

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

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: 2017

Type: Document

Technical Report or White Paper

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

Conservation and management of whitebark pine ecosystems

www.nrfirescience.org/resource/14563

This reference presents general guidelines for planning, implementing, and evaluating whitebark pine conservation and management activities on lands administered by the Bureau of Land Management.

Author(s): Dana L. Perkins, Robert E. Means, Alexia C. Cochrane

Year Published: 2016

Type: Document

Synthesis, Technical Report or White Paper

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

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

Area burned in alpine treeline ecotones reflects region-wide trends

www.nrfirescience.org/resource/14828

The direct effects of climate change on alpine treeline ecotones – the transition zones between subalpine forest and non-forested alpine vegetation – have been studied extensively, but climate-induced changes in disturbance regimes have received less attention. To determine if recent increases in area burned extend to these...

Author(s): C. Alina Cansler, Donald McKenzie, Charles B. Hansler

Year Published: 2016

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

Complex response of white pines to past environmental variability increases understanding of future vulnerability

www.nrfirescience.org/resource/13522

Ecological niche models predict plant responses to climate change by circumscribing species distributions within a multivariate environmental framework. Most projections based on modern bioclimatic correlations imply that high-elevation species are likely to be extirpated from their current ranges as a result of rising growing...

Author(s): Virginia Iglesias, Teresa R. Krause, Cathy L. Whitlock

Year Published: 2015

Type: Document
Book or Chapter or Journal Article

Previous fires moderate burn severity of subsequent wildland fires in two large western US wilderness areas

www.nrfirescience.org/resource/12051

Wildland fire is an important natural process in many ecosystems. However, fire exclusion has reduced frequency of fire and area burned in many dry forest types, which may affect vegetation structure and composition, and potential fire behavior. In forests of the western U.S., these effects pose a challenge for fire and land...

Author(s): Sean A. Parks, Carol Miller, Cara R. Nelson, Zachary A. Holden

Year Published: 2014

Type: Document

Book or Chapter or Journal Article

Northern Rockies pyrogeography: an example of fire atlas utility

www.nrfirescience.org/resource/12923

We demonstrated the utility of digital fire atlases by analyzing forest fire extent across cold, dry, and mesic forests, within and outside federally designated wilderness areas during three different fire management periods: 1900 to 1934, 1935 to 1973, and 1974 to 2008. We updated an existing atlas with a 12,070,086 ha recording...

Author(s): Penelope Morgan, Emily K. Heyerdahl, Carol Miller, Aaron M. Wilson, Carly E. Gibson

Year Published: 2014

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

Health, reproduction, and fuels in whitebark pine in the Frank Church River of No Return Wilderness Area in central Idaho (Project INT-F-05-02)

www.nrfirescience.org/resource/12010

Whitebark pine (*Pinus albicaulis* Engelm.) is in serious decline across its range, largely due to the combined effects of *Cronartium ribicola* J. C. Fisch (an introduced fungal pathogen that causes white pine blister rust), replacement by late successional species, and widespread infestation of mountain pine beetle (*Dendroctonus*...

Author(s): Lauren Fins, Ben Hoppus

Year Published: 2013

Type: Document

Technical Report or White Paper

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

Effects of climatic variability and change on forest ecosystems: a comprehensive science synthesis for the U.S. forest sector

www.nrfirescience.org/resource/12567

This report is a scientific assessment of the current condition and likely future condition of forest resources in the United States relative to climatic variability and change. It serves as the U.S. Forest Service forest sector technical report for the National Climate Assessment and includes descriptions of key regional issues and...

Year Published: 2012

Type: Document

Synthesis, Technical Report or White Paper

Ranunculus glaberrimus (sagebrush buttercup)

www.nrfirescience.org/resource/10794

This FEIS species review synthesizes information on the relationship of *Ranunculus glaberrimus* (sagebrush buttercup) to fire--how fire affects the species and its habitat, effects of the species on fuels and fire regimes, and fire management considerations. Information is also provided on the species' taxonomy, distribution, basic...

Author(s): Rachelle Meyer

Year Published: 2012

Type: Document

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

Interactions of whitepine blister rust and mountain pine beetle in whitebark pine ecosystems in the southern Greater Yellowstone Ecosystem

www.nrfirescience.org/resource/12915

Whitebark pine (*Pinus albicaulis*) is a fundamental component of alpine and subalpine habitats in the Greater Yellowstone Ecosystem. The magnitude of current white pine blister rust (WPBR) infection caused by the pathogen *Cronartium ribicola* and mountain pine beetle (MPB; *Dendroctonus*

ponderosae) impacts, combined with the effect of...

Author(s): Nancy K. Bockino, Daniel B. Tinker

Year Published: 2012

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

Influence of fire on mycorrhizal colonization of planted and natural whitebark pine seedlings: ecology and management implications

www.nrfirescience.org/resource/11898

Whitebark pine (*Pinus albicaulis*) is a threatened keystone species in subalpine zones of Western North America that plays a role in watershed dynamics and maintenance of high elevation biodiversity (Schwandt, 2006). Whitebark pine has experienced significant mortality due to white pine blister rust, mountain pine beetle outbreaks...

Author(s): Paul E. Trusty, Cathy L. Cripps

Year Published: 2011

Type: Document

Conference Proceedings

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

Oreamnos americanus (mountain goat)

www.nrfirescience.org/resource/10522

This FEIS species review synthesizes information on the relationship of *Oreamnos americanus* (mountain goat) to fire--how fire affects the species and its habitat, effects of the species on fuels and fire regimes, and fire management considerations. Information is also provided on the species' taxonomy, distribution, basic biology,...

Author(s): Robin J. Innes

Year Published: 2011

Type: Document

Synthesis

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

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 climate changes and wildfire interactions: effects on whitebark pine (*Pinus albicaulis*) and implications for restoration, Glacier National Park, Montana, USA

www.nrfirescience.org/resource/11897

Climate changes are 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. High...

Author(s): Rachel A. Loehman, Allissa Corrow, Robert E. Keane

Year Published: 2011

Type: Document

Conference Proceedings

The magnificent high-elevation five-needle white pines: ecological roles and future outlook

www.nrfirescience.org/resource/11895

The High Five symposium is devoted to exchanging information about a small group of pines with little commercial value but great importance to the ecology of high-mountain ecosystems of the West. These High Five pines include the subalpine and treeline species-whitebark (*Pinus albicaulis*), Rocky Mountain bristlecone (*P. aristata*),...

Author(s): Diana F. Tomback, Peter Achuff, Anna W. Schoettle, John W. Schwandt, Ron J. Mastrogiuseppe

Year Published: 2011

Type: Document

Conference Proceedings, 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

Falco peregrinus (peregrine falcon)

www.nrfirescience.org/resource/10748

This FEIS species review synthesizes information on the relationship of *Falco peregrinus* (peregrine falcon) to fire--how fire affects the species and its habitat, effects of the species on fuels and fire regimes, and fire management considerations. Information is also provided on the species' taxonomy, distribution, basic biology,...

Author(s): Peggy Luensmann

Year Published: 2010

Type: Document

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

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

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

Alces americanus (moose)

www.nrfirescience.org/resource/10524

This FEIS species review synthesizes information on the relationship of *Alces americanus* (moose) to fire--how fire affects the species and its habitat, effects of the species on fuels and fire regimes, and fire management considerations. Information is also provided on the species' taxonomy, distribution, basic biology, and general...

Author(s): Robin J. Innes
Year Published: 2010
Type: Document
Synthesis

Linanthus pungens (granite prickly-phlox)

www.nrfirescience.org/resource/10520

This FEIS species review synthesizes information on the relationship of *Linanthus pungens* (granite prickly-phlox) to fire--how fire affects the species and its habitat, effects of the species on fuels and fire regimes, and fire management considerations. Information is also provided on the species' taxonomy, distribution, basic...

Author(s): Robin J. Innes
Year Published: 2010
Type: Document
Synthesis

Martes americana (American marten)

www.nrfirescience.org/resource/10856

This FEIS species review synthesizes information on the relationship of *Martes americana* (American marten) to fire--how fire affects the species and its habitat, effects of the species on fuels and fire regimes, and fire management considerations. Information is also provided on the species' taxonomy, distribution, basic biology,...

Author(s): Katharine R. Stone
Year Published: 2010
Type: Document
Synthesis

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

Bark beetle conditions in western forests and formation of the Western Bark Beetle Research Group

www.nrfirescience.org/resource/11069

The recent dramatic impacts of bark beetle outbreaks across conifer forests of the West have been mapped and reported by entomology and pathology professionals with Forest Health Protection (FHP), a component of USDA Forest Service's State and Private Forestry, and their state counterparts. These forest conditions set the stage for...

Author(s): Robert J. Cain, Jane L. Hayes

Year Published: 2009

Type: Document

Conference Proceedings, Technical Report or White Paper

Equations to convert compacted crown ratio to uncompacted crown ratio for trees in the Interior West

www.nrfirescience.org/resource/8368

Crown ratio is the proportion of total tree length supporting live foliage. Inventory programs of the US Forest Service generally define crown ratio in terms of compacted or uncompacted measurements. Measurement of compacted crown ratio (CCR) involves envisioning the transfer of lower branches of trees with asymmetric crowns to fill...

Author(s): Chris Toney, Matthew C. Reeves

Year Published: 2009

Type: Document

Book or Chapter or Journal Article

Cladonia arbuscula, Cladonia mitis, Cladonia rangeferia, Cladonia stellaris (shrubby reindeer lichen, green reindeer lichen, gray reindeer lichen, alpine reindeer lichen)

www.nrfirescience.org/resource/10800

This FEIS species review synthesizes information on the relationship of Cladonia arbuscula, Cladonia mitis, Cladonia rangeferia, Cladonia stellaris (shrubby reindeer lichen, green reindeer lichen, gray reindeer lichen, alpine reindeer lichen) to fire--how fire affects the species and its habitat, effects of the species on fuels and...

Author(s): Gregory T. Munger

Year Published: 2008

Type: Document

Synthesis

Nucifraga columbiana (Clark's nutcracker)

www.nrfirescience.org/resource/10782

This FEIS species review synthesizes information on the relationship of Nucifraga columbiana (Clark's nutcracker) to fire--how fire affects the species and its habitat, effects of the species on fuels and fire regimes, and fire management considerations. Information is also provided on the species' taxonomy, distribution, basic...

Author(s): Nancy E. McMurray

Year Published: 2008

Type: Document

Synthesis

Gulo gulo (wolverine)

www.nrfirescience.org/resource/10747

This FEIS species review synthesizes information on the relationship of Gulo gulo (wolverine) to fire--how fire affects the species and its habitat, effects of the species on fuels and fire regimes, and fire management considerations. Information is also provided on the species' taxonomy, distribution, basic biology, and general...

Author(s): Peggy Luensmann
Year Published: 2008
Type: Document
Synthesis

Surface fuel litterfall and decomposition in the Northern Rocky Mountains, U.S.A.

www.nrfirescience.org/resource/11125

Surface fuel deposition and decomposition rates are important to fire management and research because they can define the longevity of fuel treatments in time and space and they can be used to design, build, test, and validate complex fire and ecosystem models useful in evaluating management alternatives. We determined rates of...

Author(s): Robert E. Keane
Year Published: 2008
Type: Document
Technical Report or White Paper

Carex rossii (Ross's sedge)

www.nrfirescience.org/resource/10594

This FEIS species review synthesizes information on the relationship of *Carex rossii* (Ross's sedge) to fire--how fire affects the species and its habitat, effects of the species on fuels and fire regimes, and fire management considerations. Information is also provided on the species' taxonomy, distribution, basic biology, and...

Author(s): Michelle B. Anderson
Year Published: 2008
Type: Document
Synthesis

Potentilla glandulosa (sticky cinquefoil)

www.nrfirescience.org/resource/10822

This FEIS species review synthesizes information on the relationship of *Potentilla glandulosa* (sticky cinquefoil) to fire--how fire affects the species and its habitat, effects of the species on fuels and fire regimes, and fire management considerations. Information is also provided on the species' taxonomy, distribution, basic...

Author(s): Sonja L. Reeves
Year Published: 2008
Type: Document
Synthesis

Charcoal and carbon storage in forest soils of the Rocky Mountain West

www.nrfirescience.org/resource/7920

Charcoal represents a super-passive form of carbon (C) that is generated during fire events and is one of the few legacies of fire recorded in the soil profile; however, the importance of this material as a form of C storage has received only limited scientific attention. Here, we review the formation of charcoal in temperate and...

Author(s): Thomas H. DeLuca, Gregory H. Aplet
Year Published: 2008
Type: Document
Book or Chapter or Journal Article, Synthesis

Arctostaphylos rubra (red fruit bearberry)

www.nrfirescience.org/resource/10655

This FEIS species review synthesizes information on the relationship of *Arctostaphylos rubra* (red fruit bearberry) to fire--how fire affects the species and its habitat, effects of the species on fuels and fire regimes, and fire management considerations. Information is also provided on the species' taxonomy, distribution, basic...

Author(s): Janet L. Fryer

Year Published: 2008

Type: Document

Synthesis

Carex rostrata, Carex utriculata (swollen beaked sedge, Northwest Territory sedge)

www.nrfirescience.org/resource/10595

This FEIS species review synthesizes information on the relationship of *Carex rostrata*, *Carex utriculata* (swollen beaked sedge, Northwest Territory sedge) to fire--how fire affects the species and its habitat, effects of the species on fuels and fire regimes, and fire management considerations. Information is also provided on the...

Author(s): Michelle B. Anderson

Year Published: 2008

Type: Document

Synthesis

Climate change effects on historical range and variability of two large landscapes in western Montana, USA

www.nrfirescience.org/resource/8162

Quantifying the historical range and variability of landscape composition and structure using simulation modeling is becoming an important means of assessing current landscape condition and prioritizing landscapes for ecosystem restoration. However, most simulated time series are generated using static climate conditions which fail...

Author(s): Robert E. Keane, Lisa M. Holsinger, Russell A. Parsons, Kathy L. Gray

Year Published: 2008

Type: Document

Book or Chapter or Journal Article

The fire-climate connection

www.nrfirescience.org/resource/11985

JFSP-funded research is exploring and quantifying relationships among the large-scale drivers of climate and the occurrence and extent of wildfire in the various regions of the western United States.

Author(s): Gail Wells

Year Published: 2007

Type: Document

Research Brief or Fact Sheet

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

Forest fire and climate change in western North America: insights from sediment charcoal records

www.nrfirescience.org/resource/7930

Millennial-scale records of forest fire provide important baseline information for ecosystem management, especially in regions with too few recent fires to describe the historical range of variability. Charcoal records from lake sediments and soil profiles are well suited for reconstructing the incidence of past fire and its...

Author(s): Daniel G. Gavin, Douglas J. Hallett, Feng S. Hu, Kenneth P. Lertzman, Susan J. Prichard, Kendrick J. Brown, Jason A. Lynch, Patrick J. Bartlein, David L. Peterson

Year Published: 2007

Type: Document

Book or Chapter or Journal Article, Synthesis

Restoration classes based on blister rust infection and grizzly bear recovery zones - Map

www.nrfirescience.org/resource/11509

Mapped locations of restoration classes based on blister rust infection and grizzly bear recovery zones within the western United States.

Author(s): Fire Modeling Institute

Year Published: 2007

Type: Document

Research Brief or Fact Sheet

Tough trees at timberline - whitebark pines in peril

www.nrfirescience.org/resource/8392

This article describes the whitebark pine tree and the tough environment it lives in, the hazards it faces, and how it fits the environment ecologically.

Author(s): Jane Kapler Smith

Year Published: 2007

Type: Document

Book or Chapter or Journal Article

Whitebark ecosystem displayed indoors

www.nrfirescience.org/resource/11091

If you had never seen a high-elevation whitebark pine community, if you had never picked up a whitebark cone emptied by nutcrackers, if you had never stepped over (or into) a bear scat full of pine nut shells, how could you appreciate the intricacy of whitebark pine habitat? How could you care about this beautiful, imperiled...

Author(s): Jane Kapler Smith

Year Published: 2007

Type: Document

Research Brief or Fact Sheet

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

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

Distribution of bark beetle attacks after whitebark pine restoration treatments: a case study

www.nrfirescience.org/resource/8366

Whitebark pine (*Pinus albicaulis* Engelm.), an important component of high elevation ecosystems in the western United States and Canada, is declining due to fire exclusion, white pine blister rust (*Cronartium ribicola* J.C. Fisch.), and mountain pine beetle (*Dendroctonus ponderosae* Hopkins). This study was conducted to evaluate the...

Author(s): Kristen M. Waring, Diana L. Six
Year Published: 2005
Type: Document
Book or Chapter or Journal Article

Global warming's unlikely harbingers

www.nrfirescience.org/resource/11497

The lodgepole pines are dying. Inside the bark of the trees, tens of millions of beetles are tunneling, birthing, hatching, maturing. In early May, when Forest Service researcher Jesse Logan drives through the Stanley Valley to inspect the damage, more than half the lodgepole pines display dull red foliage - the signal flag of...

Author(s): Michelle Nijhuis
Year Published: 2004
Type: Document
Book or Chapter or Journal Article

***Pinus albicaulis* (whitebark pine)**

www.nrfirescience.org/resource/10651

This FEIS species review synthesizes information on the relationship of *Pinus albicaulis* (whitebark pine) to fire--how fire affects the species and its habitat, effects of the species on fuels and fire regimes, and fire management considerations. Information is also provided on the species' taxonomy, distribution, basic biology, and...

Author(s): Janet L. Fryer
Year Published: 2002
Type: Document
Synthesis

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

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

Educational program about wildland fire integrates plant science into curriculum

www.nrfirescience.org/resource/8386

A science fiction story by Edmond Hamilton entitled 'Alien Earth' (Hamilton 1949) describes the experience of a young scientist in a tropical country. The scientist obtains a potion that slows his physiology to a rate at which he can perceive plant growth and interactions between plants in rapid, aggressive, even violent motion. He...

Author(s): Jane Kapler Smith, Nancy E. McMurray, Garon C. Smith

Year Published: 2001

Type: Document

Book or Chapter or Journal Article

Delayed seed germination in whitebark pine and regeneration patterns following the Yellowstone fires

www.nrfirescience.org/resource/8185

Whitebark pine (*Pinus albicaulis*) seeds are dispersed by Clark's Nutcracker (*Nucifraga columbiana*), a bird that makes caches under 2-3 cm of soil. Cached seeds may delay germination for one or more years in part because of underdeveloped embryos at the time of seed dispersal. Consequently, whitebark pine may show a soil seed bank...

Author(s): Diana F. Tomback, Angela J. Anderies, Katherine S. Carsey, Mary L. Powell, Sabine Mellmann-Brown

Year Published: 2001

Type: Document

Book or Chapter or Journal Article

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

Pinus flexilis (limber pine)

www.nrfirescience.org/resource/10741

This FEIS species review synthesizes information on the relationship of *Pinus flexilis* (limber pine) to fire--how fire affects the species and its habitat, effects of the species on fuels and fire regimes, and fire management considerations. Information is also provided on the species' taxonomy, distribution, basic biology, and...

Author(s): Kathleen A. Johnson

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

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

Mapping historic fire regimes for the western United States: integrating remote sensing and biophysical data

www.nrfirescience.org/resource/7937

We have developed a spatial database of historic natural fire regimes for the eleven western States to provide information in support of expected national increases in prescribed burning. Fire regimes are described in terms both of frequency and severity, and we have classified five distinct fire regimes:

Author(s): Colin C. Hardy, James P. Menakis, Donald G. Long, James K. Brown, David L. Bunnell

Year Published: 1998

Type: Document

Conference Proceedings

Assessing simulated ecosystem processes for climate variability research at Glacier National Park, USA

www.nrfirescience.org/resource/8378

Glacier National Park served as a test site for ecosystem analyses that involved a suite of integrated

models embedded within a geographic information system. The goal of the exercise was to provide managers with maps that could illustrate probable shifts in vegetation, net primary production (NPP), and hydrologic responses...

Author(s): Joseph D. White, Steven W. Running, Peter Thornton, Robert E. Keane, Kevin C. Ryan, Daniel B. Fagre, Carl H. Key

Year Published: 1998

Type: Document

Book or Chapter or Journal Article

Fire ecology of the forest habitat types of northern Idaho

www.nrfirescience.org/resource/11234

Provides information on fire ecology in forest habitat and community types occurring in northern Idaho. Identifies fire groups based on presettlement fire regimes and patterns of succession and stand development after fire. Describes forest fuels and suggests considerations for fire management.

Author(s): Jane Kapler Smith, William C. Fischer

Year Published: 1997

Type: Document

Synthesis, Technical Report or White Paper

Whitebark pine ecosystem restoration in western Montana

www.nrfirescience.org/resource/11251

Whitebark pine (*Pinus albicaulis*) is a major tree species of upper subalpine forests of the northern Rocky Mountains (Schmidt and McDonald 1990). It is an important nutritional and structural component of wildlife habitat (Arno and Hoff 1990; Schmidt and McDonald 1990). Its large, nutlike seeds are a major food source for many birds...

Author(s): Robert E. Keane, Stephen F. Arno

Year Published: 1996

Type: Document

Technical Report or White Paper

FIRE-BGC - a mechanistic ecological process model for simulating fire succession on coniferous forest landscapes of the northern Rocky Mountains

www.nrfirescience.org/resource/11182

An ecological process model of vegetation dynamics mechanistically simulates long-term stand dynamics on coniferous landscapes of the Northern Rocky Mountains. This model is used to investigate and evaluate cumulative effects of various fire regimes, including prescribed burning and fire exclusion, on the vegetation and fuel complex...

Author(s): Robert E. Keane, Penelope Morgan, Steven W. Running

Year Published: 1996

Type: Document

Technical Report or White Paper

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

Rapid decline of whitebark pine in western Montana: evidence from 20-year re-measurements

www.nrfirescience.org/resource/12916

Whitebark pine (*Pinus albicaulis*), an important producer of food for wildlife, is decreasing in abundance in western Montana due to attacks by the white pine blister rust fungus (*Cronartium ribicola*), epidemics of mountain pine beetle (*Dendroctonus ponderosae*) and successional replacement mainly by subalpine fir (*Abies lasiocarpa*)....

Author(s): Robert E. Keane, Stephen F. Arno

Year Published: 1993

Type: Document

Book or Chapter or Journal Article

Larix lyallii (alpine larch)

www.nrfirescience.org/resource/10689

This FEIS species review synthesizes information on the relationship of *Larix lyallii* (alpine larch) to fire--how fire affects the species and its habitat, and fire management considerations. Information is also provided on the species' taxonomy, distribution, basic biology, and general management. This species review can be used...

Author(s): James R. Habeck

Year Published: 1991

Type: Document

Synthesis

Fire ecology of western Montana forest habitat types

www.nrfirescience.org/resource/11257

Provides information on fire as an ecological factor for forest habitat types in western Montana. Identifies Fire Groups of habitat types based on fire's role in forest succession. Describes forest fuels and suggests considerations for fire management.

Author(s): William C. Fischer, Anne F. Bradley

Year Published: 1987

Type: Document

Technical Report or White Paper

Fire ecology of the forest habitat types of central Idaho

www.nrfirescience.org/resource/11258

Discusses fire as an ecological factor for forest habitat types occurring in central Idaho. Identifies "Fire Groups" of habitat types based on fire's role in forest succession. Considerations for fire management are suggested.

Author(s): Marilyn F. Crane, William C. Fischer

Year Published: 1986

Type: Document

Technical Report or White Paper

Fire ecology of Montana forest habitat types east of the Continental Divide

www.nrfirescience.org/resource/11261

Provides information on fire as an ecological factor for forest habitat types occurring east of the Continental Divide in Montana. Identifies "Fire Groups" of habitat types based on fire's role in forest succession. Describes forest fuels and suggests considerations for fire management.

Author(s): William C. Fischer, Bruce D. Clayton
Year Published: 1983
Type: Document
Synthesis, Technical Report or White Paper

Fire ecology of Lolo National Forest habitat types

www.nrfirescience.org/resource/11913

This report summarizes available information on fire as an ecological factor for forest habitat types occurring on the Lolo National Forest. The Lolo National Forest habitat types are grouped into 10 Fire Groups based primarily on fire's role in forest succession. For each Fire Group, information is presented on (1) the relationship...

Author(s): Kathleen M. Davis, Bruce D. Clayton, William C. Fischer
Year Published: 1980
Type: Document
Technical Report or White Paper

Weight and density of crowns of Rocky Mountain conifers

www.nrfirescience.org/resource/11205

ANNOTATION: Relationships between live and dead crown weight and DBH, crown length, tree height, and crown ratio are presented for 11 Rocky Mountain conifers. Also included are partitioned estimates of crown foliage and branchwood. This study shows a high correlation between DBH and crown weight.

Author(s): James K. Brown
Year Published: 1978
Type: Document
Technical Report or White Paper

Fire-dependent forests in the Northern Rocky Mountains

www.nrfirescience.org/resource/7935

One objective of wilderness and parkland fire ecology research is to describe the relationships between fire and unmanaged ecosystems, so that strategies can be determined that will provide a more nearly natural incidence of fire. More than 50 years of efforts directed toward exclusion of wildland fires in the Northern Rocky...

Author(s): James R. Habeck, Robert W. Mutch
Year Published: 1973
Type: Document
Book or Chapter or Journal Article

Clark's nutcracker demography and habitat selection in the face of whitebark pine decline

www.nrfirescience.org/resource/13734

Over five years (2009-2013), through radio tracking and conducting occupancy, fledgling and habitat surveys, I documented nutcracker reproductive success, habitat selection, movement patterns, foraging ecology, and occupancy in areas with variable WBP mortality. (1) Clark's nutcrackers at the site experienced...

Type: Media

Video

Geologic and genetic implications of restoring whitebark pine under climate change

www.nrfirescience.org/resource/14784

This presentation by Mary Frances Mahalovich, Regional Geneticist, Northern, Rocky Mountain, Southwestern and Intermountain Regions, USFS, was part of the 2016 Whitebark Pine Ecosystem

Foundation Annual Science and Management Workshop - Successes and Challenges in Managing the Jewel in the Crown of the Continent that occurred...

Type: Media

Webinar

Species Status Assessment (SSA) for whitebark pine

www.nrfirescience.org/resource/14777

This presentation by Amy C Nicholas, Biologist, U.S. Fish and Wildlife Service, was part of the 2016 Whitebark Pine Ecosystem Foundation Annual Science and Management Workshop - Successes and Challenges in Managing the Jewel in the Crown of the Continent on September 16, 2016 in Whitefish, MT.

Type: Media

Webinar

Whitebark pine response to past climate change and fire activity: are we underestimating the resilience of the species?

www.nrfirescience.org/resource/13287

This is a video recording of a presentation from the 12th Biennial Scientific Conference on the Greater Yellowstone Ecosystem. The presentation focused on using paleoecological records to inform potential future changes in whitebark pine with climate change predictions.

Type: Media

Video

Future climate suitability for mountain pine beetle outbreaks in the Crown of the Continent

www.nrfirescience.org/resource/14773

This presentation by Polly C. Buotte, Postdoc, University of Idaho, was part of the 2016 Whitebark Pine Ecosystem Foundation Annual Science and Management Workshop - Successes and Challenges in Managing the Jewel in the Crown of the Continent on September 16, 2016 in Whitefish, MT.

Type: Media

Webinar

Climate change, mountain pine beetles, and whitebark pine forests of the Greater Yellowstone Ecosystem

www.nrfirescience.org/resource/13281

This is a recording from the 12th Biennial Scientific Conference on the Greater Yellowstone Ecosystem. The talk focused on research designed to: understand causes of recent mountain pine beetle outbreaks in whitebark pine in the GYE and estimate historical, current, and future weather suitability for whitebark pine beetle attacks....

Type: Media

Video

Functional role of whitebark pine at treeline across its Rocky Mountain range

www.nrfirescience.org/resource/14771

This presentation by Diana Tomback, Professor University of Colorado – Denver and Director of the Whitebark Pine Ecosystem Foundation was part of the 2016 Whitebark Pine Ecosystem Foundation Annual Science and Management Workshop - Successes and Challenges in Managing the Jewel in the Crown of the Continent that occurred September...

Type: Media

Webinar

Forest health threats cascade upwards: modeling whitebark pine treeline community response to exotic disease and diminished seed production in the Greater Yellowstone

www.nrfirescience.org/resource/15150

This presentation was part of the 13th Biennial Scientific Conference on the Greater Yellowstone Ecosystem held at Jackson Lake Lodge in Grand Teton National Park, October 4-6, 2016. The conference theme was Building on the Past, Leading into the Future: Sustaining the Greater Yellowstone Ecosystem in the Coming Century.

Type: Media

Webinar

Vulnerability of tree species and biome types to climate change in the U.S. Northern Rocky Mountains and Yellowstone

www.nrfirescience.org/resource/13043

This presentation assesses components of vulnerability of tree species and biome types to projected future climate within the Great Northern Landscape Conservation Cooperative (GNLCC) in the US Northern Rockies and the ecosystems surrounding Glacier and Yellowstone/Grand Teton National Parks. We drew on the results of five published...

Type: Media

Webinar

Putting climate change on the map: developing specific, spatial management strategies for whitebark pine in the Greater Yellowstone Ecosystem

www.nrfirescience.org/resource/15148

This presentation was part of the 13th Biennial Scientific Conference on the Greater Yellowstone Ecosystem held at Jackson Lake Lodge in Grand Teton National Park, October 4-6, 2016. The conference theme was Building on the Past, Leading into the Future: Sustaining the Greater Yellowstone Ecosystem in the Coming Century.

Type: Media

Webinar

Using state and transition simulation models to guide sustainable management of ecosystems: three case studies from across the US

www.nrfirescience.org/resource/14867

This webinar was conducted as a part of the Climate Change Science and Management Webinar Series, put on by the USGS National Climate Change and Wildlife Science Center and the FWS National Conservation Training Center. Sustainable management of natural resources under competing demands is challenging, particularly when facing novel...

Type: Media

Webinar

A system in transition? Our high elevation forests

www.nrfirescience.org/resource/14210

This presentation was recorded during the 2016 State of the State and Forest Health Conference in Corvallis, OR.

Type: Media

Video

Adaptation to climate change: embracing natural selection and genetics in restoration

www.nrfirescience.org/resource/14792

This presentation by Diana L. Six, Professor at University of Montana, was part of the 2016 Whitebark Pine Ecosystem Foundation Annual Science and Management Workshop - Successes and Challenges in Managing the Jewel in the Crown of the Continent that occurred September 16, 2016 in Whitefish, MT.

Type: Media

Webinar

Simulating vegetation, fire, and climate dynamics in a Northern Rocky Mountain landscape

www.nrfirescience.org/resource/12873

Robert Keane presents a webinar on the results of research using models to assess potential interacting effects of climate changes, pathogens, and wildfire on the distribution and density of whitebark pine in a high-elevation watershed in Glacier National Park, Montana, USA. Climate changes are projected to profoundly influence...

Type: Media

Webinar

Whitebark pine genetic restoration program for the Northern Rockies

www.nrfirescience.org/resource/13735

As a keystone species whitebark pine maintains biodiversity and its nuts provide a nutritional food for several wildlife species. As a foundation species it protects watersheds and promotes post-fire regeneration. Restoring whitebark pine is by definition multidisciplinary, and the complex linkages to other plants and wildlife,...

Type: Media

Webinar

Inoculation of whitebark pine seedlings with native ectomycorrhizal fungi

www.nrfirescience.org/resource/14787

This presentation by Cathy L. Cripps, Associate Professor, Montana State University, was part of the 2016 Whitebark Pine Ecosystem Foundation Annual Science and Management Workshop - Successes and Challenges in Managing the Jewel in the Crown of the Continent that occurred September 16, 2016 in Whitefish, MT.

Type: Media

Webinar

Restoring whitebark pine ecosystems of the West in the face of climate change

www.nrfirescience.org/resource/13665

Speaker: Robert Keane, Research Ecologist, Rocky Mountain Research Station, USDA Forest Service, Missoula, Montana. Event: Restoring the West Conference 2015 - Restoration and Fire in the Interior West.

Type: Media

Video

Key considerations for managing the Clark's nutcracker-whitebark pine mutualism

www.nrfirescience.org/resource/14778

This presentation by Taza Schaming, Northern Rockies Conservation Cooperative, was part of the 2016 Whitebark Pine Ecosystem Foundation Annual Science and Management Workshop - Successes and Challenges in Managing the Jewel in the Crown of the Continent that occurred September 16, 2016 in Whitefish, MT.

Type: Media

Webinar

Effects of fire in whitebark pine communities of the alpine-treeline ecotone

www.nrfirescience.org/resource/14775

In this presentation by C. Alina Cansler, Research Ecologist, University of Washington, was part of the 2016 Whitebark Pine Ecosystem Foundation Annual Science and Management Workshop - Successes and Challenges in Managing the Jewel in the Crown of the Continent that occurred September 16, 2016 in Whitefish, MT.

Type: Media

Webinar

Mountain pine beetle in whitebark pine: the fire that never goes out

www.nrfirescience.org/resource/13282

This is a recording from the 12th Biennial Scientific Conference on the Greater Yellowstone Ecosystem. The talk focused on research designed to provide background on the impact of mountain pine beetles in whitebark pine trees in the GYE.

Type: Media

Video

Will whitebark pine restoration still work in the crown under future climates?

www.nrfirescience.org/resource/14772

This presentation by Bob Keane, Supervisory Research Ecologist, USFS Rocky Mountain Research Station, was part of the 2016 Whitebark Pine Ecosystem Foundation Annual Science and Management Workshop - Successes and Challenges in Managing the Jewel in the Crown of the Continent that occurred September 16, 2016 in Whitefish, MT.

Type: Media

Webinar

Restoration guidelines for creating resilient whitebark pine ecosystems using spatial simulation modeling

www.nrfirescience.org/resource/13044

To address declining whitebark pine ecosystems, a 2012 report A Range-Wide Restoration Strategy for Whitebark Pine Forests presents a strategy for restoring these ecosystems across their entire range. However, this report did not address changing climates in the implementation of a range-wide strategy. The Great Northern LCC has...

Type: Media

Webinar

The ecosystem function of whitebark pine and pathogen disturbance in the Greater Yellowstone

www.nrfirescience.org/resource/15149

This presentation was part of the 13th Biennial Scientific Conference on the Greater Yellowstone Ecosystem held at Jackson Lake Lodge in Grand Teton National Park, October 4-6, 2016. The conference theme was Building on the Past, Leading into the Future: Sustaining the Greater Yellowstone Ecosystem in the Coming Century.

Type: Media

Webinar

The viability of evolutionary rescue in natural populations

www.nrfirescience.org/resource/15103

Extinction under environmental change is a race between demography and adaptive evolution.

Evolutionary rescue (ER) occurs when genetic adaptation allows a population to recover from near extinction following rapid environmental change, with evidence coming from laboratory experiments and simulation modeling. Is ER feasible in...

Type: Media

Webinar

Multi-scale analysis of fire effects in alpine treeline ecotones

www.nrfirescience.org/resource/14333

Although direct effects of climate change have been studied through observational and experimental methods in alpine treeline ecotones (ATEs), indirect effects due to shifts in disturbance regimes have received less attention, despite evidence that the frequency and extent of large disturbances are increasing in...

Type: Media

Webinar

Mountain pine beetle in Greater Yellowstone Ecosystem whitebark pine: the fire that doesn't go out

www.nrfirescience.org/resource/13737

Since 2004 the Greater Yellowstone Inventory and Monitoring Network has been monitoring the condition of individual whitebark pine (*Pinus albicaulis*) trees over time at 176 sites across the Greater Yellowstone Ecosystem. Since 2007 a mountain pine beetle (*Dendroctonus ponderosae*) epidemic swept through the...

Type: Media

Video

Successes and challenges of whitebark pine restoration in Glacier National Park

www.nrfirescience.org/resource/14791

This presentation by Jen Asebrook, Botanist, Glacier NP, was part of the 2016 Whitebark Pine Ecosystem Foundation Annual Science and Management Workshop - Successes and Challenges in Managing the Jewel in the Crown of the Continent that occurred September 16, 2016 in Whitefish, MT.

Type: Media

Webinar