Global fire season severity analysis and forecasting
www.nrfirescience.org/resource/20694
Fire activity has a huge impact on human lives. Different models have been proposed to predict fire activity, which can be classified into global and regional ones. Global fire models focus on longer timescale simulations and can be very complex. Regional fire models concentrate on seasonal forecasting but usually require inputs...
Author(s): Leonardo N. Ferreira, Didier A. Vega-Oliveros, Liang Zhao, Manoel F. Cardoso, Elbert E.N. Macau
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

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

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

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

The Vegetation Structure Perpendicular Index (VSPI): A forest condition index for wildfire predictions
www.nrfirescience.org/resource/19494
Wildfires are a major natural hazard, causing substantial damage to infrastructure as well as being a risk to lives and homes. An understanding of their progression and behaviour is necessary to reduce risks and to develop operational management strategies in the event of an active fire. Many empirical fire-spread models have been...

Pre-fire drought and competition mediate post-fire conifer mortality in western U.S. National Parks
www.nrfirescience.org/resource/18275
Tree mortality is an important outcome of many forest fires. Extensive tree injuries from fire may lead directly to mortality, but environmental and biological stressors may also contribute to tree death. However, there is little evidence showing how the combined effects of two common stressors, drought and competition, influence...

Some Requirements for Simulating Wildland Fire Behavior Using Insight from Coupled Weather—Wildland Fire Models
www.nrfirescience.org/resource/17610
A newer generation of models that interactively couple the atmosphere with fire behavior have shown an increased potential to understand and predict complex, rapidly changing fire behavior. This is possible if they capture intricate, time-varying microscale airflows in mountainous terrain and fire-atmosphere feedbacks. However, this...

An improved non-equilibrium model for the ignition of living fuel
www.nrfirescience.org/resource/17342
This paper deals with the modelling of living fuel ignition, suggesting that an accurate description using a multiphase formulation requires consideration of a thermal disequilibrium within the vegetation particle, between the solid (wood) and the liquid (sap). A simple model at particle scale is studied to evaluate the flux...

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

The Rothermel surface fire spread model and associated developments: A comprehensive explanation
www.nrfirescience.org/resource/17537
The Rothermel surface fire spread model, with some adjustments by Frank A. Albini in 1976, has been used in fire and fuels management systems since 1972. It is generally used with other models including fireline intensity and flame length. Fuel models are often used to define fuel input parameters. Dynamic fuel models use equations...
Author(s): Patricia L. Andrews
Year Published: 2018
Type: Document
Technical Report or White Paper

Interactions between large high-severity fires and salvage logging on a short return interval reduce the regrowth of fire-prone serotinous forests
www.nrfirescience.org/resource/17175
New fire disturbance regimes under accelerating global environmental change can have unprecedented consequences for ecosystem resilience, lessening ecosystem natural regeneration. In the Mediterranean Basin, firedependent obligate seeder forests that are prone to increasingly frequent stand-replacing fires and then salvaged logged...
Author(s): Angela Taboada, Víctor Fernández-García, Elena Marcos, Leonor Calvo
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Qualitative flow visualization of flame attachment on slopes
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

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
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
An uncertainty analysis of wildfire modeling [Chapter 13]
www.nrfirescience.org/resource/14997
Before fire models can be understood, evaluated, and effectively applied to support decision making, model-based uncertainties must be analyzed. In this chapter, we identify and classify sources of uncertainty using an established analytical framework, and summarize results graphically in an uncertainty matrix. Our analysis...
Author(s): Karen L. Riley, Matthew P. Thompson
Year Published: 2017

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

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

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

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

Burning rates of wood cribs with implications for wildland fires
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

Predicting large wildfires across western North America by modeling seasonal variation in soil water balance
A lengthening of the fire season, coupled with higher temperatures, increases the probability of fires throughout much of western North America. Although regional variation in the frequency of fires is well established, attempts to predict the occurrence of fire at a spatial resolution <10 km² have generally been unsuccessful. We...

Author(s): Richard H. Waring, Nicholas C. Coops
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Autoignition of wood under combined convective and radiative heating
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

Weather, fuels, and topography impede wildland fire spread in western US landscapes
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...
The effect of wind on burning rate of wood cribs
www.nrfirescience.org/resource/14685
Wood cribs are often used as ignition sources for room fire tests. A wood crib may also apply to studies of burning rate in wildland fires, because wildland fuel beds are porous and three dimensional. A unique aspect of wildland fires is the ubiquitous presence of wind. However, very little is known about what effect the increased...

Experimental analysis of fire spread across a two-dimensional ridge under wind conditions
www.nrfirescience.org/resource/13382
Results from a laboratory-scale investigation of a fire spreading on the windward face of a triangular-section hill of variable shape with wind perpendicular to the ridgeline are reported. They confirm previous observations that the fire enlarges its lateral spread after reaching the ridgeline, entering the leeward face with a much...

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
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...

Deriving fundamental statistical shrub fuel models by laser scanning and combustion experimentation
www.nrfirescience.org/resource/15558
We exploited the measurement capacity of a terrestrial laser scanner to precisely characterize shrub fuel matrices in a laboratory setting, to abstract fuel elements for fire behavior modeling, and to identify strengths and limitations of TLS for these purposes. Simultaneously, we produced statistical distributions of combustion...
Impacts of mega-fires on large U.S. urban area air quality under changing climate and fuels
www.nrfirescience.org/resource/15569
Mega-fires can adversely impact air quality in the United States and the impacts are likely to become more serious in the future due to the possibility of more frequent and intense mega-fires in response to the projected climate change. This study investigated U.S. mega-fires and fuel conditions and their environmental impacts under...
Author(s): Yongqiang Liu, Scott L. Goodrick, John A. Stanturf, Hanqin Tian
Year Published: 2014
Type: Document
Technical Report or White Paper

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
Seasonal changes in the climatic potential for very large wildfires (VLWF > or = 50,000 ac ~20,234 ha) across the western contiguous United States are projected over the 21st century using generalized linear models and downscaled climate projections for two representative concentration pathways (RCPs). Significant (p < or =0....
Author(s): E. Natasha Stavros, John T. Abatzoglou, Donald McKenzie, Narasimhan K. Larkin
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Large wildfire trends in the western United States, 1984-2011
www.nrfirescience.org/resource/12971
We used a database capturing large wildfires (> 405 ha) in the western U.S. to document regional trends in fire occurrence, total fire area, fire size, and day of year of ignition for 1984-2011. Over the western U.S. and in a majority of ecoregions, we found significant, increasing trends in the number of large fires and/or total...
Author(s): Philip E. Dennison, Simon C. Brewer, James D. Arnold, Max A. Moritz
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Spectroscopic analysis of seasonal changes in live fuel moisture content and leaf dry mass
www.nrfirescience.org/resource/13001
Live fuel moisture content (LFMC), the ratio of water mass to dry mass contained in live plant material, is an important fuel property for determining fire danger and for modeling fire behavior. Remote sensing estimation of LFMC often relies on an assumption of changing water and stable dry mass over time. Fundamental understanding...
Author(s): Yi Qi, Philip E. Dennison, William Matt Jolly, Rachel C. Kropp, Simon C. Brewer
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Crown fire potential in lodgepole pine forests during the red stage of mountain pine beetle attack
www.nrfirescience.org/resource/12926
Mountain pine beetle (MPB) outbreaks within the previous 10-15 years have affected millions of hectares of lodgepole pine forests in western North America. Concerns about the influence of recent
tree mortality on changes in fire behaviour amongst firefighters and fire managers have led researchers
to attempt to quantify the effects...
Author(s): Wesley G. Page, Michael J. Jenkins, Martin E. Alexander
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

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

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

Models for predicting fuel consumption in sagebrush-dominated ecosystems
www.nrfirescience.org/resource/11978
Fuel consumption predictions are necessary to accurately estimate or model fire effects, including
pollutant emissions during wildland fires. Fuel and environmental measurements on a series of
operational prescribed fires were used to develop empirical models for predicting fuel consumption in
big sagebrush (Artemisia tridentata... 
Author(s): Clinton S. Wright
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Fuel Characteristic Classification System version 3.0: technical documentation
www.nrfirescience.org/resource/12407
The Fuel Characteristic Classification System (FCCS) is a software module that records wildland fuel
characteristics and calculates potential fire behavior and hazard potentials based on input
environmental variables. The FCCS 3.0 is housed within the Integrated Fuels Treatment Decision
Support System (Joint Fire Science Program... 
Author(s): Susan J. Prichard, David V. Sandberg, Roger D. Ottmar, Ellen Eberhardt, Anne Andreu,
Paige C. Eagle, Kjell Swedin
Year Published: 2013
Type: Document
Angular variation of fire rate of spread
www.nrfirescience.org/resource/12428
Laboratory fire tests were performed in still air, for variable inclinations (10°, 15°) and fuel bed dimensions (1.28 x 2.50-3.0 x 4.6 m²), with homogeneous fuel beds of pine needles and pine wood excelsior. The fire ignition was made at a point, along a closed line with no fuel inside and along a straight edge of the fuel bed...
Author(s): Jorge C. S. Andre, Joao C. Goncalves, Gilberto C. Vaz, Domingos Xavier Viegas
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

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

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

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

Modeling tree-level fuel connectivity to evaluate the effectiveness of thinning treatments for reducing crown fire potential
www.nrfirescience.org/resource/8295
Land managers have been using fire behavior and simulation models to assist in several fire management tasks. These widely-used models use average attributes to make stand-level predictions without considering spatial variability of fuels within a stand. Consequently, as the existing models have limitations in adequately modeling...
Author(s): Marco A. Contreras, Russell A. Parsons, Woodam Chung
Year Published: 2012
Type: Document
Book or Chapter or Journal Article

Towards the understanding of extreme wildland fire behavior
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

Fuels and fire behavior dynamics in bark beetle-attacked forests in Western North America and implications for fire management
www.nrfirescience.org/resource/8320
Declining forest health attributed to associations between extensive bark beetle-caused tree mortality, accumulations of hazardous fuels, wildfire, and climate change have catalyzed changes in forest health and wildfire protection policies of land management agencies. These changes subsequently prompted research to investigate the...
Author(s): Michael J. Jenkins, Wesley G. Page, Elizabeth G. Hebertson, Martin E. Alexander
Year Published: 2012
Type: Document
Book or Chapter or Journal Article, Synthesis

A method for ensemble wildland fire simulation
www.nrfirescience.org/resource/12732
An ensemble simulation system that accounts for uncertainty in long-range weather conditions and two-dimensional wildland fire spread is described. Fuel moisture is expressed based on the energy release component, a US fire danger rating index, and its variation throughout the fire season is modeled using time series analysis of...
Do mountain pine beetle outbreaks change the probability of active crown fire in lodgepole pine forests?
www.nrfirescience.org/resource/13340
Disturbance interactions have received growing interest in ecological research in the last decade. Fire and bark beetle outbreaks have recently increased in severity and extent across western North America, raising concerns about their possible interactions. Although it is often presumed that bark beetle outbreaks increase...
Author(s): Martin Simard, William H. Romme, Jacob M. Griffin, Monica G. Turner
Year Published: 2011
Type: Document
Book or Chapter or Journal Article

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

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
To control and use wildland fires safely and effectively depends on creditable assessments of fire potential, including the propensity for crowning in conifer forests. Simulation studies that use certain fire modelling systems (i.e. NEXUS, FlamMap, FARSITE, FFE-FVS (Fire and Fuels Extension to the Forest Vegetation Simulator), Fuel...
Author(s): Miguel G. Cruz, Martin E. Alexander
Year Published: 2010
Type: Document
Book or Chapter or Journal Article

Fuel treatment guidebook: illustrating treatment effects on fire hazard
www.nrfirescience.org/resource/8155
The Guide to Fuel Treatments (Johnson and others 2007) analyzes potential fuel treatments and the potential effects of those treatments for dry forest lands in the Western United States. The guide examines low- to mid-elevation dry forest stands with high stem densities and heavy ladder fuels, which are currently common due to fire...
Author(s): Crystal L. Raymond
Year Published: 2009
Type: Document
Wildland surface fire spread modelling, 1990-2007. 3: Simulation and mathematical analogue models
www.nrfirescience.org/resource/13825
In recent years, advances in computational power have led to an increase in attempts to model the behaviour of wildland fires and to simulate their spread across landscape. The present series of articles endeavours to comprehensively survey and précis all types of surface fire spread models developed during the period 1990-2007. ....
Author(s): Andrew L. Sullivan
Year Published: 2009
Type: Document
Book or Chapter or Journal Article, Synthesis

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

Seasonal predictions for wildland fire severity
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

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

Guide to fuel treatments in dry forests of the Western United States: assessing forest structure
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

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

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

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

The ability to forecast the number and location of large wildfire events (with specified confidence bounds) is important to fire managers attempting to allocate and distribute suppression efforts during...
severe fire seasons. This paper describes the development of a statistical model for assessing the forecasting skiffs of fire—

Author(s): Haiganoush K. Preisler, Anthony L. Westerling
Year Published: 2007
Type: Document
Book or Chapter or Journal Article

Fuel consumption and flammability thresholds in shrub-dominated ecosystems - Final Report to the Joint Fire Science Program
www.nrfirescience.org/resource/11164
Research to quantify fuel consumption and flammability in shrub-dominated ecosystems has received little attention despite the widespread occurrence of fire-influenced, shrub-dominated landscapes across the arid lands of the western United States. While some research has addressed issues relating to fire behavior in some shrub—

Author(s): Clinton S. Wright, Roger D. Ottmar, Sue A. Ferguson, Robert E. Vihnanek
Year Published: 2007
Type: Document
Technical Report or White Paper

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

Is global warming causing more, larger wildfires?
www.nrfirescience.org/resource/19326
On 3 April 2006, the U.S. weekly news magazine Time ran a report on global warming with the cover title “Be worried, be very worried.” Similar coverage of global warming has emerged in other general-interest magazines in recent months, triggered by scientific studies that are finding evidence for adverse impacts of global—

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

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

www.nrfirescience.org/resource/8127

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

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

A comment on models and modelling in fire/fuel management

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

MODIS Applications in 2003 Fire Management - Slide presentation

www.nrfirescience.org/resource/11516

Powerpoint presentation MODIS Applications in 2003 Fire Management

Author(s): C. A. Ryan, Bryce L. Nordgren, James P. Menakis, Mark A. Finney, Wei Min Hao
Year Published: 2004
Type: Document
Conference Proceedings

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

www.nrfirescience.org/resource/8438

Fire behavior predictions and forecasts are vital to tactical planning on wildland firefighting incidents. One major source of uncertainty in fire behavior predictions is spatial variation in the wind fields used in the fire models. In most cases wind data are limited to only a few specific locations, none of which may be actually...

Author(s): Jason M. Forthofer, Bret W. Butler, Kyle S. Shannon, Mark A. Finney, Larry S. Bradshaw, Richard D. Stratton
Year Published: 2003
Type: Document
Conference Proceedings

Assessing the value of increased model resolution in forecasting fire danger

www.nrfirescience.org/resource/10969

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

Author(s): Jeanne L. Hoadley, Miriam L. Rorig, Kenneth Westrick, Larry S. Bradshaw, Sue A. Ferguson, Scott L. Goodrick, Paul A. Werth
Year Published: 2003
Type: Document
Conference Proceedings

Climate and wildfire in the western United States
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

Performance of the Haines Index during August 2000 for Montana
www.nrfirescience.org/resource/10997
The Haines Index, introduced by Haines (1988) as the Lower Atmosphere Severity Index, is designed to gauge how readily the lower mid-troposphere (500 to 4500 m AGL) will spur an otherwise fairly predictable fire to become erratic and unmanageable. Based on stability and moisture, the Haines Index (hereafter, HI) takes on integer...

Author(s): Brian E. Potter, Scott L. Goodrick
Year Published: 2003
Type: Document
Conference Proceedings

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

Using FVS and its fire and fuels extension in the context of uncertain climate
www.nrfirescience.org/resource/11011
While the prospect of a static climate is no longer tenable, the direction of change for particular localities is not yet clear. Modelling vulnerability of silvicultural options to various scenarios of climate change requires a modelling system that can represent major processes affected by climatic variability. The Forest...

Author(s): Albert R. Stage
Year Published: 2002
Type: Document
Conference Proceedings
Statistical forecast of the 2001 western wildfire season using principal components regression
www.nrfirescience.org/resource/8396
Description not entered
Author(s): Anthony L. Westerling, Daniel R. Cayan, Alexander Gershunov, M. D. Dettinger, Timothy J. Brown
Year Published: 2001
Type: Document
Book or Chapter or Journal Article

The Mann Gulch Fire and the Canadian Forest Fire Danger Rating System
www.nrfirescience.org/resource/8408
The year 1999 marks the 50th anniversary of the Mann Gulch Fire that occurred in western Montana on August 5, 1949 (Matthews 1999). There has been considerable interest amongst the Canadian wildland fire community in the 1949 Mann Gulch Fire ever since the publishing of MacLean's (1992) book ‘Young Men and Fire’ and Rothermel's (...)
Author(s): Martin E. Alexander
Year Published: 2000
Type: Document
Conference Proceedings

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

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

The evaluation of Idaho wildfire growth using the Haines Index
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
Predicting behavior and size of crown fires in the northern Rocky Mountains
www.nrfirescience.org/resource/11195
Assessment of crown fire conditions calls for two important judgments: (1) identifying conditions for the onset of severe fires, and (2) predicting the spread rate, intensity, and size of expected crown fires. This paper addresses the second problem and provides methods for making a first approximation of the behavior of a running...
Author(s): Richard C. Rothermel
Year Published: 1991
Type: Document
Technical Report or White Paper

Fuel moisture as measured and predicted during the 1988 fires in Yellowstone National Park
www.nrfirescience.org/resource/11109
Fine fuel moisture content, relative humidity, air temperature, and fire behavior were observed hourly for 48 hours on the North Fork Fire in Yellowstone National Park from August 25 to August 27, 1988. Fine fuel reached minimum moisture content of 3 to 5 percent late in the afternoon, remained below 8 percent until after midnight,...
Author(s): Roberta A. Hartford, Richard C. Rothermel
Year Published: 1991
Type: Document
Research Brief or Fact Sheet

Predicting behavior of the 1988 Yellowstone fires: projections versus reality
www.nrfirescience.org/resource/8252
An account is presented of the initial long range, 30-day, projections of fire growth of the wildfires in the Greater Yellowstone Area in 1988. The request for information, the method of prediction, and the actual fire growth are discussed and documented with maps. The difficulties and uncertainties of long-range fire prediction...
Author(s): Richard C. Rothermel
Year Published: 1991
Type: Document
Book or Chapter or Journal Article

The Haines Index and Idaho fire growth
www.nrfirescience.org/resource/8306
[Excerpted from text] The growth of wildfires is related to three broad factors: fuel type, topography and weather. The National Fire Danger Rating System and the Fire Behavior Prediction System combine these factors to predict the probability and severity of wildland fires. However, these systems have mixed results in predicting...
Author(s): Paul A. Werth, Richard Ochoa
Year Published: 1990
Type: Document
Book or Chapter or Journal Article
The relationship between mean monthly fire potential indices and monthly fire severity
www.nrfirescience.org/resource/10970
Thirty-day forecasts of fire potential are needed, and can be computed using a variety of monthly fire weather indices. But which indices are most related to monthly fire severity? Correlation analysis was used to determine the relationships between mean monthly fire potential indices and monthly measures of fire severity at 16...
Author(s): M. H. McCutchan, William A. Main
Year Published: 1989
Type: Document
Conference Proceedings

Help with making crown fire hazard assessments
www.nrfirescience.org/resource/11046
This paper offers some suggestions and field guides with respect to the operational application of C.E. Van Wagner's (1997, Can. J. For. Res. 7:23-34) theory to calculate the threshold conditions for the start and spread of crown fires in conifer forests. Three categories of crowning are recognized (passive, active, and independent...)
Author(s): Martin E. Alexander
Year Published: 1988
Type: Document
Conference Proceedings, Technical Report or White Paper

Surface fuel loadings and predicted fire behavior for vegetation types in the northern Rocky Mountains
www.nrfirescience.org/resource/11930
Means, standard deviations, and quartiles of fuel loadings were determined for litter, for downed woody material of 0 to one-fourth inch, one-fourth to 1 inch, 0 to 1 inch, and 1 to 3 inches, for herbaceous vegetation, and for shrubs by cover types and fire groups. The studies were conducted at four locations in northwestern Wyoming...
Author(s): James K. Brown, Collin D. Bevins
Year Published: 1986
Type: Document
Research Brief or Fact Sheet

Appraising fuels and flammability in western aspen: a prescribed fire guide
www.nrfirescience.org/resource/11132
Describes a method for appraising fuels and fire behavior potential in aspen forests to guide the use of prescribed fire and the preparation of fire prescriptions. Includes an illustrated classification of aspen fuels; appraisals of fireline intensity, rate of spread, adjective ratings for fire behavior and probability of burn...
Author(s): James K. Brown, Dennis Simmerman
Year Published: 1986
Type: Document
Technical Report or White Paper

Predicting duff and woody fuel consumed by prescribed fire in the Northern Rocky Mountains
www.nrfirescience.org/resource/11265
Relationships for predicting duff reduction, mineral soil exposure, and consumption of downed woody fuel were determined to assist in planning prescribed fires. Independent variables included lower and entire duff moisture contents, loadings of downed woody fuels, duff depth, National Fire-Danger Rating System 1,000-hour moisture...
Changes in fire weather distributions: effects on predicted fire behavior
www.nrfirescience.org/resource/11221
Data that represent average worst fire weather for a particular area are used to index daily fire danger; however, they do not account for different locations or diurnal weather changes that significantly affect fire behavior potential. To study the effects that selected changes in weather databases have on computed fire behavior...
Author(s): Lucy A. Salazar, Larry S. Bradshaw
Year Published: 1984
Type: Document
Technical Report or White Paper

Wildland fires: predicting the behavior of wildland fires-among nature’s most potent forces-can save lives, money, and natural resources
www.nrfirescience.org/resource/8315
During a period of three days in mid-February 1983, bushfires swept over 400,000 ha in southern Australia, killing 74 people, destroying more than 2,000 homes, and burning out 7 towns. This tragic repetition of the fires of January 1939, in which 71 people perished, was foretold by Noble (1977), whose monograph on the 1939 fires...
Author(s): Frank A. Albini
Year Published: 1984
Type: Document
Book or Chapter or Journal Article

Fuel and fire behavior prediction in big sagebrush
www.nrfirescience.org/resource/11957
Relationships between height of big sagebrush and crown area, fuel loading, bulk density, size distribution of foliage and stemwood, and fraction dead stemwood are presented. Based upon these relationships, modeled rate-of-fire spread and fireline intensity are shown for sagebrush ranging in height from 20 to 120 cm and in coverage...
Author(s): James K. Brown
Year Published: 1982
Type: Document
Technical Report or White Paper

Influence of harvesting and residues on fuels and fire management
www.nrfirescience.org/resource/13134
Fuel and fire behavior potential in clearcut lodgepole pine and in Douglas-fir/larch under clearcutting, group selection, and shelterwood silvicultural systems were compared after logging to near-complete and conventional utilization standards. Fuels and fire behavior potentials were unaffected by silvicultural...
Author(s): James K. Brown
Year Published: 1980
Type: Document
Technical Report or White Paper
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