Earlier fall precipitation and low severity fire impacts on cheatgrass and sagebrush establishment
www.nrfirescience.org/resource/20672
In arid and semiarid ecosystems, invasion by exotic grasses may be driving state changes in vegetation defined by losses of native shrub communities. Changes in wildfire regimes and fall precipitation timing related to climate change may promote fluctuations in resource availability that reinforces invasion and state changes in...
Author(s): Tara B. B. Bishop, Baylie C. Nusink, Rebecca Lee Molinari, Justin B. Taylor, Samuel B. St. Clair
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Exploring fire response to high wind speeds: fire rate of spread, energy release and flame residence time from fires burned in pine needle beds under winds up to 27 m s⁻¹
www.nrfirescience.org/resource/20664
The relationship between wildland fire spread rate and wind has been a topic of study for over a century, but few laboratory studies report measurements in controlled winds exceeding 5 m s⁻¹. In this study, measurements of fire rate of spread, flame residence time and energy release are reported for fires burning under...
Author(s): Bret W. Butler, Steve Quarles, Christine Standohar-Alfano, Murray Morrison, Daniel M. Jimenez, Paul Sopko, Cyle E. Wold, Larry S. Bradshaw, Loren Atwood, Justin Landon, Joseph J. O'Brien, Benjamin Hornsby, Natalie S. Wagenbrenner, Wesley G. Page
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Ground wind generated near the base by the massive convective column of very large-scale mass fires
www.nrfirescience.org/resource/20737
In large-scale mass fires generated in forests or by a nuclear event, the area of the fire is large (diameter 1 or more kilometers) whereas the flame height is relatively small (less than 10 m) creating a large turbulent buoyant plume. This paper determines a correlation for the magnitude of velocity such a flow generates near...
Author(s): Michael Delichatsios, Jianping Zhang
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Wildfires front dynamics: 3D structures and intensity at small and large scales
www.nrfirescience.org/resource/20698
The 3D structure of a fire front propagating through a homogeneous porous solid-fuel layer was studied numerically at laboratory and field scales. At laboratory scale, wind-tunnel fires propagating through laser-cut cardboard fuel were numerically reproduced, while at field scale, simulations of grassland fires with quasi-infinite...
Author(s): N. Frangieh, Gilbert Accary, D. Morvan, Sofiane Meradji, Oleg Bessonov
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Integrating fire effects on vegetation carbon cycling within an ecohydrologic model
Wildfire affects landscape ecohydrologic processes through feedbacks between fire effects, vegetation growth and water availability. Despite the links between these processes, fire is rarely incorporated dynamically into ecohydrologic models, which couple vegetation growth with water and nutrient fluxes. This omission has the...
Author(s): Ryan R. Bart, Maureen C. Kennedy, Christina Tague, Donald McKenzie
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Post-fire aspen (Populus tremuloides) regeneration varies in response to winter precipitation across a regional climate gradient

Altered climate and changing fire regimes are synergistically impacting forest communities globally, resulting in deviations from historical norms and creation of novel successional dynamics. These changes are particularly important when considering the stability of a keystone species such as quaking aspen (Populus tremuloides Michx... Author(s): Susan K. McIlroy, Douglas J. Shinneman
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

The effect of ignition protocol on grassfire development

The effect of ignition protocol on the development of grassfires is investigated using physics-based simulation. Simulation allows measurement of the forward rate of spread of a fire as a function of time at high temporal resolution. Two ignition protocols are considered: the inward ignition protocol, where the ignition proceeds in...
Author(s): Duncan Sutherland, J. Sharples, K. A. M. Moinuddin
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Asking "What-if" Questions: New ST-Sim Tool Helps Managers Forecast Future Rangeland Conditions

Unforeseen Events and Climate Variability: How do land management decisions shape landscapes decades into the future? With the influence of climate change and its associated stressors, it's an increasingly thorny question. According to Paulette Ford, a research ecologist with the Rocky Mountain Research Station in Albuquerque, New...
Author(s): Jessica M. Brewen
Year Published: 2020
Type: Document
Research Brief or Fact Sheet

Role of firebrand combustion in large outdoor fire spread

Large outdoor fires are an increasing danger to the built environment. Wildfires that spread into communities, labeled as Wildland-Urban Interface (WUI) fires, are an example of large outdoor fires. Other examples of large outdoor fires are urban fires including those that may occur after earthquakes as well as in informal...
Global fire season severity analysis and forecasting
www.nrfirescience.org/resource/20694
Fire activity has a huge impact on human lives. Different models have been proposed to predict fire activity, which can be classified into global and regional ones. Global fire models focus on longer timescale simulations and can be very complex. Regional fire models concentrate on seasonal forecasting but usually require inputs...

Author(s): Leonardo N. Ferreira, Didier A. Vega-Oliveros, Liang Zhao, Manoel F. Cardoso, Elbert E.N. Macau
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Observations of turbulent heat and momentum fluxes during wildland fires in forested environments
www.nrfirescience.org/resource/19491
Turbulent fluxes of heat and momentum in the vicinity of wildland fires contribute to the redistribution of heat and momentum in the fire environment, which in turn can affect the heating of fuels, fire behavior, and smoke dispersion. As an extension of previous observational studies of turbulence regimes in the vicinity of wildland...

Author(s): Warren Heilman, Xindi Bian, Kenneth L. Clark, Shiyuan Zhong
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Mortality reconsidered: Testing and extending models of fire-induced tree mortality across the US - JFSP Final Report
www.nrfirescience.org/resource/20113
Predictive models of tree mortality and survival are vital for management planning and understanding fire effects in forests and woodlands, yet the underlying mechanisms of firecaused tree mortality remain poorly understood. This shortcoming limits the ability to accurately predict mortality and develop robust modelling...

Author(s): Sharon M. Hood, J. Morgan Varner, C. Alina Cansler
Year Published: 2019
Type: Document
Technical Report or White Paper

Reply to Cruz and Alexander: Comments on “Evaluating Crown Fire Rate of Spread Predictions from Physics-Based Models"
www.nrfirescience.org/resource/19838
We have read Cruz and Alexander’s comments regarding our manuscript titled “Evaluating Crown Fire Rate of Spread Predictions from Physics-Based Models” [1] and appreciate the opportunity to respond to their comments. In our original manuscript [1], we presented an evaluation of crown fire rate of spread predictions from...

Author(s): Chad M. Hoffman, J. Ziegler, R. R. Linn, J. Canfield, W. Mell, Carolyn Hull Sieg, F. Pimont
Year Published: 2019
Type: Document
Modeling ground firefighting resource activities to manage risk given uncertain weather
www.nrfirescience.org/resource/20415
Wildland firefighting requires managers to make decisions in complex decision environments that hold many uncertainties; these decisions need to be adapted dynamically over time as fire behavior evolves. Models used in firefighting decisions should also have the capability to adapt to changing conditions. In this paper, detailed...
Author(s): Erin J. Belval, Yu Wei, Michael Bevers
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Assessing and reinitializing wildland fire simulations through satellite active fire data
www.nrfirescience.org/resource/19103
Large wildfires can cover millions of hectares of forest every year worldwide, causing losses in ecosystems and assets. Fire simulation and modeling provides an analytical scheme to characterize and predict fire behavior and spread in several and complex environments. Spatial dynamics of large wildfires can be analyzed using...
Author(s): Adrián Cardil, Santiago Monedero, Joaquin Ramírez, Alberto Silva
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Development and Evaluation of a Reynolds-Averaged Navier-Stokes Solver in WindNinja for Operational Wildland Fire Applications
www.nrfirescience.org/resource/20085
An open source computational fluid dynamics (CFD) solver has been incorporated into the WindNinja modeling framework widely used by wildland fire managers as well as researchers and practitioners in other fields, such as wind energy, wind erosion, and search and rescue. Here we describe incorporation of the CFD solver and evaluate...
Author(s): Natalie S. Wagenbrenner, Jason M. Forthofer, Wesley G. Page, Bret W. Butler
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

The 10% wind speed rule of thumb for estimating a wildfire’s forward rate of spread in forests and shrublands
www.nrfirescience.org/resource/19774
Key message: The collective analysis of a relatively large number of wildfire observations documented in conifer forests, dry eucalypt forests and temperate shrublands revealed that the forward rate of fire spread is roughly 10% of the average 10-m open wind speed, provided both are expressed in the same units (e.g. km h⁻¹)....
Author(s): Miguel G. Cruz, Martin E. Alexander
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Burn probability simulation and subsequent wildland fire activity in Alberta, Canada – Implications for risk assessment and strategic planning
Burn probability maps produced by Monte Carlo methods involve repeated simulations of fire ignition and spread across a study area landscape to identify locations that burn more frequently than others. These maps have achieved broad acceptance for research investigations and strategic fire management planning. In this study, we...

Author(s): Jennifer L. Beverly, Neal McLoughlin
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

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

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

Author(s): Winslow D. Hansen, Monica G. Turner
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Flame spread and burning rates through vertical arrays of wooden dowels

Fuel loads in real-world fire scenarios often feature discrete elements, discontinuities, or inhomogeneities; however, most models for flame spread only assume a continuous, homogeneous fuel. Because discrete fuels represent a realistic scenario not yet well-modeled, it is of interest to find simple methods to model fire growth...

Author(s): Jiang Lin, Zhao Zhao, Wei Tang, Colin H. Miller, Jin-Hua Sun, Michael J. Gollner
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Inferring energy incident on sensors in low-intensity surface fires from remotely sensed radiation and using it to predict tree stem injury

Remotely sensed radiation, attractive for its spatial and temporal coverage, offers a means of inferring energy deposition in fires (e.g. on soils, fuels and tree stems) but coordinated remote and in situ (in-flame) measurements are lacking. We relate remotely sensed measurements of fire radiative energy density (FRED) from nadir (...)

Author(s): Matthew B. Dickinson, Bret W. Butler, Andrew T. Hudak, Benjamin C. Bright, Robert L. Kremens, Carine Klauberg
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Predictive computational fluid dynamics simulation of fire spread on wood cribs

Presently, there is a need for a robust numerical simulation approach to investigate the influence of various parameters on fire spread in large open framed structures. CFD-based methods can already be used for analyzing the fire conditions but they are difficult to apply for large calculations where the
How Much Does Fire Behavior of Leaf Litter Beds Change within Two Months?
www.nrfirescience.org/resource/19754
Fire behavior is well-recognized as a function of fuel characteristics, but in practice the dynamics of fuels are often overlooked. Here we focus on short term changes in the fuel bed structure and fire behavior. Fire behavior and structural characteristics of leaf litter beds of Pinus halepensis, Ceratonia siliqua, and Quercus...
Author(s): Zorica Kauf, Walter Damsohn, Andreas Fangmeier
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Characterizing persistent unburned islands within the Inland Northwest USA
www.nrfirescience.org/resource/20344
Background: In the Inland Pacific Northwest of the United States, fire is a dominant driver of ecological change. Within wildfire perimeters, fire effects often vary considerably and typically include remnant patches of unburned islands. As fires reburn the landscape, some unburned islands remain persistently unburned. These...
Author(s): Anthony Martinez, Arjan J. H. Meddens, Crystal A. Kolden, Eva K. Strand, Andrew T. Hudak
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Modelling the fire propagation from the fuel bed to the lower canopy of ornamental species used in wildland–urban interfaces
www.nrfirescience.org/resource/18999
South-eastern France is strongly affected by wildfires mostly occurring in the wildland–urban interfaces (WUIs). A WUI fire is often initiated in dead surface fuel, then can propagate to shrubs and trees when the lower canopy is close to (or touches) the ground. Whereas a previous study assessed the fire propagation from the fuel...
Author(s): L. Terrei, Aymeric Lamorlette, Anne Ganteaume
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Historical patterns of fire severity and forest structure and composition in a landscape structured by frequent large fires: Pumice Plateau ecoregion, Oregon, USA
www.nrfirescience.org/resource/19358
Context: Lack of quantitative observations of extent, frequency, and severity of large historical fires constrains awareness of departure of contemporary conditions from those that demonstrated resistance and resilience to frequent fire and recurring drought. Objectives: Compare historical and contemporary fire and forest...
Author(s): R. Keala Hagmann, Andrew G. Merschel, Matthew J. Reilly
Year Published: 2019
Type: Document
Book or Chapter or Journal Article
Short- and long-term hydrologic controls on smouldering fire in wetland soils

www.nrfirescience.org/resource/19258
Smouldering fire vulnerability in organic-rich, wetland soils is regulated by hydrologic regimes over short (by antecedent wetness) and long (through influences on soil properties) timescales. An integrative understanding of these controls is needed to inform fire predictions and hydrologic management to reduce fire vulnerability....

Author(s): Morgan L. Schulte, Daniel L. McLaughlin, Frederic C. Wurster, J. Morgan Varner, Ryan D. Stewart, W. Mike Aust, C. Nathan Jones, Bridget Gile
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

A promising new approach to estimate drought indices for fire danger assessment using remotely sensed data

www.nrfirescience.org/resource/20019
One of the crucial input variables in fire danger rating systems is the water content of the soil, as well as of the living and dead fuels. This study concentrates on the Keetch-Byram Drought Index (KBDI) and the Drought Code (DC), which are both used to estimate the soil moisture deficit (SMD) and are inherent parts of well-...

Author(s): Melanie Häusler, João Pedro Nunes, João M. N. Silva, Jan J. Keizer, Thorsten Warneke, Jose M. C. Pereira
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

A spatial optimization model for resource allocation for wildfire suppression and resident evacuation

www.nrfirescience.org/resource/20619
Wildland-urban interface wildfires have been a significant threat in many countries. This paper presents an integer two-stage stochastic goal programming model for comprehensive, efficient response to a wildfire including firefighting resource allocation and resident evacuation. In contrast to other natural disasters, the...

Author(s): Siqiong Zhou, Ayca Erdogan
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

A review of a new generation of wildfire–atmosphere modeling

www.nrfirescience.org/resource/19732
One of the first significant developments in wildfire modeling research was to introduce heat flux as wildfire line intensity (kW·m–1). This idea could be adapted to using weather station measurements, topography, and fuel properties to estimate rate of fire spread, shape, and intensity. This review will present, in an accessible...

Author(s): A. Bakhshaii, E. A. Johnson
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Net precipitation in burned and unburned subalpine forest stands after wildfire in the northern
Wildfire can exert considerable influence on many watershed processes, including the partitioning of precipitation by forest canopies. Despite general acknowledgement that canopy interception is reduced following wildfire, effects on net rainfall and snow accumulation have not been quantified. The objectives of this study were to...

Author(s): Chris H. S. Williams, Uldis Silins, Sheena A. Spencer, Michael J. Wagner, Micheal Stone, Monica B. Emelko
Year Published: 2019
Type: Document

Investigating effect of wind speeds on structural firebrand generation in laboratory scale experiments

Firebrands generated from structures are known to be a source of rapid flame spread within communities in large outdoor fires, such as wildland-urban (WUI) fires, and urban fires. It is important to better understand firebrand generation mechanism to prevent structure ignitions by firebrands. Though the wind plays an important role...

Author(s): Sayaka Suzuki, Sam Manzello
Year Published: 2019
Type: Document

Can peat soil support a flaming wildfire?

Smouldering wildfire in peatlands is one of the largest and longest-lasting fire phenomena on Earth, but whether peat can support a flaming fire like other surface fuels is still unclear. Our experiments demonstrate the successful piloted flaming ignition of peat soil with moisture up to 100 wt-% under external radiation, indicating...

Author(s): Shaorun Lin, Peiyi Sun, Xinyan Huang
Year Published: 2019
Type: Document

Global wildland fire management research needs

Purpose of Review: This review is on global wildland fire management research needs from the standpoint of ‘integrated fire management’. It seeks to apply a characterisation of fires to frame research needs, and also recognise some differences in research needs between ‘normal wildfires’ and ‘extreme wildfire events’ and draw some...

Author(s): Peter F. Moore
Year Published: 2019
Type: Document

Season of fire influences seed dispersal by wind in a serotinous obligate seeding tree

In temperate ecosystems, fire management involving prescribed burning and wildfire suppression often causes a shift in fire season from hot and dry summer conditions to cooler, moister conditions in spring or autumn. The effects of this change on seed dispersal by wind after fire are unknown. However,
Long-Term Impacts of Fuel Treatment Placement with Respect to Forest Cover Type on Potential Fire Behavior across a Mountainous Landscape
www.nrfirescience.org/resource/19659
Research Highlights: The impact of variation in fuels and fuel dynamics among forest cover types on the outcome of fuel treatments is poorly understood. This study investigated the potential effects of treatment placement with respect to cover type on the development of potential fire behavior over time for 48 km² of forest in...
Author(s): Seth A. Ex, Justin P. Ziegler, Wade T. Tinkham, Chad M. Hoffman
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

User guide to the FireCLIME Vulnerability Assessment (VA) tool: A rapid and flexible system for assessing ecosystem vulnerability to climate-fire interactions
www.nrfirescience.org/resource/20203
Decision makers need better methods for identifying critical ecosystem vulnerabilities to changing climate and fire regimes. Climate-wildfire-vegetation interactions are complex and hinder classification and projection necessary for development of management strategies. One such vulnerability assessment (VA) is FireCLIME VA, which...
Author(s): Megan Friggens, Rachel A. Loehman, Andrea E. Thode, William T. Flatley, A. Evans, C. Wilcox, S. Mueller, Larissa L. Yocom, Donald A. Falk
Year Published: 2019
Type: Document
Technical Report or White Paper

Pixel-level statistical analyses of prescribed fire spread
www.nrfirescience.org/resource/19200
Wildland fire dynamics are a complex three-dimensional turbulent process. Cellular automata (CA) is an efficient tool to predict fire dynamics, but the main parameters of the method are challenging to estimate. To overcome this challenge, we compute statistical distributions of the key parameters of a CA model using infrared images...
Author(s): Miles Currie, Kevin Speer, J. Kevin Hiers, Joseph J. O'Brien, Scott L. Goodrick, Bryan Quaife
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

A review of US wildland firefighter entrapments: trends, important environmental factors and research needs
www.nrfirescience.org/resource/19936
Wildland firefighters in the United States are exposed to a variety of hazards while performing their jobs. Although vehicle accidents and aircraft mishaps claim the most lives, situations where firefighters are caught in a life-threatening, fire behaviour-related event (i.e. an entrapment) constitute a considerable danger because...
Author(s): Wesley G. Page, Patrick H. Freeborn, Bret W. Butler, William Matt Jolly
Year Published: 2019
Measuring Initial Attack Suppression Effectiveness through Burn Probability
www.nrfirescience.org/resource/20549
Most wildfires in North America are quickly extinguished during initial attack (IA), the first phase of suppression. While rates of success are high, it is not clear how much IA suppression reduces annual fire risk across landscapes. This study introduces a method of estimating IA effectiveness by pairing burn probability (BP)...
Author(s): Jonathan Reimer, Dan K. Thompson, Nicholas A. Povak
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Investigating the application of a hybrid space discretisation for urban scale evacuation simulation
www.nrfirescience.org/resource/19336
The devastating effects of wildfires cannot be overlooked; these include massive resettlement of people, destruction of property and loss of lives. The considerable distances over which wild fires spread and the rates at which these fires can spread is a major concern as this places considerable challenges on the evacuation...
Author(s): Nitish Chooramun, Peter J. Lawrence, Edwin R. Galea
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Factors influencing fire suppression success in the province of Quebec (Canada)
www.nrfirescience.org/resource/19631
In the managed forest of Canada, forest fires are actively suppressed through efficient initial attack capability; however, the impact of different factors on the suppression success remains to be understood. The aim of this paper was to analyze the influence of operational suppression objectives (fire detection, initial attack, and...
Author(s): Adrián Cardil, Miren Lorente, Dominique Boucher, Jonathan Boucher, Sylvie Gauthier
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Reply to Cruz and Alexander: Comments on "Evaluating Crown Fire Rate of Spread Predictions from Physics-Based Models"
www.nrfirescience.org/resource/20192
We have read Cruz and Alexander’s comments regarding our manuscript titled “Evaluating Crown Fire Rate of Spread Predictions from Physics-Based Models” [1] and appreciate the opportunity to respond to their comments. In our original manuscript [1], we presented an evaluation of crown fire rate of spread predictions from...
Author(s): Chad M. Hoffman, J. Ziegler, R. R. Linn, J. Canfield, W. Mell, Carolyn Hull Sieg, F. Pimont
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

firebehavioR: An R Package for Fire Behavior and Danger Analysis
Wildland fire and ecological researchers use empirical and semi-empirical modeling systems to assess fire behavior and danger. This technical note describes the `firebehavioR` package, a porting of two fire behavior modeling systems, Crown Fire Initiation and Spread and a Rothermel-based framework, to the R programming language. We...

Author(s): Justin P. Ziegler, Chad M. Hoffman, William E. Mell
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Applications of simulation-based burn probability modelling: a review

Wildland fire scientists and land managers working in fire-prone areas require spatial estimates of wildfire potential. To fulfill this need, a simulation-modelling approach was developed whereby multiple individual wildfires are modelled in an iterative fashion across a landscape to obtain location-based measures of fire likelihood...

Author(s): Marc-Andre Parisien, Denyse A. Dawe, Carol Miller, Christopher A. Stockdale, O. Bradley Armitage
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Adjusting the rate of spread of fire simulations in real-time

Fire simulators allow predicting fire spread and behavior and some of which in real-time. Both strategies and tactics to suppress wildland fires depend on fire analysis which is generally based on fire simulations that need to be accurate for a proper decision making. However, limitations and assumptions of the fire models and...

Author(s): Adrián Cardil, Santiago Monedero, C. A. Silva, Joaquin Ramírez
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Climate seasonality as an essential predictor of global fire activity

Aim: Fire is a globally important disturbance that affects nearly all vegetated biomes. Previous regional studies have suggested that the predictable seasonal pattern of a climatic time series, or seasonality, might aid in the prediction of average fire activity, but it is not known whether these findings are applicable globally....

Author(s): Michael V. Saha, Todd M. Scanlon, Paolo D'Odorico
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Ensemble transform Kalman filter (ETKF) for large-scale wildland fire spread simulation using FARSITE tool and state estimation method

Ensemble transform Kalman filter (ETKF) is an extension of ensemble Kalman filter (EnKF), which avoids using 'perturbed observations' to eliminate additional sampling errors. This paper demonstrates the capability of ETKF algorithm for sequentially correcting dynamically evolving fire perimeter positions at regular time intervals to...
The impact of wildfires on particulate carbon in the western U.S.A
www.nrfirescience.org/resource/20164
Most of the previous investigations on the relationship between PM2.5 chemical characteristics and wildfire focused on the predictions of particle components concentrations or future pollution scenarios. Little research has focused on trends analyses based on large temporal datasets. Our research addresses this gap by quantifying...

Future changes in fire weather, spring droughts, and false springs across U.S. National Forests and Grasslands
www.nrfirescience.org/resource/19880
Public lands provide many ecosystem services and support diverse plant and animal communities. In order to provide these benefits in the future, land managers and policy makers need information about future climate change and its potential effects. In particular, weather extremes are key drivers of wildfires, droughts, and false...

Image-based diagnostic system for the measurement of flame properties and radiation
www.nrfirescience.org/resource/20464
Data collection in the field is fundamental in providing relevant information during fire spread across vegetation or in industrial environments. Considering the challenge and costs of obtaining measurements in the presence of a fire at such a large scale, the development of non-intrusive optical methods is a good alternative. As...

Spatial, Temporal and Electrical Characteristics of Lightning in Reported Lightning-Initiated Wildfire Events
www.nrfirescience.org/resource/19294
Analysis was performed to determine whether a lightning flash could be associated with every reported lightning-initiated wildfire that grew to at least 4 km². In total, 905 lightning-initiated wildfires within the Continental United States (CONUS) between 2012 and 2015 were analyzed. Fixed and fire radius search methods showed that...
**Predictive modeling of wildfires: a new dataset and machine learning approach**

*www.nrfirescience.org/resource/19155*

Wildfires, whether natural or caused by humans, are considered among the most dangerous and devastating disasters around the world. Their complexity comes from the fact that they are hard to predict, hard to extinguish and cause enormous financial losses. To address this issue, many research efforts have been conducted in order to...

Author(s): Younes Oulad Sayad, Hajar Mousannif, Hassan Al Moattassime

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

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**The Vegetation Structure Perpendicular Index (VSPI): A forest condition index for wildfire predictions**

*www.nrfirescience.org/resource/19494*

Wildfires are a major natural hazard, causing substantial damage to infrastructure as well as being a risk to lives and homes. An understanding of their progression and behaviour is necessary to reduce risks and to develop operational management strategies in the event of an active fire. Many empirical fire-spread models have been...

Author(s): Andrea Massetti, Christoph Rüdiger, Marta Yebra, J. E. Hilton

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

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**A review of a new generation of wildfire–atmosphere modeling**

*www.nrfirescience.org/resource/20114*

One of the first significant developments in wildfire modeling research was to introduce heat flux as wildfire line intensity (kW·m⁻¹). This idea could be adapted to using weather station measurements, topography, and fuel properties to estimate rate of fire spread, shape, and intensity. This review will present, in an accessible...

Author(s): A. Bakhshaii, E. A. Johnson

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

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**Modelling of the Radiant Heat Flux and Rate of Spread of Wildfire within the Urban Environment**

*www.nrfirescience.org/resource/18806*

One approach to increase community resilience to wildfire impacts is the enhancement of residential construction standards in an effort to provide protective shelters for families within their own homes. Current wildfire models reviewed in this study assume fire growth is unrestricted by vegetation fuel bed geometry; the head fire...

Author(s): Greg Penney, Steven Richardson

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

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

*www.nrfirescience.org/resource/19852*
Improved predictions of tree species mortality and growth metrics following fires are important to assess fire impacts on forest succession, and ultimately forest growth and yield. Recent studies have shown that North American conifers exhibit a ‘toxicological dose-response’ relationship between fire behavior and the resultant...

Author(s): Wade D. Steady, Raquel Partelli Feltrin, Daniel M. Johnson, Aaron M. Sparks, Crystal A. Kolden, Alan F. Talhelm, James A. Lutz, Luigi Boschetti, Andrew T. Hudak, Andrew S. Nelson, Alistair M. S. Smith
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Wildfire refugia in forests: severe fire weather and drought mute the influence of topography and fuel age
www.nrfirescience.org/resource/20433
Wildfire refugia (unburnt patches within large wildfires) are important for the persistence of fire-sensitive species across forested landscapes globally. A key challenge is to identify the factors that determine the distribution of fire refugia across space and time. In particular, determining the relative influence of climatic...
Author(s): Luke Collins, Andrew F. Bennett, Steven W.J. Leonard, Trent D. Penman
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

An analysis of spotting distances during the 2017 fire season in the Northern Rockies, USA
www.nrfirescience.org/resource/19277
The wildfires that burned in the Northern Rockies region of the USA during the 2017 fire season provided an opportunity to evaluate the suitability of using broadscale and temporally limited infrared data on hot spot locations to determine the influence of several environmental variables on spotting distance. Specifically,...
Author(s): Wesley G. Page, Natalie S. Wagenbrenner, Bret W. Butler, David L. Blunck
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

The FireFlux II experiment: a model-guided field experiment to improve understanding of fire–atmosphere interactions and fire spread
www.nrfirescience.org/resource/19449
The FireFlux II experiment was conducted in a tall grass prairie located in south-east Texas on 30 January 2013 under a regional burn ban and high fire danger conditions. The goal of the experiment was to better understand micrometeorological aspects of fire spread. The experimental design was guided by the use of a coupled fire—...
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Fire Ember Production from Wildland and Structural Fuels - JFSP Final Report
www.nrfirescience.org/resource/20109
Direct flame contact, radiant heat, and burning firebrands (or embers) have been identified as three principal ways that cause fire spread in the wildland and Wildland-Urban Interface (WUI). However, only burning firebrands can initiate a new spot fire at distances further than 60-m away from the main fire front. During extreme...

Author(s): Aixi Zhou, Steve Quarles, David R. Weise
Year Published: 2019
Type: Document
Technical Report or White Paper

Firefighter tenability and its influence on wildfire suppression
www.nrfirescience.org/resource/19799
This paper provides analysis of international fire service siege wildfire suppression thresholds and reports on the effect of forest fuel structure, fire weather condition and terrain on the suitability of suppression strategies. Further, this study applies a fire engineering approach whereby siege wildfire behaviour is...
Author(s): Greg Penney, Daryoush Habibi, Marcus Cattani
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Widespread severe wildfires under climate change lead to increased forest homogeneity in dry mixed?conifer forests
www.nrfirescience.org/resource/20407
Climate warming in the western United States is causing changes to the wildfire regime in mixed?conifer forests. Rising temperatures, longer fire seasons, increased drought, as well as fire suppression and changes in land use, have led to greater and more severe wildfire activity, all contributing to altered forest composition...
Author(s): Brooke A. Cassell, Robert M. Scheller, Melissa S. Lucash, Matthew D. Hurteau, E. Louise Loudermilk
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Standardized process to generate mapping of priority areas for protection against wildfires
www.nrfirescience.org/resource/19082
In the field of geographic information systems (GIS) there are certain tasks that are performed repetitively and are thus sometimes monotonous, where it is necessary to structure, integrate and analyze a series of georeferenced information, which, however, always carries the same sequence. Therefore, we developed a sequential model...
Author(s): José G. Flores Garnica, Uri David Casillas Díaz, Alejandra Macías Muro
Year Published: 2019
Type: Document
Conference Proceedings

Calculation of critical water flow rates for wildfire suppression
www.nrfirescience.org/resource/19381
Predicting water suppression requirements and its impacts on firefighting strategies and logistics within the urban environment has been the subject of many previous studies, however the same level of research has yet to be applied in the realm of wildfire suppression. To work towards addressing this knowledge gap, this paper...
Author(s): Greg Penney, Daryoush Habibi, Marcus Cattani, Murray Carter
A Cautionary Note Regarding the Use of Cumulative Burnt Areas for the Determination of Fire Danger Index Breakpoints

Identifying the links between fire danger metrics and fire activity is critical in various operational and research fields. A common methodology consists in analysing the relationship between cumulative burnt areas and fire danger metrics. Building on this approach, it has been proposed that fuel moisture content (FMC) drives fire...

Author(s): F. Pimont, Julien Ruffault, Nicolas K. Martin-StPaul, Jean-Luc Dupuy
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Inside the megafire

From the front line of the Camp Fire, the deadliest wildfire in California history, NOVA tells the stories of residents who had to flee for their lives during the 2018 fire season. Scientists racing to understand what’s behind the rise of record-breaking megafires across the American West take to the forest, and even a fire lab,...

Year Published: 2019
Type: Document
Research Brief or Fact Sheet

Contrasting human influences and macro-environmental factors on fire activity inside and outside protected areas of North America

Human activities threaten the effectiveness of protected areas (PAs) in achieving their conservation goals across the globe. In this study, we contrast the influence of human and macro-environmental factors driving fire activity inside and outside PAs. Using area burned between 1984 and 2014 for 11 ecoregions in Canada and the...

Author(s): Nicolas Mansuy, Carol Miller, Marc-Andre Parisien, Sean A. Parks, Enric Batllori, Max A. Moritz
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Integrated fire severity–land cover mapping using very-high-spatial-resolution aerial imagery and point clouds

Wildfires cause substantial environmental and socioeconomic impacts and threaten many Spanish forested landscapes. We describe how LiDAR-derived canopy fuel characteristics and spatial fire simulation can be integrated with stand metrics to derive models describing fire behaviour. We assessed the potential use of very-low-density...

Author(s): Jeremy Arkin, Nicholas C. Coops, Txomin Hermosilla, Lori D. Daniels, Andrew Plowright
Year Published: 2019
Type: Document
Book or Chapter or Journal Article
Post-fire forest regeneration shows limited climate tracking and potential for drought-induced type conversion

Disturbance such as wildfire may create opportunities for plant communities to reorganize in response to climate change. The interaction between climate change and disturbance may be particularly important in forests, where many of the foundational plant species (trees) are long-lived and where poor initial tree establishment can...

Author(s): Derek J. N. Young, Chhaya M. Werner, Kevin R. Welch, Truman P. Young, Hugh Safford, Andrew Latimer
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Setting wildfire evacuation triggers by coupling fire and traffic simulation models: a spatiotemporal GIS approach

Wildfire evacuation triggers refer to prominent geographic features used in wildfire evacuation practices, and when a fire crosses a feature, an evacuation warning is issued to the communities or firefighters in the path of the fire. The existing wildfire trigger modeling methods consider evacuation time as an input from a decision...

Author(s): Dapeng Li, Thomas J. Cova, Philip E. Dennison
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

An examination of fuel moisture, energy release and emissions during laboratory burning of live wildland fuels

A series of small-scale laboratory fires were conducted to study the relationship between fuel type, moisture content, energy released and emissions during the combustion process of live wildland fuels. The experimental design sought to understand the effects that varying moisture content of different fire-promoting plant species...

Author(s): Nathaniel W. May, Evan Ellicott, Michael J. Gollner
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Experiments on wildfire ignition by exploding targets

Tests were conducted using 97 exploding targets (ammonium nitrate and aluminum powder) to examine the effects of product formulation, environment, and shooting on wildfire ignition. Tests in 2015 produced no ignitions in cold and humid weather conditions. Ignitions in 2018 under warm and dry conditions were positively related to the...

Author(s): Mark A. Finney, C. Todd Smith, Trevor B. Maynard
Year Published: 2019
Type: Document
Technical Report or White Paper

Wildland Fire Spread Modeling Using Convolutional Neural Networks

www.nrfirescience.org/resource/19037
www.nrfirescience.org/resource/19361
www.nrfirescience.org/resource/19261
www.nrfirescience.org/resource/20047
www.nrfirescience.org/resource/20627
The computational cost of predicting wildland fire spread across large, diverse landscapes is significant using current models, which limits the ability to use simulations to develop mitigation strategies or perform forecasting. This paper presents a machine learning approach to estimate the time-resolved spatial evolution of a...

Author(s): Jonathan L. Hodges, Brian Y. Lattimer
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Deriving Fire Behavior Metrics from UAS Imagery
www.nrfirescience.org/resource/19743
The emergence of affordable unmanned aerial systems (UAS) creates new opportunities to study fire behavior and ecosystem pattern-process relationships. A rotor-wing UAS hovering above a fire provides a static, scalable sensing platform that can characterize terrain, vegetation, and fire coincidently. Here, we present methods for...

Author(s): Christopher J. Moran, Carl A. Seielstad, Matthew R. Cunningham, Valentijn Hoff, Russell A. Parsons, Lloyd P. Queen, Katie Sauerbrey, Tim Wallace
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Response of simulated burned area to historical changes in environmental and anthropogenic factors: a comparison of seven fire models
www.nrfirescience.org/resource/20293
Understanding how fire regimes change over time is of major importance for understanding their future impact on the Earth system, including society. Large differences in simulated burned area between fire models show that there is substantial uncertainty associated with modelling global change impacts on fire regimes. We draw here...

Author(s): Lina Teckentrup, Stijn Hantson, Angelika Heil, Joe R. Melton, Matthew Forrest, Fang Li, Chao Yue, Almut Arneth, Thomas Hickler, Stephen Sitch, Gitta Lasslop
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

A web-based wildfire simulator for operational applications
www.nrfirescience.org/resource/18996
Wildfire simulators and decision support systems can assist the incident command teams in charge of tactical wildfire suppression. This paper presents a web-based wildfire simulator developed to provide real-time support for wildfire management. The paper describes the overall software architecture, the modelling chain...

Author(s): Bachisio Arca, Tiziano Ghisu, Marcello Casula, Michele Salis, Pierpaolo Duce
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Scalability of a multi-physics system for forest fire spread prediction in multi-core platforms
www.nrfirescience.org/resource/19349
Advances in high-performance computing have led to an improvement in modeling multi-physics systems because of the capacity to solve complex numerical systems in a reasonable time. WRF-SFIRE is a multi-physics system that couples the atmospheric model WRF and the forest fire spread model called SFIRE with the objective of...
Thermal characterization of firebrand piles
www.nrfirescience.org/resource/19225
The cause of the majority of structure losses in wildland-urban interface fires is ignition via firebrands, small pieces of burning material generated from burning vegetation and structures. To understand the mechanism of these losses, small-scale experiments designed to capture heating from firebrand piles and to describe the...
Author(s): Raquel S. P. Hakes, Hamed Salehizadeh, Matthew J. Weston-Dawkes, Michael J. Gollner
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Severe Fire Danger Index: A Forecastable Metric to Inform Firefighter and Community Wildfire Risk Management
www.nrfirescience.org/resource/20001
Despite major advances in numerical weather prediction, few resources exist to forecast wildland fire danger conditions to support operational fire management decisions and community early-warning systems. Here we present the development and evaluation of a spatial fire danger index that can be used to assess historical events....
Author(s): William Matt Jolly, Patrick H. Freeborn, Wesley G. Page, Bret W. Butler
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Emergency logistics for wildfire suppression based on forecasted disaster evolution
www.nrfirescience.org/resource/20616
This paper aims to develop a two-layer emergency logistics system with a single depot and multiple demand sites for wildfire suppression and disaster relief. For the first layer, a fire propagation model is first built using both the flame-igniting attributes of wildfires and the factors affecting wildfire propagation and patterns....
Author(s): Zhongzhen Yang, Liquan Guo, Zaili Yang
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Evaluating Model Predictions of Fire Induced Tree Mortality Using Wildfire-Affected Forest Inventory Measurements
www.nrfirescience.org/resource/20259
Forest land managers rely on predictions of tree mortality generated from fire behavior models to identify stands for post-fire salvage and to design fuel reduction treatments that reduce mortality. A key challenge in improving the accuracy of these predictions is selecting appropriate wind and fuel moisture inputs. Our objective....
Author(s): Jason S. Barker, Jeremy S. Fried, Andrew N. Grey
Year Published: 2019
Type: Document
Book or Chapter or Journal Article
Flow visualization study of stationary fire whirls just downwind of meter-scale turbulent flames
www.nrfirescience.org/resource/19203
Laboratory experiments were conducted to determine whether stationary fire whirls just downwind of a meter-scale turbulent flame are the lowest part of the counter-rotating vortex pair (CVP) of the plume from the flame. Plumes from a turbulent pool fire and air flow around the fire were visualized. There are two types of stationary...
Author(s): Masahiko Shinohara, Sanae Matsushima
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Impacts of growing-season climate on tree growth and post-fire regeneration in ponderosa pine and Douglas-fir forests
www.nrfirescience.org/resource/19945
We studied the impacts of climate variability on low?elevation forests in the U.S. northern Rocky Mountains by quantifying how post?fire tree regeneration and radial growth varied with growing?season climate. We reconstructed post?fire regeneration and radial growth rates of Pinus ponderosa and Pseudotsuga menziesii at 33...
Author(s): Lacey Hankin, Philip E. Higuera, Kimberley T. Davis, Solomon Z. Dobrowski
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Exposure Complexity and Community Capacity to Manage Wildfire Risk: A Coupled Biophysical and Social Analysis of 60 Communities in the Western United States
www.nrfirescience.org/resource/20550
Coordinated approaches to wildfire risk mitigation strategies that cross-ownership and management boundaries are found in many policies and programs worldwide. The 'all lands' approach of the United States (US) National Cohesive Strategy, for example, attempts to address the mismatches between biophysical risk and the social...
Author(s): Max W. Nielsen-Pincus, Cody Evers, Alan A. Ager
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Flame temperatures saturate with increasing dead material in Ulex europaeus, but flame duration, fuel consumption and overall flammability continue to increase
www.nrfirescience.org/resource/19340
A key determinant of wildfire behaviour is the flammability of constituent plants. One plant trait that influences flammability is the retention of dead biomass, as the low moisture content of dead material means less energy is required to achieve combustion. However, the effect of the dead-to-live ratio of fuel on plant...
Author(s): Jennifer M. Dent, Hannah L. Buckley, Audrey Lustig, Timothy J. Curran
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Pile age and burn season influence fuelbed properties, combustion dynamics, fuel consumption, and charcoal formation when burning hand piles
www.nrfirescience.org/resource/19634
Piling and burning is widely used to dispose of unmerchantable debris resulting from thinning in forests throughout the western United States. Quite often more piles are created than are burned in a given year, however, causing piles to persist, accumulate, and age on the landscape. The effects of burning piles of increasing age has...  
Author(s): Clinton S. Wright, Alexander M. Evans, Sara Grove, Karen A. Haubensak  
Year Published: 2019  
Type: Document  
Book or Chapter or Journal Article

Fire spread upslope: Numerical simulation of laboratory experiments  
www.nrfirescience.org/resource/20196  
Numerical simulations of laboratory-scale experiments, with no wind imposed, were performed for fuel bed slopes ranging from 0° to 45°. The implementation of a vertical symmetry plane (SP) placed, span-wise, along the middle of the computational domain, was assessed as an approach to reduce computational cost. The simulations were...  
Author(s): X. Sánchez-Monroy, William E. Mell, J. Torres-Arenas, Bret W. Butler  
Year Published: 2019  
Type: Document  
Book or Chapter or Journal Article

Wildfire detection and communication-aerospace applications-trade study  
www.nrfirescience.org/resource/19177  
Wildfires have increased in frequency, duration, and intensity worldwide. Climate change, drought, and other factors have not only increased susceptibility to wildfires, but have also increased the duration of the season. There are a number of factors affecting wildfires: detection, speed of communication/response time, resources/...  
Author(s): Setrige W. Crawford, Kamran Eftekhar Shahroudi  
Year Published: 2019  
Type: Document  
Book or Chapter or Journal Article

Roadside vegetation planning and conservation: new approach to prevent and mitigate wildfires based on fire ignition potential  
www.nrfirescience.org/resource/19906  
Wildfires in urban landscapes spreading into forested landscapes are a growing problem due to socioeconomic and climate changes. Fire ignition and flame spread depend on meteorological and environmental conditions and the physicochemical traits of the fuel. In this approach, environmental variables and geostatistical techniques (...  
Author(s): Juan Ramón Molina Martínez, Ángel Lora, Cristina Prades, Francisco Rodríguez y Silva  
Year Published: 2019  
Type: Document  
Book or Chapter or Journal Article

Effects of fuel characteristics on ember generation characteristics at branch-scales  
www.nrfirescience.org/resource/20542  
Spot fires caused by lofted embers (i.e. firebrands) can be a significant factor in the spread of wildfires. Embers can be especially dangerous near the wildland–urban interface (WUI) because of the potential for the fire to be spread near or on structures. This work sought to identify how ember generation changes for different...  
Author(s): Tyler R. Hudson, David L. Blunck  
Year Published: 2019
Combining optimization and simulation modelling to measure the cumulative impacts of prescribed fire and wildfire on vegetation species diversity

Growth?stage optimization (GSO) offers a new approach to biodiversity conservation in fire?prone regions by estimating the optimal distribution of vegetation growth stages that maximize a species diversity index. This optimal growth?stage structure provides managers an operational goal explicitly linked to a positive...

Author(s): Matthew P. Chick, Alan York, Holly Sitters, Julian Di Stefano, Craig R. Nitschke
Year Published: 2019

Use of landscape simulation modeling to quantify resilience for ecological applications

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

Author(s): Robert E. Keane, Rachel A. Loehman, Lisa M. Holsinger, Donald A. Falk, Philip E. Higuera, Sharon M. Hood, Paul F. Hessburg
Year Published: 2019

On the merits of sparse surrogates for global sensitivity analysis of multi-scale nonlinear problems: application to turbulence and fire-spotting model in wildland fire simulators

Many nonlinear phenomena, whose numerical simulation is not straightforward, depend on a set of parameters in a way which is not easy to predict beforehand. Wildland fires in presence of strong winds fall into this category, also due to the occurrence of firespotting. We present a global sensitivity analysis of a new sub-model for...

Author(s): Andrea Trucchia, Vera N. Egorova, Gianni Pagnini, M. C. Rochoux
Year Published: 2019

Dynamic wildfire navigation system

Wildfire, a natural part of many ecosystems, has also resulted in significant disasters impacting ecology and human life in Australia. This study proposes a prototype of fire propagation prediction as an extension of preceding research; this system is called “Cloud computing based bushfire prediction”, the computational...

Author(s): Mitsuhiro Ozaki, Jagannath Aryal, Paul Fox-Hughes
Year Published: 2019
Classification of potential fire outbreaks: a fuzzy modeling approach based on thermal images
www.nrfirescience.org/resource/20156
Fire outbreaks are a serious risk in campsites due to the surroundings and dynamic environment of these areas. Due to climate change, conditions of high ignition propensity are becoming more frequent, leading to an increased need for the development of alternative fire prevention systems that can mitigate the consequences of fire...
Author(s): Maria João Sousa, Alexandra Moutinho, Miguel Almeida
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Evaluating ecological resilience across wildfire suppression levels under climate and fuel treatment scenarios using landscape simulation modelling
www.nrfirescience.org/resource/19870
Continued suppression of wildfires may allow more biomass to accumulate to foster even more intense fires. Enlightened fire management involves explicitly determining concurrent levels of suppression, wildland fire use (allowing some fires to burn) and fuel treatments to manage landscapes for ecological resilience. This study used...
Author(s): Robert E. Keane, Kathy L. Gray, Brett Davis, Lisa M. Holsinger, Rachel A. Loehman
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Simulation of forest fires based on a two-dimensional three-phase model
www.nrfirescience.org/resource/20458
A two-dimensional three-phase mathematical model of forest fires constructed by the method of averaging over the height of the forest fuel layer is considered. The gas phase in the model is described by gas dynamics equations with the k-? turbulence model and the eddy breakup model to describe the rate of turbulent combustion...
Author(s): Andrey A. Kuleshov, Elena E. Myshetskaya, Sergey E. Yakush
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Interactions between wind and fire disturbance in forests: Competing amplifying and buffering effects
www.nrfirescience.org/resource/19280
Many studies of ecological disturbance highlight the unexpected impact that compounded disturbances have on communities. One of the well-studied mechanisms by which forest wind and fire disturbances interact is that wind damage increases flammable fuels-amplifying the effects of fire-leading to unexpected changes in vegetation...
Author(s): Jeffery B. Cannon, Suzanne K. Henderson, Michael H. Bailey, Chris J. Peterson
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Firefighting on trees
www.nrfirescience.org/resource/19151
In the Firefighter problem, introduced by Hartnell in 1995, a fire spreads through a graph while a player chooses which vertices to protect in order to contain it. In this paper, we focus on the case of trees and we consider as well the Fractional Firefighter game where the amount of protection allocated to a vertex
Effects of fuels management on fire intensity, rate of spread, severity, and resultant forest structure within the 2013 Rim Fire landscape - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/18259
Large wildfires with uncharacteristically high severity are occurring more frequently in western U.S. forests. The increasing size and severity of wildfires has been attributed to both an increase in weather conducive to fire spread and changes to forest structure and fuel loads due to management practices that included fire...

Author(s): Brandon M. Collins, Jamie M. Lydersen, Van R. Kane, Nicholas A. Povak, Matthew L. Brooks, Douglas F. Smith
Year Published: 2018
Type: Document
Technical Report or White Paper

Corrigendum 1 (published 19 Sep 2018) and Corrigendum 2 (published 11 Dec 2018) to:
Wildland fires behaviour: wind effect versus Byram’s convective number and consequences upon the regime of propagation

www.nrfirescience.org/resource/18783
The authors wish to acknowledge that the values of the rate of spread for the grass fires in Fig. 2 (blue circles) were extracted the following reference: Cheney NP, Gould JS, Catchpole WR (1998) Prediction of fire spread in grasslands. International Journal of Wildland Fire 8, 1–13. doi:10.1071/WF9980001
Additionally, the authors...

Author(s): D. Morvan, N. Frangieh
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Fire Control and the 2015 Canyon Creek Complex Fire

www.nrfirescience.org/resource/17757
Accordingly, the average annual risk of a wildfire destroying a home in the WUI was less than 1 onehundredth of 1 percent. Of course, the risk is much higher in fire-prone parts of the South and West, but so are expectations that government firefighters will come to the rescue (NWCG 2001; Pyne 2015; Stein and others 2013). Confident...

Author(s): Hutch Brown
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

An attacker-defender model for analyzing the vulnerability of initial attack in wildfire suppression

www.nrfirescience.org/resource/17925
Wildfire managers use initial attack (IA) to control wildfires before they grow large and become difficult to suppress. Although the majority of wildfire incidents are contained by IA, the small percentage of fires that escape IA causes most of the damage. Therefore, planning a successful IA is very important. In this article, we...

Author(s): Eghbal Rashidi, Hugh R. Medal, Aaron Hoskins
Evaluating the influence of prior burn mosaics on subsequent wildfire behavior, severity, and fire management options - Final Report to the Joint Fire Science Program

The Reburn Project was motivated by a need to better understand wildfires as fuel reduction treatments and to assess the impacts of decades of wildland fire suppression activities on forested landscapes. Our study examined three areas, located in the inland Pacific Northwest, central Idaho and interior British Columbia. Each area...

Author(s): Susan J. Prichard, Paul F. Hessburg, Robert W. Gray, Nicholas A. Povak, R. Brion Salter, Camille Stevens-Rumann, Penelope Morgan

Fire spread across a sloping fuel bed: flame dynamics and heat transfers

The complex interactions between the inclined terrain and the flow generated by the fire make the slope one of the most influencing factors on fire spread. In order to gain a deeper understanding of the mechanisms involved in wildfires spreading upslope, the investigation of flow dynamics and heat transfers is fundamental. This...

Author(s): Frederic Morandini, Xavier Silvani, Jean-Luc Dupuy, Arnaud Susset

Decreasing fire season precipitation increased recent western US forest wildfire activity

Western United States wildfire increases have been generally attributed to warming temperatures, either through effects on winter snowpack or summer evaporation. However, near-surface air temperature and evaporative demand are strongly influenced by moisture availability and these interactions and their role in regulating fire...

Author(s): Zachary A. Holden, Alan Swanson, Charles H. Luce, William Matt Jolly, Marco Maneta, Jared W. Oyler, Dyer A. Warren, Russell A. Parsons, David L.R. Affleck

Use of ordinary kriging and Gaussian conditional simulation to interpolate airborne fire radiative energy density estimates [Corrigendum]

Fire radiative energy density (FRED, J m-2) integrated from fire radiative power density (FRPD, W m-2) observations of landscape-level fires can present an undersampling problem when collected from fixed-wing aircraft. In the present study, the aircraft made multiple passes over the fire at ~3 min intervals, thus failing to observe...

Author(s): C. Klauberg, Andrew T. Hudak, Benjamin C. Bright, Luigi Boschetti, Matthew B. Dickinson, Robert L. Kremens, C. A. Silva
Effect of woody debris on the rate of spread of surface fires in forest fuels in a combustion wind tunnel

www.nrfirescience.org/resource/17730

The treatment of the contribution of woody debris (WD, such as branches or small logs >6–50 mm diameter) to the rate of forward spread of a fire in current operational forest fire spread models is inconsistent. Some models do not take into account this fuel at all (i.e. only consider the combustion of fine fuels (<6 mm...)

Author(s): Andrew L. Sullivan, N. C. Surawski, Daniel A. Crawford, Richard J. Hurley, Liubov Volkova, Christopher J. Weston, Carl P. Meyer
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Characterizing fire behavior from laboratory burns of multi-aged, mixed-conifer masticated fuels in the western United States

www.nrfirescience.org/resource/17916

Mastication is the process of chipping or shredding components of the tree canopy or above-ground vegetation to reduce the canopy, alter fire spread rates, and reduce crown fire potential. Mastication as a fuel treatment, either alone or in combination with prescribed fire, has been the subject of much research. This research has...

Author(s): Faith A. Heinsch, Pamela G. Sikkink, Helen Y. Smith, Molly L. Retzlaff
Year Published: 2018
Type: Document
Technical Report or White Paper

A Statement of Common Ground Regarding the Role of Wildfire in Forested Landscapes of the Western United States

www.nrfirescience.org/resource/18361

For millennia, wildfires have markedly influenced forests and non-forested landscapes of the western United States (US), and they are increasingly seen as having substantial impacts on society and nature. There is growing concern over what kinds and amounts of fire will achieve desirable outcomes and limit harmful effects on people...

Author(s): Max A. Moritz, Christopher Topik, Craig D. Allen, Paul F. Hessburg, Penelope Morgan, Dennis C. Odion, Thomas T. Veblen, Ian M. McCullough
Year Published: 2018
Type: Document
Technical Report or White Paper

Dimensional analysis on forest fuel bed fire spread

www.nrfirescience.org/resource/16440

A dimensional analysis was performed to correlate the fuel bed fire rate of spread data previously reported in the literature. Under wind condition, six pertinent dimensionless groups were identified, namely dimensionless fire spread rate, dimensionless fuel particle size, fuel moisture content, dimensionless fuel bed depth or...

Author(s): Jiann C. Yang
Year Published: 2018
Type: Document
Book or Chapter or Journal Article
Advancing the Science of Wildland Fire Dynamics Using Process-Based Models
www.nrfirescience.org/resource/18136
As scientists and managers seek to understand fire behavior in conditions that extend beyond the limits of our current empirical models and prior experiences, they will need new tools that foster a more mechanistic understanding of the processes driving fire dynamics and effects. Here we suggest that process-based models are...
Author(s): Chad M. Hoffman, Carolyn Hull Sieg, Rodman Linn, William E. Mell, Russell A. Parsons, Justin P. Ziegler, J. Kevin Hiers
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Quantitative evaluation of the Haines Index’s ability to predict fire growth events
www.nrfirescience.org/resource/17897
The Haines Index is intended to provide information on how midtropospheric conditions could lead to large or erratic wildfires. Only a few studies have evaluated its performance and those are primarily single fire studies. This study looks at 47 fires that burned in the United States from 2004 to 2017, with sizes from 9000 ha up to...
Author(s): Brian E. Potter
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Fire behavior in chaparral–Evaluating flame models with laboratory data
www.nrfirescience.org/resource/18347
Flame and mass loss data for chaparral, a mixture of shrub plants from the Mediterranean climate zone of southwestern North America, from five previously reported experiments were used to evaluate several published models relating flame characteristics to mass loss and heat release rates. These data are unique with fuel moisture...
Author(s): David R. Weise, Thomas H. Fletcher, Wesley Cole, Shankar M. Mahalingam, Xiangyang Zhou, Lulu Sun, Jing Li
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Improving Fire Behaviour Data Obtained from Wildfires
www.nrfirescience.org/resource/17190
Organisations that manage wildfires are expected to deliver scientifically defensible decisions. However, the limited availability of high quality data restricts the rate at which research can advance. The nature of wildfires contributes to this: they are infrequent, complex events, occur with limited notice and are of relatively...
Author(s): Alexander I. Filkov, Thomas J. Duff, Trent D. Penman
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Wildland fires behaviour: wind effect versus Byram’s convective number and consequences upon the regime of propagation
www.nrfirescience.org/resource/18133
With fuel moisture content and slope, wind velocity (UW) is one of the major physical parameters that...
most affects the behaviour of wildland fires. The aim of this short paper was to revisit the relationship between the rate of spread (ROS) and the wind velocity, through the role played by the two forces governing the trajectory of...
Author(s): D. Morvan, N. Frangieh
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Simulation study of grass fire using a physics-based model: striving towards numerical rigour and the effect of grass height on the rate of spread
www.nrfirescience.org/resource/18733
Grid-independent rate of spread results from a physics-based simulation are presented. Previously, such a numerical benchmark has been elusive owing to computational restrictions. The grid-converged results are used to systematically construct correlations between the rate of spread (RoS) and both wind speed and grass height,...
Author(s): K. A. M. Moinuddin, W. Mell
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Modeling thinning effects on fire behavior with STANDFIRE
www.nrfirescience.org/resource/18335
Key message: We describe a modeling system that enables detailed, 3D fire simulations in forest fuels. Using data from three sites, we analyze thinning fuel treatments on fire behavior and fire effects and compare outputs with a more commonly used model. Context: Thinning is considered useful in altering fire behavior, reducing fire...
Author(s): Russell A. Parsons, F. Pimont, Lucas Wells, Greg M. Cohn, William Matt Jolly, Francois P. deColigny, Eric Rigolot, Jean-Luc Dupuy, William E. Mell, Rodman Linn
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

A comparison of the US National Fire Danger Rating System (NFDRS) with recorded fire occurrence and final fire size
www.nrfirescience.org/resource/17126
Most previous research has assessed the ability of the National Fire Danger Rating System (NFDRS) to portray fire activity at either single sites or on small spatial scales, despite it being a nation-wide system. This study seeks to examine the relationships between a set of NFDRS fire danger indices (Fire Danger Ratings, Staffing,...
Author(s): Nicholas G. Walding, Hywel T. P. Williams, Scott McGarvie, Claire M. Belcher
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Appropriate Sample Sizes for Monitoring Burned Pastures in Sagebrush Steppe: How Many Plots are Enough, and Can One Size Fit All?
www.nrfirescience.org/resource/18950
Statistically defensible information on vegetation conditions is needed to guide rangeland management decisions following disturbances such as wildfire, often for heterogeneous pastures. Here we evaluate sampling effort needed to achieve a robust statistical threshold using > 2 000 plots sampled on the 2015 Soda Fire that burned...
Lab-scale observations of flame attachment on slopes with implications for firefighter safety zones
www.nrfirescience.org/resource/17884
The Coanda effect is the phenomenon in which a jet entering quiescent fluid attaches to a nearby solid object due to inhibited entrainment of ambient fluid near the solid. Little is known about the influence of the Coanda effect on wildland fire behavior. Specifically, there is a lack of knowledge regarding how the flame attachment...
Author(s): Jonathan R. Gallacher, Brad Ripa, Bret W. Butler, Thomas H. Fletcher
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Quantile regression: an alternative approach to modelling forest area burned by individual fires
www.nrfirescience.org/resource/18056
Components of a fire regime have long been estimated using mean-value-based ordinary least-squares regression. But, forest and fire managers require predictions beyond the mean because impacts of small and large fires on forest ecosystems and wildland–urban interfaces are different. Therefore, different action plans are required...
Author(s): Baburam Rijal
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Analysis of the physical processes associated with junction fires at laboratory and field scales
www.nrfirescience.org/resource/16747
Junction fires, which involve the merging of two linear fire fronts intersecting at a small angle, are associated with very intense fire behaviour. The dynamic displacement of the intersection point of the two lines and the flow along the symmetry plane of the fire are analysed for symmetric boundary conditions. It is observed that...
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Modeling Fire Pathways in Montane Grassland?Forest Ecotones
www.nrfirescience.org/resource/17667
Fire plays a key role in regulating the spatial interactions between adjacent vegetation types from the stand to the landscape scale. Fire behavior modeling can facilitate the understanding of these interactions and help managers restore or maintain fire’s natural role. The Valles Caldera National Preserve (VALL), in the Jemez...
Author(s): Joshua L. Conver, Donald A. Falk, Stephen R. Yool, Robert R. Parmenter
Year Published: 2018
Type: Document
Book or Chapter or Journal Article
An evaluation of NDFD weather forecasts for wildland fire behavior prediction
www.nrfirescience.org/resource/18326
Wildland fire managers in the United States currently utilize the gridded forecasts from the National Digital Forecast Database (NDFD) to make fire behavior predictions across complex landscapes during large wildfires. However, little is known about the NDFDs performance in remote locations with complex topography for weather...
Author(s): Wesley G. Page, Natalie S. Wagenbrenner, Bret W. Butler, Jason M. Forthofer, Chris Gibson
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Some requirements for simulating wildland fire behavior using insight from coupled weather-wildland fire models
www.nrfirescience.org/resource/17104
A newer generation of models that interactively couple the atmosphere with fire behavior have shown an increased potential to understand and predict complex, rapidly changing fire behavior. This is possible if they capture intricate, time-varying microscale airflows in mountainous terrain and fire-atmosphere feedbacks. However, this...
Author(s): Janice L. Coen
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Wildfire fuel management: network-based models and optimization of prescribed burning
www.nrfirescience.org/resource/17866
Wildfires are a common phenomenon on most continents. They have occurred for an estimated 60 million years and are part of a regular climatic cycle. Nevertheless, wildfires represent a real and continuing problem that can have a major impact on people, wildlife and the environment. The intensity and severity of wildfires can be...
Author(s): Dmytro Matsypura, Oleg A. Prokopyev, Aizat Zahar
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Assessing the Influence of Roads on Fire Ignition: Does Land Cover Matter?
www.nrfirescience.org/resource/18030
In human-affected fire environments, assessing the influence of human activities on the spatial distribution of wildfire ignitions is of paramount importance for fire management planning. Previous studies have shown that roads have significant effects on fire ignition. However, since different land cover classes are subject to...
Author(s): Carlo Ricotta, Sofia Bajocco, Daniela Guglietta, Marco Conedera
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

The Cooney Ridge Fire Experiment: An Early Operation to Relate Pre-, Active, and Post-Fire Field and Remotely Sensed Measurements
www.nrfirescience.org/resource/17615
The Cooney Ridge Fire Experiment conducted by fire scientists in 2003 was a burnout operation supported by a fire suppression crew on the active Cooney Ridge wildfire incident. The fire experiment
included measurements of pre-fire fuels, active fire behavior, and immediate post-fire effects. Heat flux measurements collected at...

Author(s): Andrew T. Hudak, Patrick H. Freeborn, Sarah A. Lewis, Sharon M. Hood, Helen Y. Smith, Colin C. Hardy, Robert J. Kremens, Bret W. Butler, Casey Teske, Robert G. Tissell, Lloyd P. Queen, Bryce L. Nordgren, Benjamin C. Bright, Penelope Morgan, Philip J. Riggan, Lee Macholz, Leigh B. Lentile, Jim Riddering, Edward E. Mathews
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Surface to crown transition
www.nrfirescience.org/resource/18321
Wildland fires are generally classified into three categories: ground fires, surface fires, and crown fires (Fig. 1). Soils are described worldwide by the various layers that have formed or been deposited on top of bedrock or other parent material. In wildland areas, the layer closest to the surface is composed of organic material...

Author(s): David R. Weise, J. Cobian-Iniguez, M. Princevac
Year Published: 2018
Type: Document
Research Brief or Fact Sheet

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

Corrigendum to: Use of ordinary kriging and Gaussian conditional simulation to interpolate airborne fire radiative energy density estimates
www.nrfirescience.org/resource/18023
Fire radiative energy density (FRED, J m⁻²) integrated from fire radiative power density (FRPD, W m⁻²) observations of landscape-level fires can present an undersampling problem when collected from fixed-wing aircraft. In the present study, the aircraft made multiple passes over the fire at ~3 min intervals, thus failing....

Author(s): C. Klauberg, Andrew T. Hudak, Benjamin C. Bright, Luigi Boschetti, Matthew B. Dickinson, Robert L. Kremens, C. A. Silva
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

The Rothermel surface fire spread model and associated developments: A comprehensive explanation
www.nrfirescience.org/resource/17537
The Rothermel surface fire spread model, with some adjustments by Frank A. Albini in 1976, has been used in fire and fuels management systems since 1972. It is generally used with other models including
fireline intensity and flame length. Fuel models are often used to define fuel input parameters. Dynamic fuel models use equations...

Author(s): Patricia L. Andrews
Year Published: 2018
Type: Document
Technical Report or White Paper

Avian demographic responses to drought and fire: a community?level perspective
www.nrfirescience.org/resource/18277
Drought stress is an important consideration for wildlife in arid and semiarid regions under climate change. Drought can impact plant and animal populations directly, through effects on their physiology, as well as indirectly through effects on vegetation productivity and resource availability, and by creating conditions conducive...
Author(s): James F. Saracco, Stephen M. Fettig, George L. San Miguel, David W. Mehlman, Brent E. Thompson, Steven K. Albert
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Wyoming’s forest resources, 2011-2015
www.nrfirescience.org/resource/18841
This report summarizes the most recent inventory of Wyoming’s forests based on field data collected between 2011 and 2015. The report includes descriptive highlights and tables of area, numbers of trees, biomass, carbon, volume, growth, mortality, and removals. Most sections and tables are organized by forest type or forest-type...
Author(s): R. Justin DeRose, John D. Shaw, Sara A. Goeking, Kate Marcille, Chelsea P. McIver, James Menlove, Todd A. Morgan, Chris Witt
Year Published: 2018
Type: Document
Research Brief or Fact Sheet

Optimizing smoke and plume rise modeling approaches at local scales
www.nrfirescience.org/resource/17793
Heating from wildfires adds buoyancy to the overlying air, often producing plumes that vertically distribute fire emissions throughout the atmospheric column over the fire. The height of the rising wildfire plume is a complex function of the size of the wildfire, fire heat flux, plume geometry, and atmospheric conditions, which can...
Author(s): Derek V. Mallia, Adam K. Kochanski, Shawn P. Urbanski, John C. Lin
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Modeling Fire Pathways in Montane Grassland?Forest Ecotones
www.nrfirescience.org/resource/18013
Fire plays a key role in regulating the spatial interactions between adjacent vegetation types from the stand to the landscape scale. Fire behavior modeling can facilitate the understanding of these interactions and help managers restore or maintain fire’s natural role. The Valles Caldera National Preserve (VALL), in the Jemez...
Author(s): Joshua L. Conver, Donald A. Falk, Stephen R. Yool, Robert R. Parmenter
Year Published: 2018
Type: Document
Biological and geophysical feedbacks with fire in the Earth system

Roughly 3% of the Earth's land surface burns annually, representing a critical exchange of energy and matter between the land and atmosphere via combustion. Fires range from slow smouldering peat fires, to low-intensity surface fires, to intense crown fires, depending on vegetation structure, fuel moisture, prevailing climate, and...


Year Published: 2018
Type: Document

Tree water balance drives temperate forest responses to drought

Intensifying drought is increasingly linked to global forest diebacks. Improved understanding of drought impacts on individual trees has provided limited insight into drought vulnerability in part because tree moisture access and depletion is difficult to quantify. In forests, moisture reservoir depletion occurs through water use by...

Author(s): A. B. Berdanier, J. S. Clark

Year Published: 2018
Type: Document

Switching on the Big Burn of 2017

Fuel, aridity, and ignition switches were all on in 2017, making it one of the largest and costliest wildfire years in the United States (U.S.) since national reporting began. Anthropogenic climate change helped flip on some of these switches rapidly in 2017, and kept them on for longer than usual. Anthropogenic changes to the fire...

Author(s): Jennifer Balch, Tania L. Schoennagel, A. Park Williams, John T. Abatzoglou, Megan E. Cattau, Nathan Mietkiewicz, Lise A. St. Denis

Year Published: 2018
Type: Document

Fire behaviour in masticated forest fuels: lab and prescribed fire experiments

Managers masticate fuels to reduce extreme fire hazards, but the effect on fire behaviour within the resulting compact fuelbeds is poorly understood. We burned 54 masticated fuelbeds in laboratory experiments one and two growing seasons after mastication and 75 masticated fuelbeds in prescribed fire experiments one growing season...

Author(s): Zachary D. Lyon, Penelope Morgan, Camille Stevens-Rumann, Aaron M. Sparks, Robert F. Keefe, Alistair M. S. Smith

Year Published: 2018
Type: Document
A model-based framework to evaluate alternative wildfire suppression strategies
www.nrfirescience.org/resource/16478
The complexity and demands of wildland firefighting in the western U.S. have increased over recent decades due to factors including the expansion of the wildland-urban interface, lengthening fire seasons associated with climate change, and changes in vegetation due to past fire suppression and timber harvest. In light of these...
Author(s): Karen L. Riley, Matthew P. Thompson, Joe H. Scott, Julie W. Gilbertson-Day
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

An improved non-equilibrium model for the ignition of living fuel
www.nrfirescience.org/resource/17342
This paper deals with the modelling of living fuel ignition, suggesting that an accurate description using a multiphase formulation requires consideration of a thermal disequilibrium within the vegetation particle, between the solid (wood) and the liquid (sap). A simple model at particle scale is studied to evaluate the flux...
Author(s): A. Lamorlette, M. El Houssami, D. Morvan
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Incorporating convective feedback in wildfire simulations using pyrogenic potential
www.nrfirescience.org/resource/19107
Modelling the dynamics of wildfires is very computationally challenging. Although three-dimensional computational fluid dynamics (CFD) models have been successfully applied to wildfires, the computational time required makes them currently impractical for operational usage. In this study, we develop a two-dimensional propagation...
Author(s): J. E. Hilton, Andrew L. Sullivan, W. Swedosh, J. Sharples, C. Thomas
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Fuel and topographic influences on wildland firefighter burnover fatalities in Southern California
www.nrfirescience.org/resource/18209
Previous reviews of wildfires where a fatal firefighter burnover occurred have found that the incidents usually share similar characteristics in terms of the fire environment, such as steep slopes and complex topography (e.g. box canyons). Despite these similarities, systematic identification and communication of the locations where...
Author(s): Wesley G. Page, Bret W. Butler
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...

Deconstructing the King Megafire
www.nrfirescience.org/resource/17735
Hypotheses that megafires – very large, high impact fires – are caused by either climate effects such as drought or fuel accumulation due to fire exclusion with accompanying changes to forest structure have long been alleged and guided policy but their physical basis remains untested. Here, unique airborne observations and...

Embracing complexity to advance the science of wildland fire behavior
www.nrfirescience.org/resource/17920
Wildland fire behavior research has largely focused on the steady-state interactions between fuels and heat fluxes. Contemporary research is revealing new questions outside the bounds of this simplified approach. Here, we explore the complex interactions taking place beyond steady-state assumptions through acknowledging the...

The weather conditions for desired smoke plumes at a FASMEE burn site
www.nrfirescience.org/resource/18365
Weather is an important factor that determines smoke development, which is essential information for planning smoke field measurements. This study identifies the synoptic systems that would favor to produce the desired smoke plumes for the Fire and Smoke Model Evaluation Experiment (FASMEE). Daysmoke and PB-Piedmont (PB-P) models...

Framework for submodel improvement in wildfire modeling
www.nrfirescience.org/resource/17259
An experimental and numerical study was carried out to assess the performance of the different submodels and parameters used to describe the burning dynamics of wildfires. A multiphase formulation was used and compared to static fires of dried pitch pine needles of different bulk densities. The samples were exposed to an external...

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

Author(s): Janice L. Coen, E. Natasha Stavros, Jo Ann Fites-Kaufman
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Author(s): Kara M. Yedinak, Eva K. Strand, J. Kevin Hiers, J. Morgan Varner
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Author(s): Yongqiang Liu, Scott L. Goodrick, Gary Achtemeier
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Author(s): M. El Houssami, A. Lamorlette, D. Morvan, Rory Hadden, Albert Simeoni
Year Published: 2018
Type: Document
Book or Chapter or Journal Article
An Empirical Model for the Effect of Wind on Fire Spread Rate
www.nrfirescience.org/resource/18138
Predicting wind-driven rate of fire spread (RoS) has been the aim of many studies. Still, a field-tested model for general use, regardless of vegetation type, is currently lacking. We develop an empirical model for wind-aided RoS from laboratory fires (n = 216), assuming that it depends mainly on fire-released energy and on the...
Author(s): Carlos G. Rossa, Paulo M. Fernandes
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Live Fuel Moisture Content: The ‘Pea Under the Mattress’ of Fire Spread Rate Modeling?
www.nrfirescience.org/resource/18760
Currently, there is a dispute on whether live fuel moisture content (FMC) should be accounted for when predicting a real-world fire-spread rate (RoS). The laboratory and field data results are conflicting: laboratory trials show a significant effect of live FMC on RoS, which has not been convincingly detected in the field. It has...
Author(s): Carlos G. Rossa, Paulo M. Fernandes
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Random subset feature selection for ecological niche models of wildfire activity in western North America
www.nrfirescience.org/resource/17909
Variable selection in ecological niche modelling can influence model projections to a degree comparable to variations in future climate scenarios. Consequently, it is important to select feature (variable) subsets for optimizing model performance and characterizing variability. We utilize a novel random subset feature selection...
Author(s): James L. Tracy, Antonio Trabucco, A. Michelle Lawing, J. Tomasz Giemakowski, Maria D. Tchakerian, Gail M. Drus, Robert N. Coulson
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Thermocouple probe orientation affects prescribed fire behavior estimation
www.nrfirescience.org/resource/18357
Understanding the relationship between fire intensity and fuel mass is essential information for scientists and forest managers seeking to manage forests using prescribed fires. Peak burning temperature, duration of heating, and area under the temperature profile are fire behavior metrics obtained from thermocouple-datalogger...
Author(s): Thomas Adam Coates, Alex T. Chow, Donald L. Hagan, Thomas A. Waldrop, G. Geoff Wang, William C. Bridges, Mary-Frances Rogers, James H. Dozier
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Fuel mass and stand structure 13 years after logging of a severely burned ponderosa pine forest in northeastern Oregon, U.S.A
www.nrfirescience.org/resource/18135
Stand structure and fuel mass were measured in 2011, 13 years after logging of a seasonally dry,
ponderosa pine-dominated forest that had burned severely in the 1996 Summit Wildfire, Malheur National Forest, northeastern Oregon, U.S.A. Data are compared to those taken one year after post-fire logging (1999), and analyzed in the...

Author(s): James D. McIver, Roger D. Ottmar
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

**It matters when you measure it: using snow-cover Normalised Difference Vegetation Index (NDVI) to isolate post-fire conifer regeneration**

Landsat Normalized Difference Vegetation Index (NDVI) is commonly used to monitor post-fire green-up; however, most studies do not distinguish new growth of conifer from deciduous or herbaceous species, despite potential consequences for local climate, carbon and wildlife. We found that dual season (growing and snow cover) NDVI...

Author(s): Melanie K. Vanderhoof, Todd J. Hawbaker
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

**Observations and predictability of gap winds in the Salmon River Canyon of Central Idaho, USA**

This work investigates gap winds in a steep, deep river canyon prone to wildland fire. The driving mechanisms and the potential for forecasting the gap winds are investigated. The onset and strength of the gap winds are found to be correlated to the formation of an along-gap pressure gradient linked to periodic development of a...

Author(s): Natalie S. Wagenbrenner, Jason M. Forthofer, Chris Gibson, Abby Indreland, Brian K. Lamb, Bret W. Butler
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

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

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

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

**Interpolation framework to speed up near-surface wind simulations for data-driven wildfire applications**

Local wind fields that account for topographic interaction are a key element for any wildfire spread simulator. Currently available tools to generate near-surface winds with acceptable accuracy do not meet the tight time constraints required for data-driven applications. This article presents the specific problem of data-driven...
Simulation of fuel bed ignition by wildland firebrands
www.nrfirescience.org/resource/18061
A 3-D mathematical model of fuel bed (FB) ignition initiated by glowing firebrands originating during wildland fires is proposed. In order to test and verify the model, a series of experiments was conducted to determine the FB ignition time by a single pine bark and twig firebrand (Pinus sylvestris). Irrespective of the pine bark...

Scaling nonreactive cross flow over a heated plate to simulate forest fires
www.nrfirescience.org/resource/18331
The paper reports visualization of the flow of smoke over a flat surface inside of a low-speed wind tunnel. A heating plate flush mounted on the wind tunnel floor simulated a spreading line fire that produces uniform heat flux under constant wind speed condition. A paper-thin cloth was soaked with commercially available Vaseline and...

How do weather and terrain contribute to firefighter entrapments in Australia?
www.nrfirescience.org/resource/17122
Adverse weather conditions and topographic influences are suspected to be responsible for most entrapments of firefighters in Australia. A lack of temporally and spatially coherent set of data however, hinders a clear understanding of the contribution of each weather type or terrain driver on these events. We investigate coronial...

Existence of solution of a forest fire spread model
www.nrfirescience.org/resource/17872
We consider a wildfire spread model represented by the system (1). We use results from the theory of Hamilton-Jacobi equations to prove that there exists a classical solution of (1) for any $(?,t)?R\times(0,T)(?,t)?R\times(0,T)$ and some $T>0$ and satisfies particular initial conditions. We also use the method of characteristics...
Quantifying wildfire growth rates using smoke plume observations derived from weather radar
www.nrfirescience.org/resource/18054
Fast-moving wildfires can result in substantial losses of infrastructure, property and life. During such events, real-time intelligence is critical for managing firefighting activities and public safety. The ability of fixed-site weather radars to detect the plumes from fires has long been recognized; however, quantitative methods...
Author(s): Thomas J. Duff, Derek M. Chong, Trent D. Penman
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Conditional Performance Evaluation: Using Wildfire Observations for Systematic Fire Simulator Development
www.nrfirescience.org/resource/17657
Faster than real-time wildland fire simulators are being increasingly adopted by land managers to provide decision support for tactical wildfire management and assist with strategic risk planning. These simulators are typically based on simple forward rate-of-spread algorithms that were predominantly developed using observations of...
Author(s): Thomas J. Duff, Jane G. Cawson, Brett Cirulis, Petter Nyman, Gary J. Sheridan, Kevin G. Tolhurst
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Boundary layer instabilities in mixed convection and diffusion flames with an unheated starting length
www.nrfirescience.org/resource/18325
The following study examines the role of streaklike coherent structures in mixed convection via a horizontal heated boundary layer possessing an unheated starting length. The three-dimensionality of flows in this configuration, which is regularly encountered in practical scenarios, has been experimentally probed using non-invasive...
Author(s): Colin H. Miller, Wei Tang, Evan Sluder, Mark A. Finney, Sara S. McAllister, Jason M. Forthofer, Michael J. Gollner
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Defining Extreme Wildfire Events: Difficulties, Challenges, and Impacts
www.nrfirescience.org/resource/17072
Every year worldwide some extraordinary wildfires occur, overwhelming suppression capabilities, causing substantial damages, and often resulting in fatalities. Given their increasing frequency, there is a debate about how to address these wildfires with significant social impacts, but there is no agreement upon terminology to...
Year Published: 2018
Type: Document
Book or Chapter or Journal Article
Human-related ignitions concurrent with high winds promote large wildfires across the USA
www.nrfirescience.org/resource/17823
Large wildfires (>40 ha) account for the majority of burned area across the contiguous United States (US) and appropriate substantial suppression resources. A variety of environmental and social factors influence wildfire growth and whether a fire overcomes initial attack efforts and becomes a large wildfire. However, little is...
Author(s): John T. Abatzoglou, Jennifer Balch, Bethany A. Bradley, Crystal A. Kolden
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

The Hot-Dry-Windy Index: A New Fire Weather Index
www.nrfirescience.org/resource/18025
Fire weather indices are commonly used by fire weather forecasters to predict when weather conditions will make a wildland fire difficult to manage. Complex interactions at multiple scales between fire, fuels, topography, and weather make these predictions extremely difficult. We define a new fire weather index called the Hot-Dry-....
Author(s): Alan F. Srock, Joseph J. Charney, Brian E. Potter, Scott L. Goodrick
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Human influences superseded climate to disrupt the 20th century fire regime in Jasper National Park, Canada
www.nrfirescience.org/resource/18402
To enhance understanding of how climate and humans influenced historical fire occurrence in the montane forests of Jasper National Park, we crossdated fire-scar and tree age samples from 172 plots. We tested effects of drought and climatic variation driven by the El Niño-Southern Oscillation (ENSO) and Pacific North American (PNA)...
Author(s): Raphael D. Chavardes, Lori D. Daniels, Ze'ev Gedalof, David W. Andison
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Some Requirements for Simulating Wildland Fire Behavior Using Insight from Coupled Weather—Wildland Fire Models
www.nrfirescience.org/resource/17610
A newer generation of models that interactively couple the atmosphere with fire behavior have shown an increased potential to understand and predict complex, rapidly changing fire behavior. This is possible if they capture intricate, time-varying microscale airflows in mountainous terrain and fire-atmosphere feedbacks. However, this...
Author(s): Janice L. Coen
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Lolo Peak Fire 2017: From the wilderness to the wildland urban interface
www.nrfirescience.org/resource/19554
The lightning-ignited Lolo Peak fire in the Selway-Bitterroot Wilderness was discovered on July 12, 2017, burning in an area of high tree mortality and rugged terrain. During the field trip, which was held
as part of the May 2018 Fire Continuum Conference, managers, scientists, a county sheriff, and a property owner guided 41...
Author(s): Linda Mutch
Year Published: 2018
Type: Document
Research Brief or Fact Sheet

Applications of the United States Forest Inventory and Analysis dataset: a review and future directions
www.nrfirescience.org/resource/18287
The United States Forest Inventory and Analysis (FIA) program has been monitoring national forest resources in the United States for over 80 years; presented here is a synthesis of research applications for FIA data. A review of over 180 publications that directly utilize FIA data is broken down into broad categories of application...
Author(s): Wade T. Tinkham, Patrick R. Mahoney, Andrew T. Hudak, Grant M. Domke, Michael J. Falkowski, Christopher W. Woodall, Alistair M. S. Smith
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Natural Areas Association Fire Compendium 2
www.nrfirescience.org/resource/18853
The Natural Areas Association Fire Compendium 2 compiles articles published in the Natural Areas Journal from 2010 to 2017. This is a supplement to the NAA Fire Compendium that was compiled in 2010 for articles published from 1983 to 2009. Like the first compendium, articles in the Fire Compendium 2 focus on fire ecology and...
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Data Descriptor: TerraClimate, a high-resolution global dataset of monthly climate and climatic water balance from 1958-2015
www.nrfirescience.org/resource/17794
We present TerraClimate, a dataset of high-spatial resolution (1/24°, ~4-km) monthly climate and climatic water balance for global terrestrial surfaces from 1958–2015. TerraClimate uses climatically aided interpolation, combining high-spatial resolution climatological normals from the WorldClim dataset, with coarser resolution...
Author(s): John T. Abatzoglou, Solomon Z. Dobrowski, Sean A. Parks, Katherine C. Hegewisch
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

The Haines Index – it’s time to revise it or replace it
www.nrfirescience.org/resource/18014
The Haines Index is used in wildland fire management to evaluate the potential for ‘large and/or erratic’ fire behaviour. Published in 1988 as the Lower Atmospheric Severity Index, it was widely adopted and has become popular among fire managers, especially in the United States. Meteorologists have questioned its validity,...
Author(s): Brian E. Potter
Year Published: 2018
Type: Document
Determining Prescribed Fire and Fuel Treatment Compatibility with Semidesert Grassland Habitat Rehabilitation for the Critically Endangered Masked Bobwhite Quail (Colinus virginianus Ridgwayi)

www.nrfirescience.org/resource/19881
The Buenos Aires National Wildlife Refuge (BANWR) in southern Arizona was established in 1985 to provide habitat for threatened and endangered plant and animal species, with an emphasis on the critically endangered masked bobwhite quail (Colinus virginianus ridgwayi). Livestock grazing, fire regime disruption, pronounced drought,...
Year Published: 2018
Type: Document
Technical Report or White Paper

Optimizing precipitation thresholds for best correlation between dry lightning and wildfires

www.nrfirescience.org/resource/17429
This work examines how to adjust the definition of ‘dry lightning’ in order to optimize the correlation between dry lightning flash count and the climatology of large (>400 km2) lightning-ignited wildfires over the contiguous United States (CONUS). The National Lightning Detection Network™ and National Centers for...
Author(s): Brian Vant-Hull, Tollisha Thompson, William Koshak
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Pre-fire drought and competition mediate post-fire conifer mortality in western U.S. National Parks

www.nrfirescience.org/resource/18275
Tree mortality is an important outcome of many forest fires. Extensive tree injuries from fire may lead directly to mortality, but environmental and biological stressors may also contribute to tree death. However, there is little evidence showing how the combined effects of two common stressors, drought and competition, influence...
Author(s): Phillip J. van Mantgem, Donald A. Falk, Emma C. Williams, Adrian J. Das, Nathan L. Stephenson
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

A VIIRS direct broadcast algorithm for rapid response mapping of wildfire burned area in the western United States

www.nrfirescience.org/resource/18835
We present a direct broadcast (DB) rapid response burned area mapping algorithm for Visible Infrared Imaging Radiometer Suite (VIIRS) data that combines products driven by the spectral signal of fire-affected areas from both emissive and reflective spectral bands. The algorithm processes VIIRS infrared M-bands (750 m) using...
Author(s): Shawn P. Urbanski, Bryce L. Nordgren, Carl Albury, Brenna Schwert, David Peterson, Brad Quayle, Wei Min Hao
Year Published: 2018
Type: Document
Book or Chapter or Journal Article
Flame-front rate of spread estimates for moderate scale experimental fires are strongly influenced by measurement approach
www.nrfirescience.org/resource/17768
Understanding wildfire rate of spread (RoS) is often a key objective of many fire behavior modelling and measurement exercises. Using instrumented moderate scale laboratory burns we provide an assessment of eight different methods of flame front RoS determination, including visible imagery (VIS) analysis techniques, use of...
Author(s): Joshua M. Johnston, Melanie J. Wheatley, Martin J. Wooster, Ronan Paugam, G. Matt Davies, Kaitlin A. DeBoer
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Fire behavior and ecological effects of burning masticated forest fuels
www.nrfirescience.org/resource/17950
Managers masticate fuels to redistribute fuels within a forest. They use machines to chip and shred whole trees, shrubs, and herbaceous vegetation to reduce the fuels in the canopy and move them to the forest floor. Fires burning in the dense, compact fuelbeds resulting from mastication often burn with lower intensity and shorter...
Author(s): Penelope Morgan, Alistair M. S. Smith, Aaron M. Sparks, Camille Stevens-Rumann, Pamela G. Sikkink, Zachary D. Lyon, Robert F. Keefe
Year Published: 2018
Type: Document
Research Brief or Fact Sheet

The sensitivity of US wildfire occurrence to pre-season soil moisture conditions across ecosystems
www.nrfirescience.org/resource/17379
It is generally accepted that year-to-year variability in moisture conditions and drought are linked with increased wildfire occurrence. However, quantifying the sensitivity of wildfire to surface moisture state at seasonal lead-times has been challenging due to the absence of a long soil moisture record with the appropriate...
Author(s): Daniel Jensen, John T. Reager, Brittany Zajic, Nick Rousseau, Matthew Rodell, Everett Hinkley
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Fuel-related fire-behaviour relationships for mixed live and dead fuels burned in the laboratory
www.nrfirescience.org/resource/16452
A laboratory experimental program addressing fire spread in fuel beds composed of dead foliage litter and vertically placed quasi-live branches, representative of many natural fuel complexes, was carried out for either still-air or wind conditions. Fuel-bed characteristics, fire spread rate, flame geometry, and fuel consumption were...
Author(s): Carlos G. Rossa, Paulo M. Fernandes
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

Evidence of fuels management and fire weather influencing fire severity in an extreme fire event
Following changes in vegetation structure and pattern, along with a changing climate, large wildfire incidence has increased in forests throughout the western United States. Given this increase, there is great interest in whether fuels treatments and previous wildfire can alter fire severity patterns in large wildfires. We assessed...

Author(s): Jamie M. Lydersen, Brandon M. Collins, Matthew L. Brooks, John R. Matchett, Kristen L. Shive, Nicholas A. Povak, Van R. Kane, Douglas F. Smith
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

Climate change and the eco-hydrology of fire: will area burned increase in a warming western USA?

Wildfire area is predicted to increase with global warming. Empirical statistical models and process-based simulations agree almost universally. The key relationship for this unanimity, observed at multiple spatial and temporal scales, is between drought and fire. Predictive models often focus on ecosystems in which this...

Author(s): Donald McKenzie, Jeremy S. Littell
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

Simulated fire behaviour in young, postfire lodgepole pine forests

Early-seral forests are expanding throughout western North America as fire frequency and annual area burned increase, yet fire behaviour in young postfire forests is poorly understood. We simulated fire behaviour in 24-year-old lodgepole pine (Pinus contorta var. latifolia) stands in Yellowstone National Park, Wyoming, United States...

Author(s): Kellen N. Nelson, Monica G. Turner, William H. Romme, Daniel B. Tinker
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

The normal fire environment—Modeling environmental suitability for large forest wildfires using past, present, and future climate normals

We modeled the normal fire environment for occurrence of large forest wildfires (>40 ha) for the Pacific Northwest Region of the United States. Large forest wildfire occurrence data from the recent climate normal period (1971–2000) was used as the response variable and fire season precipitation, maximum temperature, slope, and...

Author(s): Raymond J. Davis, Zhiqiang Yang, Andrew Yost, Cole Belongie, Warren B. Cohen
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

Effects of season on ignition of live wildland fuels using the forced ignition and flame spread test apparatus

An understanding of what variables affect the ignition of live wildland fuels is crucial to predicting crown fire spread, the most poorly understood type of wildland fire. Ignition tests were performed over the
Modeling support for FASMEE experimental design using WRF-SFIRECHEM - Final Report to the Joint Fire Science Program

Recent advancements in fire-atmosphere numerical modeling have increased the number of physical processes integrated into these coupled models. This greater complexity allows for more comprehensive representation of the coupled interactions and feedbacks between the fire and the atmosphere. However, as a consequence of these...

Author(s): Adam K. Kochanski, Jan Mandel, Aimé Fournier, Mary Ann Jenkins
Year Published: 2017
Type: Document
Technical Report or White Paper

Network analysis of wildfire transmission and implications for risk governance

We characterized wildfire transmission and exposure within a matrix of large land tenures (federal, state, and private) surrounding 56 communities within a 3.3 million ha fire prone region of central Oregon US. Wildfire simulation and network analysis were used to quantify the exchange of fire among land tenures and communities and...

Author(s): Alan A. Ager, Cody Evers, Michelle A. Day, Haiganoush K. Preisler, Ana M. G. Barros, Max W. Nielsen-Pincus
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

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

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

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

Evaluating spatiotemporal tradeoffs under alternative fuel management and suppression policies: measuring returns on investment - Final Report to the Joint Fire Science Program

The primary theme of our study is the cost-effectiveness of fuel treatment at multiple scales, addressing the question of whether fuel treatments can be justified on the basis of saved suppression costs. Our study was designed to track the influence of a dollar invested in fuel treatments on final fire outcomes, and to quantify this...
Human exposure and sensitivity to globally extreme wildfire events
www.nrfirescience.org/resource/15038
Extreme wildfires have substantial economic, social and environmental impacts, but there is uncertainty whether such events are inevitable features of the Earth’s fire ecology or a legacy of poor management and planning. We identify 478 extreme wildfire events defined as the daily clusters of fire radiative power from MODIS,...

An improved canopy wind model for predicting wind adjustment factors and wildland fire behavior
www.nrfirescience.org/resource/16445
The ability to rapidly estimate wind speed beneath a forest canopy or near the ground surface in any vegetation is critical to practical wildland fire behavior models. The common metric of this wind speed is the “mid-flame” wind speed, UMF. However, the existing approach for estimating UMF has some significant shortcomings....

An uncertainty analysis of wildfire modeling [Chapter 13]
www.nrfirescience.org/resource/14997
Before fire models can be understood, evaluated, and effectively applied to support decision making, model-based uncertainties must be analyzed. In this chapter, we identify and classify sources of uncertainty using an established analytical framework, and summarize results graphically in an uncertainty matrix. Our analysis...

Trend analysis of fire season length and extreme fire weather in North America between 1979 and 2015
www.nrfirescience.org/resource/16407
We have constructed a fire weather climatology over North America from 1979 to 2015 using the North American Regional Reanalysis dataset and the Canadian Fire Weather Index (FWI) System. We tested for the presence of trends in potential fire season length, based on a meteorological definition, and extreme fire weather using the non-...
Spatio-Temporal Linkages between Declining Arctic Sea-Ice Extent and Increasing Wildfire Activity in the Western United States

We examined relationships between monthly Arctic sea-ice extent (ASIE) and annual wildfire activity for seven regions in the western United States during 1980-2015 to determine if spatio-temporal linkages exist between ASIE, upper-level flow, and surface climatic conditions conducive to western U.S. wildfire activity. Winter ASIE...

Author(s): Paul A. Knapp, Peter T. Soulé
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

Effects of accelerated wildfire on future fire regimes and implications for the United States federal fire policy

Wildland fire suppression practices in the western United States are being widely scrutinized by policymakers and scientists as costs escalate and large fires increasingly affect social and ecological values. One potential solution is to change current fire suppression tactics to intentionally increase the area burned under...

Author(s): Alan A. Ager, Ana M. G. Barros, Haiganoush K. Preisler, Michelle A. Day, Thomas A. Spies, John D. Bailey, John P. Bolte
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

An empirically based approach to defining wildland firefighter safety and survival zone separation distances

Wildland firefighters in the US are mandated to identify areas that provide adequate separation between themselves and the flames (i.e. safety zones) to reduce the risk of burn injury. This study presents empirical models that estimate the distance from flames that would result in a low probability (1 or 5%) of either fatal or non-....

Author(s): Wesley G. Page, Bret W. Butler
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

Towards improving wildland firefighter situational awareness through daily fire behaviour risk assessments in the US Northern Rockies and Northern Great Basin

Wildland firefighters must assess potential fire behaviour in order to develop appropriate strategies and tactics that will safely meet objectives. Fire danger indices integrate surface weather conditions to quantify potential variations in fire spread rates and intensities and therefore should closely relate to observed fire...

Author(s): William Matt Jolly, Patrick H. Freeborn
Year Published: 2017
Type: Document
Book or Chapter or Journal Article
Interacting effects of fire severity, time since fire and topography on vegetation structure after wildfire

Fire is an important disturbance in forest ecosystems globally. Many of the effects of fire on forest processes are mediated through effects on vegetation structure. Understanding how fire properties, fire regimes and environmental variation interact to affect structure is required in the face of predictions of increasing size and...

Author(s): Michelle Bassett, Steven W.J. Leonard, Evelyn K. Chia, Michael F. Clarke, Andrew F. Bennett

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

How to generate and interpret fire characteristics charts for the U.S. fire danger rating system

The fire characteristics chart is a graphical method of presenting U.S. National Fire Danger Rating System (NFDRS) indexes and components as well as primary surface or crown fire behavior characteristics. Computer software has been developed to produce fire characteristics charts for both fire danger and fire behavior in a format...

Author(s): Faith A. Heinsch, Patricia L. Andrews, D. A. Tirmenstein

Year Published: 2017
Type: Document
Technical Report or White Paper

Qualitative flow visualization of flame attachment on slopes

Heating of unburned fuel by attached flames and plume of a wildfire can produce high spread rates that have resulted in firefighter fatalities worldwide. Qualitative flow fields of the plume of a gas burner embedded in a table tilted to 0°, 10°, 20°, and 30° above horizontal were imaged using the retroreflective shadowgraph...

Author(s): Torben Grumstrup, Sara S. McAllister, Mark A. Finney

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

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

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

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

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

Hierarchical 3D fuel and consumption maps to support physics-based fire modeling - Final Report to the Joint Fire Science Program

To meet the data requirements of physics-based fire models and FASME objectives, traditional fuel
and consumption measures need to be integrated with spatially explicit, three-dimensional data. One of the challenges of traditional fuel measurement techniques is that they must either remove or alter the fuels that are a primary...

Author(s): Andrew T. Hudak, Susan J. Prichard, Robert E. Keane, E. Louise Loudermilk, Russell A. Parsons, Carl A. Seielstad, Eric Rowell, Nick Skowronske
Year Published: 2017
Type: Document
Technical Report or White Paper

Predicting post-fire tree mortality for 12 western US conifers using the First-Order Fire Effects Model (FOFEM)
www.nrfirescience.org/resource/16493
Accurate prediction of fire-caused tree mortality is critical for making sound land management decisions such as developing burning prescriptions and post-fire management guidelines. To improve efforts to predict post-fire tree mortality, we developed 3-year post-fire mortality models for 12 Western conifer species—white fir (...)
Author(s): Sharon M. Hood, Duncan C. Lutes
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

Spatially explicit measurements of forest structure and fire behavior following restoration treatments in dry forests
www.nrfirescience.org/resource/15044
Restoration treatments in dry forests of the western US often attempt silvicultural practices to restore the historical characteristics of forest structure and fire behavior. However, it is suggested that a reliance on non-spatial metrics of forest stand structure, along with the use of wildland fire behavior models that lack the...
Author(s): J. Ziegler, Chad M. Hoffman, Michael A. Battaglia, William E. Mell
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

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

Fire weather conditions and fire-atmosphere interactions observed during low-intensity prescribed fires - Rxcadre 2012
www.nrfirescience.org/resource/16908
The goal of this paper is to describe the overall meteorological measurement campaign design and methods and present some initial results from analyses of two burn experiments.
Author(s): Craig B. Clements, Neil Lareau, Daisuke Seto, Jonathan Contezac, Braniff Davis, Casey
As climate has warmed over recent years, a new pattern of more frequent and more intense weather events has unfolded across the globe. Climate models simulate such changes in extreme events, and some of the reasons for the changes are well understood. Warming increases the likelihood of extremely hot days and nights, favors...

Author(s): Committee on Extreme Weather Events and Climate Change Attribution
Year Published: 2016
Type: Document
Technical Report or White Paper

Finding novel ways to plan and implement landscape-level forest treatments that protect sensitive wildlife and other key ecosystem components, while also reducing the risk of large-scale, high-severity fires, can prove to be difficult. We examined alternative approaches to landscape-scale fuel-treatment design for the same landscape...

Author(s): Christopher B. Dow, Brandon M. Collins, Scott L. Stephens
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Global climate models (GCMs) have biases when simulating historical climate conditions, which in turn have implications for estimating the hydrological impacts of climate change. This study examines the differences in projected changes of aridity [defined as the ratio of precipitation (P) over potential evapotranspiration (PET), or...

Year Published: 2016
Type: Document
Book or Chapter or Journal Article

As wildland fire activity continues to surge across the western US, it is increasingly important that we understand and quantify the environmental drivers of fire and how they vary across ecosystems. At daily to annual timescales, weather, fuels, and topography are known to influence characteristics such as area burned and fire...

Author(s): Lisa M. Holsinger, Sean A. Parks, Carol Miller
Year Published: 2016
Type: Document
Book or Chapter or Journal Article
Spatial coherence of extreme precipitation events in the Northwestern United States
www.nrfirescience.org/resource/15609
The complexity of impacts resulting from extreme precipitation events varies with the spatial extent of precipitation extremes. Characteristics of precipitation extremes, defined by the top 5% of 3-day accumulated precipitation, including their spatial coherence and relationships to two contrasting synoptic phenomena, were examined...
Author(s): Lauren E. Parker, John T. Abatzoglou
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

The effect of wind on burning rate of wood cribs
www.nrfirescience.org/resource/14685
Wood cribs are often used as ignition sources for room fire tests. A wood crib may also apply to studies of burning rate in wildland fires, because wildland fuel beds are porous and three dimensional. A unique aspect of wildland fires is the ubiquitous presence of wind. However, very little is known about what effect the increased...
Author(s): Sara S. McAllister, Mark A. Finney
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Quantifying the influence of previously burned areas on suppression effectiveness and avoided exposure: a case study of the Las Conchas Fire
www.nrfirescience.org/resource/13919
We present a case study of the Las Conchas Fire (2011) to explore the role of previously burned areas (wildfires and prescribed fires) on suppression effectiveness and avoided exposure. Methodological innovations include characterisation of the joint dynamics of fire growth and suppression activities, development of a fire line...
Author(s): Matthew P. Thompson, Patrick H. Freeborn, Jon D. Rieck, David E. Calkin, Julie W. Gilbertson-Day, Mark A. Cochrane, Michael S. Hand
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Projected changes in cold hardiness zones and suitable overwinter ranges of perennial crops over the United States
www.nrfirescience.org/resource/15604
Average annual absolute minimum temperatures (TN n) provide a means of delineating agriculturally relevant climate zones and are used to define cold hardiness zones (CHZ) by the United States Department of Agriculture. Projected changes in TN n, mean winter minimum temperatures, and CHZs over the conterminous United States (CONUS)...
Author(s): Lauren E. Parker, John T. Abatzoglou
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

The impact of aging on laboratory fire behaviour in masticated shrub fuelbeds of California and Oregon, USA
www.nrfirescience.org/resource/14580
Mastication of shrubs and small trees to reduce fire hazard has become a widespread management
practice, yet many aspects of the fire behaviour of these unique woody fuelbeds remain poorly understood. To examine the effects of fuelbed aging on fire behaviour, we conducted laboratory burns with masticated Arctostaphylos spp. and...

Author(s): Jesse K. Kreye, J. Morgan Varner, Jeffrey M. Kane, Eric E. Knapp, Warren P. Reed
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

High-resolution infrared thermography for capturing wildland fire behaviour: RxCADRE 2012
www.nrfirescience.org/resource/13856
Wildland fire radiant energy emission is one of the only measurements of combustion that can be made at wide spatial extents and high temporal and spatial resolutions. Furthermore, spatially and temporally explicit measurements are critical for making inferences about fire effects and useful for examining patterns of fire spread. In...
Author(s): Joseph J. O'Brien, E. Louise Loudermilk, Benjamin Hornsby, Andrew T. Hudak, Benjamin C. Bright, Matthew B. Dickinson, J. Kevin Hiers, Casey Teske, Roger D. Ottmar
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Evaluation and optimization of fuel treatment effectiveness with an integrated experimental/modeling approach - Final Report to the Joint Fire Science Program
www.nrfirescience.org/resource/17048
The effectiveness of a hazardous fuel reduction treatment must take into account both the physical change on fuel loading and structure and the effect that this change may have on wildland fire behavior. We first took a remote sensing and field measurement approach to quantify the effects of an aggressive fuel treatment program on...
Author(s): Nick Skowronksi, Albert Simeoni, Kenneth L. Clark, William E. Mell, Rory Hadden
Year Published: 2016
Type: Document
Technical Report or White Paper

Charred forests accelerate snow albedo decay: parameterizing the post-fire radiative forcing on snow for three years following fire
www.nrfirescience.org/resource/14443
As large, high-severity forest fires increase and snowpacks become more vulnerable to climate change across the western USA, it is important to understand post-fire disturbance impacts on snow hydrology. Here, we examine, quantify, parameterize, model, and assess the post-fire radiative forcing effects on snow to improve hydrologic...
Author(s): Kelly E. Gleason, Anne W. Nolin
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Contribution of cut-off lows to precipitation across the United States
www.nrfirescience.org/resource/15602
A chronology of cutoff lows (COL) from 1979 to 2014 alongside daily precipitation observations across the conterminous United States was used to examine the contribution of COL to seasonal precipitation, extreme-precipitation events, and interannual precipitation variability. COL accounted for between 2% and 32% of annual...
Author(s): John T. Abatzoglou
Measurements relating fire radiative energy density and surface fuel consumption - RxCADRE 2011 and 2012
www.nrfirescience.org/resource/13845
Small-scale experiments have demonstrated that fire radiative energy is linearly related to fuel combusted but such a relationship has not been shown at the landscape level of prescribed fires. This paper presents field and remotely sensed measures of pre-fire fuel loads, consumption, fire radiative energy density (FRED) and fire...
Author(s): Andrew T. Hudak, Matthew B. Dickinson, Benjamin C. Bright, Robert L. Kremens, E. Louise Loudermilk, Joseph J. O'Brien, Benjamin Hornsby, Roger D. Ottmar
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

STANDFIRE: an IFT-DSS module for spatially explicit, 3D fuel treatment analysis - Final Report to the Joint Fire Science Program
www.nrfirescience.org/resource/15584
Managers are increasingly called upon to implement fuel treatments to alter potential fire behavior, in order to mitigate threats to firefighters and communities, or to maintain or restore healthy ecosystems. While some case studies have shown positive results, many questions remain about how effective certain kinds of fuel...
Author(s): Russell A. Parsons, Lucas Wells, F. Pimont, William Matt Jolly, Rodman Linn, William E. Mell
Year Published: 2016
Type: Document
Technical Report or White Paper

The net benefits of human-ignited wildfire forecasting: the case of tribal land units in the United States
www.nrfirescience.org/resource/14196
Research shows that some categories of human-ignited wildfires may be forecastable, owing to their temporal clustering, with the possibility that resources could be predeployed to help reduce the incidence of such wildfires. We estimated several kinds of incendiary and other human-ignited wildfire forecast models at the weekly time...
Author(s): Jeffrey P. Prestemon, David T. Butry, Douglas S. Thomas
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Determination of the effects of heating mechanisms and moisture content on ignition of live fuels
www.nrfirescience.org/resource/15576
Effect of moisture content and heat flux type on ignition of foliage from 10 live fuels was examined over the course of a year using two apparatuses: a flat-flame burner coupled with a radiant panel and a Forced Ignition and flame Spread Test (FIST) apparatus. Results of the experiments were compared to predictions made with the...
Author(s): David R. Weise, Thomas H. Fletcher, Shankar M. Mahalingam, Sara S. McAllister, Babak Shotorban, William Matt Jolly
Year Published: 2016
Observations of energy transport and rate of spreads from low-intensity fires in longleaf pine habitat - Rxcadre 2012
www.nrfirescience.org/resource/16909
Wildland fire rate of spread (ROS) and intensity are determined by the mode and magnitude of energy transport from the flames to the unburned fuels. Measurements of radiant and convective heating and cooling from experimental fires are reported here. Sensors were located nominally 0.5 m above ground level. Flame heights varied...
Author(s): Bret W. Butler, Casey Teske, Daniel M. Jimenez, Joseph J. O'Brien, Paul Sopko, Cyle E. Wold, Mark Vosburgh, Benjamin Hornsby, E. Louise Loudermilk
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

A comparison of level set and marker methods for the simulation of wildland fire front propagation
www.nrfirescience.org/resource/13803
Simulating an advancing fire front may be achieved within a Lagrangian or Eulerian framework. In the former, independently moving markers are connected to form a fire front, whereas in the latter, values representing the moving front are calculated at points within a fixed grid. Despite a mathematical equivalence between the two...
Author(s): Anthony S. Bova, William E. Mell, Chad M. Hoffman
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Wicked Problem, New Solutions: Our Fire, Our Problem
www.nrfirescience.org/resource/18393
This conference is being presented to bring focus to the many issues associated with fuels, fire behavior, large wildfires, and the future of fire management. Much attention is being given to wildland fire management. It seems with each passing year we recognize escalating complexity, increasing risk, and mounting challenges....
Year Published: 2016
Type: Document
Conference Proceedings

Ecohydrological implications of drought for forests in the United States
www.nrfirescience.org/resource/14110
The relationships among drought, surface water flow, and groundwater recharge are not straightforward for most forest ecosystems due to the strong role that vegetation plays in the forest water balance. Hydrologic responses to drought can be either mitigated or exacerbated by forest vegetation depending upon vegetation water use and...
Author(s): James M. Vose, Chelcy Ford Miniat, Charles H. Luce, Heidi Asbjornsen, Peter V. Caldwell, John L. Campbell, Gordon E. Grant, Daniel J. Isaak, Steven P. Loheide II, Ge Sun
Year Published: 2016
Type: Document
Book or Chapter or Journal Article
Development of the rangeland vegetation simulator: a module for FVS
www.nrfirescience.org/resource/15570
The escalating awareness of non-forested landscapes and realization that more emphasis is needed for an all lands approach to management increasingly requires timely information to improve management effectiveness. The Forest Vegetation Simulator (FVS) has been used in a large number of studies to project future vegetation...
Author(s): Matthew C. Reeves
Year Published: 2016
Type: Document
Technical Report or White Paper

Predicting large wildfires across western North America by modeling seasonal variation in soil water balance
www.nrfirescience.org/resource/14021
A lengthening of the fire season, coupled with higher temperatures, increases the probability of fires throughout much of western North America. Although regional variation in the frequency of fires is well established, attempts to predict the occurrence of fire at a spatial resolution <10 km2 have generally been unsuccessful. We...
Author(s): Richard H. Waring, Nicholas C. Coops
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Development of high-resolution (250 m) historical daily gridded air temperature data using reanalysis and distributed sensor networks for the US Northern Rocky Mountains
www.nrfirescience.org/resource/15620
Gridded temperature data sets are typically produced at spatial resolutions that cannot fully resolve fine-scale variation in surface air temperature in regions of complex topography. These data limitations have become increasingly important as scientists and managers attempt to understand and plan for potential climate change...
Author(s): Zachary A. Holden, Alan Swanson, Anna E. Klene, John T. Abatzoglou, Solomon Z. Dobrowski, Samuel A. Cushman, John Squires, Gretchen Molsen, Jared W. Oyler
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Near-term probabilistic forecast of significant wildfire events for the western United States
www.nrfirescience.org/resource/14704
Fire danger and potential for large fires in the United States (US) is currently indicated via several forecasted qualitative indices. However, landscape-level quantitative forecasts of the probability of a large fire are currently lacking. In this study, we present a framework for forecasting large fire occurrence – an extreme...
Author(s): Haiganoush K. Preisler, Karen L. Riley, Crystal S. Stonesifer, David E. Calkin, William Matt Jolly
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

A stochastic mixed integer program to model spatial wildfire behavior and suppression placement decisions with uncertain weather
www.nrfirescience.org/resource/13931
Wildfire behavior is a complex and stochastic phenomenon that can present unique tactical management challenges. This paper investigates a multistage stochastic mixed integer program with full recourse to model spatially explicit fire behavior and to select suppression locations for a wildland fire. Simplified suppression decisions...

Author(s): Erin J. Belval, Yu Wei, Michael Bevers
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

A review of the relationships between drought and forest fire in the United States
www.nrfirescience.org/resource/18719
The historical and presettlement relationships between drought and wildfire are well documented in North America, with forest fire occurrence and area clearly increasing in response to drought. There is also evidence that drought interacts with other controls (forest productivity, topography, fire weather, management activities) to...

Author(s): Jeremy S. Littell, David L. Peterson, Karen L. Riley, Yongqiang Liu, Charles H. Luce
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Closure to development of soil moisture drought index to characterize droughts
www.nrfirescience.org/resource/15608
This is a discussion article qualifying four issues related to soil moisture drought index (SODI) moisture departure.

Author(s): Mohammad Sohrabi, Jae H. Ryu, John T. Abatzoglou, John Tracy
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Suppressing fire at the wilderness boundary: The Bear Creek fires of 2015, Spotted Bear Ranger District
www.nrfirescience.org/resource/19688
As a warm up for the 2016 Learning from a Legacy of Wilderness Fire Workshop, Spotted Bear Ranger District of the Flathead National Forest and the Northern Rockies Fire Science Network (NRFSN) hosted a field trip just outside the wilderness boundary. Forty-four managers, scientists, and students learned about fire management on...

Author(s): Vita Wright
Year Published: 2016
Type: Document
Research Brief or Fact Sheet

Burning rates of wood cribs with implications for wildland fires
www.nrfirescience.org/resource/14684
Wood cribs are often used as ignition sources for room fire tests and the well characterized burning rates may also have applications to wildland fires. The burning rate of wildland fuel structures, whether the needle layer on the ground or trees and shrubs themselves, is not addressed in any operational fire model and no simple...

Author(s): Sara S. McAllister, Mark A. Finney
Year Published: 2016
Type: Document
Book or Chapter or Journal Article
Topographic and fire weather controls of contemporary fire refugia in forested ecosystems of northwestern North America
www.nrfirescience.org/resource/18922
Fire refugia, sometimes referred to as fire islands, shadows, skips, residuals, or fire remnants, are an important element of the burn mosaic, but we lack a quantitative framework that links observations of fire refugia from different environmental contexts. Here, we develop and test a conceptual model for how predictability of fire...
Author(s): Meg A. Krawchuk, Sandra L. Haire, Jonathan D. Coop, Marc-Andre Parisien, Ellen Whitman, Geneva W. Chong, Carol Miller
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Effects of drought on forests and rangelands in the United States: a comprehensive science synthesis
www.nrfirescience.org/resource/13910
This assessment provides input to the reauthorized National Integrated Drought Information System (NIDIS) and the National Climate Assessment (NCA), and it establishes the scientific foundation needed to manage for drought resilience and adaptation. Focal areas include drought characterization; drought impacts on forest processes...
Year Published: 2016
Type: Document
Synthesis, Technical Report or White Paper

Recent advances and remaining uncertainties in resolving past and future climate effects on global fire activity
www.nrfirescience.org/resource/15603
Fire is an integral component of the Earth system that will critically affect how terrestrial carbon budgets and living systems respond to climate change. Paleo and observational records document robust positive relationships between fire activity and aridity in many parts of the world on interannual to millennial timescales....
Author(s): A. Park Williams, John T. Abatzoglou
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Autoignition of wood under combined convective and radiative heating
www.nrfirescience.org/resource/15781
Many wildland fire models assume radiation heat transfer controls fuel particle ignition. However, evidence suggests that radiation is insufficient to ignite the predominantly small, thin fuel particles in wildlands and that convective heating by flame contact is a critical component. Here, convective ignition was studied using an...
Author(s): Sara S. McAllister, Mark A. Finney
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Measuring radiant emissions from entire prescribed fires with ground, airborne, and satellite sensors - RxCADRE 2012
Characterising radiation from wildland fires is an important focus of fire science because radiation relates directly to the combustion process and can be measured across a wide range of spatial extents and resolutions. As part of a more comprehensive set of measurements collected during the 2012 Prescribed Fire Combustion and... 

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

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

Synthesis of knowledge of extreme fire behavior: volume 2 for fire behavior specialists, researchers, and meteorologists

The National Wildfire Coordinating Group’s definition of extreme fire behavior indicates a level of fire behavior characteristics that ordinarily precludes methods of direct control action. One or more of the following is usually involved: high rate of spread, prolific crowning/spotting, presence of fire whirls, and strong...

Controls on interannual variability in lightning-caused fire activity in the western US

Lightning-caused wildfires account for a majority of burned area across the western United States (US), yet lightning remains among the more unpredictable spatiotemporal aspects of the fire environment and a challenge for both modeling and managing fire activity. A data synthesis of cloud-to-ground lightning strikes, climate and...
Wildland fire limits subsequent fire occurrence
www.nrfirescience.org/resource/15303
Several aspects of wildland fire are moderated by site- and landscape-level vegetation changes caused by previous fire, thereby creating a dynamic where one fire exerts a regulatory control on subsequent fire. For example, wildland fire has been shown to regulate the size and severity of subsequent fire. However, wildland fire has...
Author(s): Sean A. Parks, Carol Miller, Lisa M. Holsinger, Scott L. Baggett, Benjamin J. Bird
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Does prescribed fire promote resistance to drought in low elevation forests of the Sierra Nevada, California, USA?
www.nrfirescience.org/resource/14244
Prescribed fire is a primary tool used to restore western forests following more than a century of fire exclusion, reducing fire hazard by removing dead and live fuels (small trees and shrubs). It is commonly assumed that the reduced forest density following prescribed fire also reduces competition for resources among the...
Author(s): Phillip J. van Mantgem, Anthony C. Caprio, Nathan L. Stevenson, Adrian J. Das
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Safe separation distance score: a new metric for evaluating wildland firefighter safety zones using Lidar
www.nrfirescience.org/resource/16910
Safety zones are areas where firefighters can retreat to in order to avoid bodily harm when threatened by burnover or entrapment from wildland fire. At present, safety zones are primarily designated by firefighting personnel as part of daily fire management activities. Though critical to safety zone assessment, the effectiveness of...
Author(s): Michael J. Campbell, Philip E. Dennison, Bret W. Butler
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Seasonal reversal of the influence of El Niño–Southern Oscillation on very large wildfire occurrence in the interior northwestern United States
www.nrfirescience.org/resource/15643
Satellite-mapped fire perimeters and the multivariate El Niño–Southern Oscillation index were used to examine the impact of concurrent El Niño–Southern Oscillation (ENSO) phase on very large fire (VLF) occurrences over the intermountain northwestern United States (U.S.) from 1984 to 2012. While the warm phase of ENSO promotes...
Author(s): Renaud Barbero, John T. Abatzoglou, Timothy J. Brown
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

Wildland fire as a self-regulating mechanism: the role of previous burns and weather in limiting fire progression
www.nrfirescience.org/resource/19432
Theory suggests that natural fire regimes can result in landscapes that are both self-regulating and
resilient to fire. For example, because fires consume fuel, they may create barriers to the spread of future fires, thereby regulating fire size. Top-down controls such as weather, however, can weaken this effect. While empirical...

Author(s): Sean A. Parks, Lisa M. Holsinger, Carol Miller, Cara R. Nelson
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

The changing strength and nature of fire-climate relationships in the northern Rocky Mountains, U.S.A., 1902-2008

www.nrfirescience.org/resource/15636
Time-varying fire-climate relationships may represent an important component of fire-regime variability, relevant for understanding the controls of fire and projecting fire activity under global-change scenarios. We used time-varying statistical models to evaluate if and how fire-climate relationships varied from 1902-2008, in one...

Author(s): Philip E. Higuera, John T. Abatzoglou, Jeremy S. Littell, Penelope Morgan
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

Developing a post-processor to link the Forest Vegetation Simulator (FVS) and the Fuel Characteristic Classification System (FCCS)

www.nrfirescience.org/resource/15561
In this project, we developed a Forest Vegetation Simulator (FVS, JFSP Project #) post-processor (FVS2FCCS) to convert FVS simulated treelist and surface fuel data into Fuel Characteristics Classification System (FCCS, JFSP Project #98-1-1-06) fuelbed format (.xml) that can be read and processed by the FCCS to create estimates of...

Author(s): Morris C. Johnson, Sarah J. Beukema, Stephanie A. Rebain, Paige C. Eagle, Kjell Swedin, Maria Petrova, Susan J. Prichard
Year Published: 2015
Type: Document
Technical Report or White Paper

Role of buoyant flame dynamics in wildfire spread

www.nrfirescience.org/resource/13377
Large wildfires of increasing frequency and severity threaten local populations and natural resources and contribute carbon emissions into the earth-climate system. Although wildfires have been researched and modeled for decades, no verifiable physical theory of spread is available to form the basis for the precise predictions...

Author(s): Mark A. Finney, Jack D. Cohen, Jason M. Forthofer, Sara S. McAllister, Michael J. Gollner, Daniel J. Gorham, Kozo Saito, Nelson K. Akafuah, Brittany A. Adam, Justin D. English
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

Exploring how alternative mapping approaches influence fireshed assessment and human community exposure to wildfire

www.nrfirescience.org/resource/13949
Attaining fire-adapted human communities has become a key focus of collaborative planning on landscapes across the western United States and elsewhere. The coupling of fire simulation with GIS has expanded the analytical base to support such planning efforts, particularly through the "fireside"
Forecasting integrated lightning and fuels ignition potentials in a system with real-time analysis of fire weather prediction accuracy
www.nrfirescience.org/resource/15557
Weather forecasts can help identify environmental conditions conducive to prescribed burning or to increased fire danger. These conditions are important components of fire management tools such as fire ignition potential maps, fire danger rating systems, fire behavior predictions, and smoke dispersion modeling. Fire managers use...
Author(s): Miriam L. Rorig, Stacy Drury
Year Published: 2015
Type: Document
Technical Report or White Paper

A wildfire-relevant climatology of the convective environment of the United States
www.nrfirescience.org/resource/13270
Convective instability can influence the behaviour of large wildfires. Because wildfires modify the temperature and moisture of air in their plumes, instability calculations using ambient conditions may not accurately represent convective potential for some fire plumes. This study used the North American Regional Reanalysis to...
Author(s): Brian E. Potter, Matthew A. Anaya
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

Climate-induced variations in global wildfire danger from 1979 to 2013
www.nrfirescience.org/resource/15322
Climate strongly influences global wildfire activity, and recent wildfire surges may signal fire weather-induced pyrogeographic shifts. Here we use three daily global climate data sets and three fire danger indices to develop a simple annual metric of fire weather season length, and map spatio-temporal trends from 1979 to 2013. We...
Author(s): William Matt Jolly, Mark A. Cochrane, Patrick H. Freeborn, Zachary A. Holden, Timothy J. Brown, G.J. Williamson, David M. J. S. Bowman
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

The potential impact of regional climate change on fire weather in the United States
www.nrfirescience.org/resource/13208
Climate change is expected to alter the frequency and severity of atmospheric conditions conducive for wildfires. In this study, we assess potential changes in fire weather conditions for the contiguous United States using the Haines Index (HI), a fire weather index that has been employed operationally to detect atmospheric...
Author(s): Ying Tang, Shiyuan Zhong, Lifeng Luo, Xindi Bian, Warren Heilman, Julie Winkler
Year Published: 2015
Type: Document
Book or Chapter or Journal Article
Daily weather and other factors influencing burn severity in central Idaho and western Montana

Burn severity as inferred from satellite-derived differenced Normalized Burn Ratio (dNBR) is useful for evaluating fire impacts on ecosystems but the environmental controls on burn severity across large forest fires are both poorly understood and likely to be different than those influencing fire extent. We related dNBR to...

Author(s): Donovan Birch, Penelope Morgan, Crystal A. Kolden, John T. Abatzoglou, Gregory K. Dillon, Andrew T. Hudak, Alistair M. S. Smith
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

Observations of distributed snow depth and snow duration within diverse forest structures in a maritime mountain watershed

Spatially distributed snow depth and snow duration data were collected over two to four snow seasons during water years 2011–2014 in experimental forest plots within the Cedar River Municipal Watershed, 50 km east of Seattle, Washington, USA. These 40 × 40 m forest plots, situated on the western slope of the Cascade Range,...

Author(s): Susan E. Dickerson-Lange, James A. Lutz, Rolf Gersonde, Kael A. Martin, Jenna E. Forsyth, Jessica D. Lundquist
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

Recent findings relating to firefighter safety zones

Designation of safety zones is a primary duty of all wildland firefighters. Unfortunately, information regarding what constitutes an adequate safety zone is inadequately defined. Measurements of energy release from wildland fires have been used to develop an empirically based safety zone guideline. The basis for this work is...

Author(s): Bret W. Butler, Russell A. Parsons, William E. Mell
Year Published: 2015
Type: Document
Conference Proceedings

Proceedings of the large wildland fires conference

Large fires or “megafires” have been a major topic in wildland fire research and management for over a decade. There is great debate regarding the impacts of large fires. Many believe that they (1) are occurring too frequently, (2) are burning abnormally large areas, (3) cause uncharacteristically adverse ecological harm, and (4)...

Year Published: 2015
Type: Document
Conference Proceedings

Development of soil moisture drought index (SODI) to characterize droughts

A new drought index termed the “soil moisture drought index (SODI)” is developed to characterize
droughts. The premise of the index is based on how much water is required to attain soil moisture at
field capacity. SODI captures variations of precipitation, temperature, and soil moisture over time. Three
widely used drought...
Author(s): Mohammad Sohrabi, Jae H. Ryu, John T. Abatzoglou, John Tracy
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

Implications of climate change on wind erosion of agricultural lands in the Columbia plateau
www.nrfirescience.org/resource/15642
Climate change may impact soil health and productivity as a result of accelerated or decelerated rates
of erosion. Previous studies suggest a greater risk of wind erosion on arid and semi-arid lands due to
loss of biomass under a future warmer climate. There have been no studies conducted to assess the
impact of climate change on...
Author(s): B.S. Sharratt, J. Tatarko, John T. Abatzoglou, F.A. Fox, D. Huggins
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

Evaluating crown fire rate of spread predictions from physics-based models
www.nrfirescience.org/resource/13614
Modeling the behavior of crown fires is challenging due to the complex set of coupled processes that
drive the characteristics of a spreading wildfire and the large range of spatial and temporal scales over
which these processes occur. Detailed physics-based modeling approaches such as FIRETEC and the
Wildland Urban Interface Fire...
Author(s): Chad M. Hoffman, J. Ziegler, Rodman Linn, William E. Mell, Carolyn Hull Sieg, F. Pimont
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

Verification of Spot Fire Weather Forecasts
www.nrfirescience.org/resource/15563
Software was developed to evaluate National Weather Service (NWS) spot forecasts. Fire management
officials request spot forecasts from the NWS to provide detailed guidance as to atmospheric conditions
in the vicinity of planned prescribed burns as well as wildfires that do not have incident meteorologists
on site. A multi-year set...
Author(s): John D. Horel, Timothy J. Brown
Year Published: 2015
Type: Document
Technical Report or White Paper

Limitations and utilisation of monitoring trends in burn severity products for assessing wildfire
severity in the USA
www.nrfirescience.org/resource/15631
The Monitoring Trends in Burn Severity project is a comprehensive fire atlas for the United States that
includes perimeters and severity data for all fires greater than a particular size (,400 ha in the western
US, and,200 ha in the eastern US). Although the database was derived for management purposes, the
scientific community has...
Author(s): Crystal A. Kolden, Alistair M. S. Smith, John T. Abatzoglou
Year Published: 2015
Type: Document
Experimental analysis of fire spread across a two-dimensional ridge under wind conditions
www.nrfirescience.org/resource/13382
Results from a laboratory-scale investigation of a fire spreading on the windward face of a triangular-section hill of variable shape with wind perpendicular to the ridgeline are reported. They confirm previous observations that the fire enlarges its lateral spread after reaching the ridgeline, entering the leeward face with a much...
Author(s): J. R. Raposo, S. Cabiddu, Domingos Xavier Viegas, M. Salis, J. Sharples
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

Modeling fuel treatment impacts on fire suppression cost savings: a review
www.nrfirescience.org/resource/13950
High up-front costs and uncertain return on investment make it difficult for land managers to economically justify large-scale fuel treatments, which remove trees and other vegetation to improve conditions for fire control, reduce the likelihood of ignition, or reduce potential damage from wildland fire if it occurs. In the short-...
Author(s): Matthew P. Thompson, Nathaniel Anderson
Year Published: 2015
Type: Document
Book or Chapter or Journal Article, Synthesis

Deriving fundamental statistical shrub fuel models by laser scanning and combustion experimentation
www.nrfirescience.org/resource/15558
We exploited the measurement capacity of a terrestrial laser scanner to precisely characterize shrub fuel matrices in a laboratory setting, to abstract fuel elements for fire behavior modeling, and to identify strengths and limitations of TLS for these purposes. Simultaneously, we produced statistical distributions of combustion...
Author(s): Carl A. Seielstad, Thomas H. Fletcher, David R. Weise
Year Published: 2015
Type: Document
Technical Report or White Paper

Wildland fire as a self-regulating mechanism: the role of previous burns and weather in limiting fire progression
www.nrfirescience.org/resource/12770
Theory suggests that natural fire regimes can result in landscapes that are both self-regulating and resilient to fire. For example, because fires consume fuel, they may create barriers to the spread of future fires, thereby regulating fire size. Top-down controls such as weather, however, can weaken this effect. While empirical...
Author(s): Sean A. Parks, Lisa M. Holsinger, Carol Miller, Cara R. Nelson
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

Modeling spatial and temporal dynamics of wind flow and potential fire behavior following a mountain pine beetle outbreak in a lodgepole pine forest
Patches of live, dead, and dying trees resulting from bark beetle-caused mortality alter spatial and temporal variability in the canopy and surface fuel complex through changes in the foliar moisture content of attacked trees and through the redistribution of canopy fuels. The resulting heterogeneous fuels complexes alter within...

Author(s): Chad M. Hoffman, Rodman Linn, Russell A. Parsons, Carolyn Hull Sieg, Judith Winterkamp
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

Warning signals for eruptive events in spreading fires

Spreading fires are noisy (and potentially chaotic) systems in which transitions in dynamics are notoriously difficult to predict. As flames move through spatially heterogeneous environments, sudden shifts in temperature, wind, or topography can generate combustion instabilities, or trigger self-stabilizing feedback loops, that...

Author(s): Jerome M. Fox, George M. Whitesides
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

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

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

Relationships between fire danger and the daily number and daily growth of active incidents burning in the Northern Rocky Mountains, USA

Daily National Fire Danger Rating System (NFDRS) indices are typically associated with the number and final size of newly discovered fires, or averaged over time and associated with the likelihood and total burned area of large fires. Herein we used a decade (2003–12) of NFDRS indices and US Forest Service (USFS) fire reports to...

Author(s): Patrick H. Freeborn, Mark A. Cochrane, William Matt Jolly
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

Future mega-fires and smoke impacts

“Megafire” events, in which large high-intensity fires propagate over extended periods, can cause both immense damage to the local environment and catastrophic air quality impacts on cities and towns downwind. Increases in extreme events associated with climate change (e.g., droughts, heat waves) are projected to result in more...
Projected changes in snowfall extremes and interannual variability of snowfall in the western U.S.

Projected warming will have significant impacts on snowfall accumulation and melt, with implications for water availability and management in snow-dominated regions. Changes in snowfall extremes are confounded by projected increases in precipitation extremes. Downscaled climate projections from 20 global climate models were bias...

Managing fire, understanding ourselves: human dimensions in safety and wildland fire

Wildland fire management has risen to the forefront of land management and now receives greater social and political attention than ever before. As we progress through the 21st century, these areas of attention are continually presenting challenges never experienced before. We may consider ourselves well positioned to move into the...

Regional projections of the likelihood of very large wildland fires under a changing climate in the contiguous western United States

Seasonal changes in the climatic potential for very large wildfires (VLWF > or = 50,000 ac ~20,234 ha) across the western contiguous United States are projected over the 21st century using generalized linear models and downscaled climate projections for two representative concentration pathways (RCPs). Significant (p < or =0....

Predicting wildfire ignitions, escapes, and large fire activity using Predictive Service’s 7-Day Fire Potential Outlook in the western USA

Can fire potential forecasts assist with pre-positioning of fire suppression resources, which could result in a cost savings to the United States government? Here, we present a preliminary assessment of the 7-Day Fire Potential Outlook forecasts made by the Predictive Services program. We utilized historical fire occurrence data and...
Defining extreme wildland fires using geospatial and ancillary metrics
www.nrfirescience.org/resource/12953
There is a growing professional and public perception that 'extreme' wildland fires are becoming more common due to changing climatic conditions. This concern is heightened in the wildland-urban interface where social and ecological effects converge. 'Mega-fires', 'conflagrations', 'extreme' and 'catastrophic' are descriptors...
Author(s): Karen O. Lannom, Wade T. Tinkham, Alistair M. S. Smith, John T. Abatzoglou, Beth A. Newingham, Troy E. Hall, Penelope Morgan, Eva K. Strand, Travis B. Paveglio, John Anderson, Aaron M. Sparks
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Impacts of mega-fires on large U.S. urban area air quality under changing climate and fuels
www.nrfirescience.org/resource/15569
Mega-fires can adversely impact air quality in the United States and the impacts are likely to become more serious in the future due to the possibility of more frequent and intense mega-fires in response to the projected climate change. This study investigated U.S. mega-fires and fuel conditions and their environmental impacts under...
Author(s): Yongqiang Liu, Scott L. Goodrick, John A. Stanturf, Hanqin Tian
Year Published: 2014
Type: Document
Technical Report or White Paper

Fire behavior in masticated fuels: a review
www.nrfirescience.org/resource/12387
Mastication is an increasingly common fuels treatment that redistributes 'ladder' fuels to the forest floor to reduce vertical fuel continuity, crown fire potential, and fireline intensity, but fuel models do not exist for predicting fire behavior in these fuel types. Recent fires burning in masticated fuels have behaved in...
Author(s): Jesse K. Kreye, Nolan W. Brewer, Penelope Morgan, J. Morgan Varner, Alistair M. S. Smith, Chad M. Hoffman, Roger D. Ottmar
Year Published: 2014
Type: Document
Book or Chapter or Journal Article, Synthesis

Understanding stochastic wildfire simulation results
www.nrfirescience.org/resource/12758
Stochastic simulations of wildfire occurrence and growth have become an integral part of both wildfire incident management and land management planning applications. The FSPro simulation system, implemented in the online Wildland Fire Decision Support System (WFDSS), acknowledges that weather inputs to wildfire growth...
Author(s): Joe H. Scott
Year Published: 2014
Type: Document
Technical Report or White Paper

Observed changes in false springs over the contiguous United States
www.nrfirescience.org/resource/15668
Climate warming fosters an earlier spring green-up that may bring potential benefits to agricultural systems. However, advances in green-up timing may leave early stage vegetation growth vulnerable to cold damage when hard freezes follow green-up resulting in a false spring. Spatiotemporal patterns of green-up dates, last spring...

Author(s): Alexander G. Peterson, John T. Abatzoglou
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Extent of the rain-snow transition zone in the western U.S. under historic and projected climate
www.nrfirescience.org/resource/15660
This study investigates the extent of the rain-snow transition zone across the complex terrain of the western United States for both late 20th century climate and projected changes in climate by the mid-21st century. Observed and projected temperature and precipitation data at 4 km resolution were used with an empirical...

Author(s): P. Zion Klos, Timothy E. Link, John T. Abatzoglou
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Observed and projected changes in absolute temperature extremes across the contiguous United States
www.nrfirescience.org/resource/15657
Changes in the extent of absolute, all-time, daily temperature records across the contiguous United States were examined using observations and climate model simulations. Observations from station data and reanalysis from 1980 to 2013 show increased extent of absolute highest temperature records and decreased extent of absolute...

Author(s): John T. Abatzoglou, Renaud Barbero
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

A comparison of three approaches for simulating fine-scale surface winds in support of wildland fire management: Part I. Model formulation and comparison against measurements
www.nrfirescience.org/resource/16923
For this study three types of wind models have been defined for simulating surface wind flow in support of wildland fire management: (1) a uniform wind field (typically acquired from coarse-resolution (4 km) weather service forecast models); (2) a newly developed mass-conserving model and (3) a newly developed mass and...

Author(s): Jason M. Forthofer, Bret W. Butler, Natalie S. Wagenbrenner
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Questionable evidence of natural warming of the northwestern United States
www.nrfirescience.org/resource/15655
Johnstone and Mantua (1) claim that changes in atmospheric circulation were the primary cause of the observed warming of sea surface temperature around the northeastern Pacific margins and surface air temperature (SAT) in Northern California, Oregon, and Washington from 1901 to 2012. The results of Johnstone and Mantua's report...

Author(s): John T. Abatzoglou, David E. Rupp, Philip W. Mote
**Climate and very large wildland fires in the contiguous western USA**

www.nrfirescience.org/resource/13009

Very large wildfires can cause significant economic and environmental damage, including destruction of homes, adverse air quality, firefighting costs and even loss of life. We examine how climate is associated with very large wildland fires (VLWFs > or =50,000 acres, or ~20,234 ha) in the western contiguous USA. We used composite...

Author(s): E. Natasha Stavros, John T. Abatzoglou, Narasimhan K. Larkin, Donald McKenzie, E. Ashley Steel

Year Published: 2014

Type: Document

Book or Chapter or Journal Article

**Spectroscopic analysis of seasonal changes in live fuel moisture content and leaf dry mass**

www.nrfirescience.org/resource/13001

Live fuel moisture content (LFMC), the ratio of water mass to dry mass contained in live plant material, is an important fuel property for determining fire danger and for modeling fire behavior. Remote sensing estimation of LFMC often relies on an assumption of changing water and stable dry mass over time. Fundamental understanding...

Author(s): Yi Qi, Philip E. Dennison, William Matt Jolly, Rachel C. Kropp, Simon C. Brewer

Year Published: 2014

Type: Document

Book or Chapter or Journal Article

**Crown fire potential in lodgepole pine forests during the red stage of mountain pine beetle attack**

www.nrfirescience.org/resource/12926

Mountain pine beetle (MPB) outbreaks within the previous 10-15 years have affected millions of hectares of lodgepole pine forests in western North America. Concerns about the influence of recent tree mortality on changes in fire behaviour amongst firefighters and fire managers have led researchers to attempt to quantify the effects...

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

Year Published: 2014

Type: Document

Book or Chapter or Journal Article

**Wildland firefighter safety zones: A review of past science and summary of future needs**

www.nrfirescience.org/resource/16900

Current wildland firefighter safety zone guidelines are based on studies that assume flat terrain, radiant heating, finite flame width, constant flame temperature and high flame emissivity. Firefighter entrapments and injuries occur across a broad range of vegetation, terrain and atmospheric conditions generally when they are within...

Author(s): Bret W. Butler

Year Published: 2014

Type: Document

Book or Chapter or Journal Article
Seasonal climate variability and change in the Pacific Northwest of the United States

www.nrfirescience.org/resource/15671

Observed changes in climate of the U.S. Pacific Northwest since the early twentieth century were examined using four different datasets. Annual mean temperature increased by approximately 0.6°–0.8°C from 1901 to 2012, with corroborating indicators including a lengthened freeze-free season, increased temperature of the coldest...

Author(s): John T. Abatzoglou, David E. Rupp, Philip W. Mote
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Role of extreme snowfall events in interannual variability of snowfall accumulation in the western United States

www.nrfirescience.org/resource/15661

Water resources in the western United States are contingent on interannual variations in snow- pack. Interannual snowpack variability has been attributed to large-scale climate patterns including the El Niño-Southern Oscillation (ENSO), however, the contribution of snowfall frequency and extreme snowfall events to this...

Author(s): A.C. Lute, John T. Abatzoglou
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Representation and evaluation of wildfire propagation simulations

www.nrfirescience.org/resource/12390

This paper provides a formal mathematical representation of a wildfire simulation, reviews the most common scoring methods using this formalism, and proposes new methods that are explicitly designed to evaluate a forest fire simulation from ignition to extinction. These scoring or agreement methods are tested with synthetic cases in...

Author(s): Jean-Baptiste Filippi, Vivien Mallet, Bahaa Nader
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Challenge of assessing fire and burn severity using field measures, remote sensing and modelling

www.nrfirescience.org/resource/18881

Comprehensive assessment of ecological change after fires have burned forests and rangelands is important if we are to understand, predict and measure fire effects. We highlight the challenges in effective assessment of fire and burn severity in the field and using both remote sensing and simulation models. We draw on diverse recent...

Author(s): Penelope Morgan, Robert E. Keane, Gregory K. Dillon, Theresa B. Jain, Andrew T. Hudak, Eva C. Karau, Pamela G. Sikkink, Zachary A. Holden, Eva K. Strand
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Tracking interannual streamflow variability with drought indices in the U.S. Pacific Northwest

www.nrfirescience.org/resource/15659

Drought indices are often used for monitoring interannual variability in macroscale hydrology. However, the diversity of drought indices raises several issues: 1) which indices perform best and where; 2) does
the incorporation of potential evapotranspiration (PET) in indices strengthen relationships, and how sensitive is the choice...

Author(s): John T. Abatzoglou, Renaud Barbero, Jacob W. Wolf, Zachary A. Holden
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Fuel treatment effectiveness in reducing fire intensity and spread rate -- an experimental overview
www.nrfirescience.org/resource/16924
Fuel treatments represent a significant component of the wildfire mitigation strategy in the United States. However, the lack of research aimed at quantifying the explicit effectiveness of fuel treatments in reducing wildfire intensity and spread rate limits our ability to make educated decisions about the type and placement of...

Year Published: 2014
Type: Document
Conference Proceedings

Modeling very large-fire occurrences over the continental United States from weather and climate forcing
www.nrfirescience.org/resource/15656
Very large-fires (VLFs) have widespread impacts on ecosystems, air quality, fire suppression resources, and in many regions account for a majority of total area burned. Empirical generalized linear models of the largest fires (>5000 ha) across the contiguous United States (US) were developed at ?60 km spatial and weekly...

Author(s): Renaud Barbero, John T. Abatzoglou, E. Ashley Steel, Narasimhan K. Larkin
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

A comparison of three approaches for simulating fine-scale surface winds in support of wildland fire management. Part II. An exploratory study of the effect of simulated winds on fire growth simulations
www.nrfirescience.org/resource/16922
The effect of fine-resolution wind simulations on fire growth simulations is explored. The wind models are (1) a wind field consisting of constant speed and direction applied everywhere over the area of interest; (2) a tool based on the solution of the conservation of mass only (termed mass-conserving model) and (3) a tool based on...

Author(s): Jason M. Forthofer, Bret W. Butler, Charles W. McHugh, Mark A. Finney, Larry S. Bradshaw, Richard D. Stratton, Kyle S. Shannon, Natalie S. Wagenbrenner
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Is proportion burned severely related to daily area burned?
www.nrfirescience.org/resource/13018
The ecological effects of forest fires burning with high severity are long-lived and have the greatest impact on vegetation successional trajectories, as compared to low-to-moderate severity fires. The
primary drivers of high severity fire are unclear, but it has been hypothesized that wind-driven, large fire-growth days play a...

Author(s): Donovan Birch, Penelope Morgan, Crystal A. Kolden, Andrew T. Hudak, Alistair M. S. Smith
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Surface fire intensity influences simulated crown fire behavior in lodgepole pine forests with recent mountain pine beetle-caused tree mortality
www.nrfirescience.org/resource/12138
Recent bark beetle outbreaks have had a significant impact on forests throughout western North America and have generated concerns about interactions and feedbacks between beetle attacks and fire. However, research has been hindered by a lack of experimental studies and the use of fire behavior models incapable of accounting for the...
Author(s): Chad M. Hoffman, Penelope Morgan, William E. Mell, Russell A. Parsons, Eva K. Strand, Stephen Cook
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Crown fire behavior characteristics and prediction in conifer forests: a state-of-knowledge synthesis - Final Report to the Joint Fire Science Program
www.nrfirescience.org/resource/12447
Joint Fire Science Program (JFSP) project 09-S-03-1 was undertaken in response to JFSP Project Announcement No. FA-RFA09-0002 with respect to a synthesis on extreme fire behavior or more specifically a review and analysis of the literature dealing with certain features of crown fire behavior in conifer forests in the United States...
Author(s): Martin E. Alexander, Miguel G. Cruz, Nicole M. Vaillant, David L. Peterson
Year Published: 2013
Type: Document
Synthesis, Technical Report or White Paper

Optimising fuel treatments over time and space
www.nrfirescience.org/resource/12039
Fuel treatments have been widely used as a tool to reduce catastrophic wildland fire risks in many forests around the world. However, it is a challenging task for forest managers to prioritise where, when, and how to implement fuel treatments across a large forest landscape. In this study, an optimisation model was developed for...
Author(s): Woodam Chung, J. Greg Jones, Kurt Krueger, Jody Bramel, Marco A. Contreras
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

The missing mountain water: slower westerlies decrease orographic enhancement in the Pacific Northwest USA
www.nrfirescience.org/resource/15674
Trends in streamflow timing and volume in the Pacific Northwest United States have been attributed to increased temperatures, because trends in precipitation at lower-elevation stations were negligible. We demonstrate that observed streamflow declines are probably associated with declines in mountain precipitation, revealing...
Author(s): Charles H. Luce, John T. Abatzoglou, Zachary A. Holden
**Fuel Characteristic Classification System version 3.0: technical documentation**
www.nrfirescience.org/resource/12407
The Fuel Characteristic Classification System (FCCS) is a software module that records wildland fuel characteristics and calculates potential fire behavior and hazard potentials based on input environmental variables. The FCCS 3.0 is housed within the Integrated Fuels Treatment Decision Support System (Joint Fire Science Program).
Author(s): Susan J. Prichard, David V. Sandberg, Roger D. Ottmar, Ellen Eberhardt, Anne Andreu, Paige C. Eagle, Kjell Swedin
Year Published: 2013
Type: Document
Technical Report or White Paper

**Quantifying the potential impacts of fuel treatments on wildfire suppression costs**
www.nrfirescience.org/resource/16138
Modeling the impacts and effects of hazardous fuel reduction treatments is a pressing issue within the wildfire management community. Prospective evaluation of fuel treatment effectiveness allows for comparison of alternative treatment strategies in terms of socioeconomic and ecological impacts and facilitates analysis of tradeoffs.
Author(s): Matthew P. Thompson, Nicole M. Vaillant, Jessica R. Haas, Krista M. Gebert, Keith Stockmann
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

**Developing a computerized approach for optimizing individual tree removal to efficiently reduce crown fire potential**
www.nrfirescience.org/resource/11889
Thinning is a common silvicultural treatment being widely used to restore different types of overstocked forest stands in western U.S. because of its effect on changing fire behavior. Typically, thinning is applied at the stand level using prescriptions derived from sample plots that ignore variability in tree sizes and location.
Author(s): Marco A. Contreras, Woodam Chung
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

**Uncertainty associated with model predictions of surface and crown fire rates of spread**
www.nrfirescience.org/resource/12418
The degree of accuracy in model predictions of rate of spread in wildland fires is dependent on the model's applicability to a given situation, the validity of the model's relationships, and the reliability of the model input data. On the basis of a compilation of 49 fire spread model evaluation datasets involving 1278 observations.
Author(s): Miguel G. Cruz, Martin E. Alexander
Year Published: 2013
Type: Document
Book or Chapter or Journal Article
Modelling conditional burn probability patterns for large wildland fires

We present a technique for modelling conditional burn probability patterns in two dimensions for large wildland fires. The intended use for the model is strategic program planning when information about future fire weather and event durations is unavailable and estimates of the average probabilistic shape and extent of large fires...

Author(s): Pamela S. Ziesler, Douglas B. Rideout, Robin Reich
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Forest fire management to avoid unintended consequences: a case study of Portugal using system dynamics

Forest fires are a serious management challenge in many regions, complicating the appropriate allocation to suppression and prevention efforts. Using a System Dynamics (SD) model, this paper explores how interactions between physical and political systems in forest fire management impact the effectiveness of different allocations. A...

Author(s): Ross D. Collins, Richard de Neufville, João Claro, Tiago M. Oliveira, Abílio Pereira Pacheco
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Current status and future needs of the BehavePlus Fire Modeling System

The BehavePlus Fire Modeling System is among the most widely used systems for wildland fire prediction. It is designed for use in a range of tasks including wildfire behaviour prediction, prescribed fire planning, fire investigation, fuel hazard assessment, fire model understanding, communication and research. BehavePlus is based on...

Author(s): Patricia L. Andrews
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Combustibility of a mixture of live and dead fuel components

The problem of predicting the rate of spread of a linear fire front in a fuel bed composed of one live and one dead fuel component in no-slope and no-wind conditions is addressed. Two linear models based on the mass fraction of each fuel component are proposed to predict the rate of spread of a fire front as a function of the mass...

Author(s): Domingos Xavier Viegas, J. Soares, Miguel Almeida
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

A study of flame spread in engineered cardboard fuelbeds: part II: scaling law approach

In this second part of a two part exploration of dynamic behavior observed in wildland fires, time scales differentiating convective and radiative heat transfer is further explored. Scaling laws for the two different types of heat transfer considered: Radiation-driven fire spread, and convection-driven fire
Wildland fire emissions, carbon, and climate: modeling fuel consumption
www.nrfsrescience.org/resource/12442
Fuel consumption specifies the amount of vegetative biomass consumed during wildland fire. It is a two-stage process of pyrolysis and combustion that occurs simultaneously and at different rates depending on the characteristics and condition of the fuel, weather, topography, and in the case of prescribed fire, ignition rate and...
Author(s): Roger D. Ottmar
Year Published: 2013
Type: Document
Book or Chapter or Journal Article, Synthesis

A polygon-based modeling approach to assess exposure of resources and assets to wildfire
www.nrfsrescience.org/resource/12048
Spatially explicit burn probability modeling is increasingly applied to assess wildfire risk and inform mitigation strategy development. Burn probabilities are typically expressed on a per-pixel basis, calculated as the number of times a pixel burns divided by the number of simulation iterations. Spatial intersection of highly...
Author(s): Matthew P. Thompson, Joe H. Scott, Jeffrey D. Kaiden, Julie W. Gilbertson-Day
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Development of gridded surface meteorological data for ecological applications and modeling
www.nrfsrescience.org/resource/15682
Landscape-scale ecological modelling has been hindered by suitable high-resolution surface meteorological datasets. To overcome these limitations, desirable spatial attributes of gridded climate data are combined with desirable temporal attributes of regional-scale reanalysis and daily gauge-based precipitation to derive a spatially...
Author(s): John T. Abatzoglou
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Fire weather case study - Mann Gulch Fire, Montana
www.nrfsrescience.org/resource/11976
The intent of this report is to analyze weather conditions to determine if a 'critical fire weather pattern' also contributed to the 'blowup.'
Author(s): Paul A. Werth
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Backfire technique for prescribed burning
www.nrfsrescience.org/resource/12400
The term 'backfire' refers to a commonly used method for prescribed burning in which the igniter sets a line of fire that slowly backs into the wind. This technique should not be confused with the colloquial use of the term 'backfire' for 'suppression fire,' which refers to any fire set ahead of a wildfire in an attempt to stop it.

Author(s): Dale D. Wade
Year Published: 2013
Type: Document
Research Brief or Fact Sheet

**Fire behaviour case study of two early winter grass fires in southern Alberta, 27 November 2011**

www.nrfirescience.org/resource/11995

On November 27, 2011, two wildfires - the Lethbridge Fire and the Milk River Ridge Fire - starting within approximately an hour of each other, advanced in a north-easterly direction some 12 km and 32 km, respectively, from their point of origin in a relatively short period of time. Fortunately, no lives were lost. However, a few...

Author(s): Martin E. Alexander, Mark J. Heathcott, Randall L. Schwanke
Year Published: 2013
Type: Document
Technical Report or White Paper

**Models for predicting fuel consumption in sagebrush-dominated ecosystems**

www.nrfirescience.org/resource/11978

Fuel consumption predictions are necessary to accurately estimate or model fire effects, including pollutant emissions during wildland fires. Fuel and environmental measurements on a series of operational prescribed fires were used to develop empirical models for predicting fuel consumption in big sagebrush (Artemisia tridentata...)

Author(s): Clinton S. Wright
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

**Flame descriptors**

www.nrfirescience.org/resource/12396

The following three descriptors are used to characterize flaming combustion: 1) Flame height is the vertical distance from the base to the tip of the flames. 2) Flame length is the actual length of the flames from the tip to the midpoint of the flame footprint. Under no-wind conditions on flat ground, flame length equals flame...

Author(s): Dale D. Wade
Year Published: 2013
Type: Document
Research Brief or Fact Sheet

**Wildfire exposure and fuel management on western US national forests**

www.nrfirescience.org/resource/12756

Substantial investments in fuel management activities on national forests in the western US are part of a national strategy to reduce human and ecological losses from catastrophic wildfire and create fire resilient landscapes. Prioritizing these investments within and among national forests remains a challenge, partly because a...

Author(s): Alan A. Ager, Michelle A. Day, Charles W. McHugh, Karen C. Short, Julie W. Gilbertson-Day, Mark A. Finney, David E. Calkin
Year Published: 2013
The relationship of large fire occurrence with drought and fire danger indices in the western USA, 1984-2008: the role of temporal scale
www.nrfirescience.org/resource/12025
The relationship between large fire occurrence and drought has important implications for fire prediction under current and future climates. This study's primary objective was to evaluate correlations between drought and fire-danger-rating indices representing short- and long-term drought, to determine which had the strongest...
Author(s): Karen L. Riley, John T. Abatzoglou, Isaac C. Grenfell, Anna E. Klene, Faith A. Heinsch
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Angular variation of fire rate of spread
www.nrfirescience.org/resource/12428
Laboratory fire tests were performed in still air, for variable inclinations (10°, 15°) and fuel bed dimensions (1.28 x 2.50-3.0 x 4.6 m2), with homogeneous fuel beds of pine needles and pine wood excelsior. The fire ignition was made at a point, along a closed line with no fuel inside and along a straight edge of the fuel bed...
Author(s): Jorge C. S. Andre, Joao C. Goncalves, Gilberto C. Vaz, Domingos Xavier Viegas
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Capturing fire: RxCADRE takes fire measurements to whole new level
www.nrfirescience.org/resource/12425
Models of fire behavior and effects do not always make accurate predictions, and there is not enough systematically gathered data to validate them. To help advance fire behavior and fire effects model development, the Joint Fire Science Program is helping fund the RxCADRE, which is made up of scientists from the U.S. Forest Service...
Author(s): Gail Wells
Year Published: 2013
Type: Document
Research Brief or Fact Sheet

Are the applications of wildland fire behaviour models getting ahead of their evaluation again?
www.nrfirescience.org/resource/12417
Evaluation is a crucial component for model credibility and acceptance by researchers and resource managers. The nature and characteristics of free-burning wildland fires pose challenges to acquiring the kind of quality data necessary for adequate fire behavior model evaluation. As a result, in some circles it has led to a research...
Author(s): Martin E. Alexander, Miguel G. Cruz
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Spatial bottom-up controls on fire likelihood vary across western North America
www.nrfirescience.org/resource/8311
The unique nature of landscapes has challenged our ability to make generalizations about the effects of bottom-up controls on fire regimes. For four geographically distinct fire-prone landscapes in western North America, we used a consistent simulation approach to quantify the influence of three key bottom-up factors, ignitions,...

Author(s): Sean A. Parks, Marc-Andre Parisien, Carol Miller
Year Published: 2012
Type: Document
Book or Chapter or Journal Article

Climate extremes and their linkage to regional drought over Idaho, USA
www.nrfirescience.org/resource/15683
To investigate consequences of climate extreme and variability on agriculture and regional water resource, twenty-seven climatic indices of temperature and precipitation over Idaho, USA, were computed. Precipitation, mean temperature and maximum temperature, self-calibrated Palmer Drought Index and Standardized Precipitation Index...

Author(s): Mohammad Sohrabi, Jae H. Ryu, John T. Abatzoglou, John Tracy
Year Published: 2012
Type: Document
Book or Chapter or Journal Article

The Waldo Canyon Fire: Fires on the Colorado Front Range and Home Destruction - A Report to the Pike and San Isabel National Forests
www.nrfirescience.org/resource/11266
The purpose of this white paper is to discuss fires on the Colorado Front Range and to share initial observations of fire behavior and home destruction during the Waldo Canyon Fire. It is my hope that these lessons and observations will be beneficial to agencies and especially the public. I want to share this information early when...

Author(s): Richard D. Stratton
Year Published: 2012
Type: Document
Technical Report or White Paper

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

Entrainment regimes and flame characteristics of wildland fires
www.nrfirescience.org/resource/16925
This paper reports results from a study of the flame characteristics of 22 wind-aided pine litter fires in a laboratory wind tunnel and 32 field fires in southern rough and litter–grass fuels. Flame characteristic and fire behaviour data from these fires, simple theoretical flame models and regression techniques are used to...

Author(s): Ralph M. Nelson, Bret W. Butler, David R. Weise
Modeling tree-level fuel connectivity to evaluate the effectiveness of thinning treatments for reducing crown fire potential

www.nrfirescience.org/resource/8295

Land managers have been using fire behavior and simulation models to assist in several fire management tasks. These widely-used models use average attributes to make stand-level predictions without considering spatial variability of fuels within a stand. Consequently, as the existing models have limitations in adequately modeling...

Author(s): Marco A. Contreras, Russell A. Parsons, Woodam Chung

Effect of suppression strategies on federal wildland fire expenditures

www.nrfirescience.org/resource/17807

Policymakers and decisionmakers alike have suggested that the use of less aggressive suppression strategies for wildland fires might help stem the tide of rising emergency wildland fire expenditures. However, the interplay of wildland fire management decisions and expenditures is not well understood. In this study, we assess the...

Author(s): Krista M. Gebert, Anne E. Black

Relationships between moisture, chemistry, and ignition of Pinus contorta needles during the early stages of mountain pine beetle attack

www.nrfirescience.org/resource/8317

Very little is known about how foliar moisture and chemistry change after a mountain pine beetle attack and even less is known about how these intrinsic foliar characteristics alter foliage ignitability. Here, we examine the fuel characteristics and ignition potential of Pinus contorta (lodgepole pine) foliage during the early...

Author(s): William Matt Jolly, Russell A. Parsons, Ann M. Hadlow, Greg M. Cohn, Sara S. McAllister, John B. Popp, Robert M. Hubbard, Jose F. Negron

Properties affecting the consumption of sound and rotten coarse woody debris in northern Idaho: a preliminary investigation using laboratory fires

www.nrfirescience.org/resource/8333

This study evaluates the consumption of coarse woody debris in various states of decay. Samples from a northern Idaho mixed-conifer forest were classified using three different classification methods, ignited with two different ignition methods and consumption was recorded. Intrinsic properties that change with decay were measured...

Author(s): Joshua C. Hyde, Alistair M. S. Smith, Roger D. Ottmar
Numerical simulation of crown fire hazard immediately after bark beetle-caused mortality in lodgepole pine forests
www.nrfirescience.org/resource/8325
Quantifying the effects of mountain pine beetle (MPB)-caused tree mortality on potential crown fire hazard has been challenging partly because of limitations in current operational fire behavior models. Such models are not capable of accounting for fuel heterogeneity resulting from an outbreak. Further, the coupled interactions...
Author(s): Chad M. Hoffman, Penelope Morgan, William E. Mell, Russell A. Parsons, Eva K. Strand, Stephen Cook
Year Published: 2012
Type: Document
Book or Chapter or Journal Article

An evaluation of multi-scalar drought indices in Nevada and eastern California
www.nrfirescience.org/resource/15687
Nevada and eastern California are home to some of the driest and warmest climates, most mountainous regions, and fastest growing metropolitan areas of the United States. Throughout Nevada and eastern California, snow-dominated watersheds provide most of the water supply for both human and environmental demands. Increasing demands on...
Author(s): Daniel J. McEvoy, Justin L. Huntington, John T. Abatzoglou, Laura M. Edwards
Year Published: 2012
Type: Document
Book or Chapter or Journal Article

Characterizing fire-on-fire interactions in three large wilderness areas
www.nrfirescience.org/resource/8339
The interaction of fires, where one fire burns into another recently burned area, is receiving increased attention from scientists and land managers wishing to describe the role of fire scars in affecting landscape pattern and future fire spread. Here, we quantify fire-on-fire interactions in terms of frequency, size, and time-since...
Author(s): Casey Teske, Carl A. Seielstad, Lloyd P. Queen
Year Published: 2012
Type: Document
Book or Chapter or Journal Article

Fourmile Canyon Fire Findings
www.nrfirescience.org/resource/17701
The Fourmile Canyon Fire burned in the fall of 2010 in the Rocky Mountain Front Range adjacent to Boulder, Colorado. The fire occurred in steep, rugged terrain, primarily on privately owned mixed ponderosa pine and Douglas-fir forests. The fire started on September 6 when the humidity of the air was very dry (about <7%) and the...
Author(s): Russell T. Graham, Mark A. Finney, Charles W. McHugh, Jack D. Cohen, David E. Calkin, Richard D. Stratton, Ned Nikolov
Year Published: 2012
Type: Document
Technical Report or White Paper

Do mountain pine beetle outbreaks change the probability of active crown fire in lodgepole pine forests? Comment 1 & 2, Reply 1
Comment 1 - Simard et al. (2011) have produced a comprehensive data set and analysis concerning mountain pine beetle (MPB; Dendroctonus ponderosae)-caused mortality and associated crown fire feedbacks in lodgepole pine (Pinus contorta)-dominated forests. Misapplication of the NEXUS fire modeling system (Scott and...) 

Author(s): Christopher J. Moran, Mark A. Cochrane, William Matt Jolly, Russell A. Parsons, J. Morgan Varner, Bret W. Butler, Kevin C. Ryan, Corey L. Gucker, Martin Simard, William H. Romme, Monica G. Turner
Year Published: 2012
Type: Document
Book or Chapter or Journal Article

Spatial variability in wildfire probability across the western United States

Despite growing knowledge of fire-environment linkages in the western USA, obtaining reliable estimates of relative wildfire likelihood remains a work in progress. The purpose of this study is to use updated fire observations during a 25-year period and a wide array of environmental variables in a statistical framework to produce... 

Author(s): Marc-Andre Parisien, Susan Snetsinger, Jonathan A. Greenberg, Cara R. Nelson, Tania L. Schoennagel, Solomon Z. Dobrowski, Max A. Moritz
Year Published: 2012
Type: Document
Book or Chapter or Journal Article

Evaluating regression model estimates of canopy fuel stratum characteristics in four crown fire-prone fuel types in western North America

Two evaluations were undertaken of the regression equations developed by M. Cruz, M. Alexander and R. Wakimoto (2003, International Journal of Wildland Fire 12, 39-50) for estimating canopy fuel stratum characteristics from stand structure variables for four broad coniferous forest fuel types found in western North America. The...

Author(s): Miguel G. Cruz, Martin E. Alexander
Year Published: 2012
Type: Document
Book or Chapter or Journal Article

Towards the understanding of extreme wildland fire behavior

The author presents a brief discussion of the changing face of extreme fire behavior and an introduction to Synthesis of knowledge of extreme fire behavior: volume I for fire managers.

Author(s): Martin E. Alexander
Year Published: 2012
Type: Document
Research Brief or Fact Sheet

Influence of the PNA on declining mountain snowpack in the western United States

The widespread decrease in mountain snowpack across the Western United States is a hallmark indicator of regional climate change. Observed decreases in snowpack across lower-elevation watersheds are broadly consistent with model predictions of anthropogenic climate change; however, the magnitude of the decreases across much of the...
Linking 3D spatial models of fuels and fire: effects of spatial heterogeneity on fire behavior
www.nrfirescience.org/resource/14161
Crownfire endangers fire fighters and can have severe ecological consequences. Prediction of fire behavior in tree crowns is essential to informed decisions in fire management. Current methods used in fire management do not address variability in crown fuels. New mechanistic physics-based fire models address convective heat transfer...

Changes in climatic water balance drive downhill shifts in plant species optimum elevations
www.nrfirescience.org/resource/15690
Uphill shifts of species’ distributions in response to historical warming are well documented, which leads to widespread expectations of continued uphill shifts under future warming. Conversely, downhill shifts are often considered anomalous and unrelated to climate change. By comparing the altitudinal distributions of 64 plant...

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...

Analyzing wildfire exposure and source-sink relationships on a fire prone forest landscape
www.nrfirescience.org/resource/12736
We used simulation modeling to analyze wildfire exposure to social and ecological values on a 0.6 million ha national forest in central Oregon, USA. We simulated 50,000 wildfires that replicated recent fire events in the area and generated detailed maps of burn probability (BP) and fire intensity distributions. We also recorded the...
A method for ensemble wildland fire simulation
www.nrfirescience.org/resource/12732
An ensemble simulation system that accounts for uncertainty in long-range weather conditions and two-dimensional wildland fire spread is described. Fuel moisture is expressed based on the energy release component, a US fire danger rating index, and its variation throughout the fire season is modeled using time series analysis of...
Author(s): Mark A. Finney, Isaac C. Grenfell, Charles W. McHugh, Robert C. Seli, D. Trethewey, Richard D. Stratton, Stuart Brittain
Year Published: 2011
Type: Document
Book or Chapter or Journal Article

Synthesis of knowledge of extreme fire behavior: Volume 1 for managers
www.nrfirescience.org/resource/12566
The National Wildfire Coordinating Group definition of extreme fire behavior (EFB) indicates a level of fire behavior characteristics that ordinarily precludes methods of direct control action. One or more of the following is usually involved: high rate of spread, prolific crowning/spotting, presence of fire whirls, and strong...
Author(s): Paul A. Werth, Brian E. Potter, Craig B. Clements, Mark A. Finney, Scott L. Goodrick, Martin E. Alexander, Miguel G. Cruz, Jason M. Forthofer, Sara S. McAllister
Year Published: 2011
Type: Document
Synthesis, Technical Report or White Paper

Review of fuel treatment effectiveness in forests and rangelands and a case study from the 2007 megafires in central, Idaho, USA
www.nrfirescience.org/resource/11449
This report provides managers with the current state of knowledge regarding the effectiveness of fuel treatments for mitigating severe wildfire effects. A literature review examines the effectiveness of fuel treatments that had been previously applied and were subsequently burned through by wildfire in forests and rangelands. A case...
Author(s): Andrew T. Hudak, Ian Rickert, Penelope Morgan, Eva K. Strand, Sarah A. Lewis, Peter R. Robichaud, Chad M. Hoffman, Zachary A. Holden
Year Published: 2011
Type: Document
Synthesis, Technical Report or White Paper

Empirical downscaling of daily minimum air temperature at very fine resolutions in complex terrain
www.nrfirescience.org/resource/15692
Available air temperature models do not adequately account for the influence of terrain on nocturnal air temperatures. An empirical model for night time air temperatures was developed using a network of one hundred and forty inexpensive temperature sensors deployed across the Bitterroot National Forest, Montana. A principle...
Author(s): Zachary A. Holden, John T. Abatzoglou, Scott L. Baggett, Charles H. Luce
Year Published: 2011
Type: Document
Book or Chapter or Journal Article

A comparison of statistical downscaling methods suited for wildfire applications
Place-based data is required in wildfire analyses, particularly in regions of diverse terrain that foster not only strong gradients in meteorological variables, but also complex fire behaviour. However, a majority of downscaling methods are inappropriate for wildfire application due to the lack of daily timescales and variables such...

Author(s): John T. Abatzoglou, Timothy J. Brown
Year Published: 2011
Type: Document
Book or Chapter or Journal Article

How fuel treatments saved homes from the 2011 Wallow fire

This is a fuel treatment effectiveness assessment report from Region 3 about the success of fuel treatments in protecting several communities from the recent Wallow fire in Arizona and New Mexico. The report narrative and graphics point to the success of good forest management and good community assistance to protect life, property...

Author(s): Pam Bostwick, James P. Menakis, Tim Sexton
Year Published: 2011
Type: Document
Technical Report or White Paper

Characterization of flame radiosity in shrubland fires

The present study is aimed at quantifying the flame radiosity vertical profile and gas temperature in moderate to high intensity spreading fires in shrubland fuels. We report on the results from 11 experimental fires conducted over a range of fire rate of spread and frontal fire intensity varying respectively between 0.04–0.35 m s...

Author(s): Miguel G. Cruz, Bret W. Butler, Domingos Xavier Viegas, Pedro Palheiro
Year Published: 2011
Type: Document
Book or Chapter or Journal Article

A simulation of probabilistic wildfire risk components for the continental United States

This simulation research was conducted in order to develop a large-fire risk assessment system for the contiguous land area of the United States. The modeling system was applied to each of 134 Fire Planning Units (FPUs) to estimate burn probabilities and fire size distributions. To obtain stable estimates of these quantities, fire...

Author(s): Mark A. Finney, Charles W. McHugh, Isaac C. Grenfell, Karen L. Riley, Karen C. Short
Year Published: 2011
Type: Document
Book or Chapter or Journal Article

Simulating fuel treatment effects in dry forests of the western United States: testing the principles of a fire-safe forest

We used the Fire and Fuels Extension to the Forest Vegetation Simulator (FFE-FVS) to simulate fuel treatment effects on 45,162 stands in low- to midelevation dry forests (e.g., ponderosa pine (Pinus ponderosa Dougl. ex. P....

Author(s): Morris C. Johnson, Maureen C. Kennedy, David L. Peterson
Year Published: 2011
Both topography and climate affected forest and woodland burn severity in two regions of the western US
www.nrfirescience.org/resource/15318
Fire is a keystone process in many ecosystems of western North America. Severe fires kill and consume large amounts of above- and belowground biomass and affect soils, resulting in long-lasting consequences for vegetation, aquatic ecosystem productivity and diversity, and other ecosystem properties. We analyzed the occurrence of,...
Author(s): Gregory K. Dillon, Zachary A. Holden, Penelope Morgan, Michael A. Crimmins, Emily K. Heyerdahl, Charles H. Luce
Year Published: 2011
Type: Document
Book or Chapter or Journal Article

Detailed point weather forecasts: how to get them when you need them
www.nrfirescience.org/resource/12441
Detailed point weather forecasts are a critical component of fire management planning. Accurate hour-by-hour forecasts for your exact location are valuable when you are preparing to ignite a prescribed burn and want to compare your prescription with actual conditions. They also provide important weather documentation for your files...
Author(s): Alan J. Long, Annie Oxarart
Year Published: 2011
Type: Document
Research Brief or Fact Sheet

Effects of biomass removal treatments on stand-level fire characteristics in major forest types of the Northern Rocky Mountains
www.nrfirescience.org/resource/8189
Removal of dead and live biomass from forested stands affects subsequent fuel dynamics and fire potential. The amount of material left onsite after biomass removal operations can influence the intensity and severity of subsequent unplanned wildfires or prescribed burns. We developed a set of biomass removal treatment scenarios and...
Author(s): Elizabeth D. Reinhardt, Lisa M. Holsinger, Robert E. Keane
Year Published: 2010
Type: Document
Book or Chapter or Journal Article

Evaluating the ecological benefits of wildfire by integrating fire and ecosystem simulation models
www.nrfirescience.org/resource/19269
Fire managers are now realizing that wildfires can be beneficial because they can reduce hazardous fuels and restore fire-dominated ecosystems. A software tool that assesses potential beneficial and detrimental ecological effects from wildfire would be helpful to fire management. This paper presents a simulation platform called...
Author(s): Robert E. Keane, Eva C. Karau
Year Published: 2010
Type: Document
Book or Chapter or Journal Article
Assessing crown fire potential in coniferous forests of western North America: a critique of current approaches and recent simulation studies

To control and use wildland fires safely and effectively depends on creditable assessments of fire potential, including the propensity for crowning in conifer forests. Simulation studies that use certain fire modelling systems (i.e. NEXUS, FlamMap, FARSITE, FFE-FVS (Fire and Fuels Extension to the Forest Vegetation Simulator), Fuel...)

Author(s): Miguel G. Cruz, Martin E. Alexander
Year Published: 2010
Type: Document
Book or Chapter or Journal Article

Initialization of high resolution surface wind simulations using NWS gridded data

WindNinja is a standalone computer model designed to provide the user with simulations of surface wind flow. It is deterministic and steady state. It is currently being modified to allow the user to initialize the flow calculation using National Digital Forecast Database. It essentially allows the user to downscale the coarse scale...

Author(s): Jason M. Forthofer, Bret W. Butler
Year Published: 2010
Type: Document
Conference Proceedings

The effect of terrain slope on firefighter safety zone effectiveness

The current safety zone guidelines used in the US were developed based on the assumption that the fire and safety zone were located on flat terrain. The minimum safe distance for a firefighter to be from a flame was calculated as that corresponding to a radiant incident energy flux level of 7.0kW-m-2. Current firefighter safety...

Author(s): Bret W. Butler, Jason M. Forthofer, Kyle S. Shannon, Daniel M. Jimenez, David Frankman
Year Published: 2010
Type: Document
Conference Proceedings

Firefighter safety zone: the effect of terrain slope of separation distance

Perhaps one of the most critical decisions made on wildland fires is the identification of suitable safety zones for firefighters during daily fire management operations. To be effective (timely, repeatable, and accurate), these decisions rely on good training and good judgement. The current safety zone guidelines used in the US (...)

Author(s): Bret W. Butler, Jason M. Forthofer
Year Published: 2010
Type: Document
Conference Proceedings

A portable system for characterizing wildland fire behavior

A field deployable system for quantifying energy and mass transport in wildland fires is described. The system consists of two enclosures: The first is a sensor/data logger combination package that allows characterization of convective/radiant energy transport in fires. This package contains batteries, a
A comparison of landscape fuel treatment strategies to mitigate wildland fire risk in the urban interface and preserve old forest structure

We simulated fuel reduction treatments on a 16,000 ha study area in Oregon, US, to examine tradeoffs between placing fuel treatments near residential structures within an urban interface, versus treating stands in the adjacent wildlands to meet forest health and ecological restoration goals. The treatment strategies were evaluated...

Large scale fire whirls: can their formation be predicted?

Large scale fire whirls have not traditionally been recognized as a frequent phenomenon on wildland fires. However, there are anecdotal data suggesting that they can and do occur with some regularity. This paper presents a brief summary of this information and an analysis of the causal factors leading to their formation.

Fine fuel heating by radiant flux

Experiments were conducted wherein wood shavings and Ponderosa pine needles in quiescent air were subjected to a steady radiation heat flux from a planar ceramic burner. The internal temperature of these particles was measured using fine diameter (0.076 mm diameter) type K thermocouples. A narrow angle radiometer was used to...

In-situ characterization of wildland fire behavior

A system consisting of two enclosures has been developed to characterize wildland fire behavior: The first enclosure is a sensor/data logger combination that measures and records convective/radiant energy released by the fire. The second is a digital video camera housed in a fire proof enclosure that records visual images of fire...
Characterization of convective heating in full scale wildland fires

Data collected in the International Crown Fire modeling Experiment during 1999 are evaluated to characterize the magnitude and duration of convective energy heating in full scale crown fires. To accomplish this objective data on total and radiant incident heat flux, air temperature, and horizontal and vertical gas velocities were...

Author(s): Bret W. Butler
Year Published: 2010
Type: Document
Conference Proceedings

Wildfire risk and hazard: procedures for the first approximation

This report was designed to meet three broad goals: (1) evaluate wildfire hazard on Federal lands; (2) develop information useful in prioritizing where fuels treatments and mitigation measures might be proposed to address significant fire hazard and risk; and (3) develop risk-based performance measures to document the effectiveness...

Author(s): David E. Calkin, Alan A. Ager, Julie W. Gilbertson-Day
Year Published: 2010
Type: Document
Technical Report or White Paper

How big was Dodge's escape fire?

Several published accounts exist of how smokejumper foreman Wag Dodge survived the 1949 Mann Gulch Fire in northwestern Montana by setting an 'escape fire' in cured grass fuels, the most notable among them being Norman Maclean's 1992 book Young Men and Fire. Two other smokejumpers survived by reaching a rockslide. Sadly, 12...

Author(s): Martin E. Alexander
Year Published: 2010
Type: Document
Book or Chapter or Journal Article

Rx-CADRE (Prescribed Fire Combustion-Atmospheric Dynamics Research Experiments) collaborative research in the core fire sciences

The Rx-CADRE project was the combination of local and national fire expertise in the field of core fire research. The project brought together approximately 30 fire scientists from six geographic regions and seven different agencies. The project objectives were to demonstrate the capacity for collaborative research by bringing...

Author(s): Daniel M. Jimenez, J. Kevin Hiers, Roger D. Ottmar, Matthew B. Dickinson, Robert L. Kremens, Joseph J. O'Brien, Andrew T. Hudak, C. Clements
Year Published: 2009
Type: Document
Conference Proceedings

Seasonal predictions for wildland fire severity

The National Fire Danger Rating System (NFDRS) indices deduced from the monthly to seasonal
predictions of a meteorological climate model at 50-km grid space from January 1998 through December 2003 were used in conjunction with a probability model to predict the expected number of fire occurrences and large fires over the U.S. West...

Author(s): Shyh-Chin Chen, Haiganoush K. Preisler, Francis M. Fujioka, John W. Benoit, John O. Roads
Year Published: 2009
Type: Document
Conference Proceedings, Technical Report or White Paper

Fuel treatments, fire suppression, and their interaction with wildfire and its impact: the Warm Lake experience during the Cascade Complex of wildfires in central Idaho, 2007

www.nrfirescience.org/resource/17700
Wildfires during the summer of 2007 burned over 500,000 acres within central Idaho. These fires burned around and through over 8,000 acres of fuel treatments designed to offer protection from wildfire to over 70 summer homes and other buildings located near Warm Lake. This area east of Cascade, Idaho, exemplifies the difficulty of...

Author(s): Russell T. Graham, Theresa B. Jain, Mark Loseke
Year Published: 2009
Type: Document
Technical Report or White Paper

Fuel treatment guidebook: illustrating treatment effects on fire hazard

www.nrfirescience.org/resource/8155
The Guide to Fuel Treatments (Johnson and others 2007) analyzes potential fuel treatments and the potential effects of those treatments for dry forest lands in the Western United States. The guide examines low- to mid-elevation dry forest stands with high stem densities and heavy ladder fuels, which are currently common due to fire...

Author(s): Crystal L. Raymond
Year Published: 2009
Type: Document
Book or Chapter or Journal Article

The 1988 fires of Yellowstone and beyond as a wildland fire behavior case study

www.nrfirescience.org/resource/11217
A 'Learning Organization' is an organization that creates, acquires, interprets, transfers, and retains knowledge and purposefully modifies its behavior to reflect new knowledge and insights (Garvin 2000). Dr. Marty Alexander's report The 1988 Fires of Yellowstone and Beyond as a Wildland Fire Behavior Case Study now provides the...

Author(s): Martin E. Alexander
Year Published: 2009
Type: Document
Technical Report or White Paper

Learning the rhythm of the seasons in the face of global change: phenological research in the 21st century

www.nrfirescience.org/resource/15709
Phenology is the study of recurring life-cycle events, classic examples being the flowering of plants and animal migration. Phenological responses are increasingly relevant for addressing applied environmental issues. Yet, challenges remain with respect to spanning scales of observation, integrating observations across taxa, and...

Author(s): Jeffrey T. Morissette, Andrew D. Richardson, Alan K. Knapp, Jeremy I. Fisher, Eric A.
www.nrfirescience.org/resource/13824
In recent years, advances in computational power have led to an increase in attempts to model the behaviour of wildland fires and to simulate their spread across landscape. The present series of articles endeavours to comprehensively survey and précis all types of surface fire spread models developed during the period 1990-2007....
Author(s): Andrew L. Sullivan
Year Published: 2009
Type: Document
Book or Chapter or Journal Article, Synthesis

Influence of the Madden Julian Oscillation on summertime cloud-to-ground lightning activity over the continental US
www.nrfirescience.org/resource/15696
Summertime cloud-to-ground lightning strikes are responsible for the majority of wildfire ignitions across vast sections of the seasonally dry western United States. In this study, a strong connection between active phases of the Madden–Julian oscillation (MJO) and regional summertime lightning activity was found across the...
Author(s): John T. Abatzoglou, Timothy J. Brown
Year Published: 2009
Type: Document
Book or Chapter or Journal Article

Efforts to update firefighter safety zone guidelines
www.nrfirescience.org/resource/16935
One of the most critical decisions made on wildland fires is the identification of suitable safety zones for firefighters during daily fire management operations. To be effective (timely, repeatable, and accurate), these decisions rely on good training and judgment, but also on clear, concise guidelines. This article is a summary of...
Author(s): Bret W. Butler
Year Published: 2009
Type: Document
Book or Chapter or Journal Article

An analysis of Dodge's escape fire on the 1949 Mann Gulch Fire in terms of a survival zone for wildland firefighters
www.nrfirescience.org/resource/11020
The Wildland Fire Operations Research Group of FPInovations-Feric Division in collaboration with the University of Alberta initiated a project in late 2007 at the request of its stakeholders to examine and define the limits of wildland firefighter safety and survival zones. Part of this project involves examining past wildfire...
Author(s): Martin E. Alexander, Mark Y. Ackerman, Gregory J. Baxter
Year Published: 2009
Type: Document
Conference Proceedings
The '88 Fires: Yellowstone and Beyond IAWF Conference Proceedings
www.nrfirescience.org/resource/18464
Description not available
Author(s): Ronald E. Masters, Krista E. M. Galley, Don G. Despain
Year Published: 2009
Type: Document
Conference Proceedings

Wildland surface fire spread modelling, 1990-2007. 3: Simulation and mathematical analogue models
www.nrfirescience.org/resource/13825
In recent years, advances in computational power have led to an increase in attempts to model the behaviour of wildland fires and to simulate their spread across landscape. The present series of articles endeavours to comprehensively survey and précis all types of surface fire spread models developed during the period 1990-2007....
Author(s): Andrew L. Sullivan
Year Published: 2009
Type: Document
Book or Chapter or Journal Article, Synthesis

January 31st 2009 off-season grassland wildfire
www.nrfirescience.org/resource/11145
Wildland fires can be high impact events no matter what the season or fuel type. While the first image that comes to mind of wildland fire suppression is timbered mountainous terrain on a late summer afternoon, this wildland fire occurred in relatively flat grasslands during the overnight and early morning hours, during the...
Author(s): Robert W. Hoenisch
Year Published: 2009
Type: Document
Technical Report or White Paper

How much influence does landscape-scale physiography have on air temperature in a mountain environment?
www.nrfirescience.org/resource/15698
Spatio-temporal patterns of temperature in mountain environments are complex due to both regional synoptic-scale and landscape-scale physiographic controls in these systems. Understanding the nature and magnitude of these physiographic effects has practical and theoretical implications for the development of temperature datasets...
Author(s): Solomon Z. Dobrowski, John T. Abatzoglou, Jonathan A. Greenberg, S.G. Schladow
Year Published: 2009
Type: Document
Book or Chapter or Journal Article

Wildland surface fire spread modelling, 1990-2007. 1: Physical and quasi-physical models
www.nrfirescience.org/resource/13823
In recent years, advances in computational power have led to an increase in attempts to model the behaviour of wildland fires and to simulate their spread across the landscape. The present series of articles endeavours to comprehensively survey and précis all types of surface fire spread models developed during the period 1990-...
Climate drivers of regionally synchronous fires in the inland northwest (1651-1900)
www.nrfirescience.org/resource/16892
We inferred climate drivers of regionally synchronous surface fires from 1651 to 1900 at 15 sites with existing annually accurate fire-scar chronologies from forests dominated by ponderosa pine or Douglas-fir in the inland Northwest (interior Oregon, Washington and southern British Columbia). Years with widespread fires (35 years... 

Temporal and spatial structure in a daily wildfire-start data set from the western United States (1986-96)
www.nrfirescience.org/resource/8201
The temporal and spatial structure of 332 404 daily fire-start records from the western United States for the period 1986 through 1996 is illustrated using several complimentary visualisation techniques. We supplement maps and time series plots with Hovmoller diagrams that reduce the spatial dimensionality of the daily data in order...

An assessment of fuel treatments on three large 2007 Pacific Northwest fires
www.nrfirescience.org/resource/17705
The Monument Fire burned across a landscape with extensive but relatively low intensity fuel treatments that reduced severe fire effects. The area that burned in the Egley Complex included both extensive underburns and intensive, strategically located fuel and other vegetation treatments that improved suppression effectiveness. The...

Fuel consumption and flammability thresholds in shrub-dominated ecosystems - Final Report to the Joint Fire Science Program
www.nrfirescience.org/resource/11164
Research to quantify fuel consumption and flammability in shrub-dominated ecosystems has received little attention despite the widespread occurrence of fire-influenced, shrub-dominated landscapes across the arid lands of the western United States. While some research has addressed issues relating to fire behavior in some shrub-...
Effects of alternative treatments on canopy fuel characteristics in five conifer stands
www.nrfirescience.org/resource/11129
A detailed study of canopy fuel characteristics in five different forest types provided a unique dataset for simulating the effects of various stand manipulation treatments on canopy fuels. Low thinning, low thinning with commercial dbh limit, and crown thinning had similar effects on canopy bulk density (CBD) and canopy fuel load (...)
Author(s): Joe H. Scott, Elizabeth D. Reinhardt
Year Published: 2007
Type: Document
Conference Proceedings, Technical Report or White Paper

Contingent pacific-atlantic ocean influence on multicentury wildfire synchrony over western North America
www.nrfirescience.org/resource/8293
Widespread synchronous wildfires driven by climatic variation, such as those that swept western North America during 1996, 2000, and 2002, can result in major environmental and societal impacts. Understanding relationships between continental-scale patterns of drought and modes of sea surface temperatures (SSTs) such as El Niño-...
Author(s): Thomas Kitzberger, Peter M. Brown, Emily K. Heyerdahl, Thomas W. Swetnam, Thomas T. Veblen
Year Published: 2007
Type: Document
Book or Chapter or Journal Article

Guide to fuel treatments in dry forests of the Western United States: assessing forest structure and fire hazard
www.nrfirescience.org/resource/11166
Guide to Fuel Treatments analyzes a range of fuel treatments for representative dry forest stands in the Western United States with overstories dominated by ponderosa pine (Pinus ponderosa), Douglas-fir (Pseudotsuga menziesii), and pinyon pine (Pinus edulis). Six silvicultural options (no thinning; thinning from below to 50 trees...)
Author(s): Morris C. Johnson, David L. Peterson, Crystal L. Raymond
Year Published: 2007
Type: Document
Technical Report or White Paper

On the use of a firebrand generator to investigate the ignition of structures in wildland-urban interface (WUI) fires
www.nrfirescience.org/resource/12439
An experimental apparatus has been constructed to generate a controlled and repeatable size and mass distribution of glowing firebrands. The present study reports on a series of experiments conducted in order to characterize the performance of this firebrand generator. Firebrand generator characterization and subsequent structural...
Author(s): Anthony Manzello, John R. Shields, Jiann C. Yang, Yoshihiko Hayashi, Daisaku Nii
Year Published: 2007
Type: Document
Conference Proceedings

Testing the modeled effectiveness of an operational fuel reduction treatment in a small western
Montana interface landscape using two spatial scales
www.nrfirescience.org/resource/8410
Much of the coniferous zones in the Western United States where fires were historically frequent have seen large increases in stand densities and associated forest fuels due to 20th century anthropogenic influences. This condition is partially responsible for contemporary large, uncharacteristically severe wildfires. Therefore,...
Author(s): Michael G. Harrington, Erin Noonan-Wright, Mitchell Doherty
Year Published: 2007
Type: Document
Conference Proceedings

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

A fuel treatment reduces fire severity and increases suppression efficiency in a mixed conifer forest
www.nrfirescience.org/resource/17717
Fuel treatments are being implemented on public and private lands across the western United States. Although scientists and managers have an understanding of how fuel treatments can modify potential fire behaviour under modelled conditions, there is limited information on how treatments perform under real wildfire conditions in...
Author(s): Jason J. Moghaddas, Larry Craggs
Year Published: 2007
Type: Document
Book or Chapter or Journal Article

A physics-based approach to modelling grassland fires
www.nrfirescience.org/resource/14842
Physics-based coupled fire-atmosphere models are based on approximations to the governing equations of fluid dynamics, combustion, and the thermal degradation of solid fuel. They require significantly more computational resources than the most commonly used fire spread models, which are semi-empirical or empirical. However, there...
Author(s): William E. Mell, Mary Ann Jenkins, Jim Gould, Phil Cheney
Year Published: 2007
Type: Document
Book or Chapter or Journal Article

Simulation of long-term landscape-level fuel treatment effects on large wildfires
www.nrfirescience.org/resource/8166
A simulation system was developed to explore how fuel treatments placed in topologically random and optimal spatial patterns affect the growth and behaviour of large fires when implemented at different rates over the course of five decades. The system consisted of a forest and fuel dynamics simulation module (Forest Vegetation...
Statistical model for forecasting monthly large wildfire events in the western United States
www.nrfirescience.org/resource/8123
The ability to forecast the number and location of large wildfire events (with specified confidence bounds) is important to fire managers attempting to allocate and distribute suppression efforts during severe fire seasons. This paper describes the development of a statistical model for assessing the forecasting skiffs of fire...
Author(s): Haiganoush K. Preisler, Anthony L. Westerling
Year Published: 2007
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

Wildfires, weather, and productivity
www.nrfirescience.org/resource/11016
The object of this paper is to show the intercorrelations existing between statistics of wildfires (occurrences: N; areas burned: A), climatic parameters (precipitation: P; temperature: T) and net primary productivity: NPP. To this purpose, statistics of wildfires have been studied in several regions of the world, focusing on...
Author(s): Michel L. Bernard, Noureddine Nimour
Year Published: 2007
Type: Document
Conference Proceedings

The asymmetry of trends in spring and autumn temperature and circulation regimes over western North America
www.nrfirescience.org/resource/15710
Observational evidence shows that spring temperatures over western North America have undergone significant warming over the past half century, while autumn temperatures have shown relatively little change. Low-frequency modes of atmospheric variability for spring and autumn are demonstrated to account for a great deal of the...
Author(s): John T. Abatzoglou, Kelly T. Redmond
Year Published: 2007
Type: Document
Book or Chapter or Journal Article

A Computational Method for Optimizing Fuel Treatment Locations
Modelling and experiments have suggested that spatial fuel treatment patterns can influence the movement of large fires. On simple theoretical landscapes consisting of two fuel types (treated and untreated), optimal patterns can be analytically derived that disrupt fire growth efficiently (i.e. with less area treated than random).

Author(s): Mark A. Finney
Year Published: 2007
Type: Document
Book or Chapter or Journal Article

Employing numerical weather models to enhance fire weather and fire behavior predictions

This paper presents an assessment of fire weather and fire behavior predictions produced by a numerical weather prediction model similar to those used by operational weather forecasters when preparing their forecasts. The PSU/NCAR MM5 model is used to simulate the weather conditions associated with three fire episodes in June 2005.

Author(s): Joseph J. Charney, Lesley A. Fusina
Year Published: 2006
Type: Document
Conference Proceedings

An Overview of FlamMap Fire Modeling Capabilities

Computerized and manual systems for modeling wildland fire behavior have long been available (Rothermel 1983, Andrews 1986). These systems focus on one-dimensional behaviors and assume the fire geometry is a spreading line-fire (in contrast with point or area-source fires). Models included in these systems were developed to...

Author(s): Mark A. Finney
Year Published: 2006
Type: Document
Conference Proceedings

Windwizard: a new tool for fire management decision support

A new software tool has been developed to simulate surface wind speed and direction at the 100m to 300 m scale. This tool is useful when trying to estimate fire behavior in mountainous terrain. It is based on widely used computational fluid dynamics technology and has been tested against measured wind flows. In recent years it has...

Author(s): Bret W. Butler, Mark A. Finney, Larry S. Bradshaw, Jason M. Forthofer, Charles W. McHugh, Rick Stratton, Daniel M. Jimenez
Year Published: 2006
Type: Document
Conference Proceedings

Planetary wave breaking and nonlinear reflection: seasonal cycle and interannual variability

Forty-six years of daily averaged NCEP–NCAR reanalysis data are used to identify the occurrence of planetary wave breaking (PWB) in the subtropical upper troposphere. As large-amplitude waves propagate into the subtropics where the zonal flow is weak, they may break. PWB is diagnosed by observing the large-scale meridional...

Author(s): John T. Abatzoglou, Gudrun Magnusdottir
**Fuels Management - How to Measure Success: Conference Proceedings**

www.nrfirescience.org/resource/18399

Fuels management programs are designed to reduce risks to communities and to improve and maintain ecosystem health. The International Association of Wildland Fire initiated the 1st Fire Behavior and Fuels Conference to address development, implementation, and evaluation of these programs. The focus was on how to measure success....

Author(s): Patricia L. Andrews, Bret W. Butler
Year Published: 2006
Type: Document
Conference Proceedings

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**Fuel Treatment Evaluator 3.0**

www.nrfirescience.org/resource/11078

The Fuel Treatment Evaluator (FTE) 3.0 is a web-based tool that simulates uneven-aged and even-aged silvicultural treatments on timberland in 12 western states. This tool simulates treatments to reduce forest fire hazard to specific target levels and identifies the volume of biomass removed, harvesting costs, and estimated biomass...

Author(s): U.S. Department of Agriculture, Forest Service
Year Published: 2006
Type: Document
Research Brief or Fact Sheet

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**Biomass consumption during prescribed fires in big sagebrush ecosystems**

www.nrfirescience.org/resource/11419

Big sagebrush (Artemisia tridentata) ecosystems typically experience stand replacing fires during which some or all of the ignited biomass is consumed. Biomass consumption is directly related to the energy released during a fire, and is an important factor that determines smoke production and the effects of fire on other resources....

Author(s): Clinton S. Wright, Susan J. Prichard
Year Published: 2006
Type: Document
Conference Proceedings

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**Warming and earlier spring increase western U.S. forest wildfire activity**

www.nrfirescience.org/resource/8397

Western United States forest wildfire activity is widely thought to have increased in recent decades, but surprisingly, the extent of recent changes has never been systematically documented. Nor has it been established to what degree climate may be driving regional changes in wildfire. Much of the public and scientific discussion of...

Author(s): Anthony L. Westerling, Hugo G. Hidalgo, Daniel R. Cayan, Thomas W. Swetnam
Year Published: 2006
Type: Document
Book or Chapter or Journal Article

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**Comparison of crown fire modeling systems used in three fire management applications**

www.nrfirescience.org/resource/11200
The relative behavior of surface-crown fire spread rate modeling systems used in three fire management applications—CFIS (Crown Fire Initiation and Spread), FlamMap and NEXUS—is compared using fire environment characteristics derived from a dataset of destructively measured canopy fuel and associated stand characteristics. Although...

Author(s): Joe H. Scott
Year Published: 2006
Type: Document
Technical Report or White Paper

Organizational characteristics that contribute to success in engaging the public to accomplish fuels management at the wilderness/non-wilderness interface

In the fall of 2003, the Rocky Mountain Ranger District of the Lewis and Clark National Forest initiated a multi-year, large-scale prescribed burn in the Scapegoat Wilderness. The objectives of this burn were to make the non-wilderness side of the wilderness boundary more defensible from wildfire and to establish conditions that...

Author(s): Katie Knotek, Alan E. Watson
Year Published: 2006
Type: Document
Conference Proceedings

Is global warming causing more, larger wildfires?

On 3 April 2006, the U.S. weekly news magazine Time ran a report on global warming with the cover title “Be worried, be very worried.” Similar coverage of global warming has emerged in other general-interest magazines in recent months, triggered by scientific studies that are finding evidence for adverse impacts of global...

Author(s): Steven W. Running
Year Published: 2006
Type: Document
Book or Chapter or Journal Article

Regional relationships between climate and wildfire-burned area in the Interior West, USA

Recent studies have linked the Atlantic Multidecadal Oscillation (AMO) and the Pacific Decadal Oscillation (PDO) with drought occurrence in the interior United States. This study evaluates the influence of AMO and PDO phases on interannual relationships between climate and wildfire-burned area during the 20th century. Palmer's...

Author(s): Brandon M. Collins, Philip N. Omi, Phillip L. Chapman
Year Published: 2006
Type: Document
Book or Chapter or Journal Article

Evaluation of MM5 model resolution when applied to prediction of National Fire Danger Rating indexes

Weather predictions from the MM5 mesoscale model were used to compute gridded predictions of National Fire Danger Rating System (NFDRS) indexes. The model output was applied to a case study of the 2000 fire season in Northern Idaho and Western Montana to simulate an extreme event. To determine the preferred resolution for automating...

Author(s): Jeanne L. Hoadley, Miriam L. Rorig, Larry S. Bradshaw, Sue A. Ferguson, Kenneth Westrick,
Cumulative effects of fuel management on landscape-scale fire behavior and effects - Final Report to the Joint Fire Science Program
www.nrfirescience.org/resource/11157
The project is concerned with modeling the long-term effects of landscape fuel treatment patterns on wildfire sizes and severity. The work was initiated based on theoretical fuel treatment patterns that appeared effective at changing fire growth across large landscapes, thus reducing the acreage burned and the chances that large...
Author(s): Mark A. Finney
Year Published: 2005
Type: Document
Technical Report or White Paper

Predicting cumulative watershed effects of fuel management with improved WEPP technology
www.nrfirescience.org/resource/8436
The increase in severe wildfires in recent years is due in part to an abundance of fuels in forests. In an effort to protect values at risk, and decrease the severity of wildfires, forest managers have embarked on a major program of fuel reduction. Past research has shown that such fuel reduction may have minimal impact at a...
Author(s): William J. Elliot, Joan Q. Wu
Year Published: 2005
Type: Document
Conference Proceedings

Demonstration and integration of systems for fire remote sensing, ground-based fire measurement, and fire modeling - Final Report to the Joint Fire Science Program
www.nrfirescience.org/resource/11158
Proof-of-concept research is being conducted to: compare airborne and in situ, ground-based fire measurement systems; begin evaluation of two fire-behavior simulation models with these data; test approaches to incorporating improved wind-field and weather data in these models; test the utility of the airborne remote sensing for...
Author(s): Colin C. Hardy, Philip J. Riggan
Year Published: 2005
Type: Document
Technical Report or White Paper

Evaluation of the Experimental Climate Prediction Center's fire danger forecasts with remote automated weather station observations
www.nrfirescience.org/resource/8127
The Scripps Experimental Climate Prediction Center has been routinely making regional forecasts of atmospheric elements and fire danger indices since 27 September 1997. This study evaluates these forecasts using selected remote automated weather station observations over the western USA. Bias and anomaly correlations are computed...
Author(s): Hauss J. Reinbold, John O. Roads, Timothy J. Brown
Year Published: 2005
Type: Document
Book or Chapter or Journal Article
Characterization of firefighter safety zone effectiveness - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/11153
Firefighters are required to play close attention to fire behavior and have safety zones readily available in case of unexpected fire behavior. However, safety zone location and size are often a matter of anecdotal evidence, personal experience, and untested models. This is particularly troublesome for younger firefighters that...
Author(s): Bret W. Butler
Year Published: 2005
Type: Document
Technical Report or White Paper

Climatic controls of fire in the western United States: from the atmosphere to ecosystems - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/11155
The objective of this project is to conduct a diagnostic analysis of the variations in climate that govern the characteristics of the fire season in the western United States on intra-annual through decadal and longer time scales. We propose a retrospective, model-based analysis to understand better the role of climate as a control...
Author(s): Steven W. Hostetler, Patrick J. Bartlein, Allen M. Solomon, J. O. Holman, Richard T. Busing, Sarah L. Shafer
Year Published: 2005
Type: Document
Technical Report or White Paper

Optimizing landscape treatments for reducing wildfire risk and improving ecological sustainability of ponderosa pine forests with mixed severity fire regimes - Part 2 - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/11169
A mixed severity fire regime historically created complex landscape structures in ponderosa pine forests of the Colorado Front Range. Mitigating present wildfire risks and restoring these forests to ecologically sustainable conditions requires new guidelines for landscape treatment. However, vast acreages need treatment while only...
Author(s): Merrill R. Kaufmann, Jimmie D. Chew, J. Greg Jones
Year Published: 2005
Type: Document
Technical Report or White Paper

Modeling surface winds in complex terrain for wildland fire incident support - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/11167
One major source of uncertainty in fire behavior and fire behavior modeling is the spatial variation in wind fields. Mountainsides, valleys, ridges, and the fire itself, influence both the speed and direction of wind flows. Small scale surface wind variations cannot be predicted by synoptic forecasting methods or on-site...
Author(s): Mark A. Finney, Larry S. Bradshaw, Bret W. Butler
Year Published: 2005
Type: Document
Technical Report or White Paper
Evaluation of the Experimental Climate Prediction Center's fire danger forecasts with remote automated weather station observations

The Scripps Experimental Climate Prediction Center has been routinely making regional forecasts of atmospheric elements and fire danger indices since 27 September 1997. This study evaluates these forecasts using selected remote automated weather station observations over the western USA. Bias and anomaly correlations are computed...

Author(s): Hauss J. Reinbold, John O. Roads, Timothy J. Brown
Year Published: 2005
Type: Document
Book or Chapter or Journal Article

FuelCalc: A tool for calculating wildland fuel quantities and qualities and supporting fuel management decision - Final Report to the Joint Fire Science Program

A need exists for a simple computer program to determine surface and canopy fuel quantities (load, bulk density, depth) and qualities (fire behavior fuel model, fire-carrying fuel type) from a variety of fuel inventory data sources. In addition, fuel managers need help analyzing the potential effects of silvicultural treatments on...

Author(s): Elizabeth D. Reinhardt, Joe H. Scott, Duncan C. Lutes
Year Published: 2005
Type: Document
Technical Report or White Paper

Forest fuel treatments in western North America: merging silviculture and fire management

In order to accomplish complex and multiple management objectives related to forest structure, fuels, and fire disturbance, these two disciplines must be effectively integrated in science and practice. The authors have linked scientific and management tools to develop an analytical approach that allows resource managers to quantify...

Author(s): Morris C. Johnson, David L. Peterson
Year Published: 2005
Type: Document
Book or Chapter or Journal Article

Science basis for changing forest structure to modify wildfire behavior and severity

Fire, other disturbances, physical setting, weather, and climate shape the structure and function of forests throughout the Western United States. More than 80 years of fire research have shown that physical setting, fuels, and weather combine to determine wildfire intensity (the rate at which it consumes fuel) and severity (the...  

Author(s): Russell T. Graham, Sarah M. McCaffrey, Theresa B. Jain
Year Published: 2004
Type: Document
Synthesis, Technical Report or White Paper

Landscape fire simulation and fuel treatment optimization

Fuel treatment effects on the growth and behavior of large wildland fires depend on the spatial arrangements of individual treatment units. Evidence of this is found in burn patterns of wildland fires.
During planning stages, fire simulation is most often used to anticipate effects of fuel treatment units. Theoretical modeling shows...

Author(s): Mark A. Finney
Year Published: 2004
Type: Document
Technical Report or White Paper

Evaluating ASTER imagery and gradient modeling for mapping wildland fire fuels
www.nrfirescience.org/resource/11280
Land managers need cost-effective methods for mapping and characterizing fire fuels quickly and accurately. The advent of sensors with increased spatial resolution may improve the accuracy and reduce the cost of fuels mapping. The objective of this research is to evaluate the accuracy and utility of imagery from the Advanced...
Author(s): Michael J. Falkowski
Year Published: 2004
Type: Document
Research Brief or Fact Sheet

The impact of twenty-first century climate change on wildland fire danger in the western United States: an applications perspective
www.nrfirescience.org/resource/8343
High-temporal resolution meteorological output from the Parallel Climate Model (PCM) is used to assess changes in wildland fire danger across the western United States due to climatic changes projected in the 21st century. A business-as-usual scenario incorporating changing greenhouse gas and aerosol concentrations until the year...
Author(s): Timothy J. Brown, Beth L. Hall, Anthony L. Westerling
Year Published: 2004
Type: Document
Book or Chapter or Journal Article

'Brewer fire mystery' discussion
www.nrfirescience.org/resource/8288
Occasionally, Fire Management Today publishes comments from readers on topics of concern, offering authors a chance to respond. Stephen A. Eckert contends that the 'Brewer fire mystery' is not so mysterious. He says that the conditions were ripe for extreme fire behavior, and that under those conditions, the fire quickly went from a...
Author(s): Stephen A. Eckert, Martin E. Alexander
Year Published: 2004
Type: Document
Book or Chapter or Journal Article

MODIS Applications in 2003 Fire Management - Slide presentation
www.nrfirescience.org/resource/11516
Powerpoint presentation MODIS Applications in 2003 Fire Management
Author(s): C. A. Ryan, Bryce L. Nordgren, James P. Menakis, Mark A. Finney, Wei Min Hao
Year Published: 2004
Type: Document
Conference Proceedings

A comment on models and modelling in fire/fuel management
'Modeling is fine as long as you know what you are doing.' General remark made to the author by a retired University of Alberta forestry professor a few years ago. The April 1988 issue of the Journal of Forestry published an article by John J. Garland that I have often handed out at various training courses and workshops to impress...

Author(s): Martin E. Alexander
Year Published: 2004
Type: Document
Technical Report or White Paper

**Probability based models for estimation of wildfire risk**

We present a probability-based model for estimating fire risk. Risk is defined using three probabilities: the probability of fire occurrence; the conditional probability of a large fire given ignition; and the unconditional probability of a large fire. The model is based on grouped data at the 1 km2-day cell level. We fit a...

Author(s): Haiganoush K. Preisler, David R. Brillinger, Robert E. Burgan, John W. Benoît
Year Published: 2004
Type: Document
Book or Chapter or Journal Article

**Statistical forecasts of the 2003 western wildfire season using canonical correlation analysis**

Experimental forecasts for the 2003 fire season indicate low area burned in most western deserts and basins, high area burned in the southern Rocky Mountains and at higher elevations in Arizona and New Mexico, and mid to high area burned in the Sierra Nevada. This pattern - largely a continuation of that seen in 2002 - is the result...

Author(s): Anthony L. Westerling, Alexander Gershunov, Daniel R. Cayan
Year Published: 2003
Type: Document
Book or Chapter or Journal Article

**Fire whirls, fire tornados, and fire storms: physical and numerical modeling**

Fire whirls are a typically rare but potentially catastrophic form of fire. They are observed during urban and forest fires, where fire "tornadoes" are characterized by large-scale whirling flames which rise in 2 to 360 m diameter vortices from 10 to 1200 m high. These fire whirls accelerate combustion, produce significant suction...

Author(s): Robert N. Meroney
Year Published: 2003
Type: Document
Conference Proceedings

**Climate and wildfire in the western United States**

A 21-yr gridded monthly fire-starts and acres-burned dataset from U.S. Forest Service, Bureau of Land Management, National Park Service, and Bureau of Indian Affairs fire reports recreates the seasonality and interannual variability of wildfire in the western United States. Despite pervasive human influence in western fire regimes,....

Author(s): Anthony L. Westerling, Timothy J. Brown, Alexander Gershunov, Daniel R. Cayan, M. D. Dettinger
An initial analysis of relationships between 2- and 10-minute averaged winds at 10, 6, and 1.8 meters: implications for fire behavior and danger applications

www.nrfirescience.org/resource/8424

Recently there has been discussion in the National Wildland Fire Coordination Group (NWCG) fire danger and fire weather working teams about the impact of observations from different anemometer heights and more importantly, averaging times, on inputs to fire management systems such as National Fire Danger Rating System (Deeming and...)

Author(s): Larry S. Bradshaw, Eugene Petrescu, Isaac C. Grenfell
Year Published: 2003
Type: Document
Conference Proceedings

Comparison of 2-D wind fields and simulated wildland fire growth

www.nrfirescience.org/resource/11019

The paper discusses wildfire growth simulated by the FARSITE model using high-resolution wind fields over complex terrain extracted from operational runs of the MM5 weather forecast model supported by the USDA FS Rocky Mountain Center (RMC: http://www.fs.fed.us/rmc/). The original 12-km resolution wind field (simulated by MM5) has...

Author(s): Karl F. Zeller, Ned Nikolov, John S. Snook, Mark A. Finney, Jason M. Forthofer
Year Published: 2003
Type: Document
Conference Proceedings

The spatial context of fire: a new approach for predicting fire occurrence

www.nrfirescience.org/resource/10993

Across North America, decades of fire suppression and recent patterns of human settlement have combined to increase the risks that wildland fires pose to human life, property, and natural resource values. Various methods can be used to reduce fuel hazards and mitigate these risks, but funding and other constraints require that these...

Author(s): Carol Miller
Year Published: 2003
Type: Document
Conference Proceedings, Technical Report or White Paper

Assessing the value of increased model resolution in forecasting fire danger

www.nrfirescience.org/resource/10969

The fire season of 2000 was used as a case study to assess the value of increasing mesoscale model resolution for fire weather and fire danger forecasting. With a domain centered on Western Montana and Northern Idaho, MM5 simulations were run at 36, 12, and 4-km resolutions for a 30 day period at the height of the fire season....

Author(s): Jeanne L. Hoadley, Miriam L. Rorig, Kenneth Westrick, Larry S. Bradshaw, Sue A. Ferguson, Scott L. Goodrick, Paul A. Werth
Year Published: 2003
Type: Document
Conference Proceedings
Assessing canopy fuel stratum characteristics in crown fire prone fuel types of western North America
www.nrfirescience.org/resource/7917
Application of crown fire behavior models in fire management decision-making have been limited by the difficulty of quantitatively describing fuel complexes, specifically characteristics of the canopy fuel stratum. To estimate canopy fuel stratum characteristics of four broad fuel types found in the western United States and...
Author(s): Martin E. Alexander, Ronald H. Wakimoto
Year Published: 2003
Type: Document
Book or Chapter or Journal Article

Performance of the Haines Index during August 2000 for Montana
www.nrfirescience.org/resource/10997
The Haines Index, introduced by Haines (1988) as the Lower Atmosphere Severity Index, is designed to gauge how readily the lower mid-troposphere (500 to 4500 m AGL) will spur an otherwise fairly predictable fire to become erratic and unmanageable. Based on stability and moisture, the Haines Index (hereafter, HI) takes on integer...
Author(s): Brian E. Potter, Scott L. Goodrick
Year Published: 2003
Type: Document
Conference Proceedings

Reaction times and burning rates for wind tunnel headfires
www.nrfirescience.org/resource/8211
Catchpole et al. (1998) reported rates of spread for 357 heading and no-wind fires burned in the wind tunnel facility of the USDA Forest Service's Fire Sciences Laboratory in Missoula, Montana for the purpose of developing models of wildland fire behavior. The fires were burned in horizontal fuel beds with differing characteristics...
Author(s): Ralph M. Nelson
Year Published: 2003
Type: Document
Book or Chapter or Journal Article

Predicting surface winds in complex terrain for use in fire spread models
www.nrfirescience.org/resource/8438
Fire behavior predictions and forecasts are vital to tactical planning on wildland firefighting incidents. One major source of uncertainty in fire behavior predictions is spatial variation in the wind fields used in the fire models. In most cases wind data are limited to only a few specific locations, none of which may be actually...
Author(s): Jason M. Forthofer, Bret W. Butler, Kyle S. Shannon, Mark A. Finney, Larry S. Bradshaw, Richard D. Stratton
Year Published: 2003
Type: Document
Conference Proceedings

Wildland fire behavior case studies and analysis: part 2
www.nrfirescience.org/resource/15996
This resource is a special issue of Fire Management Today that includes articles on fire behavior and descriptions of specific large fires that have important lessons in fire fighter safety.
Year Published: 2003
Long lead statistical forecasts of area burned in western U.S. wildfires by ecosystem province
www.nrfirescience.org/resource/8377
A statistical forecast methodology exploits large-scale patterns in monthly U.S. Climatological Division Palmer Drought Severity Index (PDSI) values over a wide region and several seasons to predict area burned in western U.S. wildfires by ecosystem province a season in advance. The forecast model, which is based on canonical...
Author(s): Anthony L. Westerling, Alexander Gershunov, Daniel R. Cayan, Tim P. Barnett
Year Published: 2002
Type: Document
Book or Chapter or Journal Article

The 2000 fire season: lightning-caused fires
www.nrfirescience.org/resource/8141
A large number of lightning-caused fires burned across the western United States during the summer of 2000. In a previous study, the authors determined that a simple index of low-level moisture (85-kPa dewpoint depression) and instability (85-50-kPa temperature difference) from the Spokane, Washington, upper-air soundings was very...
Author(s): Miriam L. Rorig, Sue A. Ferguson
Year Published: 2002
Type: Document
Book or Chapter or Journal Article

Using FVS and its fire and fuels extension in the context of uncertain climate
www.nrfirescience.org/resource/11011
While the prospect of a static climate is no longer tenable, the direction of change for particular localities is not yet clear. Modelling vulnerability of silvicultural options to various scenarios of climate change requires a modelling system that can represent major processes affected by climatic variability. The Forest...
Author(s): Albert R. Stage
Year Published: 2002
Type: Document
Conference Proceedings

Statistical forecast of the 2001 western wildfire season using principal components regression
www.nrfirescience.org/resource/8396
Description not entered
Author(s): Anthony L. Westerling, Daniel R. Cayan, Alexander Gershunov, M. D. Dettinger, Timothy J. Brown
Year Published: 2001
Type: Document
Book or Chapter or Journal Article

Stevensville West Central Study
www.nrfirescience.org/resource/10981
This paper reports on an application of two modeling systems in the assessment and planning effort for a 58,038-acre area on the Bitterroot National Forest: SiMulating Vegetative Patterns and Processes at Landscape ScaLEs (SIMPPLLE), and Multi-resource Analysis and Geographic Information System
Sequential use of simulation and optimization in analysis and planning
www.nrfirescience.org/resource/11045
Management activities are analyzed at landscape scales employing both simulation and optimization. SIMPPLLLE, a stochastic simulation modeling system, is initially applied to assess the risks associated with a specific natural process occurring on the current landscape without management treatments, but with fire suppression. These...
Author(s): Hans R. Zuuring, Jimmie D. Chew, J. Greg Jones
Year Published: 2000
Type: Document
Conference Proceedings

Simulating fire patterns in heterogeneous landscapes
www.nrfirescience.org/resource/18408
A broad-scale probabilistic model of forest fires, EMBYR, has been developed to simulate the effects of large fires burning through heterogeneous landscapes. Fire ignition and spread are simulated on a gridded landscape by (1) examining each burning site at each time step, (2) independently evaluating the probability of spread to...
Author(s): William W. Hargrove, Robert H. Gardner, Monica G. Turner, William H. Romme, Don G. Despain
Year Published: 2000
Type: Document
Book or Chapter or Journal Article

An overview of the fire and fuels extension to the forest vegetation simulator
www.nrfirescience.org/resource/11037
The Fire and Fuels Extension (FFE) to the Forest Vegetation Simulator (FVS) has been developed to assess the risk, behavior, and impact of fire in forest ecosystems. This extension to the widely-used stand-dynamics model FVS simulates the dynamics of snags and surface fuels as they are affected by stand management (of trees or fuels...)
Author(s): Sarah J. Beukema, Elizabeth D. Reinhardt, Werner A. Kurz, Nicholas L. Crookston
Year Published: 2000
Type: Document
Conference Proceedings

The Mann Gulch Fire and the Canadian Forest Fire Danger Rating System
www.nrfirescience.org/resource/8408
The year 1999 marks the 50th anniversary of the Mann Gulch Fire that occurred in western Montana on August 5, 1949 (Matthews 1999). There has been considerable interest amongst the Canadian wildland fire community in the 1949 Mann Gulch Fire ever since the publishing of MacLean's (1992) book ‘Young Men and Fire’ and Rothermel's (...)
Author(s): Martin E. Alexander
Year Published: 2000
Type: Document
Conference Proceedings
Critical fire weather patterns of the United States
www.nrfirescience.org/resource/12780
Descriptions of critical fire weather patterns from across the United States. Watch out conditions discussed.
Year Published: 1999
Type: Document
Research Brief or Fact Sheet

Applying simulation and optimization to plan fuel treatments at landscape scales
www.nrfirescience.org/resource/11067
Fuel treatment activities are analyzed at the landscape scale by using both simulation and optimization. Simulating vegetative patterns and processes at landscape scales (SIMPPLLE), a stochastic simulation modeling system, is initially applied to assess wildfire risks on the current landscape without management treatments but with...
Author(s): J. Greg Jones, Jimmie D. Chew, Hans R. Zuuring
Year Published: 1999
Type: Document
Conference Proceedings, Technical Report or White Paper

Development of input data layers for the FARSITE fire growth model for the Selway-Bitterroot Wilderness Complex, USA
www.nrfirescience.org/resource/11240
Fuel and vegetation spatial data layers required by the spatially explicit fire growth model FARSITE were developed for all lands in and around the Selway-Bitterroot Wilderness Area in Idaho and Montana. Satellite imagery and terrain modeling were used to create the three base vegetation spatial data layers of potential vegetation,...
Author(s): Robert E. Keane, Janice L. Garner, Kirsten M. Schmidt, Donald G. Long, James P. Menakis, Mark A. Finney
Year Published: 1998
Type: Document
Technical Report or White Paper

Wildfire case study: Butte City Fire, southeastern Idaho, July 1, 1994
www.nrfirescience.org/resource/11146
The Butte City Fire occurred on July 1, 1994, west of Idaho Falls, ID. Ignited from a burning flat tire, the blaze was driven by high winds that caused it to cover over 20,500 acres in just over 6.5 hours. Sagebrush (Artemisia tridentata ssp. wyomingensis) is the principal shrub species of this high desert rangeland. With the...
Author(s): Bret W. Butler, Timothy D. Reynolds
Year Published: 1997
Type: Document
Technical Report or White Paper

Making sense of fire weather
www.nrfirescience.org/resource/8122
This paper analyzes data from 339 large wildland fires that occurred in the Continental United States from 1971 through 1984. Each fire burned 1,000 acres (400 ha) or more. Each fire was associated with the nearest upper-air weather station and classified according to its season (spring, summer, autumn, or winter). Results of this...
Author(s): Brian E. Potter
The ecological implications of fire in Greater Yellowstone, proceedings of the second biennial conference on the Greater Yellowstone Ecosystem

Proceedings of the second biennial conference on the Greater Yellowstone Ecosystem.
Author(s): Jason Greenlee
Year Published: 1996
Type: Document
Conference Proceedings

Intermountain West lightning-caused fires: climatic predictors of area burned

An increase in continuous fine fuels promoted by the expansion of aggressive annual exotic grasses in the Intermountain West has altered the region's fire regimes, with both ecologic and economic ramifications. I examine the predictive nature of seasonal climatic variables, seasonal precipitation and temperature data up to 2 years...
Author(s): Paul A. Knapp
Year Published: 1995
Type: Document
Book or Chapter or Journal Article

A statistical-topographic model for mapping climatological precipitation over mountainous terrain

The demand for climatological precipitation fields on a regular grid is growing dramatically as ecological and hydrological models become increasingly linked to geographic information systems that spatially represent and manipulate model output. This paper presents an analytical model that distributes point measurements of monthly...
Author(s): Christopher Daly, Ronald P. Neilson, Donald L. Phillips
Year Published: 1994
Type: Document
Book or Chapter or Journal Article

Fire growth maps for the 1988 Greater Yellowstone Area fires

Daily fire growth maps display the growth of the 1988 fires in the Greater Yellowstone Area. Information and data sources included daily infrared photography flights, satellite imagery, ground and aerial reconnaissance, command center intelligence, and the personal recollections of fire behavior observers. Fire position was...
Author(s): Richard C. Rothermel, Roberta A. Hartford, Carolyn H. Chase
Year Published: 1994
Type: Document
Technical Report or White Paper

The evaluation of Idaho wildfire growth using the Haines Index

An atmospheric index specifically designed to be related to the growth of wildland fires is evaluated for
two recent Idaho fires. The index includes terms related to high midlevel lapse rates and low-level dry air. In the cases examined, the index performs well at pinpointing the time of the most explosive fire growth. Long-term...

Author(s): Paul A. Werth, Richard Ochoa
Year Published: 1993
Type: Document
Book or Chapter or Journal Article

Probability of fire-stopping precipitation events
www.nrfirescience.org/resource/11933
Fire managers in the Northwestern United States are often confronted by the problem of determining when precipitation might stop an ongoing fire. The possibility that a useful probability for fire-stopping precipitation could be developed from historical weather records was investigated. Persons familiar with weather and fire...

Author(s): Donald J. Latham, Richard C. Rothermel
Year Published: 1993
Type: Document
Research Brief or Fact Sheet

Fuel moisture, forest type, and lightning-caused fire in Yellowstone National Park
www.nrfirescience.org/resource/13568
The occurrence and behavior of lightning-caused fires in Yellowstone National Park were summarized for 17 years (1972-1988) during a prescribed natural fire program. Both ignition (occurrence) and spread (Stand replacing fire activity) of fires were strongly influenced by fuel moisture and forest coverage type. Fuel moisture estimates...

Author(s): Roy A. Renkin, Don G. Despain
Year Published: 1992
Type: Document
Book or Chapter or Journal Article

Lookouts, communication, escape routes, safety zones
www.nrfirescience.org/resource/15460
In a presentation to the USDA Forest Service's national Fire and Aviation Staff, Gleason provides a clear overview of his proposed Lookouts, Communication, Escape Routes, Safety Zones (LCES) method of training firefighters for greater safety. After defining LCES, he discusses how it should be implemented on the ground. He emphasizes...

Author(s): Paul Gleason
Year Published: 1991
Type: Document
Management or Planning Document

Fuel moisture as measured and predicted during the 1988 fires in Yellowstone National Park
www.nrfirescience.org/resource/11109
Fine fuel moisture content, relative humidity, air temperature, and fire behavior were observed hourly for 48 hours on the North Fork Fire in Yellowstone National Park from August 25 to August 27, 1988. Fine fuel reached minimum moisture content of 3 to 5 percent late in the afternoon, remained below 8 percent until after midnight....

Author(s): Roberta A. Hartford, Richard C. Rothermel
Year Published: 1991
Type: Document
Research Brief or Fact Sheet
The 1985 Butte fire in central Idaho: a Canadian perspective on the associated burning conditions

www.nrfirescience.org/resource/11055

During the afternoon of August 29, 1985, the Butte Fire made a high-intensity crown fire run, covering a distance of 2.22 km in one hour and 40 minutes, and forcing 73 fire fighters to deploy their protective fire shelters. This paper presents a retrospective analysis of the fire behavior in terms of the two major subsystems of the...

Author(s): Martin E. Alexander
Year Published: 1991
Type: Document
Conference Proceedings, Technical Report or White Paper

Predicting behavior and size of crown fires in the northern Rocky Mountains

www.nrfirescience.org/resource/11195

Assessment of crown fire conditions calls for two important judgments: (1) identifying conditions for the onset of severe fires, and (2) predicting the spread rate, intensity, and size of expected crown fires. This paper addresses the second problem and provides methods for making a first approximation of the behavior of a running...

Author(s): Richard C. Rothermel
Year Published: 1991
Type: Document
Technical Report or White Paper

Predicting behavior of the 1988 Yellowstone fires: projections versus reality

www.nrfirescience.org/resource/8252

An account is presented of the initial long range, 30-day, projections of fire growth of the wildfires in the Greater Yellowstone Area in 1988. The request for information, the method of prediction, and the actual fire growth are discussed and documented with maps. The difficulties and uncertainties of long-range fire prediction...

Author(s): Richard C. Rothermel
Year Published: 1991
Type: Document
Book or Chapter or Journal Article

The Haines Index and Idaho fire growth

www.nrfirescience.org/resource/8306

[Excerpted from text] The growth of wildfires is related to three broad factors: fuel type, topography and weather. The National Fire Danger Rating System and the Fire Behavior Prediction System combine these factors to predict the probability and severity of wildland fires. However, these systems have mixed results in predicting...

Author(s): Paul A. Werth, Richard Ochoa
Year Published: 1990
Type: Document
Book or Chapter or Journal Article

Stream shading, summer streamflow and maximum water temperature following intense wildfire in headwater streams

www.nrfirescience.org/resource/18470

Adjacent headwater streams were monitored for postfire shade, summer streamflow and maximum
water temperature following the 40,000 ha Silver Complex fire in southern Oregon. Average postfire shade (30 percent) for the three streams was considerably less than prefire shade (est.>90 percent). Dramatic increases in direct solar...

**Author(s):** Michael Amaranthus, Howard Jubas, David Arthur
**Year Published:** 1989
**Type:** Document
**Conference Proceedings**

The relationship between mean monthly fire potential indices and monthly fire severity

www.nrfirescience.org/resource/10970

Thirty-day forecasts of fire potential are needed, and can be computed using a variety of monthly fire weather indices. But which indices are most related to monthly fire severity? Correlation analysis was used to determine the relationships between mean monthly fire potential indices and monthly measures of fire severity at 16...

**Author(s):** M. H. McCutchan, William A. Main
**Year Published:** 1989
**Type:** Document
**Conference Proceedings**

Help with making crown fire hazard assessments

www.nrfirescience.org/resource/11046

This paper offers some suggestions and field guides with respect to the operational application of C.E. Van Wagner's (1997, Can. J. For. Res. 7:23-34) theory to calculate the threshold conditions for the start and spread of crown fires in conifer forests. Three categories of crowning are recognized (passive, active, and independent...)

**Author(s):** Martin E. Alexander
**Year Published:** 1988
**Type:** Document
**Conference Proceedings, Technical Report or White Paper**

Appraising fuels and flammability in western aspen: a prescribed fire guide

www.nrfirescience.org/resource/11132

Describes a method for appraising fuels and fire behavior potential in aspen forests to guide the use of prescribed fire and the preparation of fire prescriptions. Includes an illustrated classification of aspen fuels; appraisals of fireline intensity, rate of spread, adjective ratings for fire behavior and probability of burn...

**Author(s):** James K. Brown, Dennis Simmerman
**Year Published:** 1986
**Type:** Document
**Technical Report or White Paper**

Surface fuel loadings and predicted fire behavior for vegetation types in the northern Rocky Mountains

www.nrfirescience.org/resource/11930

Means, standard deviations, and quartiles of fuel loadings were determined for litter, for downed woody material of 0 to one-fourth inch, one-fourth to 1 inch, 0 to 1 inch, and 1 to 3 inches, for herbaceous vegetation, and for shrubs by cover types and fire groups. The studies were conducted at four locations in northwestern Wyoming...

**Author(s):** James K. Brown, Collin D. Bevins
**Year Published:** 1986
**Type:** Document
Fire Review of the 1985 Log Tom Fire Complex (Butte Fire)
www.nrfirescience.org/resource/15987
This report reviews the Long Tom Fire Complex. The review team identified 11 issues and provided alternatives for them to reduce suppression costs, improve suppression efficiency, and minimize resource impacts on future large fires in the Salmon River area.
Author(s): Jerry Monesmith, Dick Flannelly, Bert Strom, Jim Lawrence
Year Published: 1985
Type: Document
Management or Planning Document

Predicting duff and woody fuel consumed by prescribed fire in the Northern Rocky Mountains
www.nrfirescience.org/resource/11265
Relationships for predicting duff reduction, mineral soil exposure, and consumption of downed woody fuel were determined to assist in planning prescribed fires. Independent variables included lower and entire duff moisture contents, loadings of downed woody fuels, duff depth, National Fire-Danger Rating System 1,000-hour moisture...
Author(s): James K. Brown, Michael A. Marsden, Kevin C. Ryan, Elizabeth D. Reinhardt
Year Published: 1985
Type: Document
Technical Report or White Paper

Behavior of the life-threatening Butte Fire: August 27-29, 1985
www.nrfirescience.org/resource/8314
On August 29, 1985, 73 firefighters were forced into safety zones, where they took refuge in their fire shelters for 1 to 2 hours while a very severe crown fire burned over them. The incident took place on the Butte Fire on the Salmon National Forest in Idaho. Five firefighters were hospitalized overnight for heat exhaustion, smoke...
Author(s): Richard C. Rothermel, Robert W. Mutch
Year Published: 1985
Type: Document
Book or Chapter or Journal Article

Modeling behavior of prescribed fires in Yosemite National Park
www.nrfirescience.org/resource/8313
The National Fire Danger Rating System and the Fire Behavior Prediction System were tested on prescribed fires burning underneath canopies in six fuel types in Yosemite National Park, California. The mean error for rate of spread was +0.03 foot per minute for the NFDRS and -0.15 foot for the FBPS. For flame length factors for...
Author(s): Jan W. van Wagtendonk, Stephen J. Botti
Year Published: 1984
Type: Document
Book or Chapter or Journal Article

Changes in fire weather distributions: effects on predicted fire behavior
www.nrfirescience.org/resource/11221
Data that represent average worst fire weather for a particular area are used to index daily fire danger; however, they do not account for different locations or diurnal weather changes that significantly affect fire behavior potential. To study the effects that selected changes in weather databases have on
Wildland fires: predicting the behavior of wildland fires—among nature’s most potent forces—can save lives, money, and natural resources

www.nrfirescience.org/resource/8315

During a period of three days in mid-February 1983, bushfires swept over 400,000 ha in southern Australia, killing 74 people, destroying more than 2,000 homes, and burning out 7 towns. This tragic repetition of the fires of January 1939, in which 71 people perished, was foretold by Noble (1977), whose monograph on the 1939 fires...

Author(s): Frank A. Albini
Year Published: 1984
Type: Document
Book or Chapter or Journal Article

Monoammonium phosphate: effect on flammability of excelsior and pine needles

www.nrfirescience.org/resource/11959

The study quantified differences between fire-retarding abilities of monoammonium phosphate samples from five different sources. Ponderosa pine needles and aspen excelsior fuel beds were spray-treated with different levels of chemical solutions, dried, and burned under controlled laboratory conditions. Flame spread and energy...

Author(s): Aylmer D. Blakely
Year Published: 1983
Type: Document
Technical Report or White Paper

Fuel and fire behavior prediction in big sagebrush

www.nrfirescience.org/resource/11957

Relationships between height of big sagebrush and crown area, fuel loading, bulk density, size distribution of foliage and stemwood, and fraction dead stemwood are presented. Based upon these relationships, modeled rate-of-fire spread and fireline intensity are shown for sagebrush ranging in height from 20 to 120 cm and in coverage...

Author(s): James K. Brown
Year Published: 1982
Type: Document
Technical Report or White Paper

Influence of harvesting and residues on fuels and fire management

www.nrfirescience.org/resource/13134

Fuel and fire behavior potential in clearcut lodgepole pine and in Douglas-fir/larch under clearcutting, group selection, and shelterwood silvicultural systems were compared after logging to near-complete and conventional utilization standards. Fuels and fire behavior potentials were unaffected by silvicultural...

Author(s): James K. Brown
Year Published: 1980
Type: Document
Technical Report or White Paper
Lightning direction-finding systems for forest fire detection throughout the western United States and Alaska

Extensive networks of magnetic direction-finding (DF) stations have been installed throughout the western United States and Alaska to facilitate early detection of lightning-caused fires. Each station contains a new wideband direction-finder that responds primarily to cloud-to-ground lightning and discriminates against cloud...

Author(s): E. Philip Krider, R. C. Noggle, A. E. Pifer, Dale L. Vance
Year Published: 1980
Type: Document
Book or Chapter or Journal Article

Progress toward locating lightning fires

Systems to enable land managers to locate, evaluate, and counter the fire threat of lightning storms are in the early stages of development. In the western U.S. and Alaska, the Bureau of Land Management has established networks of instruments that locate lightning strikes by means of recorded azimuths. Further research could add...

Author(s): Donald J. Latham
Year Published: 1979
Type: Document
Research Brief or Fact Sheet

Predicting slash depth for fire modeling

Development of equations for predicting fuel bed depth (called "bulk depth" herein) appropriate for modeling fire behavior in slash is described. Bulk depth ($y$) was correlated with the expected number of 1/4-to 1-inch-diameter particle intercepts per foot of vertical plane transect ($x$) by regressions of the form $y = a \cdot x$. Values of "...

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

Fire danger rating network density

Conventional statistical techniques are used to answer the question, "What is the necessary station density for a fire danger network?" The Burning Index of the National Fire-Danger Rating System is used as an indicator of fire danger. Results are presented as station spacing in tabular form for each of six regions in the western...

Author(s): Rudy M. King, R. William Furman
Year Published: 1976
Type: Document
Technical Report or White Paper

Broadcast burning in larch-fir clearcuts: the Miller Creek-Newman Ridge study

Seventy-three clearcuts in western larch/Douglas-fir forests of western Montana were broadcast burned over a wide range of environmental conditions for the purpose of quantifying fire characteristics and burn accomplishment. The moisture content of the upper duff, and the National Fire-Danger Rating
System Buildup Index (1964) were...
Author(s): William R. Beaufait, Charles E. Hardy, William C. Fischer
Year Published: 1975
Type: Document
Technical Report or White Paper

Meteorological factors in the Sundance Fire run
www.nrfirescience.org/resource/11905
Strong, sustained, southwesterly winds were a major factor in the Sundance Fire run in northern Idaho during which the fire front raced 16 miles northeastward within a 9-hr. period on September 1, 1967. These winds were found to be dependent upon an unusually strong summertime pressure gradient ahead of an approaching trough,...
Author(s): Arnold I. Finklin
Year Published: 1973
Type: Document
Technical Report or White Paper

Field test of a rate-of-fire-spread model in slash fuels
www.nrfirescience.org/resource/11945
Predicted rates of fire spread using a mathematical model were consistently greater but in reasonably close agreement with rates observed on test fires in ponderosa pine and Douglas-fir slash. Fuel loading, bulk density, particle density, particle surface-to-volume ratio, heat content, total plant salt content, silica-free salt,...
Author(s): James K. Brown
Year Published: 1972
Type: Document
Technical Report or White Paper

The seasonal trends in moisture content, ether extractives, and energy of ponderosa pine and Douglas-fir needles
www.nrfirescience.org/resource/11943
The moisture, ether extractive, and energy content of ponderosa pine (Pinus ponderosa Laws.) and Douglas-fir (Pseudotsuga menziesii L.) foliage were measured during two fire seasons. The moisture content of 1- and 2-year-old needles was found to rise throughout the summer. The ether extractive content was highest in the fir foliage...
Author(s): Charles W. Philpot, Robert W. Mutch
Year Published: 1971
Type: Document
Technical Report or White Paper

Tree-bole ignition in superimposed lightning scars
www.nrfirescience.org/resource/11921
This Note presents observations on a little-known mode of tree-bole ignition by lightning in which a fire-setting discharge partially superimposes its furrow upon an older lightning soar and causes ignition in the older injury.
Author(s): Alan R. Taylor
Year Published: 1969
Type: Document
Research Brief or Fact Sheet
Sundance Fire: an analysis of fire phenomena
www.nrfirescience.org/resource/11229
The Sundance Fire on September 1, 1967, made a spectacular run of 16 miles in 9 hours and destroyed more than 50,000 acres. This run became the subject of a detailed research analysis of the environmental, topographic, and vegetation variables aimed at reconstructing and describing fire phenomena. This report details the fire's...
Author(s): Hal E. Anderson
Year Published: 1968
Type: Document
Technical Report or White Paper

Mechanisms of fire spread research progress report no. 2
www.nrfirescience.org/resource/11937
In 1961 the National Science Foundation awarded grants to Washington State University and the Northern Forest Fire Laboratory of the Intermountain Forest and Range Experiment Station to further a joint study of the mechanisms of fire spread in wildland fuels. The combined efforts of the two research groups encompass theoretical...
Author(s): Hal E. Anderson
Year Published: 1966
Type: Document
Technical Report or White Paper

Characteristics of backfires and headfires in a pine needle fuel bed
www.nrfirescience.org/resource/11920
Burning characteristics of backfires, headfires, and no-wind fires in fuel beds of ponderosa pine needles were compared at the Northern Forest Fire Laboratory. Data gathered under controlled laboratory conditions indicate that fires backed into the wind (backfires) consistently burn slower, longer, and deeper than fires burned with...
Author(s): William R. Beaufait
Year Published: 1965
Type: Document
Research Brief or Fact Sheet

Conversion tables for use with the National Fire-Danger Rating System in the Intermountain Area
www.nrfirescience.org/resource/11919
Two tables prepared for use with the National Fire-Danger Rating System replace 10 tables previously used with the Model-8 Fire-Danger Rating System. They provide for the conversion of Spread Index values at various altitudes, aspects, and times of day. A rate of spread table facilitates converting Spread Index values to chains per...
Author(s): Dwight S. Stockstad, Richard J. Barney
Year Published: 1964
Type: Document
Research Brief or Fact Sheet

Calculating the National Fire-Danger Rating spread index by computer
www.nrfirescience.org/resource/11918
Changeover from use of the Intermountain Model-8 Burning Index Meter to use of the Spread Index of the National Fire-Danger Rating System required a comparative analysis of both systems. This note describes a program written in SPS to calculate various indexes of both systems on an IBM 1620 computer.
Fire behavior in Northern Rocky Mountain Forests
www.nrfirescience.org/resource/11133
The main purpose of this publication is to summarize the most important aspects of fire behavior as we now know them. The author recognizes that there are still many unknowns in the behavior of forest and range fires. These unknowns will be the targets of future research. In the meantime it is important that the best available...

Death in Blackwater Canyon
www.nrfirescience.org/resource/11494
On August 21, 1937, the tragic Blackwater Fire caused the death of 15 firefighters, burning approximately 1,700 acres of National Forest System lands on the Shoshone National Forest, near Cody, Wyoming. An electrical storm occurred in the general vicinity of Blackwater Creek on Wednesday, August 18th causing a fire, which was not...

Meteorological conditions affecting the Freeman Lake (Idaho) Fire
www.nrfirescience.org/resource/8305
[Excerpt from text] Measurements of meteorological conditions prevailing during the rapid spread of forest fires are greatly needed so that when their recurrence seems probable, fire weather forecasters may issue warnings of the danger.

Meteorological factors in the Quartz Creek forest fire
www.nrfirescience.org/resource/8304
[Excerpted from text] It is not often that a large forest fire occurs conveniently near a weather station specially equipped for measuring forest-fire weather. The 13,000-acre Quartz Creek fire on the Kaniksu National Forest during the summer of 1936 was close enough to the Priest River Experimental...

Evidence for population differentiation among Jeffrey and Ponderosa pines in survival, growth and phenology
www.nrfirescience.org/resource/18740
Ecological restoration projects that include reforestation require that land managers select appropriate source of seeds for long-term persistence. In California, the standard approach for making this choice is based on seed zone and elevational band, both geographically-based measures. However, given the pace of contemporary...

Author(s): Alejandra Martínez-Berdeja, Jill A. Hamilton, Aurore Bontemps, Johanna Schmitt, Jessica W. Wright
Type: Document
Book or Chapter or Journal Article

Proceedings of the fourth fire behavior and fuels conference
www.nrfirescience.org/resource/18396
The Fourth Fire Behavior and Fuels Conference was held in Raleigh, North Carolina, USA, February 18-22, 2013. The theme for this conference was At The Crossroads: Looking Toward the Future in a Changing Environment. Joint sponsorship of the conference was by the International Association of Wildland Fire (IAWF) and the International...
Author(s): Dale D. Wade, Rebekah L. Fox
Type: Document
Conference Proceedings