 2019

Type: Document

Book or Chapter or Journal Article

A system dynamics model examining alternative wildfire response policies

www.nrfirescience.org/resource/20284

In this paper, we develop a systems dynamics model of a coupled human and natural fire-prone system to evaluate changes in wildfire response policy. A primary motivation is exploring the implications of expanding the pace and scale of using wildfires as a forest restoration tool. We implement a model of a forested system composed of...

Author(s): Matthew P. Thompson, Yu Wei, Christopher J. Dunn, Christopher D. O'Connor
Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Fire regime and ecosystem responses: adaptive forest management in a changing world (Part 1)

www.nrfirescience.org/resource/19617

Although fire is an intrinsic factor in most terrestrial biomes, it is often perceived as a negative disturbance that must be suppressed. The application of successful fire prevention policies can lead to unsustainable fire events for ecosystems adapted to a specific fire regime. In addition, new climate and land use scenarios are...

Author(s): Daniel Moya, Giacomo Certini, Peter Z. Fule

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

The nature of the beast: examining climate adaptation options in forests with stand-replacing fire regimes

www.nrfirescience.org/resource/17221

Building resilience to natural disturbances is a key to managing forests for adaptation to climate change. To date, most climate adaptation guidance has focused on recommendations for frequent-fire forests, leaving few published guidelines for forests that naturally experience infrequent, stand-replacing wildfires. Because most...

Author(s): Joshua S. Halofsky, Daniel C. Donato, Jerry F. Franklin, Jessica E. Halofsky, David L. Peterson, Brian J. Harvey

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Fire regimes approaching historic norms reduce wildfire-facilitated conversion from forest to non-forest

www.nrfirescience.org/resource/19957

Extensive high-severity wildfires have driven major losses of ponderosa pine and mixed-conifer forests in the southwestern United States, in some settings catalyzing enduring conversions to non-forested vegetation types. Management interventions to reduce the probability of stand-replacing wildfire have included mechanical...

Author(s): Ryan B. Walker, Jonathan D. Coop, Sean A. Parks, Laura Trader

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Influence of past wildfires on wildfire effects in northern Rockies mixed-conifer forest - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/18251

Natural resource managers need to know how past wildfires influence the severity and ecological effects of subsequent wildfires in order to make informed decisions during and after wildfire events, and to effectively plan for the future. The overarching goals for this study were to quantify and compare the effects of single...

Author(s): Andrew J. Larson, R. Travis Belote

Year Published: 2018

Type: Document

Technical Report or White Paper

Pinus albicaulis Engelm. (Whitebark Pine) in Mixed-Species Stands throughout Its US Range: Broad-Scale Indicators of Extent and Recent Decline

www.nrfirescience.org/resource/17184

We used data collected from >1400 plots by a national forest inventory to quantify population-level indicators for a tree species of concern. Whitebark pine (*Pinus albicaulis*) has recently experienced high mortality throughout its US range, where we assessed the area of land with whitebark pine present, size-class distribution of...

Author(s): Sara Goeking, Deborah Kay Izlar

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Year in Review: Spotlight on 2017 Research by the Grassland, Shrubland and Desert Ecosystems Science Program

www.nrfirescience.org/resource/18044

In this issue of the GSD Update, we feature selected studies of the RMRS Grassland, Shrubland and Desert Ecosystems Science Program (GSD) that focus on the theme of fire. Significant results of recent research and science delivery by GSD scientists are highlighted. We feature program research that lines up with the strategic...

Year Published: 2018

Type: Document

Research Brief or Fact Sheet

Long-term effects of restoration fire and thinning on soil fungi, fine root biomass, and duff levels - Final report to the Joint Fire Science Program

www.nrfirescience.org/resource/17150

The proposed research will help managers understand how early soil ecosystem responses to fuel reduction treatments with prescribed fire may or may not be indicative of longer term responses. This research is necessary for better establishing, in forest management plans and decision documents, the ecosystem costs and benefits of...

Author(s): Jane E. Smith, Daniel L. Luoma, Robyn L. Darbyshire, James D. McIver, Andrew P. Youngblood
Year Published: 2018
Type: Document
Technical Report or White Paper

Growth response of whitebark pine (*Pinus albicaulis* Engelm) regeneration to thinning and prescribed burn treatments

www.nrfirescience.org/resource/17921

Whitebark pine (*Pinus albicaulis* Engelm.) forests play a prominent role throughout high-elevation ecosystems in the northern Rocky Mountains, however, they are vanishing from the high mountain landscape due to three factors: exotic white pine blister rust (*Cronartium ribicola* Fischer) invasions, mountain pine beetle (*Dendroctonus*...

Author(s): Molly L. Retzlaff, Robert E. Keane, David L.R. Affleck, Sharon M. Hood
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

A conservation paradox in the Great Basin—Altering sagebrush landscapes with fuel breaks to reduce habitat loss from wildfire

www.nrfirescience.org/resource/18949

Interactions between fire and nonnative, annual plant species (that is, “the grass/fire cycle”) represent one of the greatest threats to sagebrush (*Artemisia* spp.) ecosystems and associated wildlife, including the greater sage-grouse (*Centrocercus urophasianus*). In 2015, U.S. Department of the Interior called for a “science-...

Author(s): Douglas J. Shinneman, Cameron L. Aldridge, Peter S. Coates, Matthew J. Germino, David S. Pilliod, Nicole M. Vaillant
Year Published: 2018
Type: Document
Technical Report or White Paper

Abrupt change in ecological systems: diagnosis and inference

www.nrfirescience.org/resource/18420

Abrupt ecological changes occur rapidly relative to typical rates of ecosystem change and are increasingly observed in ecosystems worldwide, thereby challenging adaptive capacities. Abrupt ecological changes can arise from many processes, only some of which are transitions between alternative states. Focusing solely on the mean...

Author(s): Zak Ratjczak, S. R. Carpenter, A. R. Ives, Chris J. Kucharik, T. Ramiadantsoa, A. M. Stegner, J. Williams, J. Zhang, Monica G. Turner
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Predicting the future to save whitebark pine

www.nrfirescience.org/resource/17885

Whitebark pine (*Pinus albicaulis*) has been disappearing from high mountain landscapes due to mountain pine beetle outbreaks, white pine blister rust, human intrusions, and fire exclusion. It is currently a candidate species for listing under the endangered species act. In a recently published General Technical Report (RMRS-GTR-361...

Author(s): Rocky Mountain Research Station
Year Published: 2018

Type: Document
Research Brief or Fact Sheet

Thresholds and hotspots for shrub restoration following a heterogeneous megafire

www.nrfirescience.org/resource/18943

Context: Reestablishing foundational plant species through aerial seeding is an essential yet challenging step for restoring the vast semiarid landscapes impacted by plant invasions and wildfire-regime shifts. A key component of the challenge stems from landscape variability and its effects on plant recovery. Objectives: We...

Author(s): Matthew J. Germino, David M Barnard, Robert S. Arkle, David S. Pilliod, Matthew R. Fisk, Cara Applestein

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Forest management for novelty, persistence, and restoration influenced by policy and society

www.nrfirescience.org/resource/21056

The ecological literature offers many conflicting recommendations for how managers should respond to ecosystem change and novelty. We propose a framework in which forest managers may achieve desired forest characteristics by combining strategies for (1) restoring historical conditions, (2) maintaining current conditions, and (3)...

Author(s): Adena R. Rissman, Kevin D. Burke, Heather A. Kramer, Volker C. Radeloff, Paul R. Schilke, Owen A. Selles, Rachel H. Toczydlowski, Chloe B. Wardropper, Lori A. Barrow, Jennifer L. Chandler, Katelyn Geleynse, Andrew W. L'roe, Katherine M. Laushman, A. Lisa Schomaker

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Do Perennial Bunchgrasses Competitively Exclude Bromus tectorum in Post-Fire Rehabilitation? - JFSP Final Report

www.nrfirescience.org/resource/17720

Globally, wildfire size and frequency has increased in the last thirty years across numerous ecosystems. Models predict that trend to continue with increases in temperature and shifts in seasonal precipitation caused by climate change. In the western United States, these trends are exacerbated by invasive annual grasses that create...

Author(s): Eva K. Strand, Beth A. Newingham, Chris Bowman-Prideaux

Year Published: 2018

Type: Document

Technical Report or White Paper

Long-term effects of restoration fire and thinning on soil fungi, fine root biomass, and litter depth - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/16982

To increase ecosystem resiliency, and achieve the desired future condition of stands with large tree retention and low fuel loads, federal agencies have actively implemented a large number of fuel reduction and forest restoration projects in low-elevation dry conifer forests throughout the western United States. A noteworthy example...

Author(s): Jane E. Smith, Daniel L. Luoma, Benjamin T. N. Hart

Year Published: 2018

Type: Document

Technical Report or White Paper

Designer Niches Promote Seedling Survival in Forest Restoration: A 7-Year Study of Whitebark Pine (*Pinus albicaulis*) Seedlings in Waterton Lakes National Park

www.nrfirescience.org/resource/18872

Designer niches in which environmental variables are controlled are useful in forest restoration to enhance survival of planted tree seedlings. Here, we evaluate particular manipulated habitats, on site variables, and pre-seedling conditions hypothesized to improve the survival rate of whitebark pine (*Pinus albicaulis*) seedlings out...

Author(s): Cathy L. Cripps, Genoa Alger, Robert Sissons

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Influence of landscape structure, topography, and forest type on spatial variation in historical fire regimes, Central Oregon, USA

www.nrfirescience.org/resource/18317

Context: In the interior Northwest, debate over restoring mixed-conifer forests after a century of fire exclusion is hampered by poor understanding of the pattern and causes of spatial variation in historical fire regimes. Objectives: To identify the roles of topography, landscape structure, and forest type in driving spatial...

Author(s): Andrew G. Merschel, Emily K. Heyerdahl, Thomas A. Spies, Rachel A. Loehman

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Stocktype and Vegetative Competition Influences on *Pseudotsuga menziesii* and *Larix occidentalis* Seedling Establishment

www.nrfirescience.org/resource/17642

Douglas fir (*Pseudotsuga menziesii* var. *glauca* (Mayr) Franco), and western larch (*Larix occidentalis* Nutt.) are species of ecological and commercial importance that occur throughout the Western United States. Effective reforestation of these species relies on successful seedling establishment, which is affected by planting stock...

Author(s): Jeremiah R. Pinto, Bridget A. McNassar, Olga A. Kildisheva, Anthony S. Davis

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

U.S. Geological Survey Sage-Grouse and Sagebrush Ecosystem Research Annual Report for 2018

www.nrfirescience.org/resource/21258

The sagebrush (*Artemisia* spp.) ecosystem extends across a large portion of the Western United States, and the greater sage-grouse (*Centrocercus urophasianus*) is one of the iconic species of this ecosystem. Greater sage-grouse populations occur in 11 States and are dependent on relatively large expanses of sagebrush-dominated habitat...

Author(s): Steven E. Hanser

Year Published: 2018

Type: Document

Technical Report or White Paper

Fire refugia: What are they, and why do they matter for global change?

www.nrfirescience.org/resource/18303

Fire refugia are landscape elements that remain unburned or minimally affected by fire, thereby supporting postfire ecosystem function, biodiversity, and resilience to disturbances. Although fire refugia have been studied across continents, scales, and affected taxa, they have not been characterized systematically over space and...

Author(s): Arjan J. H. Meddens, Crystal A. Kolden, James A. Lutz, Alistair M. S. Smith, C. Alina Cansler, John T. Abatzoglou, Garrett W. Meigs, William M. Downing, Meg A. Krawchuk

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Large-scale restoration increases carbon stability under projected climate and wildfire regimes

www.nrfirescience.org/resource/17573

Changing climate and increasing area burned pose a challenge to forest carbon (C) storage, which is compounded by an elevated risk of high-severity wildfire due to long-term fire suppression in the western US. Restoration treatments that reduce tree density and reintroduce surface fire are effective at moderating fire effects...

Author(s): Shuang Liang, Matthew D. Hurteau, Anthony L. Westerling

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Fire resistance and regeneration characteristics of Northern Rockies tree species

www.nrfirescience.org/resource/18268

Wildfire is a common occurrence in the Northern Rockies and many tree species have adaptations to survive and regenerate after fire. The following information provides a general understanding of fire resistance and regeneration traits and strategies. This information is important for predicting how fire will impact trees in an area...

Author(s): Sharon M. Hood, Ilana L. Abrahamson, C. Alina Cansler

Year Published: 2018

Type: Document

Synthesis

Wildfires managed for restoration enhance ecological resilience

www.nrfirescience.org/resource/17222

Expanding the footprint of natural fire has been proposed as one potential solution to increase the pace of forest restoration programs in fire-adapted landscapes of the western USA. However, studies that examine the long-term socio-ecological trade-offs of expanding natural fire to reduce wildfire risk and create fire...

Author(s): Ana M. G. Barros, Alan A. Ager, Michelle A. Day, Meg A. Krawchuk, Thomas A. Spies

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Do post-fire fuel treatments and annual grasses interact to affect fire regimes in the Great Basin? - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/18252

Shifting climates and annual grass invasions have contributed to the increased number and size of fires in the western United States costing millions of dollars in fire suppression and post-fire rehabilitation. Post-fire rehabilitation implements fuel treatments, such as aerial and drill seeding, to control annual grass invasion and...

Author(s): Beth A. Newingham, Eva K. Strand
Year Published: 2018
Type: Document
Technical Report or White Paper

Cross-scale occupancy dynamics of a postfire specialist in response to variation across a fire regime

www.nrfirescience.org/resource/18083

Fire creates challenges and opportunities for wildlife through rapid destruction, modification and creation of habitat. Fire has spatially variable effects on landscapes; however, for species that benefit from the ephemeral resource patches created by fire, it is critical to understand characteristics of fires that promote postfire...

Author(s): Morgan W. Tingley, Andrew N. Stillman, Robert L. Wilkerson, Christine A. Howell, Sarah C. Sawyer, Rodney B. Siegel
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Interactions between large high-severity fires and salvage logging on a short return interval reduce the regrowth of fire-prone serotinous forests

www.nrfirescience.org/resource/17175

New fire disturbance regimes under accelerating global environmental change can have unprecedented consequences for ecosystem resilience, lessening ecosystem natural regeneration. In the Mediterranean Basin, fire-dependent obligate seeder forests that are prone to increasingly frequent stand-replacing fires and then salvaged logged...

Author(s): Angela Taboada, Víctor Fernández-García, Elena Marcos, Leonor Calvo
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Transitioning western U.S. dry forests to limited committed warming with bet-hedging and natural disturbances

www.nrfirescience.org/resource/17927

Historical evidence suggests natural disturbances could allow more forest persistence, than expected from models, over 40 yr of transition to the net-zero emissions needed to limit warming to <2.0°C (e.g., Paris Agreement). Forests must ultimately equilibrate with committed warming from accumulated emissions. Historical dry?...

Author(s): William L. Baker
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Drought, tree mortality, and wildfire in forests adapted to frequent fire

www.nrfirescience.org/resource/17144

Massive tree mortality has occurred rapidly in frequent-fire-adapted forests of the Sierra Nevada, California. This mortality is a product of acute drought compounded by the long-established removal of a key ecosystem process: frequent, low- to moderate-intensity fire. The recent tree mortality has many implications for the future...

Author(s): Scott L. Stephens, Brandon M. Collins, Christopher J. Fettig, Mark A. Finney, Chad M. Hoffman, Eric E. Knapp, Malcolm P. North, Hugh Safford, Rebecca Bewley Wayman
Year Published: 2018

Type: Document
Book or Chapter or Journal Article

Scorched earth: Suillus colonization of Pinus albicaulis seedlings planted in wildfire-impacted soil affects seedling biomass, foliar nutrient content, and isotope signatures

www.nrfirescience.org/resource/17895

In western North America ectomycorrhizal fungi are critical to establishment of conifers in low nitrogen soils. Fire can affect both ectomycorrhizal fungi and soil properties, and inoculation with ectomycorrhizal fungi is recommended when planting on burns for restoration. The aim of this study was to examine how Suillus species...

Author(s): Martha L. Jenkins, Cathy L. Cripps, Leslie Gains-Germain

Year Published: 2018

Type: Document
Book or Chapter or Journal Article

Insect communities in big sagebrush habitat are altered by wildfire and post-fire restoration seeding

www.nrfirescience.org/resource/18948

Natural resource managers sow grass, forb, and shrub seeds across millions of hectares of public lands in the western United States to restore sagebrush-steppe ecosystems burned by wildfire. The effects of post-fire vegetation treatments on insect communities in these ecosystems have not been investigated. We conducted the first...

Author(s): Ashley T. Rohde, David S. Pilliod, Stephen J. Novak

Year Published: 2018

Type: Document
Book or Chapter or Journal Article

Fire-induced deforestation in drought-prone Mediterranean forests: drivers and unknowns from leaves to communities

www.nrfirescience.org/resource/17750

Over the past 15 years, 3 million hectares of forests have been converted into shrublands or grasslands in the Mediterranean countries of the European Union. Fire and drought are the main drivers underlying this deforestation. Here we present a conceptual framework for the process of fire-induced deforestation based on the...

Author(s): Asaf Karavani, Matthias M. Boer, Mara Baudena, Carlos Colinas, Rubén Díaz-Sierra, Jesús Pemán, Martín de Luis, Álvaro Enríquez-de-Salamanca, Víctor Resco de Dios

Year Published: 2018

Type: Document
Book or Chapter or Journal Article

Monitoring Effectiveness of Forest Restoration Treatments: The Importance of Time and Space - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/16991

Fuel-reduction treatments have been used effectively in dry, fire-adapted forests to reduce risk of high-severity crown fire, but it is less certain if they achieve their ecosystem restoration objectives. To date, there has not been a comprehensive assessment of how the spatial and temporal dimensions of ecological assessments may...

Author(s): Jonathan D. Bakker, Charles B. Halpern, Richy J. Harrod, Lauren S. Urgenson, Allison K. Rossman, David W. Peterson

Year Published: 2018

Type: Document

Adapting management to a changing world: Warm temperatures, dry soil, and interannual variability limit restoration success of a dominant woody shrub in temperate drylands

www.nrfirescience.org/resource/18938

Restoration and rehabilitation of native vegetation in dryland ecosystems, which encompass over 40% of terrestrial ecosystems, is a common challenge that continues to grow as wildfire and biological invasions transform dryland plant communities. The difficulty in part stems from low and variable precipitation, combined with limited...

Author(s): Robert K. Shriver, Caitlin M. Andrews, David S. Pilliod, Robert S. Arkle, Justin L. Welty, Matthew J. Germino, Michael C. Duniway, David A. Pyke, John Bradford

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

It takes a few to tango: changing climate and fire regimes can cause regeneration failure of two subalpine conifers

www.nrfirescience.org/resource/18334

Environmental change is accelerating in the 21st century, but how multiple drivers may interact to alter forest resilience remains uncertain. In forests affected by large high-severity disturbances, tree regeneration is a resilience linchpin that shapes successional trajectories for decades. We modeled stands of two widespread...

Author(s): Winslow D. Hansen, Kristin H. Braziunas, Werner Rammer, Rupert Seidl, Monica G. Turner

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Limits to Ponderosa Pine Regeneration Following Large High-Severity Forest Fires in the United States Southwest

www.nrfirescience.org/resource/17687

High-severity fires in dry conifer forests of the United States Southwest have created large (>1000 ha) treeless areas that are unprecedented in the regional historical record. These fires have reset extensive portions of Southwestern ponderosa pine (*Pinus ponderosa* Lawson & C. Lawson var. *scopulorum* Engelm.) forest...

Author(s): Collin M. Haffey, Thomas D. Sisk, Craig D. Allen, Andrea E. Thode, Ellis Q. Margolis

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

The recovery of soil fungi following a fire

www.nrfirescience.org/resource/18315

Although burned trees are the most visible damage following a wildfire, a forest's soil can also be damaged. The heat generated by a wildfire can alter the soil's physical properties and kill the fungi and bacteria that are responsible for nutrient cycling and other ecosystem services. What isn't well understood is the extent...

Author(s): Andrea Watts, Jane E. Smith, Ariel D. Cowan, Ari A. Jumpponen

Year Published: 2018

Type: Document

Research Brief or Fact Sheet

Principles and practices for the restoration of ponderosa pine and dry mixed-conifer forests of the Colorado Front Range

www.nrfirescience.org/resource/16490

Wildfires have become larger and more severe over the past several decades on Colorado's Front Range, catalyzing greater investments in forest management intended to mitigate wildfire risks. The complex ecological, social, and political context of the Front Range, however, makes forest management challenging, especially where...

Author(s): Rob Addington, Gregory H. Aplet, Michael A. Battaglia, Jennifer S. Briggs, Peter M. Brown, Anthony S. Cheng, Yvette Dickinson, Jonas A. Feinstein, Kristen Pelz, Claudia Regan, Jim Thinnis, Rick Treux, Paula J. Fornwalt, Benjamin Gannon, Chad W. Julian, Jeffrey L. Underhill, Brett Wolk

Year Published: 2018

Type: Document

Technical Report or White Paper

Composition and Structure of Forest Fire Refugia: What Are the Ecosystem Legacies across Burned Landscapes?

www.nrfirescience.org/resource/17619

Locations within forest fires that remain unburned or burn at low severity—known as fire refugia—are important components of contemporary burn mosaics, but their composition and structure at regional scales are poorly understood. Focusing on recent, large wildfires across the US Pacific Northwest (Oregon and Washington), our...

Author(s): Garrett W. Meigs, Meg A. Krawchuk

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Drought and fire in the western USA: Is climate attribution enough?

www.nrfirescience.org/resource/21257

Purpose of Review: I sought to review the contributions of recent literature and prior foundational papers to our understanding of drought and fire. In this review, I summarize recent literature on drought and fire in the western USA and discuss research directions that may increase the utility of that body of work for twenty-first...

Author(s): Jeremy S. Littell

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Do Mixed Fire Regimes Shape Plant Flammability and Post-Fire Recovery Strategies?

www.nrfirescience.org/resource/18301

The development of frameworks for better-understanding ecological syndromes and putative evolutionary strategies of plant adaptation to fire has recently received a flurry of attention, including a new model hypothesizing that plants have diverged into three different plant flammability strategies due to natural selection. We...

Author(s): Helen M. Poulos, Andrew M. Barton, Jasper A. Slingsby, David M. J. S. Bowman

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Prescribed Fire in Grassland Butterfly Habitat: Targeting Weather and Fuel Conditions to Reduce Soil Temperatures and Burn Severity

www.nrfirescience.org/resource/17497

Prescribed burning is a primary tool for habitat restoration and management in fire-adapted grasslands. Concerns about detrimental effects of burning on butterfly populations, however, can inhibit implementation of treatments. Burning in cool and humid conditions is likely to result in lowered soil temperatures and to produce...

Author(s): Kathryn C. Hill, Jonathan D. Bakker, Peter W. Dunwiddie

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Not just about the trees: Key role of mosaic-meadows in restoration of ponderosa pine ecosystems

www.nrfirescience.org/resource/16726

Historical pre-settlement conditions in ponderosa pine ecosystems ranged from savannas (< 30% canopy cover) with contiguous grasslands and scattered tree groups, to forests with isolated mosaic-meadows surrounded by trees. We use the term mosaic-meadows for non-treed areas that weave around individual trees and tree groups,...

Author(s): Megan Matonis, Dan Binkley

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Fuel dynamics after a bark beetle outbreak impacts experimental fuel treatments

www.nrfirescience.org/resource/18779

Background: Fuel reduction treatments have been widely implemented across the western US in recent decades for both fire protection and restoration. Although research has demonstrated that combined thinning and burning effectively reduces crown fire potential in the few years immediately following treatment, little research has...

Author(s): Justin S. Crotteau, Christopher R. Keyes, Sharon M. Hood, David L.R. Affleck, Anna Sala

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Vegetation succession in post-fire seeding treatments - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/18258

Seed mixes used for post-fire seeding in the Great Basin are often selected based on short-term rehabilitation objectives, such as ability to rapidly establish and suppress invasive exotic annuals that drive altered fire-regimes via fine build-up (e.g. cheatgrass, *Bromus tectorum* L.), but longer-term considerations are also...

Author(s): Francis F. Kilkenney, Jeffrey E. Ott, Daniel D. Summers, Tyler W. Thompson

Year Published: 2018

Type: Document

Technical Report or White Paper

Land surveys show regional variability of historical fire regimes and structure of dry forests of the western USA

www.nrfirescience.org/resource/16421

An understanding of how historical fire and structure in dry forests (ponderosa pine, dry mixed conifer) varied across the western USA remains incomplete. Yet, fire strongly affects ecosystem services, and forest restoration programs are underway. We used General Land Office survey reconstructions from the late-1800s across 11...

Author(s): William L. Baker, Mark A. Williams
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Short-term ecological consequences of collaborative restoration treatments in ponderosa pine forests of Colorado

www.nrfirescience.org/resource/15484

Ecological restoration treatments are being implemented at an increasing rate in ponderosa pine and other dry conifer forests across the western United States, via the USDA Forest Service's Collaborative Forest Landscape Restoration (CFLR) program. In this program, collaborative stakeholder groups work with National Forests (NFs)...

Author(s): Jennifer S. Briggs, Paula J. Fornwalt, Jonas A. Feinsein
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

Examining the social acceptability of forest biomass harvesting and utilization from collaborative forest landscape restoration: A case study from western Colorado, USA

www.nrfirescience.org/resource/16587

Collaborative efforts have expanded in recent years to reduce fuel loads and restore the resilience of forest landscapes to future fires. The social acceptability of harvesting and using forest biomass associated with these programs are a hot topic, with questions about the extent to which collaboration can generate unified...

Author(s): Jessica M. Western, Anthony S. Cheng, Nathaniel Anderson, Pamela Motley
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

Visions of restoration in fire-adapted forest landscapes: lessons from the collaborative forest landscape restoration program

www.nrfirescience.org/resource/15086

Collaborative approaches to natural resource management are becoming increasingly common on public lands. Negotiating a shared vision for desired conditions is a fundamental task of collaboration and serves as a foundation for developing management objectives and monitoring strategies. We explore the complex socio-ecological...

Author(s): Lauren S. Urgenson, Clare M. Ryan, Charles B. Halpern, Jonathan D. Bakker, R. Travis Belote, Jerry F. Franklin, Ryan D. Haugo, Cara R. Nelson, Amy E. M. Waltz
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

Disturbances catalyze the adaptation of forest ecosystems to changing climate conditions

www.nrfirescience.org/resource/16855

The rates of anthropogenic climate change substantially exceed those at which forest ecosystems – dominated by immobile, long-lived organisms – are able to adapt. The resulting maladaptation of forests has potentially detrimental effects on ecosystem functioning. Furthermore, as many forest-dwelling species are highly dependent...

Author(s): Dominik Thom, Werner Rammer, Rupert Seidl
Year Published: 2017
Type: Document

Book or Chapter or Journal Article

Using landscape genetics simulations for planting blister rust resistant whitebark pine in the US northern Rocky Mountains

www.nrfirescience.org/resource/16568

Recent population declines to the high elevation western North America foundation species whitebark pine, have been driven by the synergistic effects of the invasive blister rust pathogen, mountain pine beetle (MPB), fire exclusion, and climate change. This has led to consideration for listing whitebark pine (WBP) as a threatened or...

Author(s): Erin L. Landguth, Zachary A. Holden, M. F. Mahalovich, Samuel A. Cushman

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Spatially explicit measurements of forest structure and fire behavior following restoration treatments in dry forests

www.nrfirescience.org/resource/15044

Restoration treatments in dry forests of the western US often attempt silvicultural practices to restore the historical characteristics of forest structure and fire behavior. However, it is suggested that a reliance on non-spatial metrics of forest stand structure, along with the use of wildland fire behavior models that lack the...

Author(s): J. Ziegler, Chad M. Hoffman, Michael A. Battaglia, William E. Mell

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

GSD Update: Year in Review: Spotlight on 2016 Research by the Grassland, Shrubland and Desert Ecosystems Science Program

www.nrfirescience.org/resource/16548

In this issue of the GSD Update, we take a look back at selected studies of the Grassland, Shrubland and Desert Ecosystems Science Program (GSD) that depict its strengths and focus areas. Significant results of recent research and science delivery by GSD scientists are highlighted. We feature program research that lines up with the...

Author(s): Deborah M. Finch

Year Published: 2017

Type: Document

Management or Planning Document

Climate drives episodic conifer establishment after fire in dry ponderosa pine forests of the Colorado Front Range, USA

www.nrfirescience.org/resource/19438

In recent years, warming climate and increased fire activity have raised concern about post-fire recovery of western U.S. forests. We assessed relationships between climate variability and tree establishment after fire in dry ponderosa pine forests of the Colorado Front Range. We harvested and aged over 400 post-fire juvenile...

Author(s): Monica T. Rother, Thomas T. Veblen

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Spatial patterns of ponderosa pine regeneration in high-severity burn patches

www.nrfirescience.org/resource/16541

Contemporary wildfires in southwestern US ponderosa pine forests can leave uncharacteristically large patches of tree mortality, raising concerns about the lack of seed-producing trees, which can prevent or significantly delay ponderosa pine regeneration. We established 4-ha plots in high-severity burn patches in two Arizona...

Author(s): Suzanne M. Owen, Carolyn Hull Sieg, Andrew Sanchez Meador, Peter Z. Fule, Jose M. Iniguez, Scott L. Baggett, Paula J. Fornwalt, Michael A. Battaglia

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Targeted woodland removal to recover at-risk grouse and their sagebrush-steppe and prairie ecosystems

www.nrfirescience.org/resource/14924

In this paper, we summarize key findings from a special issue of the journal Rangeland Ecology & Management examining socioecological aspects of woodland expansion and management actions to address this threat in sagebrush and prairie ecosystems. We highlight species and ecosystem outcomes that may result from recent...

Author(s): Richard F. Miller, David E. Naugle, Jeremy D. Maestas, Christian A. Hagen, Galon Hall

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Restoring Sage-Grouse Habitat after Fire: Success of Different Restoration Methods across an Elevation Gradient - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/17006

Greater sage-grouse (*Centrocercus urophasianus*) are threatened by a continued loss of sagebrush (*Artemisia* spp.) habitat. Recent, large scale wildfires have elevated the risk to sage-grouse as it may take up to several decades to more than a century for naturally recovery of sage-grouse habitat (i.e. reestablishment of sagebrush)....

Author(s): Kirk W. Davies, Matthew Madsen, Chad S. Boyd, Michael A. Gregg, April Hulet, Urban Strachan

Year Published: 2017

Type: Document

Technical Report or White Paper

Climate adaption and post-fire restoration of a foundational perennial in cold desert: Insights from intraspecific variation in response to weather

www.nrfirescience.org/resource/16523

1) The loss of foundational but fire-intolerant perennials such as sagebrush due to increases in fire size and frequency in semi-arid regions has motivated efforts to restore them, often with mixed or even no success. Seeds of sagebrush *Artemisia tridentata* and related species must be moved considerable distances from seed source to...

Author(s): Martha M. Brabec, Matthew J. Germino, Bryce A. Richardson

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

***Artemisia tridentata* subsp. *vaseyana* (mountain big sagebrush)**

www.nrfirescience.org/resource/16200

Mountain big sagebrush is a widely distributed shrub native to the western United States. Mountain big sagebrush ecosystems support hundreds of plant and animal species, including several sagebrush obligates. The distribution of mountain big sagebrush has been reduced since European-American settlement, and is likely to be further...

Author(s): Robin J. Innes

Year Published: 2017

Type: Document

Synthesis

Post-fire vegetation response at the woodland-shrubland interface is mediated by the pre-fire community

www.nrfirescience.org/resource/16496

Understanding the drivers of ecosystem responses to disturbance is essential for management aimed at maintaining or restoring ecosystem processes and services, especially where invasive species respond strongly to disturbance. In this study, we used repeat vegetation surveys from a network of prescribed fire treatments at the...

Author(s): Alexandra K. Urza, Peter J. Weisberg, Jeanne C. Chambers, Jessica M. Dhaemers, David Board

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Seed Production Estimation for Mountain Big Sagebrush (*Artemisia tridentata* ssp. *vaseyana*)

www.nrfirescience.org/resource/16095

Seed production is an essential component of post disturbance recovery for mountain big sagebrush (*Artemisia tridentata* Nutt. ssp. *vaseyana* [Rydb] Beetle; MBS). We tested a method for rapid estimation of MBS seed production using measurements of inflorescence morphology. We measured total stem length, stem length from first branchlet...

Author(s): Melissa L. Landeen, Loreen Allphen, Stanley G. Kitchen, Stephen L. Petersen

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Quaking aspen in the Northern Rockies: retention and restoration

www.nrfirescience.org/resource/15373

Specific objectives of this review are to address the current status and future outlook of aspen across a range of ecosystems in the US Northern Rockies. Specifically, we aim to answer the following questions: Is aspen declining in the Northern Rockies, and if so what are the underlying causes? Where should aspen...

Author(s): Camille Stevens-Rumann, Penelope Morgan, Eva K. Strand, Diane Abendroth

Year Published: 2017

Type: Document

Synthesis

Fire regimes of ponderosa pine communities in the Black Hills and surrounding areas

www.nrfirescience.org/resource/16433

Wildfire is an important disturbance in ponderosa pine communities in the Black Hills and surrounding areas. Effective management of these communities requires an understanding of historical fire regimes. This review provides a synthesis of the available scientific literature on historical patterns and contemporary changes in fuels...

Author(s): Shannon K. Murphy

Year Published: 2017

Type: Document

Synthesis

Fire history and fire-climate interactions in high elevation whitebark pine dominated forest

www.nrfirescience.org/resource/15767

The objectives of this study were to identify whitebark pine fire-climate interactions, and tree establishment and mortality patterns in a landscape context. Specific objectives were to : 1) develop a whitebark pine tree-ring chronology to date fire scar samples and reconstruct climate from tree rings; 2) identify fire climate...

Author(s): Alan H. Taylor, Catherine Airey Lauvaux

Year Published: 2017

Type: Document

Technical Report or White Paper

Selecting Control Sites for Post-Fire Ecological Studies Using Biological Criteria and MODIS Time Series Data

www.nrfirescience.org/resource/16737

Wildland fires play a key role in the functioning and structure of vegetation. The availability of sensors aboard satellites, such as Moderate Resolution Imaging Spectroradiometer (MODIS), makes possible the construction of a time series of vegetation indices (VI) and the monitoring of post-fire vegetation recovery. One of the...

Author(s): Marcos A. Landi, Carlos Di Bella, Silvia Ojeda, Paola Salvatierra, Juan Argañaraz, Laura M. Bellis

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Science framework for conservation and restoration of the sagebrush biome: Linking the Department of the Interior's Integrated Rangeland Fire Management Strategy to long-term strategic conservation actions

www.nrfirescience.org/resource/15201

The Science Framework is intended to link the Department of the Interior's Integrated Rangeland Fire Management Strategy with long-term strategic conservation actions in the sagebrush biome. The Science Framework provides a multiscale approach for prioritizing areas for management and determining effective management strategies...

Author(s): Jeanne C. Chambers, Jeffrey L. Beck, John Bradford, Jared Bybee, Steven B. Campbell, John Carlson, Thomas J. Christiansen, Karen J. Clause, Gail Collins, Michele R. Crist, Jonathan B. Dinkins, Kevin E. Doherty, Fred Edwards, Shawn Espinosa, Kathleen A. Griffin, Paul Griffin, Jessica R. Haas, Steven E. Hanser, Douglas W. Havlina, Kenneth F. Henke, Jacob D. Hennig, Linda A. Joyce, Francis F. Kilkenny, Sarah M. Kulpa, Laurie L. Kurth, Jeremy D. Maestas, Mary Manning, Kenneth E. Mayer, Brian A. Meador, Clinton McCarthy, Michael L. Pellant, Marco A. Perea, Karen L. Prentice, David A. Pyke, Lief A. Wiechman, Amarina Wuenschel

Year Published: 2017

Type: Document

Technical Report or White Paper

Mountain big sagebrush - Fire ecology and management

www.nrfirescience.org/resource/15648

Nearly half of the area occupied by sagebrush (*Artemisia* spp.) ecosystems before European-American settlement has been lost due to conversion to other land cover types, and agriculture, urbanization, and

industrial development. Thus, conservation and proper management of these ecosystems has been a priority, especially following the...

Author(s): Robin J. Innes

Year Published: 2017

Type: Document

Research Brief or Fact Sheet

Populus tremuloides seedling establishment: An underexplored vector for forest type conversion after multiple disturbances

www.nrfirescience.org/resource/16697

Ecosystem resilience to climate change is contingent on post-disturbance plant regeneration. Sparse gymnosperm regeneration has been documented in subalpine forests following recent wildfires and compounded disturbances, both of which are increasing. In the US Intermountain West, this may cause a shift to non-forest in some areas,...

Author(s): Nathan S. Gill, Florencia Sangermano, Brian Buma, Dominik Kulakowski

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Using an agent-based model to examine forest management outcomes in a fire-prone landscape in Oregon, USA

www.nrfirescience.org/resource/15133

Fire-prone landscapes present many challenges for both managers and policy makers in developing adaptive behaviors and institutions. We used a coupled human and natural systems framework and an agent-based landscape model to examine how alternative management scenarios affect fire and ecosystem services metrics in a fire-prone...

Author(s): Thomas A. Spies, Eric M. White, Alan A. Ager, Jeffrey D. Kline, John P. Bolte, Emily K. Platt, Keith A. Olsen, Robert J. Pabst, Ana M. G. Barros, John D. Bailey, Susan Charnley, Jennifer Koch, Michelle M. Steen-Adams, Peter H. Singleton, James Sulzman, Cynthia Schwartz, Blair Csuti

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Pando's lessons: restoration of a giant aspen clone

www.nrfirescience.org/resource/16378

A 106 acre (43 ha) aspen clone lives in the Fishlake National Forest in south-central Utah. Clones are comprised of multiple aspen stems, called ramets, which are genetically identical. This particular colony of ramets was named "Pando" (Latin for "I spread") by researchers believing it to be the largest living organism on...

Year Published: 2017

Type: Document

Research Brief or Fact Sheet

Fire Severity and Regeneration Strategy Influence Shrub Patch Size and Structure Following Disturbance

www.nrfirescience.org/resource/17204

Climate change is increasing the frequency and extent of high-severity disturbance, with potential to alter vegetation community composition and structure in environments sensitive to tipping points between alternative states. Shrub species display a range of characteristics that promote resistance and resilience to disturbance, and...

Author(s): Jesse Minor, Donald A. Falk, Greg A. Barron-Gafford

Year Published: 2017
Type: Document
Book or Chapter or Journal Article

Economic opportunities and trade-offs in collaborative forest landscape restoration

www.nrfirescience.org/resource/16574

We modeled forest restoration scenarios to examine socioeconomic and ecological trade-offs associated with alternative prioritization scenarios. The study examined four US national forests designated as priorities for investments to restore fire resiliency and generate economic opportunities to support local industry. We were...

Author(s): Alan A. Ager, Kevin C. Vogler, Michelle A. Day, John D. Bailey

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Adapting fuel treatments in a changing climate - Prescribed fire, mechanical treatments, wildfire, and restoration

www.nrfirescience.org/resource/15075

The Available Science Assessment Project (ASAP) leads, EcoAdapt and Oregon State University's Institute for Natural Resources, hosted a workshop during the International Association of Wildland Fire's 5th Fire Behavior and Fuels Conference, in cooperation with the Northwest Fire Science Consortium and the Northern Rockies...

Author(s): Corey L. Gucker

Year Published: 2017

Type: Document

Research Brief or Fact Sheet

Radial and stand-level thinning treatments: 15-year growth response of legacy ponderosa and Jeffrey pine trees

www.nrfirescience.org/resource/16563

Restoration efforts to improve vigor of large, old trees and decrease risk to high-intensity wildland fire and drought-mediated insect mortality often include reductions in stand density. We examined 15-year growth response of old ponderosa pine (*Pinus ponderosa*) and Jeffrey pine (*Pinus jeffreyi*) trees in northeastern California, U....

Author(s): Sharon M. Hood, Danny R. Cluck, Bobette E. Jones, Sean Pinnell

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Do Post-Fire Mulching Treatments Affect Regeneration in Serotinous Lodgepole Pine?

www.nrfirescience.org/resource/16336

Broadcast mulching is a widely implemented post-fire erosion control method, although it remains uncertain how it affects post-fire regeneration in serotinous conifers. We used field data and unbiased conditional inference trees with random effects to test if mulching affects lodgepole pine (*Pinus contorta* Dougl. ex Loud. var....

Author(s): Micah Wright, Monique E. Rocca

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Pretreatment tree dominance and conifer removal treatments affect plant succession in sagebrush communities

www.nrfirescience.org/resource/16547

In sagebrush (*Artemisia tridentata* Nutt.) ecosystems, expansion and infilling of conifers decreases the abundance of understory perennial vegetation and lowers ecosystem resilience and resistance of the once shrub grass ? dominated state. We prescribed burned or cut juniper (*Juniperus* spp. L.) and pinyon (*Pinus* spp. L.) trees at...

Author(s): Rachel E. Williams, Bruce A. Roundy, April Hulet, Richard F. Miller, Robin J. Tausch, Jeanne C. Chambers, Jeffrey Matthews, Robert Schooley, Dennis Eggett

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Restoration of the iconic Pando aspen clone: emerging evidence of recovery

www.nrfirescience.org/resource/14933

Quaking aspen (*Populus tremuloides* Michx.) is being stressed across the America West from a variety of sources including drought, herbivory, fire suppression, development, and past management practices. Rich assemblages of plants and animals that utilize aspen forests, as well as economic values of tourism, grazing, hunting,...

Author(s): Paul C. Rogers, Jody A. Gale

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Do Fuel Treatments Restore Ecosystem Function? Water Use Efficiency Before and After Fire Suppression and Fuels Treatments in Fire-Prone Pine Forests in the Western United States - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/17013

This project had three objectives. The first objective was to identify variation in discrimination of $\delta^{13}C$ and intrinsic water use efficiency (iWUE) in Ponderosa pine (*Pinus ponderosa*) tree rings from 1800 to 2012 at two Fire and Fire Surrogate study sites (Arizona, Washington). The sites are both dominated by ponderosa pine but...

Author(s): Alan H. Taylor, Soumaya Belmecheri, Lucas B. Harris

Year Published: 2017

Type: Document

Technical Report or White Paper

Evaluating future success of whitebark pine ecosystem restoration under climate change using simulation modeling

www.nrfirescience.org/resource/16535

Major declines of whitebark pine forests throughout western North America from the combined effects of mountain pine beetle (*Dendroctonus ponderosae*) outbreaks, fire exclusion policies, and the exotic disease white pine blister rust (WPBR) have spurred many restoration actions. However, projected future warming and drying may...

Author(s): Robert E. Keane, Lisa M. Holsinger, M. F. Mahalovich, Diana F. Tomback

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Disturbance and productivity interactions mediate stability of forest composition and structure

www.nrfirescience.org/resource/16499

Fire is returning to many conifer-dominated forests where species composition and structure have been altered by fire exclusion. Ecological effects of these fires are influenced strongly by the degree of forest change during the fire-free period. Response of fire-adapted species assemblages to extended fire-free intervals is highly...

Author(s): Christopher D. O'Connor, Donald A. Falk, Ann M. Lynch, Thomas W. Swetnam, Craig P. Wilcox

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Understanding mountain big sagebrush seed production variability

www.nrfirescience.org/resource/16089

Big sagebrush does not root or crown sprout but relies entirely on seed for regeneration. The soil seed bank in sagebrush communities is short-lived, with most seeds germinating within one year of dispersal (Ziegenhagen and Miller 2009). Therefore, recovery following disturbance is dependent on regular replenishment of the seed bank...

Author(s): Stanley G. Kitchen, Melissa L. Landeen, Loreen Allphen, Stephen L. Petersen

Year Published: 2017

Type: Document

Research Brief or Fact Sheet

Restoring whitebark pine ecosystems in the face of climate change

www.nrfirescience.org/resource/16423

Whitebark pine (*Pinus albicaulis*) forests have been declining throughout their range in western North America from the combined effects of mountain pine beetle (*Dendroctonus ponderosae*) outbreaks, fire exclusion policies, and the exotic disease white pine blister rust (*Cronartium ribicola*). Projected warming and drying trends in...

Author(s): Robert E. Keane, Lisa M. Holsinger, M. F. Mahalovich, Diana F. Tomback

Year Published: 2017

Type: Document

Technical Report or White Paper

Montana Climate Assessment VIGNETTE: forest Management and a Changing Climate with Diana Six

www.nrfirescience.org/resource/15727

Diana Six has been studying pine bark beetles for 25 years, and still can't say she completely understands them. Lately, she's been diving into a topic she has always found even more confounding - forest management. This article describes an interview with Six that describes forest resilience in face of climate change.

Year Published: 2017

Type: Document

Research Brief or Fact Sheet

Spatiotemporal dynamics of simulated wildfire, forest management, and forest succession in central Oregon, USA

www.nrfirescience.org/resource/15134

We use the simulation model Envision to analyze long-term wildfire dynamics and the effects of different fuel management scenarios in central Oregon, USA. We simulated a 50-year future where fuel management activities were increased by doubling and tripling the current area treated while retaining existing treatment strategies in...

Author(s): Ana M. G. Barros, Alan A. Ager, Michelle A. Day, Haiganoush K. Preisler, Thomas A. Spies,

Eric M. White, Robert J. Pabst, Keith A. Olsen, Emily K. Platt, John D. Bailey, John P. Bolte
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

A 20-year reassessment of the health and status of whitebark pine forests in the Bob Marshall Wilderness Complex, Montana

www.nrfirescience.org/resource/14676

Whitebark pine plays a prominent role in high elevation ecosystems of the northern Rocky Mountains. It is an important food source for many birds and mammals as well as an essential component of watershed stabilization. Whitebark pine is vanishing from the landscape due to three main factors: white pine blister rust, mountain pine...

Author(s): Signe B. Leirfallom, Robert E. Keane, Molly L. Retzlaff
Year Published: 2016
Type: Document
Technical Report or White Paper

Scanning the future of wildfire: resilience ahead...whether we like it or not?

www.nrfirescience.org/resource/13911

The field of so-called "futures research" provides researchers and stakeholders in a given subject area or system a way to map out and plan for alternate possible scenarios of the future. A recent research project supported by the Joint Fire Science Program brought together futures researchers and wildfire specialists to...

Author(s): Rachel Clark
Year Published: 2016
Type: Document
Research Brief or Fact Sheet

Whitebark Pine Friendly Ski Area Certification Program launches this fall at Whitefish Mountain, Montana

www.nrfirescience.org/resource/14622

Where do most of the general public encounter whitebark pines? Ski areas! These recreational areas in high elevations allow many to encounter an otherwise remote and wilderness species. This accessibility of whitebark pines at ski areas serves as the motivation behind the Whitebark Pine Ecosystem Foundation's...

Author(s): Edie Dooley
Year Published: 2016
Type: Document
Research Brief or Fact Sheet

Searching for resilience: addressing the impacts of changing disturbance regimes on forest ecosystem services

www.nrfirescience.org/resource/13898

The provisioning of ecosystem services to society is increasingly under pressure from global change. Changing disturbance regimes are of particular concern in this context due to their high potential impact on ecosystem structure, function and composition. Resilience-based stewardship is advocated to address these changes in...

Author(s): Rupert Seidl, Thomas A. Spies, David L. Peterson, Scott L. Stephens, Jeffrey A. Hicke
Year Published: 2016
Type: Document
Book or Chapter or Journal Article, Synthesis

Production possibility frontiers and socioecological tradeoffs for restoration of fire adapted forests

www.nrfirescience.org/resource/14464

We used spatial optimization to analyze alternative restoration scenarios and quantify tradeoffs for a large, multifaceted restoration program to restore resiliency to forest landscapes in the western US. We specifically examined tradeoffs between provisional ecosystem services, fire protection, and the amelioration of key...

Author(s): Alan A. Ager, Michelle A. Day, Kevin C. Vogler

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

Using resilience and resistance concepts to manage threats to sagebrush ecosystems, Gunnison sage-grouse, and Greater sage-grouse in their eastern range: a strategic multi-scale approach

www.nrfirescience.org/resource/14967

This report provides a strategic approach developed by a Western Association of Fish and Wildlife Agencies interagency working group for conservation of sagebrush ecosystems, Greater sage-grouse, and Gunnison sage-grouse. It uses information on (1) factors that influence sagebrush ecosystem resilience to disturbance and resistance...

Author(s): Jeanne C. Chambers, Jeffrey L. Beck, Steven B. Campbell, John Carlson, Thomas J. Christiansen, Karen J. Clause, Jonathan B. Dinkins, Douglas W. Havlina, Kevin E. Doherty, Kathleen A. Griffin, Douglas W. Havlina, Kenneth F. Henke, Jacob D. Hennig, Laurie L. Kurth, Jeremy D. Maestas, Mary Manning, Kenneth E. Mayer, Brian A. Meador, Clinton McCarthy, Marco A. Perea, David A. Pyke

Year Published: 2016

Type: Document

Technical Report or White Paper

Recreating forests of the past isn't enough to fix our wildfire problems

www.nrfirescience.org/resource/16310

There is general agreement that America's landscapes, certainly its wildlands, are out of whack with their fires. Wildfires are bigger, hotter, more savage and more expensive than in the past. There is wide agreement, too, that America's deeper fire problem is not that malignant megafires are crashing into our communities....

Author(s): Stephen Pyne

Year Published: 2016

Type: Document

Research Brief or Fact Sheet

Assessing the effectiveness of spatially heterogeneous fuels reduction restoration treatments - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/17044

In response to increasing wildfire severity and extent across the dry forests of the western United States in the last several decades, federal policy initiatives have encouraged joint vegetation management and fuels treatments to restore ecosystem composition, structure and function and reduce the potential for extreme fire...

Author(s): Chad M. Hoffman, Michael A. Battaglia, Tony S. Cheng, Yvette Dickinson, Frederick W. Smith

Year Published: 2016

Type: Document

Integrating theory into disturbance interaction experiments to better inform ecosystem management

www.nrfirescience.org/resource/14322

Managing multiple, interacting disturbances is a key challenge to biodiversity conservation, and one that will only increase as global change drivers continue to alter disturbance regimes. Theoretical studies have highlighted the importance of a mechanistic understanding of stressor interactions for improving the prediction and...

Author(s): Claire N. Foster, Chloe F. Sato, David B. Lindenmayer, Philip S. Barton

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

Changing disturbance regimes, climate warming and forest resilience

www.nrfirescience.org/resource/16807

Ecological memory is central to how ecosystems respond to disturbance and is maintained by two types of legacies – information and material. Species life-history traits represent an adaptive response to disturbance and are an information legacy; in contrast, the abiotic and biotic structures (such as seeds or nutrients) produced...

Author(s): Jill F. Johnstone, Craig D. Allen, Jerry F. Franklin, Lee E. Frelich, Brian J. Harvey, Philip E. Higuera, Michelle Mack, Ross K. Meentemeyer, Margaret R. Metz, George L.W. Perry, Tania L. Schoennagel, Monica G. Turner

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

U.S. federal fire and forest policy: emphasizing resilience in dry forests

www.nrfirescience.org/resource/14844

Current U.S. forest fire policy emphasizes short-term outcomes versus long-term goals. This perspective drives managers to focus on the protection of high-valued resources, whether ecosystem-based or developed infrastructure, at the expense of forest resilience. Given these current and future challenges posed by wildland fire and...

Author(s): Scott L. Stephens, Brandon M. Collins, Eric Biber, Peter Z. Fule

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

Management impacts on carbon dynamics in a Sierra Nevada mixed conifer forest

www.nrfirescience.org/resource/14230

Forest ecosystems can act as sinks of carbon and thus mitigate anthropogenic carbon emissions. When forests are actively managed, treatments can alter forests carbon dynamics, reducing their sink strength and switching them from sinks to sources of carbon. These effects are generally characterized by fast temporal dynamics. Hence...

Author(s): Sabina Dore, Danny L. Fry, Brandon M. Collins, Rodrigo Vargas, Robert A. York, Scott L. Stephens

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

Assessing landscape vulnerability to wildfire in the USA

www.nrfirescience.org/resource/14806

Wildfire is an ever present, natural process shaping landscapes. Having the ability to accurately measure and predict wildfire occurrence and impacts to ecosystem goods and services, both retrospectively and prospectively, is critical for adaptive management of landscapes. Landscape vulnerability is a concept widely utilized in the...

Author(s): Nicole M. Vaillant, Crystal A. Kolden, Alistair M. S. Smith

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

A 350-million-year legacy of fire adaptation among conifers

www.nrfirescience.org/resource/14017

Current phylogenetic evidence shows that fire began shaping the evolution of land plants 125 Ma, although the fossil charcoal record indicates that fire has a much longer history (>350 Ma). Serotiny (on-plant seed storage) is generally accepted as an adaptation to fire among woody plants. We developed a conceptual model of the...

Author(s): Tianhua He, Claire M. Belcher, Byron B. Lamont, Sim L. Lim

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

U.S. wildfire governance as social-ecological problem

www.nrfirescience.org/resource/14736

There are fundamental spatial and temporal disconnects between the specific policies that have been crafted to address our wildfire challenges. The biophysical changes in fuels, wildfire behavior, and climate have created a new set of conditions for which our wildfire governance system is poorly suited to address. To address these...

Author(s): Toddi A. Steelman

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

Is 'resilience' maladaptive? Towards an accurate lexicon for climate change adaptation

www.nrfirescience.org/resource/16876

Climate change adaptation is a rapidly evolving field in conservation biology and includes a range of strategies from resisting to actively directing change on the landscape. The term 'climate change resilience,' frequently used to characterize adaptation strategies, deserves closer scrutiny because it is ambiguous, often...

Author(s): Nicholas A. Fisichelli, Gregor W. Schuurman, Cat Hawkins Hoffman

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

Tamm Review: Management of mixed-severity fire regime forests in Oregon, Washington, and Northern California

www.nrfirescience.org/resource/13976

Increasingly, objectives for forests with moderate- or mixed-severity fire regimes are to restore successional diversity landscapes that are resistant and resilient to current and future stressors. Maintaining native species and characteristic processes requires this successional diversity, but methods to achieve it are poorly...

Author(s): Paul F. Hessburg, Thomas A. Spies, David A. Perry, Carl N. Skinner, Alan H. Taylor, Peter M. Brown, Scott L. Stephens, Andrew J. Larson, Derek J. Churchill, Nicholas A. Povak, Peter H. Singleton, Brenda McComb, William J. Zielinski, Brandon M. Collins, R. Brion Salter, Jerry F. Franklin, Gregg M. Riegel
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Yellowstone fire history and fire ecology - Insights 27 years after the 1988 fires

www.nrfirescience.org/resource/14651

In 1988, fires burned 36% (about 800,000 acres) of Yellowstone National Park (YNP). At the time, the size and severity of these fires was greater than scientists and land managers were used to and they were attributed to excessive fuel loadings that were a result of past fire suppression. However, fire history and fire ecology...

Author(s): Corey L. Gucker
Year Published: 2016
Type: Document
Research Brief or Fact Sheet

Employing resilience in the United States Forest Service

www.nrfirescience.org/resource/13901

The concept of resilience has permeated the discourse of many land use and environmental agencies in an attempt to articulate how to develop and implement policies concerned with the social and ecological dimensions of natural disturbances. Several distinct definitions of resilience exist, each with its own concepts, focus and...

Author(s): Cassandra Moseley, R. Patrick Bixler, Christopher Bone, Kirsten Vinyeta
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Fire regimes of Northern Rocky Mountain ponderosa pine communities

www.nrfirescience.org/resource/14602

Hundreds of articles are published about wildland fires in Northern Rocky Mountain ponderosa pine communities. The author of this FEIS synthesis reviewed over 300 publications on historical and contemporary fuel loads, stand structure, and fire regimes in ponderosa pine communities. Most studies found that prior to fire exclusion,...

Author(s): Janet L. Fryer
Year Published: 2016
Type: Document
Synthesis, Technical Report or White Paper

A review of precipitation and temperature control on seedling emergence and establishment for ponderosa and lodgepole pine forest regeneration

www.nrfirescience.org/resource/14995

The persistence of ponderosa pine and lodgepole pine forests in the 21st century depends to a large extent on how seedling emergence and establishment are influenced by driving climate and environmental variables, which largely govern forest regeneration. We surveyed the literature, and identified 96 publications that reported data...

Author(s): M. D. Petrie, A. M. Wildeman, John Bradford, Robert M. Hubbard, William Lauenroth
Year Published: 2016
Type: Document

Book or Chapter or Journal Article, Synthesis

Trajectories and resilience of stand structure in response to variable disturbance severities in northern hardwoods

www.nrfirescience.org/resource/16836

In late successional forests, stand development processes are often more easily monitored and are more closely related to key ecological parameters when using structural criteria rather than stand age or time since stand-replacing disturbance. In this paper, the effects of various disturbance regimes on long-term structural change...

Author(s): Corey R. Halpin, Craig G. Lorimer

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

Tamm Review: Are fuel treatments effective at achieving ecological and social objectives? A systematic review

www.nrfirescience.org/resource/14425

The prevailing paradigm in the western U.S. is that the increase in stand-replacing wildfires in historically frequent-fire dry forests is due to unnatural fuel loads that have resulted from management activities including fire suppression, logging, and grazing, combined with more severe drought conditions and increasing...

Author(s): Elizabeth L. Kalies, Larissa L. Yocom Kent

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

High and dry: post-fire tree seedling establishment in subalpine forests decreases with post-fire drought and large stand-replacing burn patches

www.nrfirescience.org/resource/18412

Aim Climate warming and increased wildfire activity are hypothesized to catalyse biogeographical shifts, reducing the resilience of fire-prone forests world-wide. Two key mechanisms underpinning hypotheses are: (1) reduced seed availability in large stand-replacing burn patches, and (2) reduced seedling establishment/survival...

Author(s): Brian J. Harvey, Daniel C. Donato, Monica G. Turner

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

Community structure, biodiversity, and ecosystem services in treeline whitebark pine communities: Potential impacts from a non-native pathogen

www.nrfirescience.org/resource/14358

Whitebark pine (*Pinus albicaulis*) has the largest and most northerly distribution of any white pine (Subgenus *Strobus*) in North America, encompassing 18° latitude and 21° longitude in western mountains. Within this broad range, however, whitebark pine occurs within a narrow elevational zone, including upper subalpine and treeline...

Author(s): Diana F. Tomback, Lynn M. Resler, Robert E. Keane, Elizabeth R. Pansing, Andrew J. Andrade, Aaron C. Wagner

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

Wildland fire: nature's fuel treatment

www.nrfirescience.org/resource/14887

Every year wildland fires affect much more acreage in the United States compared to controlled burns. Like controlled burns, wildland fire can help promote biological diversity and healthy ecosystems. But despite these facts, wildland fire is not often considered as a fuel treatment in the United States.

Scientists working with the...

Author(s): Brian Cooke

Year Published: 2016

Type: Document

Research Brief or Fact Sheet

Fortifying the forest: thinning and burning increase resistance to a bark beetle outbreak and promote forest resilience

www.nrfirescience.org/resource/14810

Fire frequency in low-elevation coniferous forests in western North America has greatly declined since the late 1800s. In many areas, this has increased tree density and the proportion of shade-tolerant species, reduced resource availability, and increased forest susceptibility to forest insect pests and high-severity wildfire. In...

Author(s): Sharon M. Hood, Stephen P. Baker, Anna Sala

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

Regeneration of lower-montane forests a quarter-century after the 1988 Yellowstone fires: a fire-catalyzed shift in lower treelines?

www.nrfirescience.org/resource/16885

Forests near the lower limit of montane tree cover are expected to be particularly vulnerable to warming climate, potentially converting to non-forest for prolonged periods if affected by canopy-removing disturbances. Such disturbance-catalyzed shifts are by nature stochastic, offering few opportunities to test these predictions. We...

Author(s): Daniel C. Donato, Brian J. Harvey, Monica G. Turner

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

Changing disturbance regimes, ecological memory, and forest resilience

www.nrfirescience.org/resource/14800

Ecological memory is central to how ecosystems respond to disturbance and is maintained by two types of legacies – information and material. Species life-history traits represent an adaptive response to disturbance and are an information legacy; in contrast, the abiotic and biotic structures (such as seeds or nutrients) produced...

Author(s): Jill F. Johnstone, Craig D. Allen, Jerry F. Franklin, Lee E. Frelich, Brian J. Harvey, Philip E. Higuera, Michelle Mack, Ross K. Meentemeyer, Margaret R. Metz, George L.W. Perry, Tania L. Schoennagel, Monica G. Turner

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

Fire severity and cumulative disturbance effects in the post-mountain pine beetle lodgepole pine forests of the Pole Creek Fire

www.nrfirescience.org/resource/14007

Recent large scale mountain pine beetle (*Dendroctonus ponderosae* Hopkins, MPB) outbreaks have created concern regarding increased fuel loadings and exacerbated fire behavior and have prompted a desire to understand the effects of sequential disturbances on the landscape. However, previous research has focused on quantifying fuel...

Author(s): Michelle Agne, Travis J. Woolley, Stephen A. Fitzgerald

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

The integrated rangeland fire management strategy actionable science plan

www.nrfirescience.org/resource/14697

The Integrated Rangeland Fire Management Strategy (hereafter Strategy, DOI 2015) outlined the need for coordinated, science-based adaptive management to achieve long-term protection, conservation, and restoration of the sagebrush (*Artemisia* spp.) ecosystem. A key component of this management approach is the...

Author(s): Integrated Rangeland Fire Management Strategy Actionable Science Plan Team

Year Published: 2016

Type: Document

Management or Planning Document

Conservation and restoration of sagebrush ecosystems and sage-grouse: an assessment of USDA Forest Service Science

www.nrfirescience.org/resource/14004

Sagebrush ecosystems are among the largest and most threatened ecosystems in North America. Greater sage-grouse has served as the bellwether for species conservation in these ecosystems and has been considered for listing under the Endangered Species Act eight times. In September 2015, the decision was made not to list greater sage...

Author(s): Deborah M. Finch, Douglas A. Boyce, Jeanne C. Chambers, Chris J. Colt, R. Kasten Dumroese, Stanley G. Kitchen, Clinton McCarthy, Susan E. Meyer, Bryce A. Richardson, Mary M. Rowland, Mark A. Rumble, Michael K. Schwartz, Monica S. Tomosy, Michael J. Wisdom

Year Published: 2016

Type: Document

Synthesis, Technical Report or White Paper

Interrogating resilience: toward a typology to improve its operationalization

www.nrfirescience.org/resource/16874

In the context of accelerated global change, the concept of resilience, with its roots in ecological theory and complex adaptive systems, has emerged as the favored framework for understanding and responding to the dynamics of change. Its transfer from ecological to social contexts, however, has led to the concept being interpreted...

Author(s): Julie L. Davidson, Chris Jacobson, Anna Lyth, Aysin Dedekorkut-Howes, Claudia L. Baldwin, Joanna C. Ellison, Neil J. Holbrook, Michael J. Howes, Silvia Serrao-Neumann, Lila Singh-Peterson, Timothy F. Smith

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

The role of fire in aspen ecology and restoration

www.nrfirescience.org/resource/16377

Quaking aspen is generally considered to be a fire-adapted species because it regenerates prolifically

after fire, and it can be replaced by more shade-tolerant tree species in the absence of fire. As early-successional aspen stands transition to greater conifer-dominance, they become increasingly fire prone, until fire returns, and...

Author(s): Douglas J. Shinneman, Kevin Krasnow, Susan K. McIlroy

Year Published: 2015

Type: Document

Research Brief or Fact Sheet

Effects of tree cutting and fire on understory vegetation in mixed conifer forests

www.nrfirescience.org/resource/12896

Mixed conifer forests of western North America are challenging for fire management, as historical fire regimes were highly variable in severity, timing, and spatial extent. Complex fire histories combined with site factors and other disturbances, such as insect outbreaks, led to great variation in understory plant communities, and...

Author(s): Scott R. Abella, Judith D. Springer

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

Paths of recovery: landscape variability in forest structure, function, and fuels after the 1988 Yellowstone Fires

www.nrfirescience.org/resource/13720

Understanding the rates, trajectories, and spatial variability in succession following severe wildfire is increasingly important for forest managers in western North America and critical for anticipating the resilience or vulnerability of forested landscapes to changing environmental conditions. However, few long-term...

Author(s): Monica G. Turner, William H. Romme, Daniel B. Tinker, Daniel C. Donato, Brian J. Harvey

Year Published: 2015

Type: Document

Technical Report or White Paper

Low-severity fire increases tree defense against bark beetle attacks

www.nrfirescience.org/resource/14366

Induced defense is a common plant strategy in response to herbivory. Although abiotic damage, such as physical wounding, pruning, and heating, can induce plant defense, the effect of such damage by large-scale abiotic disturbances on induced defenses has not been explored and could have important consequences for plant survival...

Author(s): Sharon M. Hood, Anna Sala, Emily K. Heyerdahl, Marion Boutin

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

The ecological importance of mixed-severity fire: nature's phoenix

www.nrfirescience.org/resource/16303

If you are a curious reader with a knack for the analytical, you may be asking yourself, Why start a book about fire ecology with a mythological figure? And if you are a tried-and-true scientist, like we are, you may also be asking, Isn't it a bit risky to mix myth with science, fact with fiction, observation with mystique, nature...

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

Forest resilience and tipping points at different spatio-temporal scales: approaches and challenges

www.nrfirescience.org/resource/16830

1. Anthropogenic global change compromises forest resilience, with profound impacts to ecosystem functions and services. This synthesis paper reflects on the current understanding of forest resilience and potential tipping points under environmental change and explores challenges to assessing responses using experiments,...

Author(s): Christopher P. O. Reyer, Niels Brouwers, Anja Rammig, Barry W. Brook, Jackie Epila, Robert F. Grant, Milena Holmgren, Fanny Langerwisch, Sebastian Leuzinger, Wolfgang Lucht, Belinda Medlyn, Marion Pfeifer, Jorg Steinkamp, Mark C. Vanderwel, Hans Verbeeck, Dora M. Vilella

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

Collaborative fuels reduction and restoration - Experiences from the Southwestern Crown of the Continent

www.nrfirescience.org/resource/13064

Forests that historically burned in mixed-severity fire regimes prove difficult to manage, especially when they border homes and prized recreation areas. This management challenge was the focus of the Fuels Reduction and Restoration in Mixed-Conifer Forests of the Southwestern Crown of the Continent field trip, following the May...

Author(s): Corey L. Gucker

Year Published: 2015

Type: Document

Research Brief or Fact Sheet

Historical spatial patterns and contemporary tree mortality in dry mixed-conifer forests

www.nrfirescience.org/resource/13649

Management and restoration of the dry, frequent-fire forests of the North American west depend on sound information about both historical and contemporary conditions to adequately address repercussions of fire suppression and changing climate. The purpose of this study is to quantify historical tree spatial patterns and assess...

Author(s): Kate A. Clyatt, Justin S. Crotteau, Michael S. Schaedel, Haley L. Wiggins, Harold Kelley, Derek J. Churchill, Andrew J. Larson

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

Conceptualizing forest degradation

www.nrfirescience.org/resource/16801

Forest degradation is a global environmental issue, but its definition is problematic. Difficulties include choosing appropriate reference states, timescales, thresholds, and forest values. We dispense with many such ambiguities by interpreting forest degradation through the frame of ecological resilience, and with reference to...

Author(s): Jaboury Ghazoul, Zuzana Burivalova, John Garcia-Ulloa, Lisa A. King

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

Restoring fire-prone Inland Pacific landscapes: seven core principles

www.nrfirescience.org/resource/13578

More than a century of forest and fire management of Inland Pacific landscapes has transformed their successional and disturbance dynamics. Regional connectivity of many terrestrial and aquatic habitats is fragmented, flows of some ecological and physical processes have been altered in space and time, and the frequency, size and...

Author(s): Paul F. Hessburg, Derek J. Churchill, Andrew J. Larson, Ryan D. Haugo, Carol Miller, Thomas A. Spies, Malcolm P. North, Nicholas A. Povak, R. Travis Belote, Peter H. Singleton, William L. Gaines, Robert E. Keane, Gregory H. Aplet, Scott L. Stephens, Penelope Morgan, Peter A. Bisson, Bruce E. Rieman, R. Brion Salter, Gordon H. Reeves

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

Simulated big sagebrush regeneration supports predicted changes at the trailing and leading edges of distribution shifts

www.nrfirescience.org/resource/15432

Many semi-arid plant communities in western North America are dominated by big sagebrush. These ecosystems are being reduced in extent and quality due to economic development, invasive species, and climate change. These pervasive modifications have generated concern about the long-term viability of sagebrush habitat and sagebrush-...

Author(s): Daniel Schlaepfer, Kyle A. Taylor, Victoria E. Pennington, Kellen N. Nelson, Trace E. Martyn, Caitlin M. Rottler, William Lauenroth, John Bradford

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

Prioritization of forest restoration projects: tradeoffs between wildfire protection, ecological restoration, and economic objectives

www.nrfirescience.org/resource/13729

The implementation of US federal forest restoration programs on national forests is a complex process that requires balancing diverse socioecological goals with project economics. Despite both the large geographic scope and substantial investments in restoration projects, a quantitative decision support framework to locate optimal...

Author(s): Kevin C. Vogler, Alan A. Ager, Michelle A. Day, Michael Jennings, John D. Bailey

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

A review of informal volunteerism in emergencies and disasters: Definition, opportunities and challenges

www.nrfirescience.org/resource/21922

Despite highly specialised and capable emergency management systems, ordinary citizens are usually first on the scene in an emergency or disaster, and remain long after official services have ceased. Citizens often play vital roles in helping those affected to respond and recover, and can provide invaluable assistance to official...

Author(s): Joshua Whittaker, Blythe McLennan, J. Handmer

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

Restoration of forest resilience: an achievable goal?

www.nrfirescience.org/resource/16813

Although the concept of resilience is increasingly being incorporated into environmental policy and linked to ecological restoration goals, there is considerable uncertainty regarding how resilience should be defined and measured in practice. Here we briefly review some of the definitions of resilience that have been proposed,...

Author(s): Adrian Newton, Elena Cantarello

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

Increasing weight of evidence that thinning and burning treatments help restore understory plant communities in ponderosa pine forests

www.nrfirescience.org/resource/13692

For more than a century ecosystems around the world have experienced an increase in the dominance of woody species. While the drivers of woody plant proliferation are complex, interactions between climate and land-use change are commonly invoked as primary contributing factors. In ponderosa pine forests of western North America,...

Author(s): Robert T. Strahan, Michael T. Stoddard, Judith D. Springer, David W. Huffman

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

The effects of seed source health on whitebark pine (*Pinus albicaulis*) regeneration density after wildfire

www.nrfirescience.org/resource/13603

Whitebark pine (*Pinus albicaulis* Engelm.) populations are declining nearly rangewide from a combination of factors, including mountain pine beetle (*Dendroctonus ponderosae* Hopkins, 1902) outbreaks, the exotic pathogen *Cronartium ribicola* J.C. Fisch. 1872, which causes the disease white pine blister rust, and successional replacement...

Author(s): Signe B. Leirfallom, Robert E. Keane, Diana F. Tomback, Solomon Z. Dobrowski

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

Fire legacies impact conifer regeneration across environmental gradients in the U.S. northern Rockies

www.nrfirescience.org/resource/14018

Context: An increase in the incidence of large wildfires worldwide has prompted concerns about the resilience of forest ecosystems, particularly in the western U.S., where recent changes are linked with climate warming and 20th-century land management practices. Objectives: To study forest resilience to recent wildfires, we examined...

Author(s): Kerry Kemp, Philip E. Higuera, Penelope Morgan

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

Temperate forest health in an era of emerging megadisturbance

www.nrfirescience.org/resource/13501

Although disturbances such as fire and native insects can contribute to natural dynamics of forest health, exceptional droughts, directly and in combination with other disturbance factors, are pushing

some temperate forests beyond thresholds of sustainability. Interactions from increasing temperatures, drought, native insects and...

Author(s): Constance I. Millar, Nathan L. Stephenson

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

Applying resilience thinking - Seven principles for building resilience in social-ecological systems

www.nrfirescience.org/resource/13407

This publication is a popular summary of the book "Principles for Building Resilience: Sustaining Ecosystem Services in Social-Ecological Systems", published by Cambridge University Press (2014). This book, in turn, expands on the comprehensive review "Towards principles for enhancing the resilience of..."

Author(s): Stockholm University

Year Published: 2014

Type: Document

Technical Report or White Paper

Contrasting effects of wildfire and ecological restoration in old-growth western larch forests

www.nrfirescience.org/resource/13003

The scientific basis for restoration of fire-excluded western larch/mixed-conifer forests is not as well developed as that for dry fire-frequent forests. We compared the effects of wildfire and restoration (combined thinning and prescribed fire) in fire-excluded western larch forests. In 2012, the wildfire site had more, taller, and...

Author(s): Taylor Hopkins, Andrew J. Larson, R. Travis Belote

Year Published: 2014

Type: Document

Book or Chapter or Journal Article

Using resistance and resilience concepts to reduce impacts of invasive annual grasses and altered fire regimes on the sagebrush ecosystem and greater sage-grouse: a strategic multi-scale approach

www.nrfirescience.org/resource/12989

This Report provides a strategic approach for conservation of sagebrush ecosystems and Greater Sage- Grouse (sage-grouse) that focuses specifically on habitat threats caused by invasive annual grasses and altered fire regimes. It uses information on factors that influence (1) sagebrush ecosystem resilience to disturbance and...

Author(s): Jeanne C. Chambers, David A. Pyke, Jeremy D. Maestas, Michael L. Pellant, Chad S. Boyd, Steven B. Campbell, Shawn Espinosa, Douglas W. Havlina, Kenneth E. Mayer, Amarina Wuenschel

Year Published: 2014

Type: Document

Management or Planning Document

A field guide for selecting the most appropriate treatment in sagebrush and pinon-juniper ecosystems in the Great Basin: Evaluating resilience to disturbance and resistance to invasive annual grasses, and predicting vegetation response

www.nrfirescience.org/resource/14682

This field guide identifies seven primary components that largely determine resilience to disturbance, as well as resistance to invasive grasses and plant succession following treatment of areas of concern. The primary components are (1) characteristics of the ecological site, (2) current vegetation prior to

treatment, (3)...

Author(s): Richard F. Miller, Jeanne C. Chambers, Michael L. Pellant

Year Published: 2014

Type: Document

Technical Report or White Paper

Resistance and resilience: a conceptual framework for silviculture

www.nrfirescience.org/resource/16862

Increasingly, forest management goals include building or maintaining resistance and/or resilience to disturbances in the face of climate change. Although a multitude of descriptive definitions for resistance and resilience exist, to evaluate whether specific management activities (silviculture) are effective, prescriptive...

Author(s): R. Justin DeRose, James N. Long

Year Published: 2014

Type: Document

Book or Chapter or Journal Article

Examining historical and current mixed-severity fire regimes in ponderosa pine and mixed-conifer forests of western north America

www.nrfirescience.org/resource/12904

There is widespread concern that fire exclusion has led to an unprecedented threat of uncharacteristically severe fires in ponderosa pine (*Pinus ponderosa* Dougl. ex. Laws) and mixed-conifer forests of western North America. These extensive montane forests are considered to be adapted to a low/moderate-severity fire regime that...

Author(s): Dennis C. Odion, Chad T. Hanson, Andre Arsenault, William L. Baker, Dominick A.

DellaSala, Richard L. Hutto, Walt Klenner, Max A. Moritz, Rosemary L. Sherriff, Thomas T. Veblen, Mark A. Williams

Year Published: 2014

Type: Document

Book or Chapter or Journal Article

Building resilience into quaking aspen management

www.nrfirescience.org/resource/16373

Throughout the 20th century, forest scientists and land managers were guided by principles of succession with regard to aspen forests. The historical model depicted aspen as a "pioneer species" that colonizes a site following disturbance and is eventually overtopped by conifers. Aspen systems are more diverse, however, than...

Author(s): Paul C. Rogers

Year Published: 2014

Type: Document

Research Brief or Fact Sheet

Disturbance legacies increase the resilience of forest ecosystem structure, composition, and functioning

www.nrfirescience.org/resource/16854

Disturbances are key drivers of forest ecosystem dynamics, and forests are well adapted to their natural disturbance regimes. However, as a result of climate change, disturbance frequency is expected to increase in the future in many regions. It is not yet clear how such changes might affect forest ecosystems, and which mechanisms...

Author(s): Rupert Seidl, Werner Rammer, Thomas A. Spies

Year Published: 2014

Type: Document
Book or Chapter or Journal Article

Restoration fuels treatments in old-growth- Visiting research plots in western larch and ponderosa pine forests

www.nrfirescience.org/resource/12674

Mick Harrington and Steve Arno, retired research foresters with the USFS Rocky Mountain Research Station, took participants of the May 2014 Large Wildland Fires Conference through a 300-year-old stand of ponderosa pine (*Pinus ponderosa*) and western larch (*Larix occidentalis*). While there, they discussed their research, which...

Author(s): Corey L. Gucker
Year Published: 2014
Type: Document
Research Brief or Fact Sheet

The shape of ecosystem management to come: Anticipating risks and fostering resilience

www.nrfirescience.org/resource/16831

Global change is increasingly challenging the sustainable provisioning of ecosystem services to society. Addressing future uncertainty and risk has therefore become a central problem of ecosystem management. With risk management and resilience-based stewardship, two contrasting approaches have been proposed to address this issue....

Author(s): Rupert Seidl
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Patterns and mechanisms of plant succession after fire on Artemisia-grass sites in southeastern Idaho

www.nrfirescience.org/resource/15400

Cover data for plant species on eight environmentally similar sites that were each burned in a different year (from 2 to 36 years ago) were used to construct a composite sequence of vegetational change after fire on Artemisia-grassland sites in southeastern Idaho. Some species were early successional such as *Lithospermum ruderales*,...

Author(s): David L. Humphrey
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Moving forward: responding to and mitigating effects of the MPB epidemic

www.nrfirescience.org/resource/13711

The final webinar in the Future Forest Webinar Series provided an example of how managers utilized available science to address questions about post-epidemic forest conditions. Assessments of current conditions and projected trends, and how these compare with historical patterns, provide important information for land management...

Author(s): Claudia Regan, Barry Bollenbacher, Rob Gump, Michael Hillis
Year Published: 2014
Type: Document
Conference Proceedings

Dry forest resilience varies under simulated climate-management scenarios in a central Oregon,

USA landscape

www.nrfirescience.org/resource/14233

Determining appropriate actions to create or maintain landscapes resilient to climate change is challenging because of uncertainty associated with potential effects of climate change and their interactions with land management. We used a set of climate-informed state-and-transition models to explore the effects of management and...

Author(s): Joshua S. Halofsky, Jessica E. Halofsky, Theresa Burcsu, Miles A. Hemstrom

Year Published: 2014

Type: Document

Book or Chapter or Journal Article

Recent mountain pine beetle outbreaks, wildfire severity, and postfire tree regeneration in the US northern Rockies

www.nrfirescience.org/resource/13007

Widespread tree mortality caused by outbreaks of native bark beetles (Circulionidae: Scolytinae) in recent decades has raised concern among scientists and forest managers about whether beetle outbreaks fuel more ecologically severe forest fires and impair postfire resilience. To investigate this question, we collected extensive...

Author(s): Brian J. Harvey, Daniel C. Donato, Monica G. Turner

Year Published: 2014

Type: Document

Book or Chapter or Journal Article

Challenges and opportunities for large landscape-scale management in a shifting climate: the importance of nested adaptation responses across geospatial and temporal scales

www.nrfirescience.org/resource/12994

The Yellowstone to Yukon Conservation Initiative (Y2Y) was established over 20 years ago as an experiment in large landscape conservation. Initially, Y2Y emerged as a response to large scale habitat fragmentation by advancing ecological connectivity. It also laid the foundation for large scale multi-stakeholder conservation...

Author(s): Gary M. Tabor, Anne Carlson, R. Travis Belote

Year Published: 2014

Type: Document

Technical Report or White Paper

Forest Structure, Health, and Mortality in Two Rocky Mountain Whitebark Pine Ecosystems: Implications for Restoration

www.nrfirescience.org/resource/20067

Whitebark pine (*Pinus albicaulis* Engelm.) forests in western North America are increasingly threatened by the exotic pathogen white pine blister rust (*Cronartium ribicola* J.C. Fisch.). Whitebark pine is designated a high priority species on the candidate list of Endangered or Threatened species, spurring activity to monitor the rust...

Author(s): Carl E. Fiedler, Shawn T. McKinney

Year Published: 2014

Type: Document

Book or Chapter or Journal Article

Vegetation response after post-fire mulching and native grass seeding

www.nrfirescience.org/resource/15317

Post-fire mulch and seeding treatments, often applied on steep, severely burned slopes immediately after large wildfires, are meant to reduce the potential of erosion and establishment of invasive plants,

especially non-native plants, that could threaten values at risk. However, the effects of these treatments on native vegetation...

Author(s): Penelope Morgan, Marshall Moy, Christine A. Droske, Leigh B. Lentile, Sarah A. Lewis, Peter R. Robichaud, Andrew T. Hudak

Year Published: 2014

Type: Document

Book or Chapter or Journal Article

Quantifying restoration effectiveness using multi-scale habitat models: implications for sage-grouse in the Great Basin

www.nrfirescience.org/resource/12947

A recurrent challenge in the conservation of wide-ranging, imperiled species is understanding which habitats to protect and whether we are capable of restoring degraded landscapes. For Greater Sage-grouse (*Centrocercus urophasianus*), a species of conservation concern in the western United States, we approached this problem by...

Author(s): Robert S. Arkle, David S. Pilliod, Steven E. Hanser, Matthew L. Brooks, Jeanne C. Chambers, James B. Grace, Kevin C. Knutson, David A. Pyke, Justin L. Welty, Troy A. Wirth

Year Published: 2014

Type: Document

Book or Chapter or Journal Article

Yellowstone National Park and the summer of fire

www.nrfirescience.org/resource/11997

Because of their close relationships with fires, western forest ecosystems are considered fire dependent. If we hope to sustain the communities of trees, plants, and animals that characterize these wildland forests, we need to understand the natural role of fire, changes brought about by suppressing fire, and alternatives for...

Author(s): Diane M. Smith

Year Published: 2013

Type: Document

Book or Chapter or Journal Article

The national cohesive wildland fire management strategy: phase III western regional action plan

www.nrfirescience.org/resource/11971

The Western Regional Action Plan is part of the culmination of a three-year effort put into motion by the Federal Land Assistance, Management and Enhancement Act of 2009 (FLAME Act). Representatives of federal, state, local, and tribal governments, scientists, interested governmental and nongovernmental organizations, businesses and...

Author(s): Wildland Fire Executive Council

Year Published: 2013

Type: Document

Management or Planning Document

When relationships estimated in the past cannot be used to predict the future: using mechanistic models to predict landscape ecological dynamics in a changing world

www.nrfirescience.org/resource/16834

Researchers and natural resource managers need predictions of how multiple global changes (e.g., climate change, rising levels of air pollutants, exotic invasions) will affect landscape composition and ecosystem function. Ecological predictive models used for this purpose are constructed using either a mechanistic (process-based) or...

Author(s): Eric J. Gustafson

Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Integrated fuel/restoration treatments - Field tour at the Priest River Experimental Forest

www.nrfirescience.org/resource/13694

Terrie Jain, Russell Graham, Andrew Hudak, and Bill Elliot with the United States Forest Service's (USFS) Rocky Mountain Research Station, led a tour of fuels treatments in mostly moist mixed-conifer forests in the Priest River Experimental Forest (PREF) near Priest River, Idaho. Site visits and discussions highlighted how...

Author(s): Corey L. Gucker
Year Published: 2013
Type: Document
Research Brief or Fact Sheet

Wildland fire management: are actively managed forests more resilient than passively managed forests?

www.nrfirescience.org/resource/12434

Large areas of federal lands in the western states are currently at high risk of severe wildfire and have many insect and disease problems, indicating a significant decline in forest health and resilience. Although research studies have not been done that would measure whether actively managed forests are more resilient to wildfires...

Author(s): Jay O'Laughlin
Year Published: 2013
Type: Document
Technical Report or White Paper

Restoring forest resilience: from reference spatial patterns to silvicultural prescriptions and monitoring

www.nrfirescience.org/resource/14006

Stand-level spatial pattern influences key aspects of resilience and ecosystem function such as disturbance behavior, regeneration, snow retention, and habitat quality in frequent-fire pine and mixed-conifer forests. Reference sites, from both pre-settlement era reconstructions and contemporary forests with active fire regimes,...

Author(s): Derek J. Churchill, Andrew J. Larson, Matthew C. Dahlgreen, Jerry F. Franklin, Paul F. Hessburg, James A. Lutz
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Whitebark pine restoration challenges - Restoration site visits in the Bridger Mountains

www.nrfirescience.org/resource/12929

As part of the 13th Whitebark Pine Ecosystem Science and Management Workshop - Challenges of Whitebark Pine Restoration, participants visited a whitebark pine restoration area near Fairy Lake in the Bridger Mountains north of Bozeman, MT (Figure 1). The restoration site at about 8,000 feet supports both whitebark pine (*Pinus...*

Author(s): Corey L. Gucker
Year Published: 2013
Type: Document
Research Brief or Fact Sheet

Conifer regeneration following stand-replacing wildfire varies along an elevation gradient in a ponderosa pine forest, Oregon, USA

www.nrfirescience.org/resource/19944

Climate change is expected to increase disturbances such as stand-replacing wildfire in many ecosystems, which have the potential to drive rapid turnover in ecological communities. Ecosystem recovery, and therefore maintenance of critical structures and functions (resilience), is likely to vary across environmental gradients such as...

Author(s): Erich K. Dodson, Heather Taylor Root

Year Published: 2013

Type: Document

Book or Chapter or Journal Article

Estimating critical climate-driven thresholds in landscape dynamics using spatial simulation modeling: climate change tipping points in fire management - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/11983

Climate projections for the next 20-50 years forecast higher temperatures and variable precipitation for many landscapes in the western United States. Climate changes may cause or contribute to threshold shifts, or tipping points, where relatively small shifts in climate result in large, abrupt, and persistent changes in landscape...

Author(s): Robert E. Keane, Rachel A. Loehman

Year Published: 2013

Type: Document

Technical Report or White Paper

Consequences of spatial heterogeneity for ecosystem services in changing forest landscapes: priorities for future research

www.nrfirescience.org/resource/13431

Changes in key drivers (e.g., climate, disturbance regimes and land use) may affect the sustainability of forest landscapes and set the stage for increased tension among competing ecosystem services. We addressed two questions about a suite of supporting, regulating and provisioning ecosystem services in each of two well-studied...

Author(s): Monica G. Turner, Daniel C. Donato, William H. Romme

Year Published: 2013

Type: Document

Book or Chapter or Journal Article

Living dangerously on borrowed time during slow, unrecognized regime shifts

www.nrfirescience.org/resource/16806

Regime shifts from one ecological state to another are often portrayed as sudden, dramatic, and difficult to reverse. Yet many regime shifts unfold slowly and imperceptibly after a tipping point has been exceeded, especially at regional and global scales. These long, smooth transitions between equilibrium states are easy to miss,...

Author(s): Terry P. Hughes, Cristina Linares, Vasilis Dakos, Ingrid A. van de Leemput, Egbert H. van Nes

Year Published: 2013

Type: Document

Book or Chapter or Journal Article

The impacts of changing disturbance regimes on serotinous plant populations and communities

www.nrfirescience.org/resource/12406

Climatic change is anticipated to alter disturbance regimes for many ecosystems. Among the most important effects are changes in the frequency, size, and intensity of wildfires. Serotiny (long-term canopy storage and the heat-induced release of seeds) is a fire-resilience mechanism found in many globally important terrestrial...

Author(s): Brian Buma, Carissa D. Brown, Daniel C. Donato, Joseph B. Fontaine, Jill F. Johnstone

Year Published: 2013

Type: Document

Book or Chapter or Journal Article

Appendix 3: Response of western mountain ecosystems to climatic variability and change: a synthesis from the Western Mountain Initiative

www.nrfirescience.org/resource/11904

The Western Mountain Initiative (WMI), a consortium of research groups in the Western United States, focuses on understanding and predicting responses-especially sensitivities, thresholds, resistance, and resilience-of mountain ecosystems to climatic variability and change (Peterson et al. 2012). The WMI addresses how climatic...

Author(s): Crystal L. Raymond

Year Published: 2013

Type: Document

Synthesis, Technical Report or White Paper

A review of fire effects on vegetation and soils in the Great Basin Region: response and ecological site characteristics

www.nrfirescience.org/resource/12147

This review synthesizes the state of knowledge on fire effects on vegetation and soils in semi-arid ecosystems in the Great Basin Region, including the central and northern Great Basin and Range, Columbia River Basin, and the Snake River Plain. We summarize available literature related to: (1) the effects of environmental gradients...

Author(s): Richard F. Miller, Jeanne C. Chambers, David A. Pyke, Frederick B. Pierson

Year Published: 2013

Type: Document

Synthesis, Technical Report or White Paper

Sustainability in forest management and a new role for resilience thinking

www.nrfirescience.org/resource/16879

Forest management faces a substantial challenge with ever-more-pervasive anthropogenic impacts and growing demands on forests coupled with the increasing certainty of global change. If the capacity of forests to provide valued ecological goods and services in the future is to be maintained, new tools and approaches will be needed....

Author(s): Lucy Rist, Jon Moen

Year Published: 2013

Type: Document

Book or Chapter or Journal Article

Tree spatial patterns in fire-frequent forests of western North America, including mechanisms of pattern formation and implications for designing fuel reduction and restoration treatments

www.nrfirescience.org/resource/8316

Restoring characteristic fire regimes and forest structures are central objectives of many restoration and fuel reduction projects. Within-stand spatial pattern is a fundamental attribute of forest structure and influences many ecological processes and ecosystem functions. In this review we synthesize the

available spatial reference...

Author(s): Andrew J. Larson, Derek J. Churchill

Year Published: 2012

Type: Document

Book or Chapter or Journal Article, Synthesis

A range-wide restoration strategy for whitebark pine (*Pinus albicaulis*)

www.nrfirescience.org/resource/12690

Whitebark pine (*Pinus albicaulis*), an important component of western high-elevation forests, has been declining in both the United States and Canada since the early Twentieth Century from the combined effects of mountain pine beetle (*Dendroctonus ponderosae*) outbreaks, fire exclusion policies, and the spread of the exotic disease...

Author(s): Robert E. Keane, Diana F. Tomback, C. A. Aubry, A. D. Bower, Elizabeth M. Campbell, Cathy L. Cripps, M. B. Jenkins, M. F. Mahalovich, Mary Manning, Shawn T. McKinney, Michael P. Murray, Dana L. Perkins, C. A. Ryan, Anna W. Schoettle, Cyndi M. Smith

Year Published: 2012

Type: Document

Technical Report or White Paper

Fire as a tool for controlling *Tamarix* spp. seedlings

www.nrfirescience.org/resource/13506

Fire is often used in northern grasslands to control invasive grass species but has unknown effects on *Tamarix* spp., more recent invaders. Temperature (using an oven as a fire surrogate) and duration combinations that would be most lethal to *Tamarix* seeds and seedlings were determined. *Tamarix* seeds were sown in soil-lined dishes,...

Author(s): Michelle K. Ohrtman, Sharon A. Clay, David E. Clay, Alexander J. Smart

Year Published: 2012

Type: Document

Book or Chapter or Journal Article

Do thinning and/or burning treatments in western USA ponderosa or Jeffrey pine-dominated forests help restore natural fire behavior?

www.nrfirescience.org/resource/8318

We carried out a systematic review and meta-analysis of the effects of forest thinning and burning treatments on restoring fire behavior attributes in western USA pine forests. Ponderosa pine (*Pinus ponderosa*) and Jeffrey pine (*Pinus jeffreyi*), with co-occurring species, are adapted to a disturbance regime of frequent surface fires...

Author(s): Peter Z. Fule, Joseph E. Crouse, John Paul Roccaforte, Elizabeth L. Kalies

Year Published: 2012

Type: Document

Book or Chapter or Journal Article, Synthesis

Spatially extensive reconstructions show variable-severity fire and heterogeneous structure in historical western United States dry forests

www.nrfirescience.org/resource/13484

Aim: Wildfire is often considered more severe now than historically in dry forests of the western United States. Tree-ring reconstructions, which suggest that historical dry forests were park-like with large, old trees maintained by low-severity fires, are from small, scattered studies. To overcome this limitation, we developed...

Author(s): William L. Baker, Mark A. Williams

Year Published: 2012

Type: Document
Book or Chapter or Journal Article

Climate change, forests, fire, water, and fish: building resilient landscapes, streams, and managers

www.nrfirescience.org/resource/11270

Fire will play an important role in shaping forest and stream ecosystems as the climate changes. Historic observations show increased dryness accompanying more widespread fire and forest die-off. These events punctuate gradual changes to ecosystems and sometimes generate stepwise changes in ecosystems. Climate vulnerability...

Author(s): Charles H. Luce, Penelope Morgan, Kathleen A. Dwire, Daniel J. Isaak, Zachary A. Holden, Bruce E. Rieman

Year Published: 2012

Type: Document

Technical Report or White Paper

Towards principles for enhancing the resilience of ecosystem services

www.nrfirescience.org/resource/16796

Enhancing the resilience of ecosystem services (ES) that underpin human well-being is critical for meeting current and future societal needs, and requires specific governance and management policies. Using the literature, we identify seven generic policy-relevant principles for enhancing the resilience of desired ES in the face of...

Author(s): Reinette Biggs, Maja Schlüter, Duan Biggs, Erin L. Bohensky, Shauna BurnSilver, Georgina Cundill, Vasilis Dakos, Tim M. Daw, Louisa S. Evans, Karen Kotschy, Anne M. Leitch, Chanda Meek, Allyson Quinlan, Ciara Raudsepp-Hearne, Martin D. Robards, Michael L. Schoon, Lisen Schultz, Paul C. West

Year Published: 2012

Type: Document

Book or Chapter or Journal Article

A review of logistic regression models used to predict post-fire tree mortality of western North American conifers

www.nrfirescience.org/resource/8303

Logistic regression models used to predict tree mortality are critical to post-fire management, planning prescribed burns and understanding disturbance ecology. We review literature concerning post-fire mortality prediction using logistic regression models for coniferous tree species in the western USA. We include synthesis and...

Author(s): Travis J. Woolley, David C. Shaw, Lisa Ganio, Stephen A. Fitzgerald

Year Published: 2012

Type: Document

Book or Chapter or Journal Article, Synthesis

Modelling natural disturbances in forest ecosystems: a review

www.nrfirescience.org/resource/16851

Natural disturbances play a key role in ecosystem dynamics and are important factors for sustainable forest ecosystem management. Quantitative models are frequently employed to tackle the complexities associated with disturbance processes. Here we review the wide variety of approaches to modelling natural disturbances in forest...

Author(s): Rupert Seidl, Paulo M. Fernandes, Teresa Fidalgo Fonseca, François Gillet, Anna Maria Jönsson, Katarina Merganicova, Sigrid Netherer, A. Arpaci, Jean-Daniel Bontemps, Harald Bugmann, José Ramón González Olabarria, Petra Lasch, Céline Meredieu, Francisco Moreira, Mart Jan

Schelhaas, G.M.J. Mohren
Year Published: 2011
Type: Document
Book or Chapter or Journal Article

The future of high-elevation, five-needle white pines in western North America: Proceedings of the High Five Symposium. 28-30 June 2010; Missoula, MT

www.nrfirescience.org/resource/11894

High elevation five-needle pines are rapidly declining throughout North America. The six species, whitebark (*Pinus albicaulis* Engelm.), limber (*P. flexilis* James), southwestern white (*P. strobiformis* Engelm.), foxtail (*P. balfouriana* Grev....

Author(s): Robert E. Keane, Diana F. Tomback, Michael P. Murray, Cyndi M. Smith

Year Published: 2011

Type: Document

Conference Proceedings

Comprehensive fuels treatment practices guide for mixed conifer forests: California, central and southern Rockies, and the Southwest

www.nrfirescience.org/resource/12630

The goal of this guide is to provide a resource for managers of mixed conifer forests of the Southwestern plateaus and uplands, the Central and Southern Rocky Mountains, the Sierra Nevada, and the Transverse and Peninsular Ranges in Southern California. Mixed conifer forests have different species, structures, and spatial patterns...

Author(s): Alexander M. Evans, Rick G. Everett, Scott L. Stephens, James A. Youtz

Year Published: 2011

Type: Document

Synthesis, Technical Report or White Paper

Greater sage-grouse: Ecology and conservation of a landscape species and its habitats

www.nrfirescience.org/resource/15406

The greater sage-grouse is at the center of a complex challenge to conserve sagebrush ecosystems. The species has declined across much of its range, including 11 western states and 2 Canadian provinces, mostly due to loss of critical sagebrush habitat. Agriculture, roads, development of energy resources, wildfire, and invasive...

Author(s): Steve Knick, John W. Connelly

Year Published: 2011

Type: Document

Book or Chapter or Journal Article

Restoration of whitebark pine forests in the northern Rocky Mountains, USA

www.nrfirescience.org/resource/11900

Whitebark pine (*Pinus albicaulis*) has been declining across much of its range in North America because of the combined effects of mountain pine beetle epidemics, fire exclusion policies, and widespread exotic blister rust infections. Whitebark pine seed is dispersed by a bird, the Clark's nutcracker, which caches seed in open,...

Author(s): Robert E. Keane

Year Published: 2011

Type: Document

Conference Proceedings

Saving the sagebrush sea: An ecosystem conservation plan for big sagebrush plant communities

www.nrfirescience.org/resource/15389

Vegetation change and anthropogenic development are altering ecosystems and decreasing biodiversity. Successful management of ecosystems threatened by multiple stressors requires development of ecosystem conservation plans rather than single species plans. We selected the big sagebrush (*Artemisia tridentata* Nutt.) ecosystem to...

Author(s): Kirk W. Davies, Chad S. Boyd, Jeffrey L. Beck, Jonathan D. Bates, Tony J. Svejcar, Michael A. Gregg

Year Published: 2011

Type: Document

Book or Chapter or Journal Article

Restoration relevance of recent National Fire Plan treatments in forests of the western United States

www.nrfirescience.org/resource/8226

The US National Fire Plan (NFP) is among the largest forest-restoration initiatives worldwide, removing wildland fuels on about 11 million hectares and costing over \$6 billion. We evaluated the extent to which areas treated under the NFP-from 2004 to 2008, in forest ecosystems outside the wildland-urban interface in 11 western...

Author(s): Tania L. Schoennagel, Cara R. Nelson

Year Published: 2011

Type: Document

Book or Chapter or Journal Article

Disturbance ecology of high-elevation five-needle pine ecosystems in western North America

www.nrfirescience.org/resource/11896

This paper synthesizes existing information about the disturbance ecology of high-elevation five-needle pine ecosystems, describing disturbances regimes, how they are changing or are expected to change, and the implications for ecosystem persistence. As it provides the context for ecosystem conservation/restoration programs, we...

Author(s): Elizabeth M. Campbell, Robert E. Keane, Evan R. Larson, Michael P. Murray, Anna W. Schoettle, Carmen Wong

Year Published: 2011

Type: Document

Conference Proceedings, Synthesis

Estimating the vulnerability of fifteen tree species under changing climate in Northwest North America

www.nrfirescience.org/resource/16883

In the Pacific northwestern(PNW)region of North America, climatic conditions have significantlywarmed since a predominantly cool phase of the Pacific North American circulation patterns between 1950 and 1975. What are the implications of this shift in climate for the vulnerability of native tree species? To address this question, we...

Author(s): Nicholas C. Coops, Richard H. Waring

Year Published: 2011

Type: Document

Book or Chapter or Journal Article

Can we manage for resilience? The integration of resilience thinking into natural resource management in the United States

www.nrfirescience.org/resource/12693

The concept of resilience is now frequently invoked by natural resource agencies in the US. This reflects growing trends within ecology, conservation biology, and other disciplines acknowledging that social–ecological systems require management approaches recognizing their complexity. In this paper, we examine the concept of...

Author(s): Melinda Harm Benson, Ahjond S. Garmestani

Year Published: 2011

Type: Document

Book or Chapter or Journal Article

Forest responses to climate change in the northwestern United States: ecophysiological foundations for adaptive management

www.nrfirescience.org/resource/8297

Climate change resulting from increased concentrations of atmospheric carbon dioxide ([CO₂]) is expected to result in warmer temperatures and changed precipitation regimes during this century. In the northwestern U.S., these changes will likely decrease snowpack, cause earlier snowmelt, increase summer evapotranspiration, and...

Author(s): Daniel J. Chmura, Paul D. Anderson, Glenn T. Howe, Constance A. Harrington, Jessica E. Halofsky, David L. Peterson, David C. Shaw, J. Brad St. Clair

Year Published: 2011

Type: Document

Book or Chapter or Journal Article

Converting crested wheatgrass stands to enhance big sagebrush: A literature review

www.nrfirescience.org/resource/15425

Greater sage-grouse (*Centrocercus urophasianus*) is a high priority species for federal and state land management agencies. Sage-grouse are sagebrush (*Artemisia* spp.) obligates requiring sagebrush for their survival throughout the year. Sagebrush has been removed and replaced with crested wheatgrass (*Agropyron cristatum* & A....

Author(s): Krystle A. Pehrson, Bok F. Sowell

Year Published: 2011

Type: Document

Book or Chapter or Journal Article

Strategies, tools, and challenges for sustaining and restoring high elevation five-needle white pine forests in western North America

www.nrfirescience.org/resource/11899

Many ecologically important, five-needle white pine forests that historically dominated the high elevation landscapes of western North America are now being heavily impacted by mountain pine beetle (*Dendroctonus* spp.) outbreaks, the exotic disease white pine blister rust (WPBR), and altered high elevation fire regimes. Management...

Author(s): Robert E. Keane, Anna W. Schoettle

Year Published: 2011

Type: Document

Conference Proceedings

Modeling effects of climate change and fire management on western white pine (*Pinus monticola*) in the northern rocky mountains, USA

www.nrfirescience.org/resource/13512

Climate change is projected to profoundly influence vegetation patterns and community compositions, either directly through increased species mortality and shifts in species distributions or indirectly

through disturbance dynamics such as increased wildfire activity and extent, shifting fire regimes, and pathogenesis. Mountainous...

Author(s): Rachel A. Loehman, Jason A. Clark, Robert E. Keane

Year Published: 2011

Type: Document

Book or Chapter or Journal Article

A regional experiment to evaluate effects of fire and fire surrogate treatments in the sagebrush biome - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/11225

SageSTEP is a comprehensive regional experiment that provides critical information to managers faced with a sagebrush steppe ecosystem that is increasingly at risk from wildfire, invasive plants, and climate change. The experiment provides managers with information that can be used to restore ecological communities across the 100+...

Author(s): James D. Mclver, Hugh Barrett, Mark W. Brunson, Stephen C. Bunting, Jeanne C. Chambers, Carla M. D'Antonio, Paul S. Doescher, Dale Johnson, Sherm Karl, Steve Knick, Richard F. Miller, Michael L. Pellant, Frederick B. Pierson, David A. Pyke, Kimberly Rollins, Bruce A. Roundy, Eugene Schupp, Robin J. Tausch, David Turner, Michael J. Wisdom

Year Published: 2011

Type: Document

Technical Report or White Paper

Restoring whitebark pine forests of the northern Rocky Mountains, USA

www.nrfirescience.org/resource/8394

Whitebark pine (*Pinus albicaulis*) has been declining across much of its range in North America because of the combined effects of mountain pine beetle (*Dendroctonus ponderosae*) epidemics, fire exclusion policies, and widespread exotic blister rust infections. Whitebark pine seed is dispersed by a bird, the Clark's nutcracker (...)

Author(s): Robert E. Keane, Russell A. Parsons

Year Published: 2010

Type: Document

Book or Chapter or Journal Article

Restoring whitebark pine ecosystems in the Northern Rocky Mountains, USA

www.nrfirescience.org/resource/19231

Whitebark pine (*Pinus albicaulis*) has been declining across much of its range in North America because of the combined effects of mountain pine beetle (*Dendroctonus ponderosae*) epidemics, fire exclusion policies, and widespread exotic blister rust infections. Whitebark pine seed is dispersed by a bird, the Clark's nutcracker (...)

Author(s): Robert E. Keane, Russell A. Parsons

Year Published: 2010

Type: Document

Book or Chapter or Journal Article

Disturbance and landscape dynamics in a changing world

www.nrfirescience.org/resource/13432

Disturbance regimes are changing rapidly, and the consequences of such changes for ecosystems and linked social-ecological systems will be profound. This paper synthesizes current understanding of disturbance with an emphasis on fundamental contributions to contemporary landscape and ecosystem ecology, then identifies future...

Author(s): Monica G. Turner

Year Published: 2010
Type: Document
Book or Chapter or Journal Article, Synthesis

Management guide to ecosystem restoration treatments: whitebark pine forests of the Northern Rocky Mountains, U.S.A.

www.nrfirescience.org/resource/11143

Whitebark pine is declining across much of its range in North America because of the combined effects of mountain pine beetle epidemics, fire exclusion policies, and widespread exotic blister rust infections. This management guide summarizes the extensive data collected at whitebark pine treatment sites for three periods: (1) pre-...

Author(s): Robert E. Keane, Russell A. Parsons

Year Published: 2010

Type: Document

Technical Report or White Paper

Restoration treatment effects on stand structure, tree growth, and fire hazard in a ponderosa pine/Douglas-fir forest in Montana

www.nrfirescience.org/resource/8159

Crown fires that burned thousands of ha of ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.) forests in recent years attest to the hazardous conditions extant on the western landscape. Managers have responded with broad-scale implementation of fuel reduction treatments; however, because threats to pine forests extend beyond fire, so...

Author(s): Carl E. Fiedler, Kerry L. Metlen, Erich K. Dodson

Year Published: 2010

Type: Document

Book or Chapter or Journal Article

Populus alba and hybrids

www.nrfirescience.org/resource/16368

This document covers several species of *Populus* and includes their general distribution, habitat types, plant communities, and fire adaptations.

Author(s): Corey L. Gucker

Year Published: 2010

Type: Document

Synthesis

Current health issues and management strategies for white pines in the western United States and Canada

www.nrfirescience.org/resource/8233

The introduced pathogen *Cronartium ribicola*, cause of white pine blister rust, has spread across much of western North America and established known infestations within all but one species of white pine endemic to western Canada and the United States. Blister rust damage to severely diseased trees reduces reproduction and survival....

Author(s): John W. Schwandt, I. Blakley Lockman, John T. Kliejunas, J. A. Muir

Year Published: 2010

Type: Document

Book or Chapter or Journal Article, Synthesis

Integrating fuel treatment into ecosystem management: a proposed project planning process

www.nrfirescience.org/resource/8206

Concern over increased wildland fire threats on public lands throughout the western United States makes fuel reduction activities the primary driver of many management projects. This single-issue focus recalls a management planning process practiced frequently in recent decades - a least-harm approach where the primary objective is...

Author(s): Keith Stockmann, Kevin D. Hyde, J. Greg Jones, Dan R. Loeffler, Robin P. Silverstein

Year Published: 2010

Type: Document

Book or Chapter or Journal Article, Management or Planning Document

Post-wildfire seeding in forests of the western United States: an evidence-based review

www.nrfirescience.org/resource/12595

Broadcast seeding is one of the most widely used post-wildfire emergency response treatments intended to reduce soil erosion, increase vegetative ground cover, and minimize establishment and spread of non-native plant species. We conducted an evidence-based review to examine the effectiveness and effects of post-wildfire seeding...

Author(s): Donna Peppin, Peter Z. Fule, Carolyn Hull Sieg, Jan L. Beyers, Molly E. Hunter

Year Published: 2010

Type: Document

Book or Chapter or Journal Article, Synthesis

Silvicultural management of white pines in western North America

www.nrfirescience.org/resource/8235

Since the introduction prior to 1915 of white pine blister rust (*Cronartium ribicola*) into the forests of western North America, many populations of native white pine species have seriously declined. Because western white pine (*Pinus monticola*) and sugar pine (*P. lambertiana*) are highly valued timber species, their silviculture...

Author(s): Stefan Zeglen, John Pronos, H. Merler

Year Published: 2010

Type: Document

Book or Chapter or Journal Article

Interactive effects of historical logging and fire exclusion on ponderosa pine forest structure in the northern Rockies

www.nrfirescience.org/resource/8210

Increased forest density resulting from decades of fire exclusion is often perceived as the leading cause of historically aberrant, severe, contemporary wildfires and insect outbreaks documented in some fire-prone forests of the western United States. Based on this notion, current U.S. forest policy directs managers to reduce stand...

Author(s): Cameron Naficy, Anna Sala, Eric G. Keeling, Jon Graham, Thomas H. DeLuca

Year Published: 2010

Type: Document

Book or Chapter or Journal Article

The Sagebrush Steppe Treatment Evaluation Project (SageSTEP): a test of state-and-transition theory

www.nrfirescience.org/resource/11226

The Sagebrush Steppe Treatment Evaluation Project (SageSTEP) is a comprehensive, integrated, long-term study that evaluates the ecological effects of fire and fire surrogate treatments designed to reduce fuel and to restore sagebrush (*Artemisia* spp.) communities of the Great Basin and surrounding areas. SageSTEP has several features...

Author(s): James D. Mclver, Mark W. Brunson, Stephen C. Bunting, Jeanne C. Chambers, Nora Devoe, Paul S. Doescher, James B. Grace, Dale Johnson, Steve Knick, Richard F. Miller, Michael L. Pellant, Frederick B. Pierson, David A. Pyke, Kimberly Rollins, Bruce A. Roundy, Eugene Schupp, Robin J. Tausch, David Turner
Year Published: 2010
Type: Document
Technical Report or White Paper

Emergency post-fire rehabilitation treatment effects on burned area ecology and long-term restoration

www.nrfirescience.org/resource/12591

The predicted continuation of strong drying and warming trends in the southwestern United States underlies the associated prediction of increased frequency, area, and severity of wildfires in the coming years. As a result, the management of wildfires and fire effects on public lands will continue to be a major land management...

Author(s): Peter R. Robichaud, Sarah A. Lewis, Robert E. Brown, Louise E. Ashmun
Year Published: 2009
Type: Document
Book or Chapter or Journal Article, Synthesis

Invasive pathogen threatens bird-pine mutualism: implications for sustaining a high-elevation ecosystem

www.nrfirescience.org/resource/8190

Human-caused disruptions to seed-dispersal mutualisms increase the extinction risk for both plant and animal species. Large-seeded plants can be particularly vulnerable due to highly specialized dispersal systems and no compensatory regeneration mechanisms. Whitebark pine (*Pinus albicaulis*), a keystone subalpine species, obligately...

Author(s): Shawn T. McKinney, Carl E. Fiedler, Diana F. Tomback
Year Published: 2009
Type: Document
Book or Chapter or Journal Article

Variable impacts of imazapic rate on downy brome (*Bromus tectorum*) and seeded species in two rangeland communities

www.nrfirescience.org/resource/8332

The herbicide imazapic is registered for use on rangelands and provides effective short-term control of certain invasive annual grasses. However, details about optimal application rates for downy brome and susceptibility of simultaneously seeded species are lacking. Thus, we investigated downy brome and seeded species responses to...

Author(s): Christo Morris, Thomas A. Monaco, Craig W. Rigby
Year Published: 2009
Type: Document
Book or Chapter or Journal Article

Short-term effects of forest restoration management on non-symbiotic nitrogen-fixation in western Montana

www.nrfirescience.org/resource/13154

Forest restoration treatments involving selection harvest and prescribed fire have been applied throughout the Rocky Mountain West with only a limited understanding of how these treatments influence plant community composition and soil processes. Forest restoration treatments, especially those involving fire, have the potential to...

Author(s): Tricia A. Burgoyne, Thomas H. DeLuca
Year Published: 2009
Type: Document
Book or Chapter or Journal Article

Tree squirrel habitat selection and predispersal seed predation in a declining subalpine conifer
www.nrfirescience.org/resource/8395

Differential responses by species to modern perturbations in forest ecosystems may have undesirable impacts on plant-animal interactions. If such disruptions cause declines in a plant species without corresponding declines in a primary seed predator, the effects on the plant could be exacerbated. We examined one such interaction...

Author(s): Shawn T. McKinney, Carl E. Fiedler
Year Published: 2009
Type: Document
Book or Chapter or Journal Article

Integrated analysis for management of fire and fuels, terrestrial and aquatic - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/12111

The potential for fire to negatively impact habitat that supports a threatened or endangered species, either directly or indirectly through phenomena such as debris flows, presents resource managers with a tough choice: treat fuels to reduce the risk of fire but potentially degrade stream habitat or do not treat fuels knowing an...

Author(s): Charles H. Luce, Bruce E. Rieman, Paul F. Hessburg, Anne E. Black, Matthew R. Dare
Year Published: 2009
Type: Document
Technical Report or White Paper

Landscape heterogeneity following large fires: insights from Yellowstone National Park, USA

www.nrfirescience.org/resource/8198

We characterised the remarkable heterogeneity following the large, severe fires of 1988 in Yellowstone National Park (YNP), in the northern Rocky Mountains, Wyoming, USA, by focussing on spatial variation in post-fire structure, composition and ecosystem function at broad, meso, and fine scales. Ecological heterogeneity at multiple...

Author(s): Tania L. Schoennagel, Erica A. H. Smithwick, Monica G. Turner
Year Published: 2008
Type: Document
Book or Chapter or Journal Article

Soils under fire: soils research and the Joint Fire Science Program

www.nrfirescience.org/resource/22819

Soils are fundamental to a healthy and functioning ecosystem. Therefore, forest land managers can greatly benefit from a more thorough understanding of the ecological impacts of fire and fuel management activities on the vital services soils provide. We present a summary of new research on fire effects and soils made possible...

Author(s): Heather E. Erickson, Rachel White
Year Published: 2008
Type: Document
Technical Report or White Paper

Living artifacts: the ancient ponderosa pines of the West

www.nrfirescience.org/resource/8160

Until late in the nineteenth century, magnificent ponderosa pine forests blanketed much of the inland West. They covered perhaps 30 million acres, an area the size of New York state, spreading across the mountains of New Mexico, Arizona, and California and flourishing throughout the eastern Cascades, the intermountain Pacific...

Author(s): Stephen F. Arno, Lars Ostlund, Robert E. Keane

Year Published: 2008

Type: Document

Book or Chapter or Journal Article

Wildland fire in ecosystems: fire and nonnative invasive plants

www.nrfirescience.org/resource/12531

This state-of-knowledge review of information on relationships between wildland fire and nonnative invasive plants can assist fire managers and other land managers concerned with prevention, detection, and eradication or control of nonnative invasive plants. The 16 chapters in this volume synthesize ecological and botanical...

Year Published: 2008

Type: Document

Synthesis, Technical Report or White Paper

Cone production in young post-fire *Pinus contorta* stands in Greater Yellowstone (USA)

www.nrfirescience.org/resource/8248

Spatial and temporal variability in cone production may influence post-disturbance succession, yet it is not well understood. We sampled 15-year old lodgepole pine (*Pinus contorta* var. *latifolia*) stands (n = 16) that regenerated naturally after the 1988 Yellowstone fires and varied in stand density (566-545,200 stems ha⁻¹) and...

Author(s): Monica G. Turner, Devin M. Turner, William H. Romme, Daniel B. Tinker

Year Published: 2007

Type: Document

Book or Chapter or Journal Article

CCE fire regimes and their management

www.nrfirescience.org/resource/8369

A spectacular forest in the center of the Crown of the Continent Ecosystem (CCE) cuts a 15- by 5-km swath along the Flathead River's South Fork around Big Prairie in the middle of the Bob Marshall Wilderness Area in Montana (Figure 13- 1). This wide valley bottom, which contains two patches (of about 1,000 ha each) of the last...

Author(s): Robert E. Keane, Carl H. Key

Year Published: 2007

Type: Document

Book or Chapter or Journal Article

Ten-year responses of ponderosa pine growth, vigor, and recruitment to restoration treatments in the Bitterroot Mountains, Montana, USA

www.nrfirescience.org/resource/13370

Little is known about ponderosa pine forest ecosystem responses to restoration practices in the Northern Rocky Mountains, USA. In this study, restoration treatments aimed at approximating historical forest structure and disturbances included modified single-tree selection cutting, with and without prescribed burning. We compared the...

Author(s): Alex Fajardo, Jon Graham, John M. Goodburn, Carl E. Fiedler

Year Published: 2007
Type: Document
Book or Chapter or Journal Article

Fire, fuels and restoration of ponderosa pine-Douglas fir forests in the Rocky Mountains, USA

www.nrfirescience.org/resource/8223

Forest restoration in ponderosa pine and mixed ponderosa pine-Douglas fir forests in the US Rocky Mountains has been highly influenced by a historical model of frequent, low-severity surface fires developed for the ponderosa pine forests of the Southwestern USA. A restoration model, based on this low-severity fire model, focuses on...

Author(s): William L. Baker, Thomas T. Veblen, Rosemary L. Sherriff

Year Published: 2007

Type: Document

Book or Chapter or Journal Article

Stand and fuel treatments for restoring old-growth ponderosa pine forests in the interior west (Boise Basin Experimental Forest) - Final report to the Joint Fire Science Program

www.nrfirescience.org/resource/13105

Fire exclusion, especially in the dry forests (i.e. those dominated or potentially dominated by ponderosa pine) has most often altered tree and shrub composition and structure and, though often overlooked in many locales, the forest floor from conditions that occurred historically (pre-1900). When fires are excluded...

Author(s): Russell T. Graham, Theresa B. Jain

Year Published: 2007

Type: Document

Technical Report or White Paper

Post-fire recovery of Wyoming big sagebrush shrub-steppe in central and southeast Montana

www.nrfirescience.org/resource/15386

Sagebrush is a widespread habitat throughout our study area and a number of species including Greater Sage-grouse, pronghorn, Brewers Sparrow, Sage Sparrow, Sage Thrasher and sagebrush vole are sagebrush dependent, at least at some stage of their life cycles. Fire constitutes an important driver in structuring sagebrush ecosystems;...

Author(s): Stephen V. Cooper, Peter Lesica, Greg Kudray

Year Published: 2007

Type: Document

Book or Chapter or Journal Article

The influence of white pine blister rust on seed dispersal in whitebark pine

www.nrfirescience.org/resource/8391

We tested the hypotheses that white pine blister rust (*Cronartium ribicola* J.C. Fisch.) damage in whitebark pine (*Pinus albicaulis* Engelm.) stands leads to reduced (1) seed cone density, (2) predispersal seed survival, and (3) likelihood of Clark's Nutcracker (*Nucifraga columbiana* (Wilson, 1811)) seed dispersal. We gathered data...

Author(s): Shawn T. McKinney, Diana F. Tomback

Year Published: 2007

Type: Document

Book or Chapter or Journal Article

Floods, fire, and ice: disturbance ecology of riparian cottonwoods

www.nrfirescience.org/resource/8237

Cottonwoods are poplar trees that are well adapted to dynamic riparian, or streamside, zones throughout the Northern Hemisphere. Here we assess the influences of three prominent physical disturbances, floods, fire, and ice, on cottonwood population ecology. We emphasize cottonwoods along rivers from the 'Crown of the Continent', the...

Author(s): Stewart B. Rood, Lori A. Goater, John M. Mahoney, Cheryl M. Pearce, Derald G. Smith

Year Published: 2007

Type: Document

Book or Chapter or Journal Article, Synthesis

Whitebark pine in peril: a case for restoration

www.nrfirescience.org/resource/12917

The purpose of this paper is to: 1) provide a range-wide assessment of whitebark pine health, 2) describe range-wide restoration strategies for conserving and restoring whitebark pine, 3) provide a brief managers guide for selecting restoration strategies, and 4) describe information needs and challenges to...

Author(s): John W. Schwandt

Year Published: 2006

Type: Document

Technical Report or White Paper

Interactions among fire, insects, and pathogens in coniferous forests of the interior western United States and Canada

www.nrfirescience.org/resource/8120

Natural and recurring disturbances caused by fire, native forest insects and pathogens have interacted for millennia to create and maintain forests dominated by seral or pioneering species of conifers in the interior regions of the western United States and Canada. Changes in fire suppression and other factors in the last century...

Author(s): Thomas J. Parker, Karen M. Clancy, Robert L. Mathiasen

Year Published: 2006

Type: Document

Book or Chapter or Journal Article, Synthesis

Influence of fire regimes on lodgepole pine stand age and density across the Yellowstone National Park (USA) landscape

www.nrfirescience.org/resource/18410

A probabilistic spatial model was created based on empirical data to examine the influence of different fire regimes on stand structure of lodgepole pine (*Pinus contorta* var. *latifolia*) forests across a >500,000-ha landscape in Yellowstone National Park, Wyoming, USA. We asked how variation in the frequency of large fire events...

Author(s): Tania L. Schoennagel, Monica G. Turner, Daniel M. Kashian, Andrew Fall

Year Published: 2006

Type: Document

Book or Chapter or Journal Article

The complexity of managing fire-dependent ecosystems in wilderness: relict ponderosa pine in the Bob Marshall Wilderness

www.nrfirescience.org/resource/7953

Isolated wilderness ecosystems with a history of frequent, low-severity fires have been altered due to many decades of fire exclusion and, as a result, are difficult to restore for philosophical and logistical reasons. In this paper, we describe the successional conditions of ponderosa pine (*Pinus ponderosa*)

communities along the...

Author(s): Robert E. Keane, Stephen F. Arno, Laura J. Dickinson

Year Published: 2006

Type: Document

Book or Chapter or Journal Article

Nitrogen spatial heterogeneity influences diversity following restoration in a ponderosa pine forest, Montana

www.nrfirescience.org/resource/7898

The resource heterogeneity hypothesis (RHH) is frequently cited in the ecological literature as an important mechanism for maintaining species diversity. The RHH has rarely been evaluated in the context of restoration ecology in which a commonly cited goal is to restore diversity. In this study we focused on the spatial...

Author(s): Michael J. Gundale, Thomas H. DeLuca, Carl E. Fiedler, Kerry L. Metlen

Year Published: 2006

Type: Document

Book or Chapter or Journal Article

Ponderosa pine ecosystems

www.nrfirescience.org/resource/11142

Ponderosa pine is one of the most widely distributed tree species in western North America. It is highly-valued as a source of lumber, but also is key to the health and social value western forests, whether growing in pure stands or in mixture with other conifer and hardwood species. In recent years, management objectives for...

Author(s): Russell T. Graham, Theresa B. Jain

Year Published: 2006

Type: Document

Synthesis, Technical Report or White Paper

Managing fire-prone forests in the Western United

www.nrfirescience.org/resource/16308

The management of fire-prone forests is one of the most controversial natural resource issues in the US today, particularly in the west of the country. Although vegetation and wildlife in these forests are adapted to fire, the historical range of fire frequency and severity was huge. When fire regimes are altered by human activity,...

Author(s): Reed F. Noss, Jerry F. Franklin, William L. Baker, Tania L. Schoennagel, Peter B. Moyle

Year Published: 2006

Type: Document

Book or Chapter or Journal Article

Salvage logging, ecosystem processes, and biodiversity conservation

www.nrfirescience.org/resource/16297

We summarize the documented and potential impacts of salvage logging—a form of logging that removes trees and other biological material from sites after natural disturbance. Such operations may reduce or eliminate biological legacies, modify rare postdisturbance habitats, influence populations, alter community composition, impair...

Author(s): D.B. Lindenmeyer, Reed F. Noss

Year Published: 2006

Type: Document

Book or Chapter or Journal Article

Fire and restoration of sagebrush ecosystems

www.nrfirescience.org/resource/15377

Wildlife managers often resort to prescribed fire to restore sagebrush (*Artemisia* spp.) ecosystems thought to have been affected by fire exclusion. However, a fire mosaic of burned and unburned areas may be tolerated by certain wildlife but can be detrimental to sagebrush obligates. This article assesses evidence about the...

Author(s): William L. Baker

Year Published: 2006

Type: Document

Book or Chapter or Journal Article

Whitebark pine guidelines for planting prescriptions

www.nrfirescience.org/resource/11005

This paper reviews general literature, research studies, field observations, and standard Forest Service survival surveys of high-elevation whitebark pine plantations and presents a set of guidelines for outplanting prescriptions. When planting whitebark pine, the recommendations are: 1) reduce overstory competition; 2) reduce...

Author(s): Joe H. Scott, Ward W. McCaughey

Year Published: 2006

Type: Document

Conference Proceedings

Vegetation response to restoration treatments in ponderosa pine-Douglas-fir forests

www.nrfirescience.org/resource/11503

The study site is located at the University of Montana's Lubrecht Experimental Forest, Missoula County, Montana, USA. This study is 1 of 13 in a nationwide network of Fire/Fire Surrogate (FFS) studies investigating the interdisciplinary effects of treatments designed to reduce fire hazard and restore the structure and function of...

Author(s): Kerry L. Metlen, Erich K. Dodson, Carl E. Fiedler

Year Published: 2006

Type: Document

Research Brief or Fact Sheet

Restoration treatments in a Montana ponderosa pine forest: effects on soil physical, chemical, and biological properties

www.nrfirescience.org/resource/7899

Low-elevation ponderosa pine ecosystems of the inland northwestern United States experienced frequent, low-severity fire that promoted open stands dominated by large diameter ponderosa pine (*Pinus ponderosa*). Fire exclusion has led to increased stand densities, often due to proliferation of less fire-tolerant species and an...

Author(s): Michael J. Gundale, Thomas H. DeLuca, Carl E. Fiedler, Philip W. Ramsey, Michael G.

Harrington, James E. Gannon

Year Published: 2005

Type: Document

Book or Chapter or Journal Article

Plant succession and approaches to community restoration

www.nrfirescience.org/resource/8418

The processes of vegetation change over time, or plant succession, are also the processes involved in plant community restoration. Restoration efforts attempt to use designed disturbance, seedbed

preparation and sowing methods, and selection of adapted and compatible native plant materials to enhance ecological function. The large...

Author(s): Bruce A. Roundy

Year Published: 2005

Type: Document

Conference Proceedings, Synthesis

Changes in bird abundance after wildfire: importance of fire severity and time since fire

www.nrfirescience.org/resource/8256

Fire can cause profound changes in the composition and abundance of plant and animal species, but logistics, unpredictability of weather, and inherent danger make it nearly impossible to study high-severity fire effects experimentally. We took advantage of a unique opportunity to use a before-after/control-impact (BACI) approach to...

Author(s): Kristina M. Smucker, Richard L. Hutto, Brian M. Steele

Year Published: 2005

Type: Document

Book or Chapter or Journal Article

Restoring Wyoming big sagebrush

www.nrfirescience.org/resource/8420

The widespread occurrence of big sagebrush can be attributed to many adaptive features. Big sagebrush plays an essential role in its communities by providing wildlife habitat, modifying local environmental conditions, and facilitating the reestablishment of native herbs. Currently, however, many sagebrush steppe communities are...

Author(s): Cindy R. Lysne

Year Published: 2005

Type: Document

Conference Proceedings, Synthesis

Fire ecology of ponderosa pine and the rebuilding of fire-resilient ponderosa pine ecosystems

www.nrfirescience.org/resource/11074

The ponderosa pine ecosystems of the West have change dramatically since Euro-American settlement 140 years ago due to past land uses and the curtailment of natural fire. Today, ponderosa pine forests contain overabundance of fuel, and stand densities have increased from a range of 49-124 trees ha⁻¹ (20-50 trees acre⁻¹) to a range...

Author(s): Stephen A. Fitzgerald

Year Published: 2005

Type: Document

Conference Proceedings, Synthesis

Strategies to enhance plant structure and diversity in crested wheatgrass seedings

www.nrfirescience.org/resource/8417

Crested wheatgrass (*Agropyron cristatum* sensu amplo [L.] Gaertn.) is an introduced, caespitose grass that has been seeded on millions of acres of Western rangelands. In some areas, crested wheatgrass seedings overlap with critical sage-grouse (*Centrocercus urophasianus*; *C. minimus*) habitat, raising the question of how plant...

Author(s): Michael L. Pellant, Cindy R. Lysne

Year Published: 2005

Type: Document

Conference Proceedings, Synthesis

Sage-grouse habitat restoration symposium proceedings

www.nrfirescience.org/resource/11007

Declines in habitat of greater sage-grouse and Gunnison sage-grouse across the western United States are related to degradation, loss, and fragmentation of sagebrush ecosystems resulting from development of agricultural lands, grazing practices, changes in wildfire regimes, increased spread of invasive species, gas and oil...

Author(s): Nancy L. Shaw, Michael L. Pellant, Stephen B. Monsen

Year Published: 2005

Type: Document

Conference Proceedings

Effective management strategies for sage-grouse and sagebrush: a question of triage?

www.nrfirescience.org/resource/8367

The sagebrush (*Artemisia* spp.) ecosystem once occupied over 150 million acres of western North America (Barbour and Billings 1988). The ecosystem still occupies over 100 million acres (Connelly et al. 2004, Wisdom et al. 2005), but the abundance and condition of sagebrush communities is declining rapidly in response to a variety of...

Author(s): Michael J. Wisdom, Mary M. Rowland, Robin J. Tausch

Year Published: 2005

Type: Document

Book or Chapter or Journal Article

Nitrogen cycling and spatial heterogeneity following fire and restoration treatments in the ponderosa pine/douglas-fir ecosystem

www.nrfirescience.org/resource/11281

Lower elevation ponderosa pine ecosystems of the Rocky Mountain West (U.S.) historically experienced a frequent, low-intensity fire regime that promoted dominance of large diameter ponderosa pine (*Pinus ponderosa*). An abrupt change in this historical disturbance regime occurred upon Euro-American settlement of the West in the late...

Author(s): Michael J. Gundale

Year Published: 2005

Type: Document

Dissertation or Thesis

Restoration of ponderosa pine forests in the interior western U.S. after logging, grazing, and fire suppression

www.nrfirescience.org/resource/8195

No description entered.

Author(s): Merrill R. Kaufmann, Kevin C. Ryan, Peter Z. Fule, William H. Romme

Year Published: 2005

Type: Document

Book or Chapter or Journal Article

Big sagebrush: A sea fragmented into lakes, ponds, and puddles

www.nrfirescience.org/resource/15446

Pioneers traveling along the Oregon Trail from western Nebraska, through Wyoming and southern Idaho and into eastern Oregon, referred to their travel as an 800 mile journey through a sea of sagebrush, mainly big sagebrush (*Artemisia tridentata*). Today approximately 50 percent of the sagebrush sea has given way to agriculture, cities...

Author(s): Bruce L. Welch

Year Published: 2005
Type: Document
Technical Report or White Paper

Seeding considerations in restoring big sagebrush habitat

www.nrfirescience.org/resource/8421

This paper describes methods of managing or seeding to restore big sagebrush communities for wildlife habitat. The focus is on three big sagebrush subspecies, Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), and mountain big sagebrush (*Artemisia tridentata*...

Author(s): Scott M. Lambert
Year Published: 2005
Type: Document
Conference Proceedings, Synthesis

Physiological response of ponderosa pine in western Montana to thinning, prescribed fire, and burning season

www.nrfirescience.org/resource/8147

Low-elevation ponderosa pine (*Pinus ponderosa* Dougl. ex. Laws.) forests of the northern Rocky Mountains historically experienced frequent low-intensity fires that maintained open uneven-aged stands. A century of fire exclusion has contributed to denser ponderosa pine forests with greater competition for resources, higher tree stress...

Author(s): Anna Sala, Gregory D. Peters, Lorna R. McIntyre, Michael G. Harrington
Year Published: 2005
Type: Document
Book or Chapter or Journal Article

Landscape restoration for greater sage-grouse: implications for multiscale planning and monitoring

www.nrfirescience.org/resource/8419

Habitats and populations of greater sage-grouse (*Centrocercus urophasianus*) have declined throughout western North America in response to a myriad of detrimental land uses. Successful restoration of this species' habitat, therefore, is of keen interest to Federal land agencies who oversee management of most remaining habitat. To...

Author(s): Michael J. Wisdom, Mary M. Rowland, Miles A. Hemstrom, Barbara C. Wales
Year Published: 2005
Type: Document
Conference Proceedings, Synthesis

Reseeding big sagebrush: techniques and issues

www.nrfirescience.org/resource/11006

Reestablishing big sagebrush on rangelands now dominated by native perennial grasses, introduced perennial grasses, or exotic annual grasses, particularly cheatgrass (*Bromus tectorum*), serves to stabilize soil, improve moisture availability and nutrient recycling, increase biological diversity, and foster community stability and...

Author(s): Nancy L. Shaw, Ann M. DeBolt, Roger Rosentreter
Year Published: 2005
Type: Document
Conference Proceedings

Dry forests and wildland fires of the inland Northwest USA: contrasting the landscape ecology of the pre-settlement and modern eras

www.nrfirescience.org/resource/7941

Prior to Euro-American settlement, dry ponderosa pine and mixed conifer forests (hereafter, the 'dry forests') of the Inland Northwest were burned by frequent low- or mixed-severity fires. These mostly surface fires maintained low and variable tree densities, light and patchy ground fuels, simplified forest structure, and favored...

Author(s): Paul F. Hessburg, James K. Agee, Jerry F. Franklin

Year Published: 2005

Type: Document

Book or Chapter or Journal Article, Synthesis

Restoring dry and moist forests of the inland northwestern U. S.

www.nrfirescience.org/resource/7903

The complex topography of the inland northwestern U.S. (58.4 million ha) interacts with continental and maritime air masses to create a highly variable climate, which results in a variety of forest settings.

Historically (1850 to 1900), approximately 20% of the area was covered by dry forests (*Pinus ponderosa*, *Pseudotsuga menziesii*...

Author(s): Theresa B. Jain, Russell T. Graham

Year Published: 2005

Type: Document

Book or Chapter or Journal Article

Basic considerations for range and wildlife revegetation and restoration

www.nrfirescience.org/resource/11118

Plummer and others (1968) proposed 10 principles to follow when planning and implementing rangeland revegetation programs. These principles - or basic considerations for rangeland managers - are applicable to most sites in the Western United States (Jordan 1981; Merkel and Herbal 1973), and many projects in the Intermountain area...

Author(s): Richard Stevens

Year Published: 2004

Type: Document

Technical Report or White Paper

Incorporating wildlife habitat needs into restoration and rehabilitation projects

www.nrfirescience.org/resource/11119

Description not entered

Author(s): Richard Stevens

Year Published: 2004

Type: Document

Technical Report or White Paper

Restoring vigor and reducing hazard in an old growth western larch stand (Montana)

www.nrfirescience.org/resource/7926

Description not entered

Author(s): Carl E. Fiedler, Michael G. Harrington

Year Published: 2004

Type: Document

Book or Chapter or Journal Article

Enhancing moist forest restoration opportunities in riparian systems

www.nrfirescience.org/resource/10976

In northern Rocky Mountain moist forests, riparian systems contain many attributes that create unique biophysical conditions that alter disturbances and microenvironments; thus creating distinct forest structures, species composition, and management challenges. For example, browsing, limited opening size, competition from...

Author(s): Theresa B. Jain, Russell T. Graham

Year Published: 2004

Type: Document

Conference Proceedings, Synthesis

Forbs for seeding range and wildlife habitats

www.nrfirescience.org/resource/11120

Description not entered

Author(s): Richard Stevens, Stephen B. Monsen

Year Published: 2004

Type: Document

Technical Report or White Paper

Guidelines for restoration and rehabilitation of principal plant communities

www.nrfirescience.org/resource/11121

Range and wildland improvement projects conducted throughout the Intermountain region normally occur within specific plant communities. Each plant community has unique features that require different equipment, planting techniques, and plant materials to conduct improvement projects. Plant communities or associations discussed in...

Author(s): Richard Stevens, Stephen B. Monsen

Year Published: 2004

Type: Document

Technical Report or White Paper

Postfire management on forested public lands of the western United States

www.nrfirescience.org/resource/7913

Forest ecosystems in the western United States evolved over many millennia in response to disturbances such as wildfires. Land use and management practices have altered these ecosystems, however, including fire regimes in some areas. Forest ecosystems are especially vulnerable to postfire management practices because such practices...

Author(s): Robert L. Beschta, Jonathan J. Rhodes, J. Boone Kauffman, Robert E. Gresswell, G. Wayne Minshall, James R. Karr, David A. Perry, F. Richard Hauer, Christopher A. Frissell

Year Published: 2004

Type: Document

Book or Chapter or Journal Article

The effect of fire interval on understory communities in Yellowstone National Park (USA)

www.nrfirescience.org/resource/21731

Questions: How does the time interval between subsequent stand-replacing fire events affect post-fire understory cover and composition following the recent event? How important is fire interval relative to broad- or local-scale environmental variability in structuring post-fire understory communities?

Location:...

Author(s): Tania L. Schoennagel, D. M. Waller, Monica G. Turner, William H. Romme

Year Published: 2004

Type: Document

Book or Chapter or Journal Article

Status of native fishes in the western United States and issues for fire and fuels management

www.nrfirescience.org/resource/8131

Conservation of native fishes and changing patterns in wildfire and fuels are defining challenges for managers of forested landscapes in the western United States. Many species and populations of native fishes have declined in recorded history and some now occur as isolated remnants of what once were larger more complex systems....

Author(s): Bruce E. Rieman, Danny C. Lee, Denver P. Burns, Robert E. Gresswell, Michael K. Young, Rick Stowell, John N. Rinne, Phil Howell

Year Published: 2003

Type: Document

Book or Chapter or Journal Article, Synthesis

Comparing two methods of identifying ecological restoration opportunities

www.nrfirescience.org/resource/8430

Two methods for identifying ecological restoration opportunities in the Northern Region of the Forest Service are compared. Different analysis methods are often used to address issues at different planning scales. The first method is a nonspatial characterization of current vegetation conditions using Forest Inventory and Analysis (...)

Author(s): Jimmie D. Chew

Year Published: 2003

Type: Document

Conference Proceedings

Key issues in fire regime research for fuels management and ecological restoration

www.nrfirescience.org/resource/11025

The premise behind many projects aimed at wildfire hazard reduction and ecological restoration in forests of the western United States is the idea that unnatural fuel buildup has resulted from suppression of formerly frequent fires. This premise and its implications need to be critically evaluated by conducting area-specific...

Author(s): Thomas T. Veblen

Year Published: 2003

Type: Document

Conference Proceedings

Prescribed fire effects on dalmation toadflax

www.nrfirescience.org/resource/8281

Prescribed fires are important for rangeland restoration and affect plant community composition and species interactions. Many rangeland plant communities have been, or are under the threat of noxious weed invasion, however there is little information on how fire effects weeds. Our objective was to determine the effects of...

Author(s): James S. Jacobs, Roger L. Sheley

Year Published: 2003

Type: Document

Book or Chapter or Journal Article

Simulated indigenous management: a new model for ecological restoration in national parks

www.nrfirescience.org/resource/16119

Native American land management practices could revive the processes needed to maintain the classic

ecosystems and cultural integrity of our nation parks.

Author(s): M. Kat Anderson, Michael G. Barbour

Year Published: 2003

Type: Document

Book or Chapter or Journal Article

Cascading effects of fire exclusion in Rocky Mountain ecosystems: a literature review

www.nrfirescience.org/resource/11187

The health of many Rocky Mountain ecosystems is in decline because of the policy of excluding fire in the management of these ecosystems. Fire exclusion has actually made it more difficult to fight fires, and this poses greater risks to the people who fight fires and for those who live in and around Rocky Mountain forests and...

Author(s): Robert E. Keane, Kevin C. Ryan, Thomas T. Veblen, Craig D. Allen, Jesse A. Logan, Brad C. Hawkes

Year Published: 2002

Type: Document

Synthesis, Technical Report or White Paper

Effect of thinning and prescribed burning on crown fire severity in ponderosa pine forests

www.nrfirescience.org/resource/8121

Fire exclusion policies have affected stand structure and wildfire hazard in north American ponderosa pine forests. Wildfires are becoming more severe in stands where trees are densely stocked with shade-tolerant understory trees. Although forest managers have been employing fuel treatment techniques to reduce wildfire hazard for...

Author(s): Jolie Pollet, Philip N. Omi

Year Published: 2002

Type: Document

Book or Chapter or Journal Article

Use of fire and silvicultural techniques for whitebark pine restoration successes, caveats, and assessment techniques

www.nrfirescience.org/resource/10982

Whitebark pine (*Pinus albicaulis*) is a keystone species in upper subalpine forests of many parts of the northern Rocky Mountains and Cascades in the United States and Canada. These diverse ecosystems have been declining in parts of its range because of recent mountain pine beetle (*Dendroctonus ponderosae*) and blister rust (...)

Author(s): Robert E. Keane, Katherine Kendall, Robert Crabtree

Year Published: 2002

Type: Document

Conference Proceedings

Aspen's ecological role in the West

www.nrfirescience.org/resource/11883

Aspen exhibits a variety of ecological roles. In southern Colorado, the 1880 landscape mosaic contained a range of stand ages, of which half were >70 years old and half were younger. Pure aspen stands in southern Colorado are widespread and may result from previous short fire intervals that eliminated local conifer seed sources....

Author(s): William H. Romme, Lisa Floyd-Hanna, David D. Hanna, Elisabeth Bartlett

Year Published: 2001

Type: Document

Conference Proceedings

Whitebark pine communities: ecology and restoration

www.nrfirescience.org/resource/16422

Whitebark pine is a dominant feature of western high-mountain regions, offering an important source of food and high-quality habitat for species ranging from Clark's nutcracker to the grizzly bear. But in the northwestern United States and southwestern Canada, much of the whitebark pine is disappearing.

Why is a high-mountain...

Year Published: 2001

Type: Document

Book or Chapter or Journal Article

Strategies for managing whitebark pine in the presence of white pine blister rust

www.nrfirescience.org/resource/7902

Description not entered

Author(s): Raymond J. Hoff, Dennis E. Ferguson, GERAL I. McDONALD, Robert E. Keane

Year Published: 2001

Type: Document

Book or Chapter or Journal Article, Synthesis

Restoration concepts and techniques

www.nrfirescience.org/resource/8399

Innovative techniques are needed to restore the health of whitebark pine (*Pinus albicaulis*) communities in the northern Rocky Mountains of the United States, inland West, and adjacent areas of Canada, because of the detrimental effects of the exotic disease white pine blister rust (*Cronartium ribicola*) coupled with fire exclusion...

Author(s): Robert E. Keane, Stephen F. Arno

Year Published: 2001

Type: Document

Book or Chapter or Journal Article

Alternative ponderosa pine restoration treatments in the western United States

www.nrfirescience.org/resource/8409

Compared to presettlement times, many ponderosa pine forest of the United States are now more dense and have greater quantities of fuels. Widespread treatments are needed in these forests to restore ecological integrity and to reduce the risk of uncharacteristically severe fires. Among possible restorative treatments, however, the...

Author(s): James D. McIver, Charles P. Weatherspoon, Carleton B. Edminster

Year Published: 2001

Type: Document

Conference Proceedings

Ponderosa pine ecosystems restoration and conservation: steps toward stewardship; April 25-27, 2000; Flagstaff, AZ

www.nrfirescience.org/resource/11888

This volume is divided into three sections: (1) Ecological, Biological, and Physical Science; (2) Social and Cultural; and (3) Economics and Utilization. Effective ecological restoration requires a combination of science and management. The authors of the first section exemplified this integration in the course of addressing a broad...

Author(s): Regina K. Vance, Carleton B. Edminster, W. Wallace Covington, Julie A. Blake

Year Published: 2001

Type: Document
Conference Proceedings

Effects of disturbance and management of forest health on fish and fish habitat in eastern Oregon and Washington

www.nrfirescience.org/resource/18562

Effects of fire, forest insects and diseases, grazing, and forest health treatments on fish populations and habitat are reviewed. Fire, insects, and disease affect fish habitat by their influence on the rate and volume of woody debris recruitment to streams, canopy cover and water temperature, stream flow, channel erosion,...

Author(s): Phil Howell

Year Published: 2001

Type: Document

Book or Chapter or Journal Article

Linking wilderness research and management, volume 1. Wilderness fire restoration and management: an annotated reading list

www.nrfirescience.org/resource/19692

This reference list provides an overview of key literature relating to fire restoration and management in wilderness and similarly protected areas. This list, which centers on the United States, should be helpful to managers or researchers new to the topic, or to those seeking knowledge about specific aspects of wilderness fire...

Author(s): Marion Hourdequin

Year Published: 2001

Type: Document

Synthesis

Can the fire-dependent whitebark pine be saved?

www.nrfirescience.org/resource/7927

In recent decades, whitebark pine has been declining due to epidemics and fire exclusion (Keane and Arno 1993; Kendall and Arno 1990). In the northern Rocky Mountains, a project is underway to explore the feasibility of using fire and silviculture to restore the tree's high-elevation habitat.

Author(s): Robert E. Keane

Year Published: 2001

Type: Document

Book or Chapter or Journal Article, Synthesis

Mixed-severity fire regimes in the Northern Rocky Mountains: consequences of fire exclusion and options for the future

www.nrfirescience.org/resource/8426

Findings from fire history studies have increasingly indicated that many forest ecosystems in the northern Rocky Mountains were shaped by mixed-severity fire regimes, characterized by fires of variable severities at intervals averaging between about 30 and 100 years. Perhaps because mixed-severity fire regimes and their resulting...

Author(s): Stephen F. Arno, David J. Parsons, Robert E. Keane

Year Published: 2000

Type: Document

Conference Proceedings, Synthesis

Landscape trends (1753-1993) of whitebark pine (*Pinus albicaulis*) forests in the west big hole

range of Idaho/Montana

www.nrfirescience.org/resource/7965

Pinus albicaulis (whitebark pine) is an important tree species in subalpine forests of the Northern Rocky Mountains. Populations have been declining at unprecedented rates due to the introduction of an exotic pathogen and fire suppression. We initiated this study to evaluate historical trends in Pinus albicaulis abundance along with...

Author(s): Michael P. Murray, Stephen C. Bunting, Michael P. Murray

Year Published: 2000

Type: Document

Book or Chapter or Journal Article

Guidelines to manage sage grouse populations and their habitats

www.nrfirescience.org/resource/15385

The status of sage grouse populations and habitats has been a concern to sportsmen and biologists for >80 years. Despite management and research efforts that date to the 1930s, breeding populations of this species have declined throughout much of its range. In May 1999, the western sage grouse (*C. urophasianus phaios*) in...

Author(s): John W. Connelly, Michael A. Schroeder, Alan R. Sands, Clait E. Braun

Year Published: 2000

Type: Document

Management or Planning Document

Associated riparian communities

www.nrfirescience.org/resource/10962

Some 100 years of fire exclusion in the Interior Northwest has resulted in riparian areas dominated by dense thickets of shade-tolerant trees. If former, more open conditions could be restored, these habitats could once more support a more diverse bird community. Efforts toward this at two study sites are described.

Author(s): Colin C. Hardy, Robert E. Keane, Michael G. Harrington

Year Published: 2000

Type: Document

Conference Proceedings

Restoration of whitebark pine ecosystems in western Montana and central Idaho

www.nrfirescience.org/resource/19232

No description available

Author(s): Robert E. Keane, Stephen F. Arno

Year Published: 2000

Type: Document

Conference Proceedings

Protecting people and sustaining resources in fire-adapted ecosystems: a cohesive strategy

www.nrfirescience.org/resource/11223

This strategy is based on the premise that sustainable resources are predicated on healthy, resilient ecosystems. In fire-adapted ecosystems, some measure of fire use-at appropriate intensity, frequency, and time of year-should be included in management strategies intended to protect and sustain watersheds, species, and other...

Author(s): Lyle Laverty, Gerald W. Williams

Year Published: 2000

Type: Document

Technical Report or White Paper

Miller Creek: ecosystem recovery in a western Montana forest 30 years after prescribed burning and wildfire

www.nrfirescience.org/resource/18682

Thirty years ago the effects of timber harvest, prescribed burning, and wildfire were investigated in a western larch/Douglas-fir forest on the Flathead National Forest in western Montana. The original study was designed to investigate the effects of prescribed burning on soil physical and biological properties, and on subsequent...

Author(s): Jonalea R. Tonn, Martin F. Jurgensen, G. D. Mroz, Deborah S. Page-Dumroese

Year Published: 2000

Type: Document

Conference Proceedings

Synergy between ecological needs and economic aspects of ecosystem restoration

www.nrfirescience.org/resource/11050

The implementation of properly designed treatments to restore and sustain desired forest conditions in the Inland Northwest, besides moving forest stands more rapidly to an ecologically desirable and sustainable condition, can generate positive revenues from the timber to be removed. These treatments also have potential to increase...

Author(s): Charles E. Keegan, Carl E. Fiedler

Year Published: 2000

Type: Document

Technical Report or White Paper

Ecosystem-based management in the whitebark pine zone

www.nrfirescience.org/resource/11892

Declining whitebark pine (*Pinus albicaulis*) forests have necessitated development of innovative methods to restore these ecologically valuable, high elevation ecosystems. We have begun an extensive restoration study using prescribed fire and silvicultural cuttings to return native ecological processes to degenerating whitebark pine...

Author(s): Robert E. Keane, Stephen F. Arno, Catherine A. Stewart

Year Published: 2000

Type: Document

Conference Proceedings

Silvicultural treatments

www.nrfirescience.org/resource/11891

Sustainable, ecologically-based management of pine/fir forests requires silviculturists to integrate several treatments that emulate historic disturbance processes. Restoration prescriptions typically include cleaning or heavy understory thinning, improvement cutting to reduce the proportion of firs, and modified selection cutting...

Author(s): Carl E. Fiedler

Year Published: 2000

Type: Document

Conference Proceedings

White pine in the American West: a vanishing species - can we save it?

www.nrfirescience.org/resource/13112

Forest scientists ask that everyone, from the home gardener to the forest manager, help revive western white pine by planting it everywhere, even in nonforest environments such as our neighborhood streets,

parks, and backyards. White pine, long ago considered the "King Pine," once dominated the moist inland forests of the Northwest...

Author(s): Leon F. Neuenschwander, James W. Byler, Alan E. Harvey, GERAL I. McDonald, Denise S. Ortiz, Harold L. Osborne, Gerry C. Snyder, Arthur Zack

Year Published: 1999

Type: Document

Technical Report or White Paper

Proceedings: ecology and management of pinyon-juniper communities within the Interior West; September 15-18, 1997; Provo, UT

www.nrfirescience.org/resource/11884

A symposium held September 15-18, 1997, in Provo, UT, and Sanpete County, UT, provided information on the ecology, management, resource values, and restoration of pinyon-juniper communities in the Interior Western United States. The conference was hosted by the USDA Forest Service, Rocky Mountain Research Station and the Utah...

Author(s): Stephen B. Monsen, Richard Stevens

Year Published: 1999

Type: Document

Conference Proceedings

Transitions and thresholds: influences and implications for management in pinyon and juniper woodlands

www.nrfirescience.org/resource/12107

Thresholds are important to understanding Great Basin ecology. Once a threshold has been crossed, the new community may have very different functional capabilities than the previous community. Management action needs to occur well before a threshold is crossed to be effective, and that action needs to reflect the scales of time and...

Author(s): Robin J. Tausch

Year Published: 1999

Type: Document

Conference Proceedings

Patterns of lodgepole pine regeneration following the 1988 Yellowstone fires

www.nrfirescience.org/resource/8276

In 1988, fires killed extensive lodgepole pine (*Pinus contorta* Dougl. ex. Loud) in Yellowstone National Park. This species bears both serotinous and non-serotinous cones, with the former most common in fire-origin stands of an even-aged character. Reconnaissance of burned stands indicated that former even-aged communities...

Author(s): Ralph D. Nyland

Year Published: 1998

Type: Document

Book or Chapter or Journal Article

Restoring fire in lodgepole pine forests of the Intermountain West

www.nrfirescience.org/resource/8347

We are developing new management treatments for regenerating and sustaining lodgepole pine (*Pinus contorta*) forests through emulation of natural disturbance processes. Lodgepole pine is the principal forest cover on over 26 million hectares in western North America. While infrequent, stand replacing fires following mountain pine...

Author(s): Colin C. Hardy, Ward W. McCaughey

Year Published: 1997

Type: Document
Book or Chapter or Journal Article

Coarse-scale restoration planning and design in Interior Columbia River Basin ecosystems: an example for restoring declining whitebark pine forests

www.nrfirescience.org/resource/11243

During the last 2 years, many people from numerous government agencies and private institutions compiled a scientific assessment of the natural and human resources of the Interior Columbia River Basin (Jensen and Bourgeron 1993). This assessment is meant to guide the development of a coarse-scale Environmental Impact Statement for...

Author(s): Robert E. Keane, James P. Menakis, Wendel J. Hann

Year Published: 1996

Type: Document

Management or Planning Document, Technical Report or White Paper

Dealing with public concerns in restoring fire to the forest

www.nrfirescience.org/resource/11253

Public support is important to all restoration efforts on public lands. Some types of restoration activities are easier for the public to support than others. Restoring wetlands, habitat restoration for salmon or burrowing owls, and vegetative rehabilitation are generally acceptable practices. Most restoration projects and...

Author(s): Leslie A. C. Weldon

Year Published: 1996

Type: Document

Technical Report or White Paper

Silvicultural applications: restoring ecological structure and process in ponderosa pine forests

www.nrfirescience.org/resource/11246

A primary goal of restoration treatments in ponderosa pine (*Pinus ponderosa*)/fir forests is to create more open stand structures, thereby improving tree vigor and reducing vulnerability to insects, disease, and severe fire. An additional goal in some stands is to manipulate existing species composition and site conditions to favor...

Author(s): Carl E. Fiedler

Year Published: 1996

Type: Document

Technical Report or White Paper

The concept: restoring ecological structure and process in ponderosa pine forests

www.nrfirescience.org/resource/11245

Elimination of the historic pattern of frequent low-intensity fires in ponderosa pine and pine-mixed conifer forests has resulted in major ecological disruptions. Prior to 1900, open stands of large, long-lived, fire-resistant ponderosa pine were typical. These were accompanied in some areas by other fire-dependent species such as...

Author(s): Stephen F. Arno

Year Published: 1996

Type: Document

Technical Report or White Paper

Stand hazard rating for central Idaho forests

www.nrfirescience.org/resource/11254

Growing concern over sustainability of central Idaho forests has created a need to assess the health of forest stands on a relative basis. A stand hazard rating was developed as a composite of 11 individual ratings to compare the health hazards of different stands. The composite rating includes Douglas-fir beetle, mountain pine...

Author(s): Robert W. Steele, Ralph E. Williams, Julie C. Weatherby, Elizabeth D. Reinhardt, James T. Hoffman, R. W. Thier

Year Published: 1996

Type: Document

Technical Report or White Paper

The use of fire in forest restoration

www.nrfirescience.org/resource/11235

The 26 papers in this document address the current knowledge of fire as a disturbance agent, fire history and fire regimes, applications of prescribed fire for ecological restoration, and the effects of fire on the various forested ecosystems of the north-western United States. The main body of this document is organized in three...

Author(s): Colin C. Hardy, Stephen F. Arno

Year Published: 1996

Type: Document

Technical Report or White Paper

Restoring historic landscape patterns through management: restoring fire mosaics on the landscape

www.nrfirescience.org/resource/11250

Seral, fire dependent lodgepole pine (*Pinus contorta* Dougl.) communities are an important component of upper elevation forests throughout the Northern Rockies, where they cover 4 million acres, or about 17 percent of the land base. On the Bitterroot National Forest, lodgepole pine occurs mostly between 5,500 and 7,500 feet.

Author(s): Catherine A. Stewart

Year Published: 1996

Type: Document

Technical Report or White Paper

Whitebark pine ecosystem restoration in western Montana

www.nrfirescience.org/resource/11251

From the Background... 'A rapid decline in whitebark pine has occurred during the last 60 years as a result of three interrelated factors: epidemics of mountain pine beetle (*Dendroctonus ponderosae*); the introduced disease white pine blister rust (*Cronartium ribicola*); and successional replacement by shade-tolerant conifers,...

Author(s): Robert E. Keane, Stephen F. Arno

Year Published: 1996

Type: Document

Book or Chapter or Journal Article

Prescribed fire applications: restoring ecological structure and process in ponderosa pine forests

www.nrfirescience.org/resource/11247

The decision to include the fire process as part of a restoration treatment for a particular forest site is most logically made in conjunction with the decision for a silvicultural treatment. In other words, forest managers do not typically wait to visually or quantitatively evaluate the post harvest site before deciding whether or...

Author(s): Michael G. Harrington
Year Published: 1996
Type: Document
Technical Report or White Paper

Reestablishing fire-adapted communities to riparian forests in the ponderosa pine zone

www.nrfirescience.org/resource/11248

Ecological research has implicated the practice of fire exclusion as a major contributor to forest health problems in the semiarid ponderosa pine (*Pinus ponderosa*) zone of the Inland West (Mutch and others 1993; Sampson and others 1994). Prior to 1900, frequent, low-intensity fires occurred on upland forests in this forest zone at...

Author(s): Matthew K. Arno
Year Published: 1996
Type: Document
Technical Report or White Paper

Restoring recreational and residential forests

www.nrfirescience.org/resource/11249

Several decades of fire suppression following logging around the turn-of-the-century has produced dense, even-age stands of ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*). They contrast with the original forests where frequent, low-intensity fires gave rise to open, parklike, and often uneven-age stands of...

Author(s): Joe H. Scott
Year Published: 1996
Type: Document
Technical Report or White Paper

Examples of fire restoration in Glacier National Park

www.nrfirescience.org/resource/11252

Covering just over 1 million acres, Glacier National Park straddles the Continental Divide in northwestern Montana. Diverse vegetation communities include moist western cedar- western hemlock (*Thuja plicata* - *Tsuga heterophylla*) old growth forests similar to those of the Pacific Coast, dry western grasslands and prairies, dense...

Author(s): Laurie L. Kurth
Year Published: 1996
Type: Document
Technical Report or White Paper

Ecological implications of sagebrush manipulation: A literature review

www.nrfirescience.org/resource/15427

The Montana Department of Fish, Wildlife & Parks (FWP) has long recognized the importance of sagebrush/grassland vegetative communities as wildlife habitat. Efforts to manipulate these communities concern FWP because of the potential implications to wildlife. Some groups believe sagebrush control generally will have beneficial...

Author(s): Joel G. Peterson
Year Published: 1995
Type: Document
Management or Planning Document

Restoring fire-dependent ponderosa pine forests in western Montana

www.nrfirescience.org/resource/13364

Many foresters and ecologists recognize that disruption of the historic pattern of frequent fires in ponderosa pine forests has resulted in major ecological changes, including increasingly severe wildfires and insect and disease epidemics (Weaver, 1943; Covington and Moore, 1992; Mutch and others, 1993; Everett, 1994). In response...

Author(s): Stephen F. Arno, Michael G. Harrington, Carl E. Fiedler, Clinton E. Carlson

Year Published: 1995

Type: Document

Book or Chapter or Journal Article

Restoration of upper subalpine whitebark pine ecosystems in western Montana

www.nrfirescience.org/resource/19233

Description not available

Author(s): Robert E. Keane, Stephen F. Arno, Catherine A. Stewart

Year Published: 1995

Type: Document

Conference Proceedings

Social and political issues in ecological restoration

www.nrfirescience.org/resource/12415

There are four major questions affecting the future of ecological restoration. The first and most serious question is philosophical. Should we attempt to restore ecosystems? Some people want to separate humans from nature because they believe that human intervention is bad or imperfect. They define "natural" as the absence of human...

Author(s): Thomas M. Bonnicksen

Year Published: 1994

Type: Document

Conference Proceedings, Technical Report or White Paper

Proceedings-ecology and management of annual rangelands; 1992 May 18-21; Boise, ID

www.nrfirescience.org/resource/12046

Annual weeds continue to expand throughout the West eliminating many desirable species and plant communities. Wildfires are now common on lands infested with annual weeds, causing a loss of wildlife habitat and other natural resources. Measures can be used to reduce burning and restore native plant communities, but restoration is...

Author(s): Stephen B. Monsen, Stanley G. Kitchen

Year Published: 1994

Type: Document

Conference Proceedings, Technical Report or White Paper

Recovery of lotic communities and ecosystems from disturbance - a narrative review of case studies

www.nrfirescience.org/resource/18696

We present a narrative account of case studies of the recovery of flowing water systems from disturbance, focusing on the investigators' conclusions about recovery time and the factors contributing to recovery. We restrict our attention to case studies in which the recovery of some biological property of the system has been examined...

Author(s): J. David Yount, Gerald J. Niemi

Year Published: 1990

Type: Document

Book or Chapter or Journal Article

Disturbance regimes, resilience, and recovery of animal communities and habitats in lotic ecosystems

www.nrfirescience.org/resource/18623

Disturbance regime is a critical organizing feature of stream communities and ecosystems. The position of a given reach in the river basin and the sediment type within that reach are two key determinants of the frequency and intensity of flow-induced disturbances. We distinguish between predictable and unpredictable events and...

Author(s): Seth R. Reice, Robert C. Wissmar, Robert J. Naiman

Year Published: 1990

Type: Document

Book or Chapter or Journal Article

Whitebark pine cone crops - a diminishing source of wildlife food

www.nrfirescience.org/resource/19234

Whitebark pine (*Pinus albicaulis*)s found at timberline and in subalpine forests from central California and western Wyoming north to British Columbia and Alberta. This species has been of little interest for commercial timber, but in recent years its large seeds(average 2 ,600/1bh) have been recognized as an important food source...

Author(s): Stephen F. Arno

Year Published: 1986

Type: Document

Book or Chapter or Journal Article

Presettlement vegetation in the sagebrush-grass area of the Intermountain West

www.nrfirescience.org/resource/15437

Twenty-nine journals and diaries were reviewed for their vegetation descriptions of the sagebrush-grass area in an attempt to assess the relative importance of herbaceous plants and woody brush in the northern Intermountain West. The early writings suggest a pristine vegetation visual& dominated by shrubs. Stands of grass...

Author(s): Thomas R. Vale

Year Published: 1975

Type: Document

Book or Chapter or Journal Article

Evidence for population differentiation among Jeffrey and Ponderosa pines in survival, growth and phenology

www.nrfirescience.org/resource/18740

Ecological restoration projects that include reforestation require that land managers select appropriate source of seeds for long-term persistence. In California, the standard approach for making this choice is based on seed zone and elevational band, both geographically-based measures. However, given the pace of contemporary...

Author(s): Alejandra Martínez-Berdeja, Jill A. Hamilton, Aurore Bontemps, Johanna Schmitt, Jessica W. Wright

Type: Document

Book or Chapter or Journal Article

Rice straw mulch for post-fire erosion control: assessing non-target effects on vegetation communities

www.nrfirescience.org/resource/22074

Straw mulch is commonly used for post-fire erosion control in severely burned areas but this practice can introduce non-native species, even when certified weed-free straw is used. Rice straw has recently been promoted as an alternative to wheat under the hypothesis that non-native species that are able to grow in a rice field are...

Author(s): Kristen L. Shive, Becky L. Estes, Angela M. White, Hugh Safford, Kevin L. O'Hara, Scott L. Stephens

Type: Document

Book or Chapter or Journal Article