

### **Framework for submodel improvement in wildfire modeling**

[www.nrfirescience.org/resource/17259](http://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): M. El Houssami, A. Lamolette, D. Morvan, Rory Hadden, Albert Simeoni

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

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

[www.nrfirescience.org/resource/17175](http://www.nrfirescience.org/resource/17175)

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

Author(s): Angela Taboada, Víctor Fernández-García, Elena Marcos, Leonor Calvo

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

### **Modeling Fire Pathways in Montane Grassland?Forest Ecotones**

[www.nrfirescience.org/resource/17667](http://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

### **Optimizing smoke and plume rise modeling approaches at local scales**

[www.nrfirescience.org/resource/17793](http://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

### **How do weather and terrain contribute to firefighter entrapments in Australia?**

[www.nrfirescience.org/resource/17122](http://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...

Author(s): Sébastien Lahaye, J. Sharples, Stuart Matthews, Simon Heemstra, Owen F. Price, Rachel Badlan  
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](http://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

### **Optimizing precipitation thresholds for best correlation between dry lightning and wildfires**

[www.nrfirescience.org/resource/17429](http://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 km<sup>2</sup>) 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

### **Switching on the Big Burn of 2017**

[www.nrfirescience.org/resource/17761](http://www.nrfirescience.org/resource/17761)

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  
Book or Chapter or Journal Article

### **Defining Extreme Wildfire Events: Difficulties, Challenges, and Impacts**

[www.nrfirescience.org/resource/17072](http://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...

Author(s): Fantina Tedim, Vittorio Leone, Malik Amraoui, Christophe Bouillon, Michael R. Coughlan,

Giuseppe M. Delogu, Paulo M. Fernandes, Carmen Ferreira, Sarah M. McCaffrey, Tara K. McGee, Joana Parente, Douglas Paton, Mário G. Pereira, Luís M. Ribeiro, Domingos Xavier Viegas, Gavriil Xanthopoulos  
Year Published: 2018  
Type: Document  
Book or Chapter or Journal Article

### **The sensitivity of US wildfire occurrence to pre-season soil moisture conditions across ecosystems**

[www.nrfirescience.org/resource/17379](http://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

### **Deconstructing the King Megafire**

[www.nrfirescience.org/resource/17735](http://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...

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

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

[www.nrfirescience.org/resource/17311](http://www.nrfirescience.org/resource/17311)

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  
Year Published: 2018  
Type: Document  
Book or Chapter or Journal Article

### **Improving Fire Behaviour Data Obtained from Wildfires**

[www.nrfirescience.org/resource/17190](http://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

**Data Descriptor: TerraClimate, a high-resolution global dataset of monthly climate and climatic water balance from 1958-2015**

[www.nrfirescience.org/resource/17794](http://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

**Analysis of the physical processes associated with junction fires at laboratory and field scales**

[www.nrfirescience.org/resource/16747](http://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...

Author(s): J. R. Raposo, Domingos Xavier Viegas, X. Xie, Miguel Almeida, A. R. Figueiredo, L. Porto, J. Sharples

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](http://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

**Conditional Performance Evaluation: Using Wildfire Observations for Systematic Fire Simulator Development**

[www.nrfirescience.org/resource/17657](http://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

### **Some requirements for simulating wildland fire behavior using insight from coupled weather-wildland fire models**

[www.nrfirescience.org/resource/17104](http://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

### **Some Requirements for Simulating Wildland Fire Behavior Using Insight from Coupled Weather—Wildland Fire Models**

[www.nrfirescience.org/resource/17610](http://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

### **The Rothermel surface fire spread model and associated developments: A comprehensive explanation**

[www.nrfirescience.org/resource/17537](http://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

### **Flame-Front Rate of Spread Estimates for Moderate Scale Experimental Fires Are Strongly Influenced by Measurement Approach**

[www.nrfirescience.org/resource/17768](http://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

### **Biological and geophysical feedbacks with fire in the Earth system**

[www.nrfirescience.org/resource/17407](http://www.nrfirescience.org/resource/17407)

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...

Author(s): Sally Archibald, Caroline E. R. Lehmann, Claire M. Belcher, William J. Bond, Ross A. Bradstock, Anne Laure Daniau, K. G. Dexter, Elisabeth J. Forrestel, M. Greve, Tianhua He, Steven I. Higgins, William A. Hoffmann, Byron B. Lamont, D. J. McGlenn, G. R. Moncrieff, Colin P. Osborne, Juli G. Pausas, Owen F. Price, Brad S. Ripley, Brendan M. Rogers, Dylan W. Schwilk, M. F. Simon, Merritt R. Turetsky, Guido R. Van der Werf, Amy E. Zanne

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](http://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 improved non-equilibrium model for the ignition of living fuel**

[www.nrfirescience.org/resource/17342](http://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

### **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](http://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

### **Dimensional analysis on forest fuel bed fire spread**

[www.nrfirescience.org/resource/16440](http://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

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

[www.nrfirescience.org/resource/15489](http://www.nrfirescience.org/resource/15489)

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

### **Human exposure and sensitivity to globally extreme wildfire events**

[www.nrfirescience.org/resource/15038](http://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,...

Author(s): David M. J. S. Bowman, Grant J. Williamson, John T. Abatzoglou, Crystal A. Kolden, Mark A. Cochrane, Alistair M. S. Smith

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**

[www.nrfirescience.org/resource/15371](http://www.nrfirescience.org/resource/15371)

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

### **Spatio-Temporal Linkages between Declining Arctic Sea-Ice Extent and Increasing Wildfire Activity in the Western United States**

[www.nrfirescience.org/resource/17201](http://www.nrfirescience.org/resource/17201)

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  
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Book or Chapter or Journal Article

### **An uncertainty analysis of wildfire modeling [Chapter 13]**

[www.nrfirescience.org/resource/14997](http://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...

Author(s): Karen L. Riley, Matthew P. Thompson  
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**

[www.nrfirescience.org/resource/16748](http://www.nrfirescience.org/resource/16748)

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

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

[www.nrfirescience.org/resource/14916](http://www.nrfirescience.org/resource/14916)

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

### **Interacting effects of fire severity, time since fire and topography on vegetation structure after wildfire**

[www.nrfirescience.org/resource/16674](http://www.nrfirescience.org/resource/16674)

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

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

[www.nrfirescience.org/resource/16525](http://www.nrfirescience.org/resource/16525)

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 course of an entire year for ten species (three species in year one, seven in year two) to evaluate seasonal changes in...

Author(s): Sara S. McAllister, David R. Weise

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

### **Network analysis of wildfire transmission and implications for risk governance**

[www.nrfirescience.org/resource/16507](http://www.nrfirescience.org/resource/16507)

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

### **An improved canopy wind model for predicting wind adjustment factors and wildland fire behavior**

[www.nrfirescience.org/resource/16445](http://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....

Author(s): William J. Massman, Jason M. Forthofer, Mark A. Finney

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**

[www.nrfirescience.org/resource/15134](http://www.nrfirescience.org/resource/15134)

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

Author(s): Ana M. G. Barros, Alan A. Ager, Michelle A. Day, Haiganoush K. Preisler, Thomas A. Spies, Eric M. White, Robert J. Pabst, Keith A. Olsen, Emily K. Platt, John D. Bailey, John P. Bolte

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Book or Chapter or Journal Article

## **Trend analysis of fire season length and extreme fire weather in North America between 1979 and 2015**

[www.nrfirescience.org/resource/16407](http://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-...

Author(s): Piyush Jain, Xianli Wang, Michael D. Flannigan

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](http://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

## **Evidence of fuels management and fire weather influencing fire severity in an extreme fire event**

[www.nrfirescience.org/resource/17228](http://www.nrfirescience.org/resource/17228)

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

## **Simulated fire behaviour in young, postfire lodgepole pine forests**

[www.nrfirescience.org/resource/16291](http://www.nrfirescience.org/resource/16291)

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**

[www.nrfirescience.org/resource/16643](http://www.nrfirescience.org/resource/16643)

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

### **Qualitative flow visualization of flame attachment on slopes**

[www.nrfirescience.org/resource/16566](http://www.nrfirescience.org/resource/16566)

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**

[www.nrfirescience.org/resource/16523](http://www.nrfirescience.org/resource/16523)

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

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

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

### **Fuel-related fire-behaviour relationships for mixed live and dead fuels burned in the laboratory**

[www.nrfirescience.org/resource/16452](http://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

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

[www.nrfirescience.org/resource/17007](http://www.nrfirescience.org/resource/17007)

To meet the data requirements of physics-based fire models and FASMEE 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 Skowronski  
Year Published: 2017  
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](http://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

### **High-resolution infrared thermography for capturing wildland fire behaviour: RxCADRE 2012**

[www.nrfirescience.org/resource/13856](http://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

### **The Influence of Climate Model Biases on Projections of Aridity and Drought**

[www.nrfirescience.org/resource/15624](http://www.nrfirescience.org/resource/15624)

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

### **Measurements relating fire radiative energy density and surface fuel consumption - RxCADRE 2011 and 2012**

[www.nrfirescience.org/resource/13845](http://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

### **Spatial coherence of extreme precipitation events in the Northwestern United States**

[www.nrfirescience.org/resource/15609](http://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

### **Projected changes in cold hardiness zones and suitable overwinter ranges of perennial crops over the United States**

[www.nrfirescience.org/resource/15604](http://www.nrfirescience.org/resource/15604)

Average annual absolute minimum temperatures (TN<sub>n</sub>) 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<sub>n</sub>, 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

### **Prior wildfires influence burn severity of subsequent fires**

[www.nrfirescience.org/resource/15306](http://www.nrfirescience.org/resource/15306)

With longer and more severe fire seasons predicted, the incidence and extent of fires are expected to increase in western North America. As more area is burned, past wildfires may influence the spread and burn severity of subsequent fires, with implications for ecosystem resilience and fire management. We examined how previous burn...

Author(s): Camille Stevens-Rumann, Susan J. Prichard, Eva K. Strand, Penelope Morgan

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](http://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

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

### **Ecohydrological implications of drought for forests in the United States**

[www.nrfirescience.org/resource/14110](http://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 Miniati, 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

### **Near-term probabilistic forecast of significant wildfire events for the western United States**

[www.nrfirescience.org/resource/14704](http://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

### **Attribution of extreme weather events in the context of climate change - Report in brief**

[www.nrfirescience.org/resource/14069](http://www.nrfirescience.org/resource/14069)

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

### **Burning rates of wood cribs with implications for wildland fires**

[www.nrfirescience.org/resource/14684](http://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

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

[www.nrfirescience.org/resource/15574](http://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

### **The impact of aging on laboratory fire behaviour in masticated shrub fuelbeds of California and Oregon, USA**

[www.nrfirescience.org/resource/14580](http://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

### **Safe separation distance score: a new metric for evaluating wildland firefighter safety zones using Lidar**

[www.nrfirescience.org/resource/16910](http://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

### **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](http://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

### **The net benefits of human-ignited wildfire forecasting: the case of tribal land units in the United States**

[www.nrfirescience.org/resource/14196](http://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



**Fire weather conditions and fire-atmosphere interactions observed during low-intensity prescribed fires - Rxcadre 2012**

[www.nrfirescience.org/resource/16908](http://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 Teske, Thomas J. Zajkowski, Andrew T. Hudak, Benjamin C. Bright, Matthew B. Dickinson, Bret W. Butler, Daniel M. Jimenez, J. Kevin Hiers

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**

[www.nrfirescience.org/resource/13855](http://www.nrfirescience.org/resource/13855)

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...

Author(s): Matthew B. Dickinson, Andrew T. Hudak, Thomas J. Zajkowski, E. Louise Loudermilk, Wilfrid Schroeder, Luke Ellison, Robert L. Kremens, William Holley, Otto Martinez, Alexander Paxton, Benjamin C. Bright, Joseph J. O'Brien, Benjamin Hornsby, Charles Ichoku, Jason Faulring, Aaron Gerace, David L. Peterson, Joseph Mauceri

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](http://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 Moisen, Jared W. Oyler

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](http://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

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

[www.nrfirescience.org/resource/14330](http://www.nrfirescience.org/resource/14330)

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...

Author(s): Paul A. Werth, Brian E. Potter, Martin E. Alexander, Miguel G. Cruz, Craig B. Clements, Mark A. Finney, Jason M. Forthofer, Scott L. Goodrick, Chad M. Hoffman, William Matt Jolly, Sara S. McAllister, Roger D. Ottmar, Russell A. Parsons

Year Published: 2016

Type: Document

Synthesis, Technical Report or White Paper

## **Autoignition of wood under combined convective and radiative heating**

[www.nrfirescience.org/resource/15781](http://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

## **Recent advances and remaining uncertainties in resolving past and future climate effects on global fire activity**

[www.nrfirescience.org/resource/15603](http://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

## **Wildland fire limits subsequent fire occurrence**

[www.nrfirescience.org/resource/15303](http://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

## **A comparison of level set and marker methods for the simulation of wildland fire front propagation**

[www.nrfirescience.org/resource/13803](http://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

### **Weather, fuels, and topography impede wildland fire spread in western US landscapes**

[www.nrfirescience.org/resource/14716](http://www.nrfirescience.org/resource/14716)

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

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

[www.nrfirescience.org/resource/15601](http://www.nrfirescience.org/resource/15601)

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...

Author(s): John T. Abatzoglou, Crystal A. Kolden, Jennifer Balch, Bethany A. Bradley

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](http://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

### **Determination of the effects of heating mechanisms and moisture content on ignition of live fuels**

[www.nrfirescience.org/resource/15576](http://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  
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](http://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 km<sup>2</sup> have generally been unsuccessful. We...

Author(s): Richard H. Waring, Nicholas C. Coops

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](http://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

**Does prescribed fire promote resistance to drought in low elevation forests of the Sierra Nevada, California, USA?**

[www.nrfirescience.org/resource/14244](http://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

**Observations of energy transport and rate of spreads from low-intensity fires in longleaf pine habitat - Rxcadre 2012**

[www.nrfirescience.org/resource/16909](http://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

### **Effects of drought on forests and rangelands in the United States: a comprehensive science synthesis**

[www.nrfirescience.org/resource/13910](http://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

### **A wildfire-relevant climatology of the convective environment of the United States**

[www.nrfirescience.org/resource/13270](http://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

### **Future mega-fires and smoke impacts**

[www.nrfirescience.org/resource/15579](http://www.nrfirescience.org/resource/15579)

"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...

Author(s): Narasimhan K. Larkin, John T. Abatzoglou, Donald McKenzie, Brian E. Potter, E. Ashley Steel, Brian J. Stocks

Year Published: 2015

Type: Document

Technical Report or White Paper

### **Evaluating crown fire rate of spread predictions from physics-based models**

[www.nrfirescience.org/resource/13614](http://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

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

[www.nrfirescience.org/resource/14278](http://www.nrfirescience.org/resource/14278)

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

### **Experimental analysis of fire spread across a two-dimensional ridge under wind conditions**

[www.nrfirescience.org/resource/13382](http://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

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

[www.nrfirescience.org/resource/15645](http://www.nrfirescience.org/resource/15645)

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

### **The potential impact of regional climate change on fire weather in the United States**

[www.nrfirescience.org/resource/13208](http://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

### **Verification of Spot Fire Weather Forecasts**

[www.nrfirescience.org/resource/15563](http://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

### **Implications of climate change on wind erosion of agricultural lands in the Columbia plateau**

[www.nrfirescience.org/resource/15642](http://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

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

[www.nrfirescience.org/resource/14527](http://www.nrfirescience.org/resource/14527)

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

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

Year Published: 2015

Type: Document  
Book or Chapter or Journal Article

### **Forecasting integrated lightning and fuels ignition potentials in a system with real-time analysis of fire weather prediction accuracy**

[www.nrfirescience.org/resource/15557](http://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

### **Limitations and utilisation of monitoring trends in burn severity products for assessing wildfire severity in the USA**

[www.nrfirescience.org/resource/15631](http://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  
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**

[www.nrfirescience.org/resource/13298](http://www.nrfirescience.org/resource/13298)

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

### **Climate-induced variations in global wildfire danger from 1979 to 2013**

[www.nrfirescience.org/resource/15322](http://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

### **Warning signals for eruptive events in spreading fires**

[www.nrfirescience.org/resource/13265](http://www.nrfirescience.org/resource/13265)

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

### **Daily weather and other factors influencing burn severity in central Idaho and western Montana**

[www.nrfirescience.org/resource/15316](http://www.nrfirescience.org/resource/15316)

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

### **Wildland fire as a self-regulating mechanism: the role of previous burns and weather in limiting fire progression**

[www.nrfirescience.org/resource/12770](http://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

### **Projected changes in snowfall extremes and interannual variability of snowfall in the western U.S.**

[www.nrfirescience.org/resource/15647](http://www.nrfirescience.org/resource/15647)

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-...

Author(s): A.C. Lute, John T. Abatzoglou, Katherine C. Hegewisch

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

### **Recent findings relating to firefighter safety zones**

[www.nrfirescience.org/resource/16918](http://www.nrfirescience.org/resource/16918)

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

### **Role of buoyant flame dynamics in wildfire spread**

[www.nrfirescience.org/resource/13377](http://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

### **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](http://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

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

[www.nrfirescience.org/resource/13170](http://www.nrfirescience.org/resource/13170)

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

### **Deriving fundamental statistical shrub fuel models by laser scanning and combustion experimentation**

[www.nrfirescience.org/resource/15558](http://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

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

[www.nrfirescience.org/resource/15636](http://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

### **Representation and evaluation of wildfire propagation simulations**

[www.nrfirescience.org/resource/12390](http://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

### **Is proportion burned severely related to daily area burned?**

[www.nrfirescience.org/resource/13018](http://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

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

[www.nrfirescience.org/resource/16900](http://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

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

[www.nrfirescience.org/resource/13006](http://www.nrfirescience.org/resource/13006)

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 ( $p < 0.05$ )...

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

Year Published: 2014

Type: Document

Book or Chapter or Journal Article

### **Observed changes in false springs over the contiguous United States**

[www.nrfirescience.org/resource/15668](http://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

### **Defining extreme wildland fires using geospatial and ancillary metrics**

[www.nrfirescience.org/resource/12953](http://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

### **Extent of the rain-snow transition zone in the western U.S. under historic and projected climate**

[www.nrfirescience.org/resource/15660](http://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](http://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

### **Fuel treatment effectiveness in reducing fire intensity and spread rate -- an experimental overview**

[www.nrfirescience.org/resource/16924](http://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...

Author(s): Eric Mueller, Nick Skowronski, Albert Simeoni, Kenneth L. Clark, Robert L. Kremens, William E. Mell, Michael R. Gallagher, Jan C. Thomas, Alexander I. Filkov, M. El Houssami, John L. Hom, Bret W. Butler

Year Published: 2014

Type: Document

Conference Proceedings

### **Questionable evidence of natural warming of the northwestern United States**

[www.nrfirescience.org/resource/15655](http://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  
Year Published: 2014  
Type: Document  
Book or Chapter or Journal Article

### **Fire behavior in masticated fuels: a review**

[www.nrfirescience.org/resource/12387](http://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

### **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](http://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

### **Seasonal climate variability and change in the Pacific Northwest of the United States**

[www.nrfirescience.org/resource/15671](http://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

### **Climate and very large wildland fires in the contiguous western USA**

[www.nrfirescience.org/resource/13009](http://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](http://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

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

[www.nrfirescience.org/resource/15661](http://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 ~ no-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

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

[www.nrfirescience.org/resource/15659](http://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

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

[www.nrfirescience.org/resource/12926](http://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

### **Modeling very large-fire occurrences over the continental United States from weather and**



## **climate forcing**

[www.nrfirescience.org/resource/15656](http://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 I. Model formulation and comparison against measurements**

[www.nrfirescience.org/resource/16923](http://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

## **Impacts of mega-fires on large U.S. urban area air quality under changing climate and fuels**

[www.nrfirescience.org/resource/15569](http://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

## **The missing mountain water: slower westerlies decrease orographic enhancement in the Pacific Northwest USA**

[www.nrfirescience.org/resource/15674](http://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

Year Published: 2013

Type: Document

Book or Chapter or Journal Article

## **Modelling conditional burn probability patterns for large wildland fires**

[www.nrfirescience.org/resource/12005](http://www.nrfirescience.org/resource/12005)

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

### **Angular variation of fire rate of spread**

[www.nrfirescience.org/resource/12428](http://www.nrfirescience.org/resource/12428)

Laboratory fire tests were performed in still air, for variable inclinations ( $10^\circ$ ,  $15^\circ$ ) and fuel bed dimensions (1.28 x 2.50-3.0 x 4.6 m<sup>2</sup>), 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](http://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](http://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

### **Fuel Characteristic Classification System version 3.0: technical documentation**

[www.nrfirescience.org/resource/12407](http://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

### **Wildland fire emissions, carbon, and climate: modeling fuel consumption**

[www.nrfirescience.org/resource/12442](http://www.nrfirescience.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

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

[www.nrfirescience.org/resource/11995](http://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

### **Uncertainty associated with model predictions of surface and crown fire rates of spread**

[www.nrfirescience.org/resource/12418](http://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

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

[www.nrfirescience.org/resource/11978](http://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

### **Development of gridded surface meteorological data for ecological applications and modeling**

[www.nrfirescience.org/resource/15682](http://www.nrfirescience.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

### **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](http://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

### **Current status and future needs of the BehavePlus Fire Modeling System**

[www.nrfirescience.org/resource/12392](http://www.nrfirescience.org/resource/12392)

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**

[www.nrfirescience.org/resource/12427](http://www.nrfirescience.org/resource/12427)

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**

[www.nrfirescience.org/resource/12419](http://www.nrfirescience.org/resource/12419)

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 spread, which can both...

Author(s): Brittany A. Adam, Nelson K. Akafuah, Mark A. Finney, Jason M. Forthofer, Kozo Saito  
Year Published: 2013  
Type: Document  
Conference Proceedings

### **Developing a computerized approach for optimizing individual tree removal to efficiently reduce crown fire potential**

[www.nrfirescience.org/resource/11889](http://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

### **Backfire technique for prescribed burning**

[www.nrfirescience.org/resource/12400](http://www.nrfirescience.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

### **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](http://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](http://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

### **Fire weather case study - Mann Gulch Fire, Montana**

[www.nrfirescience.org/resource/11976](http://www.nrfirescience.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

### **Flame descriptors**

[www.nrfirescience.org/resource/12396](http://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

### **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](http://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

### **Numerical simulation of crown fire hazard immediately after bark beetle-caused mortality in lodgepole pine forests**

[www.nrfirescience.org/resource/8325](http://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

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

[www.nrfirescience.org/resource/8317](http://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. Negrón

Year Published: 2012  
Type: Document  
Book or Chapter or Journal Article

### **Effect of suppression strategies on federal wildland fire expenditures**

[www.nrfirescience.org/resource/17807](http://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  
Year Published: 2012  
Type: Document  
Book or Chapter or Journal Article

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

[www.nrfirescience.org/resource/8320](http://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

### **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](http://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  
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](http://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



### **Fourmile Canyon Fire Findings**

[www.nrfirescience.org/resource/17701](http://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

### **Spatial bottom-up controls on fire likelihood vary across western North America**

[www.nrfirescience.org/resource/8311](http://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

### **Towards the understanding of extreme wildland fire behavior**

[www.nrfirescience.org/resource/11092](http://www.nrfirescience.org/resource/11092)

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

### **Characterizing fire-on-fire interactions in three large wilderness areas**

[www.nrfirescience.org/resource/8339](http://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

### **Spatial variability in wildfire probability across the western United States**

[www.nrfirescience.org/resource/8322](http://www.nrfirescience.org/resource/8322)

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

### **Entrainment regimes and flame characteristics of wildland fires**

[www.nrfirescience.org/resource/16925](http://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  
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**

[www.nrfirescience.org/resource/8312](http://www.nrfirescience.org/resource/8312)

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

### **Modeling tree-level fuel connectivity to evaluate the effectiveness of thinning treatments for reducing crown fire potential**

[www.nrfirescience.org/resource/8295](http://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  
Year Published: 2012  
Type: Document  
Book or Chapter or Journal Article

### **Do mountain pine beetle outbreaks change the probability of active crown fire in lodgepole pine forests? Comment 1 & 2, Reply 1**

[www.nrfirescience.org/resource/13342](http://www.nrfirescience.org/resource/13342)

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

### **Climate extremes and their linkage to regional drought over Idaho, USA**

[www.nrfirescience.org/resource/15683](http://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

### **Both topography and climate affected forest and woodland burn severity in two regions of the western US**

[www.nrfirescience.org/resource/15318](http://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

### **Characterization of flame radiosity in shrubland fires**

[www.nrfirescience.org/resource/16927](http://www.nrfirescience.org/resource/16927)

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

### **Analyzing wildfire exposure and source-sink relationships on a fire prone forest landscape**

[www.nrfirescience.org/resource/12736](http://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...

Author(s): Alan A. Ager, Nicole M. Vaillant, Mark A. Finney, Haiganoush K. Preisler

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](http://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](http://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](http://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

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

[www.nrfirescience.org/resource/13340](http://www.nrfirescience.org/resource/13340)

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

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

Year Published: 2011

Type: Document

Book or Chapter or Journal Article

### **Linking 3D spatial models of fuels and fire: effects of spatial heterogeneity on fire behavior**

[www.nrfirescience.org/resource/14161](http://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...

Author(s): Russell A. Parsons, William E. Mell, Peter McCauley

Year Published: 2011

Type: Document

Book or Chapter or Journal Article

### **How fuel treatments saved homes from the 2011 Wallow fire**

[www.nrfirescience.org/resource/17699](http://www.nrfirescience.org/resource/17699)

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

### **A method for ensemble wildland fire simulation**

[www.nrfirescience.org/resource/12732](http://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

### **A comparison of statistical downscaling methods suited for wildfire applications**

[www.nrfirescience.org/resource/11973](http://www.nrfirescience.org/resource/11973)

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

### **Detailed point weather forecasts: how to get them when you need them**

[www.nrfirescience.org/resource/12441](http://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

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

[www.nrfirescience.org/resource/15695](http://www.nrfirescience.org/resource/15695)

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...

Author(s): John T. Abatzoglou

Year Published: 2011

Type: Document

Book or Chapter or Journal Article

### **Changes in climatic water balance drive downhill shifts in plant species optimum elevations**

[www.nrfirescience.org/resource/15690](http://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...

Author(s): Shawn M. Crimmins, Solomon Z. Dobrowski, Jonathan A. Greenberg, John T. Abatzoglou, Alison R. Mynsberge

Year Published: 2011

Type: Document

Book or Chapter or Journal Article

### **Fine fuel heating by radiant flux**

[www.nrfirescience.org/resource/16903](http://www.nrfirescience.org/resource/16903)

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...

Author(s): David Frankman, Brent W. Webb, Bret W. Butler, Donald J. Latham

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**

[www.nrfirescience.org/resource/8187](http://www.nrfirescience.org/resource/8187)

To control and use wildland fires safely and effectively depends on credible 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

### **In-situ characterization of wildland fire behavior**

[www.nrfirescience.org/resource/16932](http://www.nrfirescience.org/resource/16932)

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...

Author(s): Bret W. Butler, Daniel M. Jimenez, Jason M. Forthofer, Paul Sopko, Kyle S. Shannon, James J. Reardon

Year Published: 2010

Type: Document

Conference Proceedings

### **Characterization of convective heating in full scale wildland fires**

[www.nrfirescience.org/resource/16929](http://www.nrfirescience.org/resource/16929)

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

### **Initialization of high resolution surface wind simulations using NWS gridded data**

[www.nrfirescience.org/resource/16936](http://www.nrfirescience.org/resource/16936)

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**

[www.nrfirescience.org/resource/16934](http://www.nrfirescience.org/resource/16934)

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  $7.0\text{kW}\cdot\text{m}^{-2}$ .

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**

[www.nrfirescience.org/resource/16930](http://www.nrfirescience.org/resource/16930)

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



### **Effects of biomass removal treatments on stand-level fire characteristics in major forest types of the Northern Rocky Mountains**

[www.nrfirescience.org/resource/8189](http://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

### **A portable system for characterizing wildland fire behavior**

[www.nrfirescience.org/resource/16928](http://www.nrfirescience.org/resource/16928)

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 programmable data logger,...

Author(s): Bret W. Butler, Daniel M. Jimenez, Jason M. Forthofer, Kyle S. Shannon, Paul Sopko

Year Published: 2010

Type: Document

Conference Proceedings

### **How big was Dodge's escape fire?**

[www.nrfirescience.org/resource/8289](http://www.nrfirescience.org/resource/8289)

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

### **Large scale fire whirls: can their formation be predicted?**

[www.nrfirescience.org/resource/16937](http://www.nrfirescience.org/resource/16937)

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.

Author(s): Jason M. Forthofer, Bret W. Butler

Year Published: 2010

Type: Document

Conference Proceedings

### **Efforts to update firefighter safety zone guidelines**

[www.nrfirescience.org/resource/16935](http://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

### **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](http://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

### **January 31st 2009 off-season grassland wildfire**

[www.nrfirescience.org/resource/11145](http://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

### **Wildland surface fire spread modelling, 1990-2007. 2: Empirical and quasi-empirical models**

[www.nrfirescience.org/resource/13824](http://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

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

[www.nrfirescience.org/resource/15709](http://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. Morrisette, Andrew D. Richardson, Alan K. Knapp, Jeremy I. Fisher, Eric A.

Graham, John T. Abatzoglou, Bruce E. Wilson, David D. Breshears, Geoffrey M. Henebry, Jonathan M.

Hanes, Liang Liang  
Year Published: 2009  
Type: Document  
Book or Chapter or Journal Article

**Influence of the Madden Julian Oscillation on summertime cloud-to-ground lightning activity over the continental US**

[www.nrfirescience.org/resource/15696](http://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

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

[www.nrfirescience.org/resource/16939](http://www.nrfirescience.org/resource/16939)

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

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

[www.nrfirescience.org/resource/11217](http://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

**Wildland surface fire spread modelling, 1990-2007. 3: Simulation and mathematical analogue models**

[www.nrfirescience.org/resource/13825](http://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

### **Wildland surface fire spread modelling, 1990-2007. 1: Physical and quasi-physical models**

[www.nrfirescience.org/resource/13823](http://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 present all types of surface fire spread models developed during the period 1990-...

Author(s): Andrew L. Sullivan

Year Published: 2009

Type: Document

Book or Chapter or Journal Article, Synthesis

### **Seasonal predictions for wildland fire severity**

[www.nrfirescience.org/resource/11064](http://www.nrfirescience.org/resource/11064)

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

### **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](http://www.nrfirescience.org/resource/11020)

The Wildland Fire Operations Research Group of FPIInnovations-Feris 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

### **Fuel treatment guidebook: illustrating treatment effects on fire hazard**

[www.nrfirescience.org/resource/8155](http://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

### **How much influence does landscape-scale physiography have on air temperature in a mountain environment?**

[www.nrfirescience.org/resource/15698](http://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

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

[www.nrfirescience.org/resource/11435](http://www.nrfirescience.org/resource/11435)

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

### **Temporal and spatial structure in a daily wildfire-start data set from the western United States (1986-96)**

[www.nrfirescience.org/resource/8201](http://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...

Author(s): Patrick J. Bartlein, Steven W. Hostetler, Sarah L. Shafer, J. O. Holman, Allen M. Solomon

Year Published: 2008

Type: Document

Book or Chapter or Journal Article

### **Climate drivers of regionally synchronous fires in the inland northwest (1651-1900)**

[www.nrfirescience.org/resource/16892](http://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...

Author(s): Emily K. Heyerdahl, Donald McKenzie, Lori D. Daniels, Amy E. Hessler, Jeremy S. Littell, Nathan J. Mantua

Year Published: 2008

Type: Document

Book or Chapter or Journal Article

### **An assessment of fuel treatments on three large 2007 Pacific Northwest fires**

[www.nrfirescience.org/resource/17705](http://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...

Author(s): Steve Harbert, Andrew T. Hudak, Laura Mayer, T. D. Rich, Sarah Robertson

Year Published: 2007

Type: Document

Technical Report or White Paper

### **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](http://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

### **A physics-based approach to modelling grassland fires**

[www.nrfirescience.org/resource/14842](http://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](http://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...

Author(s): Mark A. Finney, Robert C. Seli, Charles W. McHugh, Alan A. Ager, Bernhard Bahro, James K. Agee

Year Published: 2007

Type: Document

Book or Chapter or Journal Article

### **Fuel consumption and flammability thresholds in shrub-dominated ecosystems - Final Report to the Joint Fire Science Program**

[www.nrfirescience.org/resource/11164](http://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-...

Author(s): Clinton S. Wright, Roger D. Ottmar, Sue A. Ferguson, Robert E. Vihnanek

Year Published: 2007

Type: Document

**On the use of a firebrand generator to investigate the ignition of structures in wildland-urban interface (WUI) fires**

[www.nrfirescience.org/resource/12439](http://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

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

[www.nrfirescience.org/resource/12113](http://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

**Wildfires, weather, and productivity**

[www.nrfirescience.org/resource/11016](http://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, Nouredine Nimour

Year Published: 2007

Type: Document

Conference Proceedings

**Contingent pacific-atlantic ocean influence on multicentury wildfire synchrony over western North America**

[www.nrfirescience.org/resource/8293](http://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

**A fuel treatment reduces fire severity and increases suppression efficiency in a mixed conifer**



## **forest**

[www.nrfirescience.org/resource/17717](http://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

## **The fire-climate connection**

[www.nrfirescience.org/resource/11985](http://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

## **Statistical model for forecasting monthly large wildfire events in the western United States**

[www.nrfirescience.org/resource/8123](http://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 skills of fire-...

Author(s): Haiganoush K. Preisler, Anthony L. Westerling

Year Published: 2007

Type: Document

Book or Chapter or Journal Article

## **The asymmetry of trends in spring and autumn temperature and circulation regimes over western North America**

[www.nrfirescience.org/resource/15710](http://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

## **Guide to fuel treatments in dry forests of the Western United States: assessing forest structure and fire hazard**

[www.nrfirescience.org/resource/11166](http://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

### **Fuel Treatment Evaluator 3.0**

[www.nrfirescience.org/resource/11078](http://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

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

[www.nrfirescience.org/resource/15713](http://www.nrfirescience.org/resource/15713)

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

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**

[www.nrfirescience.org/resource/7943](http://www.nrfirescience.org/resource/7943)

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, Scott L. Goodrick, Paul A. Werth

Year Published: 2006

Type: Document

Book or Chapter or Journal Article

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

[www.nrfirescience.org/resource/11419](http://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

### **Windwizard: a new tool for fire management decision support**

[www.nrfirescience.org/resource/16902](http://www.nrfirescience.org/resource/16902)

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

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

[www.nrfirescience.org/resource/8397](http://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

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

[www.nrfirescience.org/resource/11200](http://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

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

[www.nrfirescience.org/resource/11507](http://www.nrfirescience.org/resource/11507)

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

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

[www.nrfirescience.org/resource/11428](http://www.nrfirescience.org/resource/11428)

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

**Evaluation of the Experimental Climate Prediction Center's fire danger forecasts with remote automated weather station observations**

[www.nrfirescience.org/resource/8127](http://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

**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](http://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

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

[www.nrfirescience.org/resource/11165](http://www.nrfirescience.org/resource/11165)

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

**Characterization of firefighter safety zone effectiveness - Final Report to the Joint Fire Science Program**

[www.nrfirescience.org/resource/11153](http://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](http://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

### **Evaluation of the Experimental Climate Prediction Center's fire danger forecasts with remote automated weather station observations**

[www.nrfirescience.org/resource/8208](http://www.nrfirescience.org/resource/8208)

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

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

[www.nrfirescience.org/resource/11167](http://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

### **MODIS Applications in 2003 Fire Management - Slide presentation**

[www.nrfirescience.org/resource/11516](http://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

### **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](http://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](http://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

### **Landscape fire simulation and fuel treatment optimization**

[www.nrfirescience.org/resource/111](http://www.nrfirescience.org/resource/111)

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

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

[www.nrfirescience.org/resource/15018](http://www.nrfirescience.org/resource/15018)

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

### **Fuels planning: science synthesis and integration; forest structure and fire hazard fact sheet 2: fire hazard**

[www.nrfirescience.org/resource/14954](http://www.nrfirescience.org/resource/14954)

Fire hazard reflects the potential fire behavior and magnitude of effects as a function of fuel conditions. This fact sheet discusses crown fuels, surface fuels, and ground fuels and their contribution and involvement in wildland fire.

Author(s): Kelly O'Brian

Year Published: 2004

Type: Document

### **A comment on models and modelling in fire/fuel management**

[www.nrfirescience.org/resource/12394](http://www.nrfirescience.org/resource/12394)

'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

### **Performance of the Haines Index during August 2000 for Montana**

[www.nrfirescience.org/resource/10997](http://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

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

[www.nrfirescience.org/resource/8193](http://www.nrfirescience.org/resource/8193)

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

### **Predicting surface winds in complex terrain for use in fire spread models**

[www.nrfirescience.org/resource/8438](http://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

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

[www.nrfirescience.org/resource/8184](http://www.nrfirescience.org/resource/8184)

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

Year Published: 2003

Type: Document

Book or Chapter or Journal Article

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

[www.nrfirescience.org/resource/11022](http://www.nrfirescience.org/resource/11022)

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

### **Reaction times and burning rates for wind tunnel headfires**

[www.nrfirescience.org/resource/8211](http://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

### **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](http://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

### **Wildland fire behavior case studies and analysis: part 2**

[www.nrfirescience.org/resource/15996](http://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

Type: Document

Book or Chapter or Journal Article

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

[www.nrfirescience.org/resource/11019](http://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

### **Assessing canopy fuel stratum characteristics in crown fire prone fuel types of western North America**

[www.nrfirescience.org/resource/7917](http://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

### **Assessing the value of increased model resolution in forecasting fire danger**

[www.nrfirescience.org/resource/10969](http://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

### **Long lead statistical forecasts of area burned in western U.S. wildfires by ecosystem province**

[www.nrfirescience.org/resource/8377](http://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

### **Using FVS and its fire and fuels extension in the context of uncertain climate**

[www.nrfirescience.org/resource/11011](http://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

### **The 2000 fire season: lightning-caused fires**

[www.nrfirescience.org/resource/8141](http://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

### **Statistical forecast of the 2001 western wildfire season using principal components regression**

[www.nrfirescience.org/resource/8396](http://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

### **The Mann Gulch Fire and the Canadian Forest Fire Danger Rating System**

[www.nrfirescience.org/resource/8408](http://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

### **Stevensville West Central Study**

[www.nrfirescience.org/resource/10981](http://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 (MAGIS). SIMPPLLE was a useful model...

Author(s): J. Greg Jones, Jimmie D. Chew, Nan K. Christianson, D. J. Silvieus, Catherine A. Stewart

Year Published: 2000

Type: Document

Conference Proceedings

### **Critical fire weather patterns of the United States**

[www.nrfirescience.org/resource/12780](http://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

### **Development of input data layers for the FARSITE fire growth model for the Selway-Bitterroot Wilderness Complex, USA**

[www.nrfirescience.org/resource/11240](http://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

### **Making sense of fire weather**

[www.nrfirescience.org/resource/8122](http://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

Year Published: 1997

Type: Document

Book or Chapter or Journal Article

### **Wildfire case study: Butte City Fire, southeastern Idaho, July 1, 1994**

[www.nrfirescience.org/resource/11146](http://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

### **The ecological implications of fire in Greater Yellowstone, proceedings of the second biennial conference on the Greater Yellowstone Ecosystem**

[www.nrfirescience.org/resource/11989](http://www.nrfirescience.org/resource/11989)

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**

[www.nrfirescience.org/resource/11460](http://www.nrfirescience.org/resource/11460)

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

### **Fire growth maps for the 1988 Greater Yellowstone Area fires**

[www.nrfirescience.org/resource/11212](http://www.nrfirescience.org/resource/11212)

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

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

[www.nrfirescience.org/resource/8361](http://www.nrfirescience.org/resource/8361)

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

### **Probability of fire-stopping precipitation events**

[www.nrfirescience.org/resource/11933](http://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

### **The evaluation of Idaho wildfire growth using the Haines Index**

[www.nrfirescience.org/resource/8307](http://www.nrfirescience.org/resource/8307)

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

### **Fuel moisture, forest type, and lightning-caused fire in Yellowstone National Park**

[www.nrfirescience.org/resource/13568](http://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 cover type. Fuel moisture estimates...

Author(s): Roy A. Renkin, Don G. Despain

Year Published: 1992

Type: Document

Book or Chapter or Journal Article

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

[www.nrfirescience.org/resource/11195](http://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

### **The 1985 Butte fire in central Idaho: a Canadian perspective on the associated burning conditions**

[www.nrfirescience.org/resource/11055](http://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

### **Fuel moisture as measured and predicted during the 1988 fires in Yellowstone National Park**

[www.nrfirescience.org/resource/11109](http://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

### **Lookouts, communication, escape routes, safety zones**

[www.nrfirescience.org/resource/15460](http://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

### **Predicting behavior of the 1988 Yellowstone fires: projections versus reality**

[www.nrfirescience.org/resource/8252](http://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](http://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

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

[www.nrfirescience.org/resource/10970](http://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](http://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](http://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](http://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  
Research Brief or Fact Sheet

### **Predicting duff and woody fuel consumed by prescribed fire in the Northern Rocky Mountains**

[www.nrfirescience.org/resource/11265](http://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

### **Fire Review of the 1985 Log Tom Fire Complex (Butte Fire)**

[www.nrfirescience.org/resource/15987](http://www.nrfirescience.org/resource/15987)

This report reviews the Log 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

### **Behavior of the life-threatening Butte Fire: August 27-29, 1985**

[www.nrfirescience.org/resource/8314](http://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](http://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 -0.15foot 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

### **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](http://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

### **Changes in fire weather distributions: effects on predicted fire behavior**

[www.nrfirescience.org/resource/11221](http://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 computed fire behavior...

Author(s): Lucy A. Salazar, Larry S. Bradshaw

Year Published: 1984

Type: Document

Technical Report or White Paper

### **Monoammonium phosphate: effect on flammability of excelsior and pine needles**

[www.nrfirescience.org/resource/11959](http://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](http://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

### **Lightning direction-finding systems for forest fire detection throughout the western United States and Alaska**

[www.nrfirescience.org/resource/7958](http://www.nrfirescience.org/resource/7958)

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

### **Influence of harvesting and residues on fuels and fire management**

[www.nrfirescience.org/resource/13134](http://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

### **Progress toward locating lightning fires**

[www.nrfirescience.org/resource/12120](http://www.nrfirescience.org/resource/12120)

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**

[www.nrfirescience.org/resource/11954](http://www.nrfirescience.org/resource/11954)

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**

[www.nrfirescience.org/resource/11969](http://www.nrfirescience.org/resource/11969)

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**

[www.nrfirescience.org/resource/11950](http://www.nrfirescience.org/resource/11950)

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](http://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](http://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](http://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](http://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 scar 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](http://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](http://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](http://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

### **Calculating the National Fire-Danger Rating spread index by computer**

[www.nrfirescience.org/resource/11918](http://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.

Author(s): Richard J. Barney

Year Published: 1964

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](http://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

### **Fire behavior in Northern Rocky Mountain Forests**

[www.nrfirescience.org/resource/11133](http://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...

Author(s): Jack S. Barrows

Year Published: 1951

Type: Document

Technical Report or White Paper

### **Death in Blackwater Canyon**

[www.nrfirescience.org/resource/11494](http://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...

Author(s): Erle Kauffman

Year Published: 1937

Type: Document

Book or Chapter or Journal Article

### **Meteorological conditions affecting the Freeman Lake (Idaho) Fire**

[www.nrfirescience.org/resource/8305](http://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.

Author(s): George M. Jemison

Year Published: 1932

Type: Document

Book or Chapter or Journal Article

### **Meteorological factors in the Quartz Creek forest fire**

[www.nrfirescience.org/resource/8304](http://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...

Author(s): Harry T. Gisborne

Year Published: 1927

Type: Document

Book or Chapter or Journal Article

### **Beyond the stability index: fire management and forecasting tools for air quality, weather and climate impacts of prescribed fires**

[www.nrfirescience.org/resource/13063](http://www.nrfirescience.org/resource/13063)

This webinar introduced and described forecasting tools for air quality, weather and climate impacts of prescribed fires.

Type: Media

Webinar

### **Predicting Burn Severity Patterns in Yosemite National Park and the Douglas Complex Fires in Oregon**

[www.nrfirescience.org/resource/15798](http://www.nrfirescience.org/resource/15798)

Mountainous topography creates fine-scale environmental mosaics that vary in precipitation, temperature, insolation, and slope position. This mosaic in turn influences fuel accumulation, moisture, and forest structure that in turn influence patterns of burn severity. We studied the effects of varying environmental conditions on burn...

Type: Media

Seminar

### **Critical fire weather patterns - Western United States**

[www.nrfirescience.org/resource/12820](http://www.nrfirescience.org/resource/12820)

In this webinar, presented on February 11, 2015, Paul Werth, a fire weather meteorologist with Weather Research and Consulting Services, LLC, provides a discussion of weather elements that promote extreme fire behavior, regional critical fire weather patterns, and forecast products that are useful in determining areas at risk for...

Type: Media

Webinar



## **Climate, Megafires, and Conservation Financing**

[www.nrfirescience.org/resource/16356](http://www.nrfirescience.org/resource/16356)

Join us in a discussion on how climatic changes can influence wildland fire activity across the globe and how these critical fire weather variables have changed over the last 40 years. These changes in key weather variables have combined to both lengthen the fire season and increase the fire weather severity within the fire season....

Type: Media

Webinar

## **Fire Modeling in the Wildland Fire Decision Support System - WFDSS**

[www.nrfirescience.org/resource/59](http://www.nrfirescience.org/resource/59)

Mediasite video presentation given by Sam Amato, (National Fire Decision Support Center) at the 2011 Southwest Interagency Fuels Workshop, Flagstaff, AZ on March 10, 2011. The Wildland Fire Decision Support System (WFDSS) model uses different fire models to provide landscape scale fire modeling. This presentation defines the model...

Type: Media

Video

## **Fires of 2000 overview: a fire manager perspective**

[www.nrfirescience.org/resource/13311](http://www.nrfirescience.org/resource/13311)

In this video, Jacquie Parks, Fire and Fuels Management Specialist with the Bitterroot National Forest, describes fire management challenges during the Bitterroot fires of 2000. This was filmed at the Bitterroot National Forest headquarters in Hamilton, MT, which was one of the stops during the Fires of 2000 field trip that was part...

Type: Media

Video

## **Burn boss stories**

[www.nrfirescience.org/resource/14148](http://www.nrfirescience.org/resource/14148)

Veteran burn bosses share their stories and firsthand insights.

Type: Media

Video

## **Fuel particle heat exchange**

[www.nrfirescience.org/resource/14336](http://www.nrfirescience.org/resource/14336)

This seminar was recorded by the RMRS Fire Sciences Laboratory.

Type: Media

Seminar

## **Development of a Fully Integrated Meteorological/Fire Behavior/Smoke Modeling**

[www.nrfirescience.org/resource/15793](http://www.nrfirescience.org/resource/15793)

An modeling/science team of the US Forest Service Washington Office, Rocky Mountain Research Station, and Pacific Northwest Research Station is conducting a proof-of-concept study integrating meteorological, fire behavior, fuels, and air quality models to improve the accuracy of smoke model dispersion forecasts. The atmospheric...

Type: Media

Seminar

## **The Story Behind the Yellowstone Fires of 198: retro Report**

[www.nrfirescience.org/resource/16084](http://www.nrfirescience.org/resource/16084)

This 11 minute video covers the lessons learned from the summer of 1988 when fires burned nearly one third of Yellowstone National Park. The 1988 fire continue to shape the way we fight wildfires raging across the West today.

Type: Media

Video

### **Introduction to the Canadian Forest Fire Weather Index System**

[www.nrfirescience.org/resource/14134](http://www.nrfirescience.org/resource/14134)

This video provides an introduction to the Canadian Forest Fire Weather Index System.

Type: Media

Video

### **Energy transport in fires and how it relates to firefighter safety zones**

[www.nrfirescience.org/resource/14334](http://www.nrfirescience.org/resource/14334)

All wildland firefighters are required to identify a location to which they can retreat in the event that fire conditions threaten their safety. These areas termed safety zones. However it was not until the work by Butler and Cohen in 1995 that any quantitative information existed for actually gauging the...

Type: Media

Webinar

### **The structure of fire size distributions: a broad view of interacting gradients in wilderness management, spatial climate, and topography in three western regions**

[www.nrfirescience.org/resource/12813](http://www.nrfirescience.org/resource/12813)

Determining the effects of land management on fire regime characteristics is complicated by the interaction of several factors that vary in space and time. First, fire size and frequency are linked to climate conditions, including drought, as well as wind and temperature that define weather conditions during burning. Second,...

Type: Media

Webinar

### **Evaluating the Swiss SNOWPACK modeling system across the Northern Rocky Mountains**

[www.nrfirescience.org/resource/15791](http://www.nrfirescience.org/resource/15791)

Since late 2015, a one dimensional model of snow pack structure, know as SNOWPACK, has been evaluated by the National Weather Service at Missoula, in collaboration with Montana State University. The model is driven by point-based output from a high-resolution numerical model (WRF-ARW).Hourly forecasts of incoming radiation,...

Type: Media

Seminar

### **Wildland Urban Interface Fires: An Overview for Homeowners**

[www.nrfirescience.org/resource/16067](http://www.nrfirescience.org/resource/16067)

This 58 minute video covers what the wildland-urban interface is and what the public and firefighters need to know about fighting fire in it.

Type: Media

Video

### **Influence of buoyant dynamics on wildfire spread**

[www.nrfirescience.org/resource/13251](http://www.nrfirescience.org/resource/13251)

Technology has improved our utilization of existing fire models but has contributed little to advancing knowledge of fire spread. The knowledge of physical processes, and their organization in producing fire spread, is essential to reliably modeling wildland fire behaviors beyond current capabilities (crown fire, thresholds etc.)....

Type: Media

Webinar

### **Close call - What you can learn from the Ahorn fire shelter deployment**

[www.nrfirescience.org/resource/14120](http://www.nrfirescience.org/resource/14120)

A look at the "close call" firefighter shelter deployment that occurred on the Ahorn Fire—focusing on key lessons and effective practices to be learned from this incident. This video from the Wildland Fire Lessons Learned Center.

Type: Media

Video

### **American burning: the Yarnell Hill fire tragedy and the nation's wildfire crisis**

[www.nrfirescience.org/resource/14305](http://www.nrfirescience.org/resource/14305)

On June 30, 2013, 19 firefighters from the Granite Mountain Hotshots were killed battling a wildfire near Yarnell, Arizona. Huge questions remain about the last moments of their lives. Why did they move out of a safe area in their final minutes of life? Why did the fire move so quickly? Could their deaths have been prevented? The...

Type: Media

Video

### **Computer models for wildland and wildland-urban interface fires**

[www.nrfirescience.org/resource/13808](http://www.nrfirescience.org/resource/13808)

Hosted by the Northwest Fire Science Consortium. Ruddy Mell from the USFS Pacific Wildland Fire Sciences Lab in Seattle, WA provides an overview of the current state, limitations, and future developments in wildland and wildland-urban interface fire behavior models.

Type: Media

Webinar

### **The New Generation Fire Shelter**

[www.nrfirescience.org/resource/16010](http://www.nrfirescience.org/resource/16010)

The New Generation Fire Shelter - National Wildfire Coordinating Group 2003 - NFES 2712 The new generation fire shelter offers improved protection from radiant and convective heat. All federal, state, and local wildland firefighters carry the fire shelter while working federal fires. As always, the fire shelter should be used only...

Type: Media

Video

### **Assessing the drivers of 'spring dip' in foliar moisture content and their potential impact on forest fire behavior**

[www.nrfirescience.org/resource/13248](http://www.nrfirescience.org/resource/13248)

This webinar discussed the following - 1) Foliar moisture content changes are driven by changes in density, 2) Density changes are primarily due to an increase in starch, 3) Starch content may be the missing link in the increased flammability during the Spring Dip, 4) Density or LFM can be measured throughout the...

Type: Media

Webinar

### **How effective were fuel treatments in the 2011 Wallow fire?**

[www.nrfirescience.org/resource/14301](http://www.nrfirescience.org/resource/14301)

This webinar presents results of an opportunistic study to quantify the performance of thinning and surface fuel treatment in migrating wildfire behavior and severity, as represented by bole char, crown scorch proportion, tree burn severity index, on the largest wildfire in southwest USA history: 2011 Wallow fire. The results...

Type: Media

Webinar

### **BehavePlus Updates and Changes**

[www.nrfirescience.org/resource/17779](http://www.nrfirescience.org/resource/17779)

In this 38 minute webinar, Faith Ann briefly describes major changes from version 5 to version 6; shows sample Runs demonstrating these changes; provides suggestions for calculating surface fire behavior using BehavePlus v6; describes how changes in BehavePlus affect NWCG courses that use this program (e.g., S-490; RX-301/341); and...

Type: Media

Webinar

### **Spot fires**

[www.nrfirescience.org/resource/12940](http://www.nrfirescience.org/resource/12940)

Brian Potter, a research meteorologist with the USDA Forest Service, presented a summary of the state of science behind spot fires. Spotting is one characteristic of "extreme fire behavior," capable of short range acceleration of fires as well as producing long-distance spot fires that complicate management efforts. The...

Type: Media

Webinar

### **BehavePlus Fire Modeling System**

[www.nrfirescience.org/resource/16640](http://www.nrfirescience.org/resource/16640)

The BehavePlus fire modeling system is managed by the U.S. Forest Service, Rocky Mountain Research Station, Fire, Fuel, and Smoke Science Program (FFS) in Missoula, Montana. In 2014, information on BehavePlus was transferred from [www.FireModels.org](http://www.FireModels.org) to this web location. If you are looking for information on FlamMap, FARSITE, or...

Type: Website

Website

### **Part 3. Wildland fire, smoke & roadway visibility series: Planned Burn (PB) Piedmont Web Tool - Estimating Superfog potential from Smoldering Combustion**

[www.nrfirescience.org/resource/15297](http://www.nrfirescience.org/resource/15297)

In Part 3 of the Wildland Fire Smoke and Roadway Visibility Webinar Series, Matthew Fearon, research meteorologist for the Desert Research Institute, presented on the PB-Piedmont Web Tool, Super-Fog Potential, and Estimated Smoldering Potential - all with a focus on moving science to a usable tool for managers and others.

Type: Media

Webinar

### **Comparison of sling psychrometer to digital weather meters**

[www.nrfirescience.org/resource/13774](http://www.nrfirescience.org/resource/13774)

Belt weather kits for recording of weather information have been in use since 1959. The use of a sling psychrometer from these kits is standard practice for the recording of dry and wet bulb temperatures to calculate relative humidity. Electronic based meters for recording weather information could replace belt...

Type: Media

Webinar

### **The evolving role of the IMET and their interaction with other intelligence folks**

[www.nrfirescience.org/resource/17086](http://www.nrfirescience.org/resource/17086)

This presentation is the second video available for a webinar entitled "Fire Season 2016 Hot Topics." As the fire community aspires to promote firefighter safety and best practices, this webinar strived to share information regarding lessons learned from the 2016 wildfire season. Every fire season there are parts of the country that...

Type: Media

Video

### **Look Up, Look Down, Look Around**

[www.nrfirescience.org/resource/15995](http://www.nrfirescience.org/resource/15995)

Look Up, Look Down, Look Around is a fire environment factors and fire behavior training video, released in 1993. It was assigned NFES #2244, and PMS #427. It contains several chapters on fuel characteristics that are important to fire behavior.

Type: Media

Video

### **Mega fire project PNW**

[www.nrfirescience.org/resource/13243](http://www.nrfirescience.org/resource/13243)

Haiganoush Preisler talks about her work modeling very large fires over very large areas. She is a research scientist and statistician with the USFS PSW Research Station and lead author on the attached paper. You can find out more about her work at: <http://www.wfas.net/index.php/large-fire-potential-and-fire-potential-indexes-...>

Type: Media

Webinar

### **Vegetation, fuel, and potential fire dynamics years after Montana's Fire and Fire Surrogate Study**

[www.nrfirescience.org/resource/17602](http://www.nrfirescience.org/resource/17602)

This seminar is part of the Missoula Fire Sciences Laboratory 2018 Seminar Series.

Type: Media

Seminar

### **Wildland Fire Assessment Tool**

[www.nrfirescience.org/resource/14297](http://www.nrfirescience.org/resource/14297)

WFAT provides an interface between ArcMap, FlamMap 5, and the First Order Fire Effects Model (FOFEM), combining their strengths into a spatial fire behavior and fire effects analysis tool in GIS. In the webinar, you will learn how to use WFAT to locate potential fuel treatment units, develop a prescription for those units, and...

Type: Media

Webinar

## **Near Real-time Wildfire Simulation Using Spark Big Data Platform**

[www.nrfirescience.org/resource/17777](http://www.nrfirescience.org/resource/17777)

There has been a lack of tools and platforms for real-time prediction of wildfire movement and risk. Commonly used models do not address the dynamic nature of an area's current meteorological conditions such as the wind, humidity, and precipitation when determining the direction and speed of fire propagation. Near-real time...

Type: Media

Seminar

## **Weather forecast verification for fire behavior predictions**

[www.nrfirescience.org/resource/12876](http://www.nrfirescience.org/resource/12876)

Interpret results from a verification study of the NDFD grids from the local Missoula Weather Forecast Office and the implications for fire behavior forecasts that use NDFD data. Afternoon temperature, minimum humidity, and winds are investigated specifically, and the effects on a fire behavior forecast are evaluated with BehavePlus...

Type: Media

Webinar

## **Part 1. Wildland fire, smoke & roadway visibility series: Superfog: how it forms, where it forms, where it goes, what to do**

[www.nrfirescience.org/resource/15293](http://www.nrfirescience.org/resource/15293)

In Part 1 of the Wildland Fire Smoke and Roadway Visibility Webinar Series, Gary Achtemeier, former research meteorologist for the USFS Southern Research Station, presented information on the following topics: • What is Superfog and how it forms on your burn site • How common is Superfog on burn sites • Superfog weather:...

Type: Media

Webinar

## **Presentation 2: Finny versus Scott and Reinhardt crown fire methods in FSPPro. (applicable to other fire spread models)**

[www.nrfirescience.org/resource/17081](http://www.nrfirescience.org/resource/17081)

This presentation contains the four powerpoint presentations comprising a webinar entitled "Sharing Fire Behavior Practices & Lessons Learned: Fire Season 2015". As the fire behavior community aspires to promote best practices amongst a range of fire behavior experience, this webinar strives to share information regarding...

Type: Media

Webinar

## **Modeling Dynamic Fuels with an Index System: MoD-FIS in the Great Basin and Southwest U.S.**

[www.nrfirescience.org/resource/15947](http://www.nrfirescience.org/resource/15947)

This webinar is co-hosted by LANDFIRE and members of the Joint Fire Science Program: Great Basin Fire Science Exchange, Southwest Fire Science Consortium, and the Northern Rockies Fire Science Network. Content will address challenges that managers of large landscapes deal with in these regions. The LANDFIRE Program strives to...

Type: Media

Webinar

## **Demonstration of Canadian fire behavior calculator REDApp**

[www.nrfirescience.org/resource/13238](http://www.nrfirescience.org/resource/13238)

REDapp is a universal fire behavior calculator developed with financial support from the Canadian

Interagency Forest Fire Centre (CIFFC), and in-kind support from fire management agencies across Canada. This application is currently in a beta stage of development, with public release expected in early 2015. Unlike WFDSS, Behave,...

Type: Media

Webinar

### **Fire behavior in the wildland/urban interface**

[www.nrfirescience.org/resource/14009](http://www.nrfirescience.org/resource/14009)

The National Wildland/Urban Interface Fire Protection Program ([www.firewise.org](http://www.firewise.org)) Firefighter Safety Series FWC-602-03-DVD. Part 1: Fire Behavior in the Wildland/Urban Interface. The Fire Fighter Safety Series is a multipart instructional package developed for small community fire departments to address the...

Type: Media

Video

### **Introduction to FlamMap5**

[www.nrfirescience.org/resource/12850](http://www.nrfirescience.org/resource/12850)

FlamMap is a fire behavior mapping and analysis program that computes potential fire behavior characteristics (spread rate, flame length, fireline intensity, etc.) over an entire FARSITE landscape for constant weather and fuel moisture conditions. Since 2006 FlamMap3 has been widely used by the U.S. Forest Service, National Park...

Type: Media

Webinar

### **Fundamental research on how wildfires spread**

[www.nrfirescience.org/resource/15228](http://www.nrfirescience.org/resource/15228)

About half of the Forest Service budget is spent on fire suppression, yet we still can't explain exactly how wildland fires spread. In order to make more informed decisions and improve fire fighter safety, a new research program at the Missoula Fire Lab is going back to the basics. This webinar with Sara McAllister discusses the...

Type: Media

Webinar

### **Burn Severity: Where, Why and So What?**

[www.nrfirescience.org/resource/15805](http://www.nrfirescience.org/resource/15805)

Do large fire "runs" consistently result in high severity fires? What are the trends in proportion burned severely? Do climate, vegetation and topography influence burn severity in the same way that they affect area burned? How do severe fire disturbances influence vegetation response? I draw on recent and ongoing work to...

Type: Media

Seminar

### **Fuels and fire behavior data collected on wildland fires by the fire behavior assessment team**

[www.nrfirescience.org/resource/12833](http://www.nrfirescience.org/resource/12833)

Fire behavior and effects models are frequently used to inform fire and land management decisions despite a lack of testing against field measurements. The Adaptive Management Services Enterprise Team (AMSET, USFS) coordinates a module focused on the collection of pre- and post-fire fuels and fire behavior data during wildland fires...

Type: Media



Webinar

### **Latest research on estimating safety zones**

[www.nrfirescience.org/resource/13343](http://www.nrfirescience.org/resource/13343)

Bret Butler, of the Fire Lab in Missoula, addresses the problem stated in the IRPG, of how to calculate the increase in Safety Zone sizes when considering slope and wind. Currently, there is a beta version Safety Zone Calculator android app available for testing and feedback. Contact Bret Butler if interested at: [bwbutler@fs.fed...](mailto:bwbutler@fs.fed...)

Type: Media

Video

### **Understanding the spread of wildfire**

[www.nrfirescience.org/resource/13878](http://www.nrfirescience.org/resource/13878)

Rocky Mountain Research Station Research Mechanical Engineer Sara McAllister talks about and demonstrates her research on the understanding of fire ignition and the dynamics behind the spread of wildfire.

Type: Media

Video

### **Fire and Lightning from Space: Using the new GOES-16 Satellite for Fire and Total Lightning Detection**

[www.nrfirescience.org/resource/15802](http://www.nrfirescience.org/resource/15802)

GOES-16 is NOAA's latest earth-observing geostationary satellite, launched Nov 19, 2016. The GOES-16 platform hosts many improved earth-and sun-looking instruments, of which the Advanced Baseline Imager (ABI) and the Geostationary Lightning Mapper (GLM) are the primary earth-pointing instruments. Both instruments take current...

Type: Media

Seminar

### **Effects of complex terrain on extreme fire behavior**

[www.nrfirescience.org/resource/12822](http://www.nrfirescience.org/resource/12822)

This webinar, presented on January 27, 2015 by Craig Clements and Neil Lareau from the Fire Weather Research Laboratory at San Jose State University, provides a discussion of wind systems in mountainous terrain, modeling fire behavior on slopes, and wind modeling tools.

Type: Media

Webinar

### **A research model of flame spread**

[www.nrfirescience.org/resource/14342](http://www.nrfirescience.org/resource/14342)

Current operational models of fire spread rely on several constraining assumptions that would ideally be relaxed. A promising method to do this is to develop a more physically based model rather than the mostly empirical basis for the current models. This seminar gives a preliminary look at one such model in...

Type: Media

Seminar

### **Post-outbreak fire risk and behavior: mountain pine beetle influences on fuel characteristics and fire behavior**

[www.nrfirescience.org/resource/13033](http://www.nrfirescience.org/resource/13033)

This study attempts to understand how the Mountain Pine Beetle affects various fuels and how those

various fuel changes actually affect fire behavior. This webinar was hosted by the Southern Rockies Fire Science Network, and was presented by Matt Jolly.

Type: Media

Webinar

### **Temporal Dynamics of Wildfire Risk Assessments: Assessing tradeoffs and asking the hard questions**

[www.nrfirescience.org/resource/15794](http://www.nrfirescience.org/resource/15794)

Recent advances in integrating wildfire planning and strategic wildfire response can create more tangible fire outcomes that are better aligned the national cohesive strategy goals of living sustainably with wildfire. By integrating both in-situ and transboundary wildfire risk assessments with potential operations delineations, we...

Type: Media

Seminar

### **Provision of science-based information and technology in support of the Canadian wildland fire strategy**

[www.nrfirescience.org/resource/14137](http://www.nrfirescience.org/resource/14137)

erry Anderson of the Canadian Forest Service, begins this presentation on the current fire research in Canada. The Canadian Forest Service provides national monitoring, model and software development, mapping, and decision support systems, but is not in the business of fire suppression, since natural resources are owned by the...

Type: Media

Video

### **National and global fire danger rating systems: development, applications, and improvements**

[www.nrfirescience.org/resource/14335](http://www.nrfirescience.org/resource/14335)

Wildland fire potential is best described as a combination of available fuels, suitable weather conditions and sources of ignitions and weather is the most spatially and temporally variable of these three components. Weather variables such as temperature, relative humidity, precipitation and wind speed...

Type: Media

Webinar

### **Fire columns and plume dynamics**

[www.nrfirescience.org/resource/12819](http://www.nrfirescience.org/resource/12819)

Brian Potter, a research meteorologist with the USDA Forest Service, presented a webinar on February 26, 2015 regarding the state of science with respect to the airflow associated with fire convection plumes. This includes the concepts of plume dominated fires, adverse wind profiles, the role of atmospheric stability in fire...

Type: Media

Webinar

### **Complex Patterns of the Lolo Peak Fire from Carlton Ridge to Bass Creek**

[www.nrfirescience.org/resource/15792](http://www.nrfirescience.org/resource/15792)

The recent Lolo Peak Fire and associated burnouts and backburns resulted in both expected and unexpected burn patterns related to differences in forest structure, topography, and weather. It also illustrates the "perfect storm" of stifling constraints the Forest Service faces in attempting to implement ecologically-based management...

Type: Media

Seminar

### **Wildland Urban Interface Fires: An Overview for Responders**

[www.nrfirescience.org/resource/16068](http://www.nrfirescience.org/resource/16068)

This 58 minute video is produced for fire responders to improve knowledge and safety when fighting fires in the wildland-urban interface

Type: Media

Video

### **WFDSS modeling and weather**

[www.nrfirescience.org/resource/14131](http://www.nrfirescience.org/resource/14131)

This webinar was facilitated by Tom St. Clair, Fairbanks, Alaska, and focused on WFDSS modeling and weather. The agenda items covered included: how to pick RAWs to get the best data for wind and fuels, using predicted weather, ERC classes tab in WFDSS, ERC streams tab in WFDSS, winds tab in WFDSS, dealing with weather forecast...

Type: Media

Webinar

### **The ability of wildfire to act as a fuel treatment**

[www.nrfirescience.org/resource/12802](http://www.nrfirescience.org/resource/12802)

This webinar highlighted results from a study investigating the ability of wildfire to act as a fuel treatment. The study evaluated whether or not wildfires limited the occurrence, size, and severity of subsequent wildfires in four large wilderness complexes in Idaho, Montana, and New Mexico. The study focused on protected areas to...

Type: Media

Webinar

### **Learning From The Experts: Margit Bucher - Another Pair of Eyes**

[www.nrfirescience.org/resource/16040](http://www.nrfirescience.org/resource/16040)

In this 9 minute video, Margit Bucher explains how she uses her crew as another pair of eyes and the importance of double checking assumptions that you are working on within the burn plan. The goal of the Learning from the Experts video series is to speed up individual and organizational learning. Project personnel have...

Type: Media

Video

### **STANDFIRE: a prototype 3-D fuels and fire modeling platform for fuel treatment analysis**

[www.nrfirescience.org/resource/14872](http://www.nrfirescience.org/resource/14872)

Across the country, hundreds of millions of dollars have been spent, and tens of millions of acres of fuels have been treated with the intention of altering fire behavior, either to mitigate threats to firefighters and communities, or to maintain or restore healthy ecosystems. While some case studies have shown...

Type: Media

Webinar

### **A new look at the seasonal dynamics of live fuel physio-chemistry and their potential influence on wildland fire behavior**

[www.nrfirescience.org/resource/13250](http://www.nrfirescience.org/resource/13250)

Wildland fires spread through combinations of living and dead vegetation and the largest fires generally occur in fuels that are dominated by living plants. While much is known about the factors that regulate

fire spread through dead fuels, the controlling factors of live fuel flammability have proven elusive. Here we present an...

Type: Media

Webinar

### **Lessons from the Woodview fire burnover**

[www.nrfirescience.org/resource/14118](http://www.nrfirescience.org/resource/14118)

This video examines a near miss that occurred when inadequate planning and communication put an initial attack crew in the middle of a crowning fire without a viable escape route.

Type: Media

Video

### **Past meets the present: using old burns in fire management**

[www.nrfirescience.org/resource/14303](http://www.nrfirescience.org/resource/14303)

Over the past two decades the size of wildfires has dramatically increased across the Southwest. These large burned areas have become so common that newer wildfires are burning into and around them. Fire managers increasingly use these previous burns as treatments that either stop or slow fire spread. The interaction of past and...

Type: Media

Video

### **Introduction to the 2017 Prescribed Fire Complexity Rating System Guide and Worksheets**

[www.nrfirescience.org/resource/17780](http://www.nrfirescience.org/resource/17780)

This 45 minute webinar covers significant changes made to the 2017 Prescribed Fire Complexity Rating System Guide (PMS 424).

Type: Media

Webinar

### **A day in the life of a fire behavior analyst**

[www.nrfirescience.org/resource/12944](http://www.nrfirescience.org/resource/12944)

Ever wish you could be out on the ground watching how fire behaves over the terrain, in different fuels with effects from weather, then use that experience to try and replicate what you saw and predict what will happen tomorrow? Well the Fire Behavior Analyst job is for you. Learn what it's like to be able to watch Mother Nature at...

Type: Media

Webinar

### **Elements of the National Weather Service fire weather forecast**

[www.nrfirescience.org/resource/13247](http://www.nrfirescience.org/resource/13247)

Casey Sullivan provides an overview of the National Weather Service fire weather forecast program and discusses elements of the fire weather forecast available to any fire practitioner. The hourly weather graph and definitions of surface winds were emphasized.

Type: Media

Webinar

### **Lodgepole pine ecology & fire behavior**

[www.nrfirescience.org/resource/14098](http://www.nrfirescience.org/resource/14098)

This webinar was not recorded. Media link below is to a pdf of the webinar slide show. This presentation covers the following points: 1) Surprises/Lessons from the 1988 fires in Yellowstone

National Park; 2) Resistance to an aggressive invasive species in post-fire lodgepole pine forests; 3) Interactions of mountain pine...

Type: Media

Webinar

### **A deadly beauty: the danger of fire whirls**

[www.nrfirescience.org/resource/14300](http://www.nrfirescience.org/resource/14300)

A 22-minute video about the dangers of fire whirls.

Type: Media

Video

### **The US National Fire Danger Rating System: Past, Present and Future**

[www.nrfirescience.org/resource/17778](http://www.nrfirescience.org/resource/17778)

This one hour webinar explores the US National Fire Danger Rating System, history and updates, that is in use today.

Type: Media

Webinar

### **Part 2. Wildland fire, smoke & roadway visibility series: Weather information and tools available to stay ahead of superfog events**

[www.nrfirescience.org/resource/15295](http://www.nrfirescience.org/resource/15295)

In Part 2 of the Wildland Fire Smoke and Roadway Visibility Webinar Series, Gary Curcio, former Fire Environment Branch Head NC Forest Service, presented information on the following topics: •

Obtaining and tracking key environmental variables • Reviewing operationally developed indexes (Turner Stability Index (TS),...

Type: Media

Webinar

### **Burning rate of porous fuel beds with and without wind**

[www.nrfirescience.org/resource/13770](http://www.nrfirescience.org/resource/13770)

This webinar was presented as part of the 2015-2016 RMRS Fire Sciences Laboratory's weekly seminar series.

Type: Media

Seminar

### **Using IRAWS observations and alternative NWS point forecasts in Near Term Fire**

[www.nrfirescience.org/resource/17084](http://www.nrfirescience.org/resource/17084)

Cary Newman is the Fire Planner for the San Juan National Forest in southern Colorado. Cary is a Long Term Fire Analyst who used some different methodologies for modeling fire behavior on the Soberanes Fire in California this season. Working with geospatial fire behavior models for more than a decade he has learned that in spite of...

Type: Media

Video

### **Introduction to remote sensing for wildfire applications: terrain data applications**

[www.nrfirescience.org/resource/13242](http://www.nrfirescience.org/resource/13242)

The fifth webinar in this series covered data access, tools, and recent terrain data releases.

Type: Media

Webinar

### **Synthesis of knowledge of extreme fire behavior for fire managers**

[www.nrfirescience.org/resource/14287](http://www.nrfirescience.org/resource/14287)

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 convection column. This webinar will summarize the recent JFSP...

Type: Media

Webinar

### **Introduction to WFDSS - air quality tools**

[www.nrfirescience.org/resource/12865](http://www.nrfirescience.org/resource/12865)

Introduction to WFDSS - Air Quality Tools Smoke management is an important aspect of managing wildland fire. While mitigating smoke impacts from prescribed burns is important, smoke from large wildfire complexes (such as the AZ/NM fires in 2011) can expose millions of people to significant smoke, with hundreds of thousands living in...

Type: Media

Webinar

### **A topographically resolved wildfire danger and drought monitoring system for the conterminous United States**

[www.nrfirescience.org/resource/15242](http://www.nrfirescience.org/resource/15242)

Patterns of energy and available moisture vary over small distances in mountainous regions and available climate data are too coarse to resolve these terrain-mediated effects. This seminar focused on efforts to improve the physical template we use to analyze vegetation patterns and post-fire ecological effects, including what has...

Type: Media

Seminar

### **Presentation 1: Analyst considerations in Alaska (concepts applicable to the lower 48)**

[www.nrfirescience.org/resource/17080](http://www.nrfirescience.org/resource/17080)

This presentation is the first of two within a webinar entitled "Sharing Fire Behavior Practices & Lessons Learned: Fire Season 2015". As the fire behavior community aspires to promote best practices amongst a range of fire behavior experience, this webinar strives to share information regarding lessons learned from fire...

Type: Media

Webinar

### **An Assessment of Temperature and RH from a Variety of Weather Meters**

[www.nrfirescience.org/resource/15934](http://www.nrfirescience.org/resource/15934)

Do you use belt weather kits or electronic handheld weather meters for measuring temperature and relative humidity in the field? Which device do you trust? Belt weather kits for obtaining weather information on prescribed fires and wildfires have been in use since the 1960's and the use of sling psychrometers from these kits has...

Type: Media

Webinar

### **The fire lab**

[www.nrfirescience.org/resource/14664](http://www.nrfirescience.org/resource/14664)

Massive wildfires cost billions of dollars and burn millions of acres in the U.S. every year, but we know surprisingly little about the basic science of how they spread. At the Fire Lab in Missoula, Montana, researchers reverse-engineer spreading fires using wind tunnels, fire-whirl generators, and giant combustion chambers. They're...

Type: Media

Video

### **Vortices and wildland fire**

[www.nrfirescience.org/resource/13222](http://www.nrfirescience.org/resource/13222)

Scott Goodrick, a research meteorologist with the USDA Forest Service, and Jason Forthofer, a mechanical engineer with the USDA Forest Service, present a summary of vortices and wildland fire. Vortices are almost always present in the wildland fire environment and can sometimes interact with the fire in unpredictable ways, causing...

Type: Media

Webinar

### **Predicting local smoke dispersion during low-intensity wildland fires in forested environments**

[www.nrfirescience.org/resource/12835](http://www.nrfirescience.org/resource/12835)

Smoke generated from low-intensity prescribed fires used for fuels management can have an adverse impact on local air quality, raising human health and safety concerns especially in wildland-urban-interface areas. Local smoke behavior is a complex process and is highly dependent on local ambient atmospheric conditions (e.g....

Type: Media

Webinar

### **Transitioning from a small fire: fire behavior driving episodic fire growth after 1988 in Yellowstone National Park**

[www.nrfirescience.org/resource/15154](http://www.nrfirescience.org/resource/15154)

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

Type: Media

Webinar

### **Rapidly-updating numerical weather prediction for fire weather situational awareness and forecasting: The High-Resolution Rapid Refresh model**

[www.nrfirescience.org/resource/15804](http://www.nrfirescience.org/resource/15804)

The 3-km High-Resolution Rapid Refresh (HRRR) numerical weather prediction model, developed at the NOAA Earth System Research Laboratory and operational since September 2014, is a tool for situational weather awareness and short-range forecasting for a variety of end-user applications, ranging from severe weather prediction to...

Type: Media

Seminar

### **A dynamic, severe fire weather potential mobile mapping program**

[www.nrfirescience.org/resource/14536](http://www.nrfirescience.org/resource/14536)

Goal of this tool is to provide spatial, dynamic fire danger and fire behavior assessment tools so that firefighters can abide by the Standard Fire Orders 1 and 3: "Keep informed of fire weather conditions and forecasts" and "Base all action on current and expected fire behavior".



Type: Media

Video

### **The how, what, and where of safety zones: recent findings**

[www.nrfirescience.org/resource/12823](http://www.nrfirescience.org/resource/12823)

Bret Butler presented a webinar on December 2, 2014. Current safety zone guidelines for wildland firefighters are based on the assumption of flat ground, no wind, and radiative heating only. Recent measurements in grass, shrub and crown fires indicate that convective heating can be significant especially when wind or slope are...

Type: Media

Webinar

### **A summary of fire season 2016 in Oregon and Washington**

[www.nrfirescience.org/resource/15112](http://www.nrfirescience.org/resource/15112)

John Saltenberger, Meteorologist with the US Fish and Wildlife Service, presented A Summary of Fire Season 2016 in OR and WA. This webinar was hosted by the NW Fire Science Consortium.

Type: Media

Webinar

### **Fire.org**

[www.nrfirescience.org/resource/114](http://www.nrfirescience.org/resource/114)

Fire.org is the home page of Systems for Environmental Management, a Montana nonprofit research and educational corporation. For over 29 years we've specialized in issues concerning wildland fire planning, behavior, fuel, weather, and effects. Here we post many of the publications and software packages we've developed in cooperation...

Type: Website

Website

### **Lessons from the behavior of the 2002 Hayman fire**

[www.nrfirescience.org/resource/14187](http://www.nrfirescience.org/resource/14187)

Mark Finney, Research Forester, US Forest Service, Rocky Mountain Research Station, presents an overview fire behavior during the Hayman Fire at the Hayman Fire Science Symposium: Lessons Learned After Ten Years of Recovery, Rehabilitation, & Restoration on June 21, 2012.

Type: Media

Video