

Fire impacts on soil microorganisms: mass, activity and diversity

www.nrfirescience.org/resource/23540

The ecosystem response to fire is often linked to fire severity and recurrence, with potentially large consequences on both above- and below-ground processes. Understanding the fire impact has become increasingly important in the light of recent changes to disturbance regimes due to climate change. While the impacts on the above...

Author(s): Ana Barreiro, Montserrat Diaz-Raviña

Year Published: 2021

Type: Document

Book or Chapter or Journal Article

Impacts of bark beetle-induced tree mortality on pyrogenic carbon production and heat output in wildfires for fire modeling and global carbon accounting

www.nrfirescience.org/resource/22911

Forests store significant quantities of carbon, and accurate quantification of the fate of this carbon after fire is necessary for global carbon accounting. Pyrogenic carbon (PyC) encompasses various carbonaceous products of incomplete combustion formed during fires and has potential to act as a carbon sink for up to millennia, but...

Author(s): Alexandra Howell, Mario Bretfeld, Erica Belmont

Year Published: 2021

Type: Document

Book or Chapter or Journal Article

Wildfire severity influences offspring sex ratio in a native solitary bee

www.nrfirescience.org/resource/22740

Although ecological disturbances can have a strong influence on pollinators through changes in habitat, virtually no studies have quantified how characteristics of wildfire influence the demography of essential pollinators. Nevertheless, evaluating this topic is critical for understanding how wildfire is linked to pollinator...

Author(s): Sara M. Galbraith, James H. Cane, James W. Rivers

Year Published: 2021

Type: Document

Book or Chapter or Journal Article

Predicting the spatiotemporal exposure of aquatic species to intrusions of fire retardant in streams with limited data

www.nrfirescience.org/resource/23557

Because fire retardant can enter streams and harm aquatic species including endangered fish, agencies such as the U.S. Forest Service (USFS) must estimate the downstream extent of toxic effects every time fire retardant enters streams (denoted as an "intrusion"). A challenge in estimating the length of stream affected by the...

Author(s): Chris R. Rehmann, P. Ryan Jackson, Holly J. Puglis

Year Published: 2021

Type: Document

Book or Chapter or Journal Article

Prescribed fire use promotes native bee biodiversity in a semi-arid forest ecosystem

www.nrfirescience.org/resource/23474

Insect pollinators, especially bees, are an essential component ecosystem function. Native bees provide key ecosystem services and shape the structure and composition of plant communities. However, recent research suggests a large-scale decline in bee populations, compelling the need for

further research of the drivers and...

Author(s): Ryleigh V. Gelles, Thomas S. Davis, Camille Stevens-Rumann, Kevin J. Barrett

Year Published: 2021

Type: Document

Technical Report or White Paper

Biotic and abiotic drivers of plant–pollinator community assembly across wildfire gradients

www.nrfirescience.org/resource/22756

Understanding how abiotic disturbance and biotic interactions determine pollinator and flowering?plant diversity is critically important given global climate change and widespread pollinator declines. To predict responses of pollinators and flowering?plant communities to changes in wildfire disturbance, a mechanistic...

Author(s): Joseph A. LaManna, Laura A. Burkle, R. Travis Belote, Jonathan A. Myers

Year Published: 2021

Type: Document

Book or Chapter or Journal Article

Future dominance by quaking aspen expected following short?interval, compounded disturbance interaction

www.nrfirescience.org/resource/22560

The spatial overlap of multiple ecological disturbances in close succession has the capacity to alter trajectories of ecosystem recovery. Widespread bark beetle outbreaks and wildfire have affected many forests in western North America in the past two decades in areas of important habitat for native ungulates. Bark beetle outbreaks...

Author(s): Robert A. Andrus, Sarah J. Hart, Niko Tutland, Thomas T. Veblen

Year Published: 2021

Type: Document

Book or Chapter or Journal Article

Management of forest fire buffer zones: Implications for flowering plants and bees

www.nrfirescience.org/resource/22098

Pollination, especially by bees, has high importance for man and nature. Ongoing global declines in bee populations make their present and future conservation crucial. We investigated how management of natural areas affects plants and pollinators, in the context of fire prevention measures in Mediterranean forests. The standard...

Author(s): Alon Ornai, Gidi Ne'eman, Tamar Keasar

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Disturbance history modulates how litter and herbaceous cover influence conifer regeneration after fire

www.nrfirescience.org/resource/21417

Climate-driven increases in disturbance frequency and extent augment the potential for compounded disturbances. Drawing on well-studied forests that experienced successive disturbances, we asked: (1) how does post-fire cover of litter, herbaceous cover and bare ground vary between stands affected by combinations of blow-down, insect...

Author(s): Nathan S. Gill, Daniel Jarvis, John Rogan, Dominik Kulakowski

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Mountain pine beetle in Colorado: A story of changing forests

www.nrfirescience.org/resource/21010

The mountain pine beetle (MPB) (*Dendroctonus ponderosae*) is one of the most prevalent disturbance agents in western conifer forests. It utilizes various species of pines (*Pinus* spp.) as host trees. Eruptive populations can cause extensive tree mortality. Since the late 1990s, extensive outbreaks have occurred from the southern...

Author(s): Jose F. Negrón, Bob Cain

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Bark beetle infestation of western US forests: A context for assessing and evaluating impacts

www.nrfirescience.org/resource/21007

Bark beetles are primary disturbance agents in western US forests. Outbreaks affect goods and services associated with forest ecosystems including timber, water, fish and wildlife habitats and populations, recreation opportunities, and many others. They can also affect wildfire behavior and its intensity. Assessments and evaluations...

Author(s): Daniel W. McCollum, John E. Lundquist

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

High-severity wildfire limits available floral pollen quality and bumble bee nutrition compared to mixed-severity burns

www.nrfirescience.org/resource/20835

High-severity wildfires, which can homogenize floral communities, are becoming more common relative to historic mixed-severity fire regimes in the Northern Rockies of the U.S. High-severity wildfire could negatively affect bumble bees, which are typically diet generalists, if floral species of inadequate pollen quality dominate the...

Author(s): Michael P. Simanonok, Laura A. Burkle

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Climatic influences on forest fire and mountain pine beetle outbreaks and resulting runoff effects in large watersheds in British Columbia, Canada

www.nrfirescience.org/resource/22331

Many studies have defined the interrelationships between climate, forest disturbance, and runoff at small scales (<100 km²), but few have translated these relationships to large watersheds (>500 km²). In this study, we explore the relationship between climate, extreme forest fire seasons, mountain pine beetle (MPB) outbreaks,...

Author(s): Margot E. Vore, Stephen J. Déry, Yiping Hou, Xiaohua Wei

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Use of microarthropods to evaluate the impact of fire on soil biological quality

www.nrfirescience.org/resource/21668

Edaphic (i.e. soil dwelling) microarthropods play crucial roles in soil ecosystem services. Fire is a

widespread form of disturbance with severe effects on soil invertebrates. Research on the effects of fire on soil arthropods, however, has been mostly focused on surface-active species. Information on the effects of fire on strictly...

Author(s): Cristina Mantoni, Michele Di Musciano, Simone Fattorini

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Fire weather drives daily area burned and observations of fire behavior in mountain pine beetle affected landscapes

www.nrfirescience.org/resource/21279

In the western United States, mountain pine beetles (MPBs) have caused tree mortality across 7% of the forested area over the past three decades, leading to concerns of increased fire activity in MPB-affected landscapes. While fire behavior modeling suggests MPB-associated changes in fuels may influence fire behavior, retrospective...

Author(s): Sarah J. Hart, Daniel L. Preston

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Taking the Long View: Mountain Pine Beetles as Agents of Change

www.nrfirescience.org/resource/21008

Mountain pine beetles (MPB) are a constant presence in the Rocky Mountain Region, with a long history of periodic outbreaks. The latest beetle epidemic, which lasted from the late 1990s until about 2012, was particularly impactful in Colorado, where an estimated 800 million lodgepole and ponderosa pine trees were killed. However, as...

Author(s): Jose F. Negrón, Robert J. Cain

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

A global synthesis of fire effects on pollinators

www.nrfirescience.org/resource/20328

Aim: Understanding fire effects on pollinators is critical in the context of fire regime changes and the global pollination crisis. Through a systematic and quantitative review of the literature, we provide the first global assessment of pollinator responses to fire. We hypothesize that pollinators increase after fire and during the...

Author(s): Lucas M. Carbone, Julia Tavella, Juli G. Pausas, Ramiro Aguilar

Year Published: 2019

Type: Document
Book or Chapter or Journal Article

Mountain pine beetle outbreak enhanced resin duct-defenses of lodgepole pine trees

www.nrfirescience.org/resource/19737

Millions of hectares of lodgepole pine trees have been affected by the recent mountain pine beetle outbreaks, which also left significant numbers of live host trees in some areas. Studies have primarily focused on the changes of forest conditions in post-outbreak stands, but whether such changes impact the growth, defense, and their...

Author(s): Shiyang Zhao, Jennifer G. Klutsch, Jonathan A. Cale, Nadir Erbilgin

Year Published: 2019

Type: Document
Book or Chapter or Journal Article

Beyond red crowns: complex changes in surface and crown fuels and their interactions 32 years following mountain pine beetle epidemics in south-central Oregon, USA

www.nrfirescience.org/resource/19250

Background: Mountain pine beetle (*Dendroctonus ponderosae* Hopkins; MPB), a bark beetle native to western North America, has caused vast areas of tree mortality over the last several decades. The majority of this mortality has been in lodgepole pine (*Pinus contorta* Douglas ex Loudon) forests and has heightened concerns over the...

Author(s): Travis J. Woolley, David C. Shaw, LaWen Hollingsworth, Michelle Agne, Stephen A. Fitzgerald, Andris Eglitis, Laurie L. Kurth

Year Published: 2019

Type: Document
Book or Chapter or Journal Article

Immediate fire-induced changes in soil microbial community composition in an outdoor experimental controlled system

www.nrfirescience.org/resource/20601

Short-term fire-induced changes to the soil microbial community are usually closely associated to fire severity, which essentially consists in the fire-induced loss or decomposition of organic matter above ground and below ground. Many functional processes and soil properties, including plant recolonization and soil microorganism...

Author(s): Manuel E. Lucas-Borja, Isabel Miralles, Raul Ortega, Pedro A. Plaza-Álvarez, Javier González-Romero, Javier Sagra Cózar, Miguel Soriano-Rodríguez, Giacomo Certini, Daniel Moya, Jorge de las Heras

Year Published: 2019

Type: Document
Book or Chapter or Journal Article

TRIA-Net: 10 years of collaborative research on turning risk into action for the mountain pine beetle epidemic

www.nrfirescience.org/resource/20547

Forest insects are showing increasing intensity of outbreaks and expanded ranges, and this has become a major challenge for forest managers. An understanding of these systems often depends upon detailed examination of complex interactions involving multiple organisms. In 2013, a team of researchers formed TRIA-Net, an NSERC support...

Author(s): Patrick M.A. James, Dezene P.W. Huber

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

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

Wildfire alters the structure and seasonal dynamics of nocturnal pollen-transport networks

www.nrfirescience.org/resource/20335

Wildfires drive global biodiversity patterns and affect plant–pollinator interactions, and are expected to become more frequent and severe under climate change. Post-fire plant communities often have increased floral abundance and diversity, but the effects of wildfires on the ecological process of pollination are poorly...

Author(s): Paula Banza, Callum J. Macgregor, Anabela D. F. Belo, Richard Fox, Michael J. O. Pocock, Darren M. Evans

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Effects of variable density thinning and burning treatments - JFSP Final Report

www.nrfirescience.org/resource/20111

Over recent decades, increases in substantial tree mortality events have coincided with severe drought and bark beetle outbreak. This has prompted forest managers to find treatments that enhance resistance to disturbances. Variable density thinning is an alternative management method intended to increase spatial heterogeneity, with...

Author(s): Jeffrey M. Kane, Alexis Bernal

Year Published: 2019

Type: Document

Technical Report or White Paper

Wild bee diversity increases with local fire severity in a fire-prone landscape

www.nrfirescience.org/resource/19428

As wildfire activity increases in many regions of the world, it is imperative that we understand how key components of fire-prone ecosystems respond to spatial variation in fire characteristics. Pollinators provide a foundation for ecological communities by assisting in the reproduction of native plants, yet our understanding of...

Author(s): Sara M. Galbraith, James H. Cane, Andrew R. Moldenke, James W. Rivers

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Post-spruce beetle timber salvage drives short-term surface fuel increases and understory vegetation shifts

www.nrfirescience.org/resource/19317

Recent, widespread spruce beetle (*Dendroctonus rufipennis*) outbreaks have driven extensive tree mortality across western North America. Post-disturbance forest management often includes salvage logging to capture economic value of dead timber, reduce fire hazard, and meet other social or ecological objectives. Little is known about...

Author(s): Lucas R. Mattson, Jonathan D. Coop, Michael A. Battaglia, Anthony S. Cheng, Jason S. Sibold, Sara Viner

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Spatial-Temporal Patterns of Spruce Budworm Defoliation within Plots in Québec

www.nrfirescience.org/resource/19062

We investigated the spatial-temporal patterns of spruce budworm (*Choristoneura fumiferana* (Clem.); SBW) defoliation within 57 plots over 5 years during the current SBW outbreak in Québec. Although spatial-temporal variability of SBW defoliation has been studied at several scales, the spatial dependence between individual defoliated...

Author(s): Mingke Li, David A. MacLean, Chris R. Hennigar, Jae Ogilvie

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Large, high-severity burn patches limit fungal recovery 13 years after wildfire in a ponderosa pine forest

www.nrfirescience.org/resource/20607

Over the past three decades, wildfires in southwestern US ponderosa pine (*Pinus ponderosa* Lawson & C. Lawson) forests have increased in size and severity. These wildfires can remove large, contiguous patches of mature forests, alter dominant plant communities and increase woody debris, potentially altering fungal community...

Author(s): Suzanne M. Owen, Adair M. Patterson, Catherine A. Gehring, Carolyn Hull Sieg, L. Scott Baggett, Peter Z. Fule

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Salvage logging reduces wild bee diversity, but not abundance, in severely burned mixed-conifer forest

www.nrfirescience.org/resource/20575

Natural disturbances are critical for supporting biodiversity in many ecosystems, but subsequent management actions can influence the quality of habitat that follow these events. Post-disturbance salvage logging has negative consequences on certain components of forest biodiversity, but populations of some early seral-adapted...

Author(s): Sara M. Galbraith, James H. Cane, Andrew R. Moldenke, James W. Rivers

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Biological Aspects of Mountain Pine Beetle in Lodgepole Pine Stands of Different Densities in Colorado, USA

www.nrfirescience.org/resource/18813

Research highlights: The biology of mountain pine beetle (MPB), *Dendroctonus ponderosae* Hopkins, in

Colorado's lodgepole pine forests exhibits similarities and differences to other parts of its range. Brood emergence was not influenced by stand density nor related to tree diameter. The probability of individual tree attack is...

Author(s): Jose F. Negrón

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Nesting success of wood-cavity-nesting bees declines with increasing time since wildfire

www.nrfirescience.org/resource/20488

Bees require distinct foraging and nesting resources to occur in close proximity. However, spatial and temporal patterns in the availability and quantity of these resources can be affected by disturbances like wildfire. The potential for spatial or temporal separation of foraging and nesting resources is of particular concern for...

Author(s): Michael P. Simanonok, Laura A. Burkle

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Modelling landscape genetic connectivity of the mountain pine beetle in western Canada

www.nrfirescience.org/resource/20388

The current mountain pine beetle (MPB; *Dendroctonus ponderosae* Hopkins, 1902) outbreak has reached more than 25 million hectares of forests in North America, affecting pine species throughout the region and substantially changing landscapes. However, landscape features that enhance or limit dispersal during the geographic expansion...

Author(s): Julian Wittische, Jasmine K. Janes, Patrick M.A. James

Year Published: 2019

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

Balancing ecological costs and benefits of fire for population viability of disturbance-dependent butterflies

www.nrfirescience.org/resource/17368

Disturbance is a fundamental ecological process and driver of population dynamics. Ecologists seek to understand the effects of disturbance on ecological systems and to use disturbance to modify habitats degraded by anthropogenic change. Demographic responses by plants to disturbance are often well described, but demographic...

Author(s): Norah Warchola, Elizabeth E. Crone, Cheryl B. Schultz

Year Published: 2018

Type: Document
Book or Chapter or Journal Article

Fire-induced change in floral abundance, density, and phenology benefits bumble bee foragers

www.nrfirescience.org/resource/17345

Fire is a dominant, and well-studied, structuring force in many temperate and semi-arid communities; yet, few studies have investigated the effects of fire on multi-trophic interactions. Here, we ask how fire-induced changes in flowering affect the abundance of bumble bee foragers (*Bombus vosnesenskii*) and whether differences in...

Author(s): John M. Mola, Neal M. Williams

Year Published: 2018

Type: Document
Book or Chapter or Journal Article

Simulation of net ecosystem productivity of a lodgepole pine forest after mountain pine beetle attack using a modified version of 3-PG

www.nrfirescience.org/resource/17169

The most recent mountain pine beetle (MPB) (*Dendroctonus ponderosae*) outbreak in British Columbia (BC), which began in the late 1990s, killed ~54% of the mature merchantable lodgepole pine and was expected to impact gross primary productivity (GPP), ecosystem respiration (R) and thus net ecosystem productivity (NEP) of infested...

Author(s): Gesa Meyer, T. Andrew Black, Rachhpal S. Jassal, Zoran Nesic, Nicholas C. Coops, Andreas Christen, Arthur L. Fredeen, David L. Spittlehouse, Nicholas J. Grant, Vanessa N. Foord, Rebecca Bowler

Year Published: 2018

Type: Document
Book or Chapter or Journal Article

Effects of Disturbance on Tree Community Dynamics in Whitebark Pine (*Pinus albicaulis* Engelm.) Ecosystems

www.nrfirescience.org/resource/18870

Whitebark pine (*Pinus albicaulis* Engelm.), an ecologically important tree species in high-elevation ecosystems of western North America, is threatened by white pine blister rust (*Cronartium ribicola* Fischer) and increased pressure from mountain pine beetle (*Dendroctonus ponderosae* Hopkins) due to climate warming. In addition, there...

Author(s): Jeremy T. Amberson, Megan P. Keville, Cara R. Nelson

Year Published: 2018

Type: Document
Book or Chapter or Journal Article

Severity of Overstory Mortality Influences Conifer Recruitment and Growth in Mountain Pine Beetle-Affected Forests

www.nrfirescience.org/resource/18310

The severity of lodgepole pine mortality from mountain pine beetle outbreaks varies with host tree diameter, density, and other structural characteristics, influencing subcanopy conditions and tree regeneration. We measured density and leader growth of shade-intolerant lodgepole pine, shade-tolerant Engelmann spruce, and very shade-...

Author(s): Kristen Pelz, Charles C. Rhoades, Robert M. Hubbard, Frederick W. Smith

Year Published: 2018

Type: Document
Book or Chapter or Journal Article

Recovering from the mountain pine beetle

www.nrfirescience.org/resource/18838

Beginning in the late 1990s, the pine forests of Montana began to experience the largest mountain pine beetle outbreak in recorded history. Large swaths of forests began to turn red, then gray as the beetles ate their way through Pacific Northwest stands. At their peak in 2009, this native insect infested nearly 3.7 million acres...

Author(s): Dan R. Loeffler, Nathaniel Anderson

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

Conventional fire behavior modeling systems are inadequate for predicting fire behavior in bark beetle-impacted forests (Project INT-EM-F-11-03) - Chapter 13

www.nrfirescience.org/resource/17919

Understanding the impacts of mountain pine beetle (MPB; *Dendroctonus ponderosae* Hopkins) on fire behavior is important from both an ecological and land management viewpoint. However, numerous uncertainties exist in the linkages of MPB-caused tree mortality to changes in canopy and surface fuels (e.g., fuel loading, arrangement, and...

Author(s): Sharon M. Hood, Robert E. Keane, Helen Y. Smith, Joel M. Egan, Lisa M. Holsinger

Year Published: 2018

Type: Document

Technical Report or White Paper

Overlapping bark beetle outbreaks, salvage logging and wildfire restructure a lodgepole pine ecosystem

www.nrfirescience.org/resource/17365

The 2010 Church's Park Fire burned beetle-killed lodgepole pine stands in Colorado, including recently salvage-logged areas, creating a fortuitous opportunity to compare the effects of salvage logging, wildfire and the combination of logging followed by wildfire. Here, we examine tree regeneration, surface fuels, understory plants...

Author(s): Charles C. Rhoades, Kristen Pelz, Paula J. Fornwalt, Brett Wolk, Anthony S. Cheng

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Landscape Topoedaphic Features Create Refugia from Drought and Insect Disturbance in a Lodgepole and Whitebark Pine Forest

www.nrfirescience.org/resource/18867

Droughts and insect outbreaks are primary disturbance processes linking climate change to tree mortality in western North America. Refugia from these disturbances—locations where impacts are less severe relative to the surrounding landscape—may be priorities for conservation, restoration, and monitoring. In this study,...

Author(s): Jennifer Cartwright

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Whitebark Pine Prevalence and Ecological Function in Treeline Communities of the Greater Yellowstone Ecosystem, U.S.A.: Potential Disruption by White Pine Blister Rust

www.nrfirescience.org/resource/18305

In the northern Rocky Mountains of the U.S. and Canada, whitebark pine (*Pinus albicaulis* Engelm.) is a functionally important species in treeline communities. The introduced fungal pathogen *Cronartium ribicola*, which causes white pine blister rust, has led to extensive whitebark pine mortality nearly rangewide. We examined four...

Author(s): Aaron C. Wagner, Diana F. Tomback, Lynn M. Resler, Elizabeth R. Pansing

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Ecological effects and effectiveness of silvicultural restoration treatments in whitebark pine forests

www.nrfirescience.org/resource/18064

Silvicultural thinning treatments to restore whitebark pine (*Pinus albicaulis*) are widely used in subalpine forests throughout the western United States (US) and Canada. The objectives of these treatments are to (1) improve the condition of whitebark pine at all ages, (2) to improve seedling recruitment processes, and (3) mitigate...

Author(s): Colin T. Maher, Cara R. Nelson, Andrew J. Larson, Anna Sala

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

A multientury dendrochronological reconstruction of western spruce budworm outbreaks in the Okanogan Highlands, northeastern Washington

www.nrfirescience.org/resource/16464

The western spruce budworm (*Choristoneura occidentalis occidentalis* Freeman) is recognized as the most ecologically and economically damaging defoliator in western North America. Synchronous western spruce budworm outbreaks can occur over much of a host species' range, causing widespread limb and tree mortality, regeneration...

Author(s): Todd M. Ellis, Aquila Flower

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Fires following bark beetles: factors controlling severity and disturbance interactions in ponderosa pine

www.nrfirescience.org/resource/16316

Previous studies have suggested that bark beetles and fires can be interacting disturbances, whereby bark beetle– caused tree mortality can alter the risk and severity of subsequent wildland fires. However, there remains considerable uncertainty around the type and magnitude of the interaction between fires

following bark beetle...

Author(s): Carolyn Hull Sieg, Rodman Linn, F. Pimont, Chad M. Hoffman, Joel D. McMillin, Judith Winterkamp, Scott L. Baggett

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Effects of fire on pollinators and pollination

www.nrfirescience.org/resource/15080

Summary: 1) Increased incidence of landscape fire and pollinator declines with co-extinctions of dependent plant species are both globally significant. Fire can alter species distributions, but its effects on plant–pollinator interactions are poorly understood so its present and future role in coupled plant–pollinator declines...

Author(s): Julian Brown, Alan York, Fiona J. Christie, Michael A. McCarthy

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Fires following Bark Beetles: Factors Controlling Severity and Disturbance Interactions in Ponderosa Pine

www.nrfirescience.org/resource/16727

Previous studies have suggested that bark beetles and fires can be interacting disturbances, whereby bark beetle–caused tree mortality can alter the risk and severity of subsequent wildland fires. However, there remains considerable uncertainty around the type and magnitude of the interaction between fires following bark beetle...

Author(s): Carolyn Hull Sieg, Rodman Linn, F. Pimont, Chad M. Hoffman, Joel D. McMillin, Judith Winterkamp, Scott L. Baggett

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Uneven-aged silviculture can reduce negative effects of forest management on beetles

www.nrfirescience.org/resource/16656

Decline in biodiversity have increased the interest in alternative forest management approaches. Unevenaged silviculture has been proposed as a mean to maintain continuity of forest canopy cover, mimic small-scale disturbances and provide a stratified forest structure similar to that of old-growth forests and therefore better...

Author(s): Klara Joelsson, Joakim Hjältén, Timothy Work, Heloise Gibb, Jean-Michel Roberge, Therese Löfroth

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Evidence of compounded disturbance effects on vegetation recovery following high-severity wildfire and spruce beetle outbreak

www.nrfirescience.org/resource/16510

Spruce beetle (*Dendroctonus rufipennis*) outbreaks are rapidly spreading throughout subalpine forests of the Rocky Mountains, raising concerns that altered fuel structures may increase the ecological severity of wildfires. Although many recent studies have found no conclusive link between beetle outbreaks and increased fire size or...

Author(s): Amanda R. Carlson, Jason S. Sibold, Timothy J. Assal, Jose F. Negron

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

Western Spruce Budworm and Wildfire: Is There a Connection?

www.nrfirescience.org/resource/17546

In the interior Pacific Northwest, extensive defoliation of mixed conifer forests during outbreaks of western spruce budworm (WSB) may leave the visual impression of a tinderbox with trees primed to burst into flame. But is this the case? We addressed this question with funding from the USDA/U.S. Department of the Interior Joint...

Author(s): Daniel G. Gavin, Aquila Flower, Greg M. Cohn, Russell A. Parsons, Emily K. Heyerdahl

Year Published: 2017

Type: Document
Book or Chapter or Journal Article

Prescribed fire in grassland butterfly habitat: targeting weather and fuel conditions to reduce soil temperature and burn severity

www.nrfirescience.org/resource/16319

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: 2017

Type: Document
Book or Chapter or Journal Article

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

Interactions of landscape disturbances and climate change dictate ecological pattern and process: spatial modeling of wildfire, insect, and disease dynamics under future climates

www.nrfirescience.org/resource/15531

Context: Interactions among disturbances, climate, and vegetation influence landscape patterns and ecosystem processes. Climate changes, exotic invasions, beetle outbreaks, altered fire regimes, and human activities may interact to produce landscapes that appear and function beyond historical analogs. Objectives We used the...

Author(s): Rachel A. Loehman, Robert E. Keane, Lisa M. Holsinger, Zhiwei Wu

Year Published: 2017

Type: Document
Book or Chapter or Journal Article

Separating Trends in Whitebark Pine Radial Growth Related to Climate and Mountain Pine Beetle Outbreaks in the Northern Rocky Mountains, USA

www.nrfirescience.org/resource/17206

Drought and mountain pine beetle (*Dendroctonus ponderosae* Hopkins) outbreaks have affected millions of hectares of high-elevation conifer forests in the Northern Rocky Mountains during the past century. Little research has examined the distinction between mountain pine beetle outbreaks and climatic influence on radial growth in...

Author(s): Saskia L. van de Gevel, Evan R. Larson, Henri D. Grissino-Mayer

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

The Influence of Western Spruce Budworm on Fire in Spruce-Fir Forests

www.nrfirescience.org/resource/16730

Western spruce budworm (*Choristoneura freemani* Razowski; WSBW) is the most significant defoliator of coniferous trees in the western United States. Despite its important influence on Western forests, there are still gaps in our knowledge of WSBW's impact on fire, and little research has been done on this relationship in high-...

Author(s): Eric Vane, Kristen M. Waring, Adam Polinko

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Recent and future climate suitability for whitebark pine mortality from mountain pine beetles varies across the western US

www.nrfirescience.org/resource/16680

Recent mountain pine beetle outbreaks in whitebark pine forests have been extensive and severe. Understanding the climate influences on these outbreaks is essential for developing management plans that account for potential future mountain pine beetle outbreaks, among other threats, and informing listing decisions under the...

Author(s): Polly C. Buotte, Jeffrey A. Hicke, Haiganoush K. Preisler, John T. Abatzoglou, Kenneth F. Raffa, Jesse A. Logan

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Estimating aboveground tree biomass for beetle-killed lodgepole pine in the Rocky Mountains of northern Colorado

www.nrfirescience.org/resource/16593

The recent mountain pine beetle (*Dendroctonus ponderosae* Hopkins) epidemic has affected millions of hectares of conifer forests in the Rocky Mountains. Land managers are interested in using biomass from beetle-killed trees for bioenergy and biobased products, but they lack adequate information to accurately estimate biomass in...

Author(s): Woodam Chung, Paul Evangelista, Nathaniel Anderson, Anthony Vorster, Hee Han, Krishna Poudel, Robert Sturtevant

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Native bee nesting habitat use after wildfire in Montana - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/17561

Changing fire regimes are leading to increasing scale and severity of burns, which may affect habitat for species of concern. Wood-cavity nesting bees are one such community, in that they have discrete foraging and nesting habitats which can both be maintained or removed by wildfire. Our objective is to provide data on how different...

Author(s): Michael P. Simanonok, Laura A. Burkle

Year Published: 2017

Type: Document

Technical Report or White Paper

The Influence of fuel moisture and flammable monoterpenes on the combustibility of conifer fuels

www.nrfirescience.org/resource/15574

Bark beetle-caused tree mortality and its effect on both the fuels complex and potential fire behavior in affected forests, particularly lodgepole pine forests, has been a topic of much debate in recent years (Hicke et al. 2012; Jenkins et al. 2012; Black et al. 2013). Early research on the subject seemed to suggest a...

Author(s): Michael J. Jenkins, Justin B. Runyon, Martin E. Alexander, Wesley G. Page, Andrew Guinta

Year Published: 2016

Type: Document

Technical Report or White Paper

Climate influences on whitebark pine mortality from mountain pine beetle in the Greater Yellowstone Ecosystem

www.nrfirescience.org/resource/14565

Extensive mortality of whitebark pine, beginning in the early to mid-2000s, occurred in the Greater Yellowstone Ecosystem (GYE) of the western US, primarily from mountain pine beetle but also from other threats such as white pine blister rust. The climatic drivers of this recent mortality and the potential for future whitebark pine...

Author(s): Polly C. Buotte, Jeffrey A. Hicke, Haiganoush K. Preisler, John T. Abatzoglou, Kenneth F. Raffa, Jesse A. Logan

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

Effects of post-fire logging on fuel dynamics in a mixed-conifer forest, Oregon, USA: a 10-year assessment

www.nrfirescience.org/resource/14429

Removal of fire-killed trees (i.e. post-fire or salvage logging) is often conducted in part to reduce woody fuel loads and mitigate potential reburn effects. Studies of post-salvage fuel dynamics have primarily used chronosequence or modelling approaches, with associated limitations; longitudinal studies tracking fuels over time...

Author(s): John L. Campbell, Daniel C. Donato, Joseph B. Fontaine

Year Published: 2016

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

Fuel loads and simulated fire behavior in 'old-stage' beetle-infested ponderosa pine of the Colorado Plateau

www.nrfirescience.org/resource/14527

Recent bark beetle outbreaks in western North America have led to concerns regarding changes in fuel profiles and associated changes in fire behavior. Data are lacking for a range of infestation severities and time since outbreak, especially for relatively arid cover types. We surveyed fuel loads and simulated fire behavior for...

Author(s): E. Matthew Hansen, Morris C. Johnson, Barbara J. Bentz, A. Steven Munson

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

Temperate forest health in an era of emerging megadisturbance

www.nrfirescience.org/resource/13722

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

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

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

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

The role of wildfire, prescribed fire, and mountain pine beetle infestations on the population dynamics of black-backed woodpeckers in the Black Hills, South Dakota

www.nrfirescience.org/resource/18216

Wildfire and mountain pine beetle infestations are naturally occurring disturbances in western North American forests. Black-backed woodpeckers (*Picoides arcticus*) are emblematic of the role these disturbances play in creating wildlife habitat, since they are strongly associated with recently-killed forests. However, management...

Author(s): Christopher T. Rota, Joshua J. Millspaugh, Mark A. Rumble, Chad P. Lehman, Dillon C. Kesler

Year Published: 2014

Type: Document
Book or Chapter or Journal Article

Landsat time series and lidar as predictors of live and dead basal area across five bark beetle-affected forests

www.nrfirescience.org/resource/13623

Bark beetle-caused tree mortality affects important forest ecosystem processes. Remote sensing methodologies that quantify live and dead basal area (BA) in bark beetle-affected forests can provide valuable information to forest managers and researchers. We compared the utility of light detection and ranging (lidar) and the Landsat...

Author(s): Benjamin C. Bright, Andrew T. Hudak, Robert E. Kennedy, Arjan J. H. Meddens

Year Published: 2014

Type: Document
Book or Chapter or Journal Article

Ecological Consequences Of Mountain Pine Beetle Outbreaks For Wildlife In Western North American Forests

www.nrfirescience.org/resource/17469

Mountain pine beetle (*Dendroctonus ponderosae*) (MPB) outbreaks are increasingly prevalent in western North America, causing considerable ecological change in pine (*Pinus* spp.) forests with important implications for wildlife. We reviewed studies examining wildlife responses to MPB outbreaks and postoutbreak salvage logging to inform...

Author(s): Victoria A. Saab, Quresh Latif, Mary M. Rowland, Tracey N. Johnson, Anna D. Chalfoun, Steven W. Buskirk, Joslin E. Heyward, Matthew A. Dresser

Year Published: 2014

Type: Document
Book or Chapter or Journal Article

Future Forests Webinar Series, webinar proceedings and summary: ongoing research and management responses to the mountain pine beetle outbreak

www.nrfirescience.org/resource/12963

The Future Forest Webinar Series facilitated dialogue between scientists and managers about the challenges and opportunities created by the mountain pine beetle (MPB) epidemic. The series consisted of six webinars facilitated by the USFS Rocky Mountain Research Station, the Northern and Rocky Mountain Regions, and the Colorado Forest...

Year Published: 2014

Type: Document

Conference Proceedings

Simulated western spruce budworm defoliation reduces torching and crowning potential: a sensitivity analysis using a physics-based fire model

www.nrfirescience.org/resource/16893

The widespread, native defoliator western spruce budworm (*Choristoneura occidentalis* Freeman) reduces canopy fuels, which might affect the potential for surface fires to torch (ignite the crowns of individual trees) or crown (spread between tree crowns). However, the effects of defoliation on fire behaviour are poorly understood. We...

Author(s): Greg M. Cohn, Russell A. Parsons, Emily K. Heyerdahl, Daniel G. Gavin, Aquila Flower

Year Published: 2014

Type: Document

Book or Chapter or Journal Article

Interactions among the mountain pine beetle, fires, and fuels

www.nrfirescience.org/resource/12022

Bark beetle outbreaks and wildfires are principal drivers of change in western North American forests, and both have increased in severity and extent in recent years. These two agents of disturbance interact in complex ways to shape forest structure and composition. For example, mountain pine beetle, *Dendroctonus ponderosae* Hopkins...

Author(s): Michael J. Jenkins, Justin B. Runyon, Christopher J. Fettig, Wesley G. Page, Barbara J. Bentz

Year Published: 2014

Type: Document

Book or Chapter or Journal Article, Synthesis

Post-epidemic fire risk and behavior

www.nrfirescience.org/resource/13708

Citizens, government officials, and natural resource managers are greatly concerned about potential impacts of the mountain pine beetle (MPB) epidemic on fire hazards and risk. Some mountain towns are surrounded by dead and dying trees. In the Rocky Mountain Region of the Forest Service, the MPB epidemic threatens over 250,000 acres...

Author(s): Russell A. Parsons, William Matt Jolly, Paul G. Langowski, Megan Matonis, I. Sue Miller

Year Published: 2014

Type: Document

Conference Proceedings

Progress in understanding bark beetle effects on fire behavior using physics-based models

www.nrfirescience.org/resource/13297

Bark beetle outbreaks are a major disturbance of forests throughout western North America affecting

ecological processes and social and economic values (Amman 1977, Bond and Keeley 2005). Since the 1990s, bark beetle outbreaks have affected between 1.1 and 13.5 million acres in the western United States and an additional 13.5...

Author(s): Chad M. Hoffman, Carolyn Hull Sieg, Penelope Morgan, William E. Mell, Rodman Linn, Camille Stevens-Rumann, Joel D. McMillin, Russell A. Parsons, Helen Maffei

Year Published: 2013

Type: Document

Book or Chapter or Journal Article

Characterizing wildfire hazard and risk in mountain pine beetle-affected stands and how to identify those characteristics at the landscape-scale

www.nrfirescience.org/resource/11977

The transformation of fuels resulting from the mountain pine beetle epidemic is unprecedented in its large geographic extent and the rapid pace of the transformation. This paper describes a proposed fire risk and hazard characterization system, as well as methodology for locating certain stand types on the landscape.

Author(s): Robert W. Gray

Year Published: 2013

Type: Document

Book or Chapter or Journal Article

Fuels and fire behavior dynamics in bark beetle-attacked forests in Western North America and implications for fire management

www.nrfirescience.org/resource/8320

Declining forest health attributed to associations between extensive bark beetle-caused tree mortality, accumulations of hazardous fuels, wildfire, and climate change have catalyzed changes in forest health and wildfire protection policies of land management agencies. These changes subsequently prompted research to investigate the...

Author(s): Michael J. Jenkins, Wesley G. Page, Elizabeth G. Hebertson, Martin E. Alexander

Year Published: 2012

Type: Document

Book or Chapter or Journal Article, Synthesis

Bark beetles and fire: two forces of nature transforming western forests

www.nrfirescience.org/resource/11984

Bark beetles are chewing a wide swath through forests across North America. Over the past few years, infestations have become epidemic in lodgepole and spruce-fir forests of the Intermountain West. The resulting extensive acreages of dead trees are alarming the public and raising concern about risk of severe fire. Researchers...

Author(s): Gail Wells

Year Published: 2012

Type: Document

Research Brief or Fact Sheet

Fire and fish: a synthesis of observation and experience

www.nrfirescience.org/resource/11271

The effects of wildfire on aquatic systems and fishes occurring in them has been linked to the direct or immediate influence of the fire on water quality and the indirect or subsequent effects on watershed characteristics and processes that influence water quality and quantity, stream channels, and aquatic biota (Gresswell 1999)....

Author(s): Bruce E. Rieman, Robert E. Gresswell, John N. Rinne

Year Published: 2012
Type: Document
Synthesis, Technical Report or White Paper

Effects of bark beetle-caused tree mortality on wildfire

www.nrfirescience.org/resource/13294

Millions of trees killed by bark beetles in western North America have raised concerns about subsequent wildfire, but studies have reported a range of conclusions, often seemingly contradictory, about effects on fuels and wildfire. In this study, we reviewed and synthesized the published literature on modifications to fuels and fire...

Author(s): Jeffrey A. Hicke, Morris C. Johnson, Jane L. Hayes, Haiganoush K. Preisler

Year Published: 2012

Type: Document

Book or Chapter or Journal Article, Synthesis

Bark beetle outbreaks, wildfires and defensible space: how much area do we need to treat to protect homes and communities?

www.nrfirescience.org/resource/8340

Extensive beetle outbreaks across western North American forests have spurred debates about how to best protect communities from wildfire. Previous work has found that fuels in the wildland-urban interface and especially in the defensible space (40-m radius) around structures are the most important determinants of the flammability...

Author(s): Glen Aronson, Dominik Kulakowski, Glen Aronson, Dominik Kulakowski

Year Published: 2012

Type: Document

Book or Chapter or Journal Article

Fuel and fire behavior in high-elevation five-needle pines affected by mountain pine beetle

www.nrfirescience.org/resource/12112

Bark beetle-caused tree mortality in conifer forests affects the quantity and quality of forest fuels and has long been assumed to increase fire hazard and potential fire behavior. In reality, bark beetles and their effects on fuel accumulation and subsequent fire hazard have only recently been described. We have extensively sampled...

Author(s): Michael J. Jenkins

Year Published: 2011

Type: Document

Conference Proceedings

Predicted fates of ground-nesting bees in soil heated by wildfire: thermal tolerances of life stages and a survey of nesting depths

www.nrfirescience.org/resource/12144

Periodic wildfire defines plant community composition and dynamics in many of the world's semi-arid biomes, whose climates and floras also favor wild bee diversity. Invasive flammable grasses, deforestation, historical fire suppression and human ignition are increasing fire frequency and intensifying its severity, as well as...

Author(s): James H. Cane, John L. Neff

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

Do mountain pine beetle outbreaks change the probability of active crown fire in lodgepole pine forests?

www.nrfirescience.org/resource/13340

Disturbance interactions have received growing interest in ecological research in the last decade. Fire and bark beetle outbreaks have recently increased in severity and extent across western North America, raising concerns about their possible interactions. Although it is often presumed that bark beetle outbreaks increase...

Author(s): Martin Simard, William H. Romme, Jacob M. Griffin, Monica G. Turner

Year Published: 2011

Type: Document

Book or Chapter or Journal Article

A tool to estimate the impact of bark beetle activity on fuels and fire behavior

www.nrfirescience.org/resource/12129

Recent bark beetle outbreaks have resulted in the loss of hundreds of thousands of conifers on approximately 74 million acres (30 million hectares) of forest in western North America during the last decade. Stand conditions, drought, and warming temperatures have contributed to the severity of these outbreaks, particularly in high-...

Author(s): Michael J. Jenkins, Elizabeth G. Hebertson, Wesley G. Page, Wanda E. Lindquist

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

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

Blister rust and western forest biodiversity: ecology, values and outlook for white pines

www.nrfirescience.org/resource/8234

Eight white pine species are widely distributed among the forests of western Canada and the United States. The different forest communities with these species contribute biodiversity to the western landscape. The trees themselves provide various ecosystem services, including wildlife habitat and watershed protection. White pine...

Author(s): Diana F. Tomback, Peter Achuff

Year Published: 2010

Type: Document

Book or Chapter or Journal Article, Synthesis

Reciprocal interactions between bark beetles and wildfire in subalpine forests: landscape patterns and the risk of high-severity fire - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/11136

The interactions of wildfire and bark beetle outbreaks and their reciprocal influences on fire behavior, bark beetle dynamics, and ecosystem structure are critical research issues in many coniferous forests of the Intermountain West. We combined field studies with new remote sensing methods to address three main questions regarding...

Author(s): Daniel B. Tinker

Year Published: 2009

Type: Document

Technical Report or White Paper

Bark beetle responses to vegetation management treatments

www.nrfirescience.org/resource/11070

Native tree-killing bark beetles (Coleoptera: Curculionidae, Scolytinae) are a natural component of forest ecosystems. Eradication is neither possible nor desirable and periodic outbreaks will occur as long as susceptible forests and favorable climatic conditions co-exist. Recent changes in forest structure and tree composition by...

Author(s): Joel D. McMillin, Christopher J. Fettig

Year Published: 2009

Type: Document

Conference Proceedings, Technical Report or White Paper

Cross-scale drivers of natural disturbances prone to anthropogenic amplification: the dynamics of bark beetle eruptions

www.nrfirescience.org/resource/16887

Biome-scale disturbances by eruptive herbivores provide valuable insights into species interactions, ecosystem function, and impacts of global change. We present a conceptual framework using one system as a model, emphasizing interactions across levels of biological hierarchy and spatiotemporal scales. Bark beetles are major natural...

Author(s): Kenneth F. Raffa, Brian H. Aukema, Barbara J. Bentz, Allan L. Carroll, Jeffrey A. Hicke, Monica G. Turner, William H. Romme

Year Published: 2008

Type: Document

Book or Chapter or Journal Article

Bark beetles, fuels, fires, and implications for forest management in the Intermountain West

www.nrfirescience.org/resource/8239

Bark beetle-caused tree mortality in conifer forests affects the quantity and quality of forest fuels and has long been assumed to increase fire hazard and potential fire behavior. In reality, bark beetles, and their effects on fuel accumulation, and subsequent fire hazard, are poorly understood. We extensively sampled fuels in...

Author(s): Michael J. Jenkins, Elizabeth G. Hebertson, Wesley G. Page, C. Arik Jorgensen

Year Published: 2008

Type: Document

Book or Chapter or Journal Article, Synthesis

Holocene records of Dendroctonus bark beetles in high elevation pine forests of Idaho and Montana, USA

www.nrfirescience.org/resource/8224

Paleoecological reconstructions from two lakes in the U.S. northern Rocky Mountain region of Idaho and Montana revealed the presence of bark beetle elytra and head capsules (cf. *Dendroctonus* spp., most likely *D. ponderosae*, mountain pine beetle). Occurrence of these macrofossils during the period of time associated with the 1920/...

Author(s): Andrea R. Brunelle, Gerald E. Rehfeldt, Barbara J. Bentz, A. Steven Munson

Year Published: 2008

Type: Document

Book or Chapter or Journal Article

Assessing post-fire Douglas-fir mortality and Douglas-fir beetle attacks in the Northern Rocky Mountains

www.nrfirescience.org/resource/11126

Douglas-fir has life history traits that greatly enhance resistance to injury from fire, thereby increasing post-fire survival rates. Tools for predicting the probability of tree mortality following fire are important components of both pre-fire planning and post-fire management efforts. Using data from mixed-severity wildfire in...

Author(s): Sharon M. Hood, Barbara J. Bentz, Ken E. Gibson, Kevin C. Ryan, Gregg DeNitto

Year Published: 2007

Type: Document

Technical Report or White Paper

Predicted fire behavior in selected mountain pine beetle-infested lodgepole pine

www.nrfirescience.org/resource/12113

Using custom fuel models developed for use with Rothermel's surface fire spread model, we predicted and compared fire behavior in lodgepole pine (*Pinus contorta* Dougl. var. *latifolia* Engelm.) stands with endemic, current epidemic, and postepidemic mountain pine beetle (*Dendroctonus ponderosae* Hopkins) populations using standardized...

Author(s): Wesley G. Page, Michael J. Jenkins

Year Published: 2007

Type: Document

Book or Chapter or Journal Article

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

Wildlife and invertebrate response to fuel reduction treatments in dry coniferous forests of the Western United States: a synthesis

www.nrfirescience.org/resource/11192

This paper synthesizes available information on the effects of hazardous fuel reduction treatments on terrestrial wildlife and invertebrates in dry coniferous forest types in the West. We focused on thinning and/or prescribed fire studies in ponderosa pine (*Pinus ponderosa*) and dry-type Douglas-fir (*Pseudotsuga menziesii*), lodgepole...

Author(s): David S. Pilliod, Evelyn L. Bull, Jane L. Hayes, Barbara C. Wales

Year Published: 2006

Type: Document

Synthesis, Technical Report or White Paper

Five-year operational trial of verbenone to deter mountain pine beetle (*Dendroctonus ponderosae*; Coleoptera: Scolytidae) attack of lodgepole pine (*Pinus contorta*)

www.nrfirescience.org/resource/11410

The antiaggregation pheromone verbenone was operationally tested for 5 yr to deter mass attack by the mountain pine beetle on lodgepole pine in campgrounds and administrative areas surrounding Redfish and Little Redfish Lakes at the Sawtooth National Recreation Area in central Idaho. Each year, five-gram verbenone pouches were...

Author(s): Robert Progar

Year Published: 2005

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

Ghost forests, global warming, and the mountain pine beetle (Coleoptera: Scolytidae)

www.nrfirescience.org/resource/19322

The mountain pine beetle, *Dendroctonus ponderosae* Hopkins, is a significant ecological force at the landscape level. The majority of the life cycle is spent as larvae feeding in the phloem tissue (inner bark) of host pine trees. This feeding activity eventually girdles and kills successfully attacked trees

(Amman and Cole 1983,...
Author(s): Jesse A. Logan, James A. Powell
Year Published: 2001
Type: Document
Book or Chapter or Journal Article

Water quality substratum and biotic responses of five central Idaho (USA) streams during the first year following the Mortar Creek fire

www.nrfirescience.org/resource/18606

The Mortar Creek Fire burned 26 000 ha of mixed-conifer Rocky Mountain forest in July-August 1979. Changes in burn stream conditions were examined relative to reference streams for various ecological factors on two to six occasions, from October 1979 to August 1980. Factors included major ions and nutrients, suspended and benthic...

Author(s): G. Wayne Minshall, James T. Brock, Douglas A. Andrews, Christopher T. Robinson
Year Published: 2001
Type: Document
Book or Chapter or Journal Article

Response of the Cache Creek macroinvertebrates during the first 10 years following disturbance by the 1988 Yellowstone wildfires

www.nrfirescience.org/resource/18604

We evaluated the effects of disturbance on stream benthic macroinvertebrates at the ecological scales of time, stream size, and burn extent in six segments of Cache Creek over the first 10 postfire years. Postfire changes in macroinvertebrate taxa richness, density, and dominant taxa in the burn streams were significantly different...

Author(s): G. Wayne Minshall, Todd V. Royer, Christopher T. Robinson
Year Published: 2001
Type: Document
Book or Chapter or Journal Article

Prescribed fire effects on biological control of leafy spurge

www.nrfirescience.org/resource/8282

The flea beetle, *Aphthona nigriscutis* Foudras, is a potentially useful agent for biological control of leafy spurge (*Euphorbia esula* L.) in grasslands devoted to wildlife conservation. However, effects of other grassland management practices on the persistence and dynamics of flea beetle populations are not well understood. We...

Author(s): David P. Fellows, Wesley E. Newton
Year Published: 1999
Type: Document
Book or Chapter or Journal Article

Wildfire and native fish: issues of forest health and conservation of sensitive species

www.nrfirescience.org/resource/8129

Issues related to forest health and the threat of larger, more destructive wildfires have led to major new initiatives to restructure and recompose forest communities in the western United States. Proposed solutions will depend, in part, on silvicultural treatments and prescribed burning. Large fires can produce dramatic changes in...

Author(s): Bruce E. Rieman, Jim Clayton
Year Published: 1997
Type: Document
Book or Chapter or Journal Article

Acute toxicity of fire-retardant and foam-suppressant chemicals to *Hyalella azteca* (Saussure)

www.nrfirescience.org/resource/18595

Acute toxicity tests were conducted with *Hyalella azteca* Saussure (an amphipod) exposed in soft and hard waters to three fire retardants (Fire-Trol GTS-R, Fire-Trol LCG-R, and Phos-Chek D75-F) and two foam suppressants (Phos-Chek WD-881 and Silv-Ex). The chemicals were slightly to moderately toxic to amphipods. The...

Author(s): S. F. McDonald, Steven J. Hamilton, Kevin J. Buhl, James F. Heisinger

Year Published: 1997

Type: Document

Book or Chapter or Journal Article

Postfire responses of lotic ecosystems in Yellowstone National Park, U.S.A.

www.nrfirescience.org/resource/18607

Wildfire is a major large-scale disturbance affecting terrestrial landscapes and lotic ecosystems in many regions of the world. We examined environmental and biological responses of 20 streams in Yellowstone National Park, U.S.A., over 5 years following extensive wildfires in 1988. Streams of burned catchments displayed increases in...

Author(s): G. Wayne Minshall, Christopher T. Robinson, Deron E. Lawrence

Year Published: 1997

Type: Document

Book or Chapter or Journal Article

Acute toxicity of fire control chemicals to *Daphnia magna* (Straus) and *Selenastrum capricornutum* (Printz)

www.nrfirescience.org/resource/18594

Acute toxicity tests were conducted exposing *Daphnia magna* Straus (daphnid) in soft and hard reconstituted waters (hardness 42 and 162 mg/liter as CaCO₃, respectively), and *Selenastrum capricornutum* Printz (algae) in ASTM algal assay medium (hardness 15 mg/liter as CaCO₃) to fire retardants Fire-Trol GTS-R, Fire-Trol LCG-R, and Phos...

Author(s): S. F. McDonald, Steven J. Hamilton, Kevin J. Buhl, James F. Heisinger

Year Published: 1996

Type: Document

Book or Chapter or Journal Article

Benthic community structure in two adjacent streams in Yellowstone National Park five years after the 1988 wildfires

www.nrfirescience.org/resource/18609

Physical characteristics, benthic macroinvertebrates, and periphyton assemblages in two adjacent headwater streams in Yellowstone National Park were evaluated five years after the 1988 wildfires. The catchment of one stream was burned by wildfire (burned stream) while the other catchment was unburned (unburned stream). Physical...

Author(s): G. Wayne Minshall, Christopher T. Robinson, Todd V. Royer, Samuel R. Rushforth

Year Published: 1995

Type: Document

Book or Chapter or Journal Article

Trophic generalists vs. trophic specialists: implications for food web dynamics in post-fire streams

www.nrfirescience.org/resource/8260

The trophic ecology of 11 benthic macroinvertebrate taxa found in Cache Creek, Yellowstone National Park (YNP) was studied to determine if burned organic matter is an important resource and how resource utilization patterns may be altered in post-fire streams. Laboratory food quality experiments were conducted to determine the...

Author(s): Timothy B. Mihuc, G. Wayne Minshall

Year Published: 1995

Type: Document

Book or Chapter or Journal Article

Diatom assemblages of streams influenced by wildfire

www.nrfirescience.org/resource/18646

The Greater Yellowstone Area ecosystem experienced major wildfires in 1988, resulting in a substantial number of catchments being burned. We studied diatom assemblage structure at 14 sites over 5 years in catchments ranging from 0 to over 90% burned. Coefficients of variation for selected physical measures provided a good assessment...

Author(s): Christopher T. Robinson, Samuel R. Rushforth, G. Wayne Minshall

Year Published: 1994

Type: Document

Book or Chapter or Journal Article

Spatial and temporal trends in stream macroinvertebrate communities: the influence of catchment disturbance

www.nrfirescience.org/resource/18632

Macroinvertebrate communities of five headwater streams in catchments disturbed by wildfire were compared with five similar streams with no catchment disturbance. Over the five years of observation, communities in disturbed streams were more similar to one another than they were to reference streams. Communities in disturbed streams...

Author(s): Carl Richards, G. Wayne Minshall

Year Published: 1992

Type: Document

Book or Chapter or Journal Article

Deterioration of fire-killed and fire-damaged timber in the Western United States

www.nrfirescience.org/resource/11159

Fire-killed and fire-damaged timber are an important source of fiber and are becoming more important because of a decrease in the land base available for timber harvest. Forest managers need to know the causes of deterioration and degrade, the expected losses in product volume and value, and the impact of time on deterioration. This...

Author(s): Eini C. Lowell, Susan A. Willits, Robert L. Krahmer

Year Published: 1992

Type: Document

Technical Report or White Paper

Lodgepole pine arthropod litter community structure one year after the 1988 Yellowstone fires

www.nrfirescience.org/resource/12034

Litter arthropod data was collected every 10 days from nine intensively burned forest stands, five lightly burned stands, and nine unburned forest stands. For burned forest stands (n=540 samples, there were decreases in insect density (87 percent), noninsect density (67 Percent), noninsect taxa (63 percent), and noninsect diversity...

Author(s): Tim A. Christiansen, Robert J. Lavigne, Jeffrey A. Lockwood

Year Published: 1991

Type: Document
Technical Report or White Paper

Recovery of lotic macroinvertebrate communities from disturbance

www.nrfirescience.org/resource/18684

Ecosystem disturbances produce changes in macrobenthic community structure (abundances, biomass, and production) that persist for a few weeks to many decades. Examples of disturbances with extremely long-term effects on benthic communities include contamination by persistent toxic agents, physical changes in habitats, and altered...

Author(s): J. Bruce Wallace

Year Published: 1990

Type: Document

Book or Chapter or Journal Article

Effects of disturbance frequency on stream benthic community structure in relation to canopy cover and season

www.nrfirescience.org/resource/18645

Field experiments were conducted to examine the effects of disturbance frequency on invertebrates and periphyton colonizing bricks in a third order Rocky Mountain (USA) stream. After an initial colonization period (30 days), sets of bricks were turned over at intervals of 0, 3, 9, 27, or 54 days. Invertebrate species richness and...

Author(s): Christopher T. Robinson, G. Wayne Minshall

Year Published: 1986

Type: Document

Book or Chapter or Journal Article

Trichopteran communities of streams associated with aspen and conifer forests: long-term structural change

www.nrfirescience.org/resource/18611

A comparison of the trichopteran communities of streams associated with aspen, spruce—fir, and mixed—conifer forests demonstrated significant differences in structure. Though trichopteran species composition in aspen—associated and spruce—fir associated streams was virtually identical, relative abundances of shredder and...

Author(s): Manuel C. Molles Jr.

Year Published: 1982

Type: Document

Book or Chapter or Journal Article

Fire's influence on wildlife habitat on the Bridger-Teton National Forest, Wyoming - Volume II: changes and causes, management implications

www.nrfirescience.org/resource/12126

Provides information on wildlife habitat condition and trend on the Bridger-Teton National Forest in the Jackson Hole Region of Wyoming by analysis of broad plant communities. Visual evidence of condition and trend are provided in Volume I, The Photo Record. Management implications are included.

Author(s): George E. Gruell

Year Published: 1980

Type: Document

Technical Report or White Paper

Effects of a forest fire upon the benthic community of a mountain stream in northeast Idaho

www.nrfirescience.org/resource/18664

The purpose of this study which was conducted in 1974 and 1975 was to investigate the effects of the Fitz Creek fire of August, 1973 upon the benthic community of White Cap Creek which was partially surrounded by the burn. Study sections of White Cap Creek within the burn, below the burn, and above the burn were examined. Taxonomic...

Author(s): Deborah Cynthia Stefan

Year Published: 1977

Type: Document

Dissertation or Thesis