Modelling the effect of accelerated forest management on long-term wildfire activity

We integrated a widely used forest growth and management model, the Forest Vegetation Simulator, with the FSim large wildfire simulator to study how management policies affected future wildfire over 50 years on a 1.3 million ha study area comprised of a US national forest and adjacent lands. The model leverages decades of research...

Author(s): Alan A. Ager, Ana M. G. Barros, Rachel M. Houtman, Robert C. Seli, Michelle A. Day

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Evaluating the Ability of FARSITE to Simulate Wildfires Influenced by Extreme, Downslope Winds in Santa Barbara, California

Extreme, downslope mountain winds often generate dangerous wildfire conditions. We used the wildfire spread model Fire Area Simulator (FARSITE) to simulate two wildfires influenced by strong wind events in Santa Barbara, CA. High spatial-resolution imagery for fuel maps and hourly wind downscaled to 100 m were used as model inputs,...

Author(s): Katelyn Zigner, Leila M. V. Carvalho, Seth H. Peterson, Francis M. Fujioka, Gert-Jan Duine, Charles Jones, Dar A. Roberts, Max A. Moritz

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

QUIC-fire: a fast-running simulation tool for prescribed fire planning

Coupled fire-atmospheric modeling tools are increasingly used to understand the complex and dynamic behavior of wildland fires. Multiple research tools linking combustion to fluid flow use Navier-Stokes numerical solutions coupled to a thermodynamic model to understand fire-atmospheric feedbacks, but these computational fluid...

Author(s): Rodman Linn, Scott L. Goodrick, Sara Brambilla, Martin J. Brown, R. S. Middleton, Joseph J. O'Brien, J. Kevin Hiers

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Commentary on the article "Burn probability simulation and subsequent wildland fire activity in Alberta, Canada - Implications for risk assessment and strategic planning" by J. L. Beverly and N. McLoughlin

Monte Carlo simulations using wildland fire spread models have been conducted to produce numerical estimates of fire likelihood, project potential fire effects, and produce event sets of realistic wildfires (Parisien et al., 2019). The application of these methods has greatly expanded over the last few decades as a result of...

Author(s): Marc-Andre Parisien, Alan A. Ager, Ana M. G. Barros, Denyse A. Dawe, Sandy Erni, Mark A. Finney, Charles W. McHugh, Carol Miller, Sean A. Parks, Karen L. Riley, Karen C. Short, Christopher A. Stockdale, Xianli Wang, Ellen Whitman

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Predicting Emission Source Terms in a Reduced-Order Fire Spread Model—Part 1: Particulate Emissions

A simple, easy-to-evaluate, surrogate model was developed for predicting the particle emission source term in wildfire simulations. In creating this model, we conceptualized wildfire as a series of flamelets, and using this concept of flamelets, we developed a one-dimensional model to represent the structure of these flamelets which...

Author(s): Alexander J. Josephson, Troy M. Holland, Sara Brambilla, Michael J. Brown, Rodman Linn
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

A multiscale model of wood pyrolysis in fire to study the roles of chemistry and heat transfer at the mesoscale

Pyrolysis is a key process in all stages of wood burning from ignition to extinction. Understanding each stage is crucial to tackle wildfires and assess the fire safety of timber buildings. A model of appropriate complexity of wood pyrolysis and oxidation is missing, which limits the understanding of fires fuelled by wood. Progress...

Author(s): Franz Richter, Guillermo Rein
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Ground wind generated near the base by the massive convective column of very large-scale mass fires

In large-scale mass fires generated in forests or by a nuclear event, the area of the fire is large (diameter 1 or more kilometers) whereas the flame height is relatively small (less than 10 m) creating a large turbulent buoyant plume. This paper determines a correlation for the magnitude of velocity such a flow generates near...

Author(s): Michael Delichatsios, Jianping Zhang
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Fire as a fundamental ecological process: Research advances and frontiers

...

Author(s): Kendra K. McLauchlan, Philip E. Higuera, Jessica R. Miesel, Brendan M. Rogers, Jennifer A. Schweitzer, Jacquelyn Kremper Shuman, Alan J. Tepley, J. Morgan Varner, Thomas T. Veblen, Solny A. Adalsteinsson, Jennifer Balch, Enric Batllori, Erica R. Bigio, Paulo M. Brando, Megan E. Cattau, Janice L. Coen, Raelene M. Crandall, Lori D. Daniels, Neal J. Enright, Wendy S. Gross, Brian J. Harvey, Jeff A. Hatten, Sharon M. Hermann, Rebecca E. Hewitt, Leda N. Kobziar, Jennifer B. Landesmann, Michael M. Loranty, S. Yoshi Maezumi, Linda Mearns, Max A. Moritz, Jonathan A. Myers, Juli G. Pausas, Adam F. A. Pellegrini, William J. Platt, Jennifer Roozeboom, Hugh Safford, Fernanda Santos, Robert M. Scheller, Rosemary L. Sherriff, Kevin G. Smith, Melinda D. Smith, Adam C. Watts
Year Published: 2020
Type: Document
Synthesis

Global fire season severity analysis and forecasting

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

Learning-based prediction of wildfire spread with real-time rate of spread measurement

A learning-based wildfire spread model was developed in this study to predict short-term wildfire spread. Real-time rate of spread (RoS) measurement was first conducted by calculating normal movements of fire fronts. Subsequently, machine learning was employed to correlate the local RoS and environmental parameters and predict the...

Author(s): Chunjie Zhai, Siyu Zhang, Zhaolou Cao, Xinmeng Wang

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

The effect of ignition protocol on grassfire development

The effect of ignition protocol on the development of grassfires is investigated using physics-based simulation. Simulation allows measurement of the forward rate of spread of a fire as a function of time at high temporal resolution. Two ignition protocols are considered: the inward ignition protocol, where the ignition proceeds in...

Author(s): Duncan Sutherland, J. Sharples, K. A. M. Moinuddin

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Evaluation of Global Fire Weather Database reanalysis and short-term forecast products

Daily Fire Weather Index (FWI) System components calculated from the NASA Modern-Era Retrospective analysis for Research and Applications, Version 2 (MERRA-2), are compared to FWI calculations from a global network of weather stations over 2004–2018, and short-term, experimental (8 d) daily FWI forecasts are evaluated for their...

Author(s): Robert Field

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Investigating live fuel moisture content estimation in fire-prone shrubland from remote sensing using empirical modelling and RTM simulations

Previous research has demonstrated that remote sensing can provide spectral information related to vegetation moisture variations essential for estimating live fuel moisture content (LFMC), but accuracy and timeliness still present challenges to using this information operationally. Consequently, many

regional administrations are...
Author(s): Eva Marino, Marta Yebra, Mariluz Guillén-Climent, Nur Algeet, José Luis Tomé, Javier Madrigal, Mercedes Guijarro, Carmen Hernando
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

LES simulation of terrain slope effects on wind enhancement by a point source fire
www.nrfirescience.org/resource/21102
Fire-driven flows associated with wind intervention can dangerously threaten buildings in bushfire-prone areas by increasing pressure load on the structures through fire-wind enhancement phenomenon. This phenomenon through which wind is enhanced by interacting with fire is exacerbated when the affected terrain is located in a...
Author(s): Esmaeel Eftekharian, Maria Rashidi, Maryam Ghodrat, Yaping He, Kenny C.S. Kwok
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

PROPAGATOR: An Operational Cellular-Automata Based Wildfire Simulator
www.nrfirescience.org/resource/21627
PROPAGATOR is a stochastic cellular automaton model for forest fire spread simulation, conceived as a rapid method for fire risk assessment. The model uses high-resolution information such as topography and vegetation cover considering different types of vegetation. Input parameters are wind speed and direction and the ignition...
Author(s): Andrea Trucchia, Mirko D'Andrea, Francesco Baghino, Paolo Fiorucci, Luca Ferraris, Dario Negro, Andrea Gollini, Massimiliano Severino
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Wildfire detection using transfer learning on augmented datasets
www.nrfirescience.org/resource/20976
Wildfire detection is a time-critical application as the difficulty to pinpoint ignition locations in a short time-frame often leads to the escalation of the severity of fire events. This problem has motivated considerable interest from expert systems research to develop accurate early-warning applications and the breakthroughs in...
Author(s): Maria João Sousa, Alexandra Moutinho, Miguel Almeida
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Wildfire decision support tools: an exploratory study of use in the United States
www.nrfirescience.org/resource/21587
In the United States, many decision support tools exist to provide fire managers with weather and fire behaviour information to inform and facilitate risk-based decision-making. Relatively little is known about how managers use these tools in the field and when and how they may serve to influence decisions. To address this gap, we...
Author(s): Claire Rapp, Emily Rabung, Robyn S. Wilson, Eric L. Toman
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Mathematical modeling of wildland fire initiation and spread

The aim of this paper is to create a user-friendly computational tool for analysis of wildland fire behavior and its effect on urban and other structures. A physics-based multiphase Computational Fluid Dynamics (CFD) model of wildfire initiation and spread has been developed and incorporated into the multi-purpose CFD software,...

Author(s): Vladimir Agranat, Valeriy Perminov

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Processed-based fire models: New tools for an era of novel conditions

The first few years of the 21st century brought a series of unprecedented natural disturbances to the southwestern U.S. A severe drought, later tagged as a "global change type drought," triggered the mortality of 1,000 of native trees. For some species, such as the ponderosa pine, the drought was especially lethal due to high...

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

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

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

Unforeseen Events and Climate Variability: How do land management decisions shape landscapes decades into the future? With the influence of climate change and its associated stressors, it's an increasingly thorny question. According to Paulette Ford, a research ecologist with the Rocky Mountain Research Station in Albuquerque, New...

Author(s): Jessica M. Brewen

Year Published: 2020

Type: Document

Research Brief or Fact Sheet

Global sensitivity analysis of fuel-type-dependent input variables of a simplified physical fire spread model

A new global sensitivity analysis has been conducted of fuel-type-dependent input variables of the simplified physical fire spread model (PhyFire) to understand how the use of spatial averages, that is, fuel models, influences the results of PhyFire with a view to enhancing its understanding and improving its design. The model's...

Author(s): María Isabel Asensio-Sevilla, M. Teresa Santos-Martín, David Álvarez-León, Luis Ferragut-Canals

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

Wildfires front dynamics: 3D structures and intensity at small and large scales

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

A machine-learning framework for rapid adaptive digital-twin based fire-propagation simulation in complex environments

The objective of this work is to illustrate how to algorithmically integrate Machine-Learning Algorithms (MLA's) with multistage/multicomponent fire spread models. In order to tangibly illustrate this process, this work develops a framework for a specific model problem combining: (I) a meshless discrete element 'submodel' that...
Author(s): T. J. Zohdi
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Integrating fire effects on vegetation carbon cycling within an ecohydrologic model

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

Simulating the Effectiveness of Improvement Cuts and Commercial Thinning to Enhance Fire Resistance in West Coast Dry Mixed Conifer Forests

Nine multipurpose silvicultural treatments, formulated as a synthesis of recently implemented prescriptions offered by forest managers, were simulated to evaluate their effectiveness at enhancing fire resistance. The Forest Vegetation Simulator was applied, within the BioSum Framework, on over 3,000 Forest Inventory and Analysis...
Author(s): Theresa B. Jain, Jeremy S. Fried, Sara Loreno
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Physical model of wildland fire spread: parametric uncertainty analysis

For the physical model of wildland fire spread, errors or discrepancies in the prediction of spread rate may arise from uncertain, imprecise or improper determinations of the model parameters due to unreasonable assumptions, rough approximations, or inaccurate measurements. In this study, a parametric uncertainty analysis is made on...

Author(s): Xieshang Yuan, Naian Liu, Xiaodong Xie, Domingos Xavier Viegas
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Animals as agents in fire regimes

Fire is a powerful ecological and evolutionary force. Animals that modify drivers of fire behaviour could therefore have far-reaching effects on ecosystems. Yet, with a few notable exceptions, effects of animals on fire have been often overlooked. We show how animals can affect fire behaviour by modifying the amount, structure, or...
Author(s): Claire N. Foster, Sam C. Banks, Geoffrey J. Cary, Christopher N. Johnson, David B. Lindenmayer, Leonie E. Valentine
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Soft-computing-centric framework for wildfire monitoring, prediction and forecasting

Wildfires are exorbitantly cataclysmic disasters that lead to the destruction of forest cover, wildlife, land resources, human assets, reduced soil fertility and global warming. Every year wildfires wreck havoc across the globe. Therefore, there is a need of an efficient and reliable system for real-time wildfire monitoring to...
Author(s): Harkiran Kaur, Sandeep K. Sood
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Long-Term Impacts of Fuel Treatment Placement with Respect to Forest Cover Type on Potential Fire Behavior across a Mountainous Landscape

Research Highlights: The impact of variation in fuels and fuel dynamics among forest cover types on the outcome of fuel treatments is poorly understood. This study investigated the potential effects of treatment placement with respect to cover type on the development of potential fire behavior over time for 48 km2 of forest in...
Author(s): Seth A. Ex, Justin P. Ziegler, Wade T. Tinkham, Chad M. Hoffman
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Modelling the fire propagation from the fuel bed to the lower canopy of ornamental species used in wildland–urban interfaces

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

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

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

Author(s): Jeremy Arkin, Nicholas C. Coops, Txomin Hermosilla, Lori D. Daniels, Andrew Plowright

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

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

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

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

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Evaluating Model Predictions of Fire Induced Tree Mortality Using Wildfire-Affected Forest Inventory Measurements

Forest land managers rely on predictions of tree mortality generated from fire behavior models to identify stands for post-fire salvage and to design fuel reduction treatments that reduce mortality. A key challenge in improving the accuracy of these predictions is selecting appropriate wind and fuel moisture inputs. Our objective...

Author(s): Jason S. Barker, Jeremy S. Fried, Andrew N. Grey

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Scalability of a multi-physics system for forest fire spread prediction in multi-core platforms

Advances in high-performance computing have led to an improvement in modeling multi-physics systems because of the capacity to solve complex numerical systems in a reasonable time. WRF-SFIRE is a multi-physics system that couples the atmospheric model WRF and the forest fire spread model called SFIRE with the objective of...

Author(s): Angel Farguell, Ana Cortés, Tomàs Margalef, Josep R. Miró, J. Mercader

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Use of landscape simulation modeling to quantify resilience for ecological applications

Goals of fostering ecological resilience are increasingly used to guide U.S. public land management in the context of anthropogenic climate change and increasing landscape disturbances. There are, however, few operational means of assessing the resilience of a landscape or ecosystem. We present a method to evaluate resilience using...
Author(s): Robert E. Keane, Rachel A. Loehman, Lisa M. Holsinger, Donald A. Falk, Philip E. Higuera, Sharon M. Hood, Paul F. Hessburg
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Combining optimization and simulation modelling to measure the cumulative impacts of prescribed fire and wildfire on vegetation species diversity
www.nrfirescience.org/resource/19332
Growth?stage optimization (GSO) offers a new approach to biodiversity conservation in fire?prone regions by estimating the optimal distribution of vegetation growth stages that maximize a species diversity index. This optimal growth?stage structure provides managers an operational goal explicitly linked to a positive...
Author(s): Matthew P. Chick, Alan York, Holly Sitters, Julian Di Stefano, Craig R. Nitschke
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Mortality reconsidered: Testing and extending models of fire-induced tree mortality across the US - JFSP Final Report
www.nrfirescience.org/resource/20113
Predictive models of tree mortality and survival are vital for management planning and understanding fire effects in forests and woodlands, yet the underlying mechanisms of firecaused tree mortality remain poorly understood. This shortcoming limits the ability to accurately predict mortality and develop robust modelling...
Author(s): Sharon M. Hood, J. Morgan Varner, C. Alina Cansler
Year Published: 2019
Type: Document
Technical Report or White Paper

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

firebehavioR: An R Package for Fire Behavior and Danger Analysis
www.nrfirescience.org/resource/19886
Wildland fire and ecological researchers use empirical and semi-empirical modeling systems to assess fire behavior and danger. This technical note describes the firebehavioR package, a porting of two fire behavior modeling systems, Crown Fire Initiation and Spread and a Rothermel-based framework, to the R programming language. We...

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

Rating Fire Danger from the Ground Up

Wildfires consumed more than 3.5 million hectares in the United States in 2018, and federal fire suppression costs topped US$3 billion. These fires destroyed more than 18,000 residences and caused the deaths of at least 85 people. Wildfire damages like these are not unique to the United States; they are a threat in many nations....
Author(s): Matthew R. Levi, Erik S. Krueger, Grant J. Snitker, Tyson Ochsner, Miguel L. Villarreal, Emile H. Elias, Dannele E. Peck
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

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

Many nonlinear phenomena, whose numerical simulation is not straightforward, depend on a set of parameters in a way which is not easy to predict beforehand. Wildland fires in presence of strong winds fall into this category, also due to the occurrence of firespotting. We present a global sensitivity analysis of a new sub-model for...
Author(s): Andrea Trucchia, Vera N. Egorova, Gianni Pagnini, M. C. Rochoux
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

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

Wildland-urban interface wildfires have been a significant threat in many countries. This paper presents an integer two-stage stochastic goal programming model for comprehensive, efficient response to a wildfire including firefighting resource allocation and resident evacuation. In contrast to other natural disasters, the...
Author(s): Siqiong Zhou, Ayca Erdogan
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Reply to Cruz and Alexander: Comments on "Evaluating Crown Fire Rate of Spread Predictions from Physics-Based Models"

We have read Cruz and Alexander's comments regarding our manuscript titled ''Evaluating Crown Fire Rate of Spread Predictions from Physics-Based Models'' [1] and appreciate the opportunity to respond to their comments. In our original manuscript [1], we presented an evaluation of crown fire rate of spread predictions from...
Author(s): Chad M. Hoffman, J. Ziegler, R. R. Linn, J. Canfield, W. Mell, Carolyn Hull Sieg, F. Pimont
Year Published: 2019
Type: Document

Applications of simulation-based burn probability modelling: a review

www.nrfirescience.org/resource/20540

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

Author(s): Marc-Andre Parisien, Denyse A. Dawe, Carol Miller, Christopher A. Stockdale, O. Bradley Armitage

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

A review of a new generation of wildfire–atmosphere modeling

www.nrfirescience.org/resource/19732

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

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

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Standardized process to generate mapping of priority areas for protection against wildfires

www.nrfirescience.org/resource/19082

In the field of geographic information systems (GIS) there are certain tasks that are performed repetitively and are thus sometimes monotonous, where it is necessary to structure, integrate and analyze a series of georeferenced information, which, however, always carries the same sequence. Therefore, we developed a sequential model...

Author(s): José G. Flores Garnica, Uri David Casillas Díaz, Alejandra Macías Muro

Year Published: 2019

Type: Document

Conference Proceedings

Burn probability simulation and subsequent wildland fire activity in Alberta, Canada – Implications for risk assessment and strategic planning

www.nrfirescience.org/resource/20395

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

Author(s): Jennifer L. Beverly, Neal McLoughlin

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

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

Ensemble transform Kalman filter (ETKF) is an extension of ensemble Kalman filter (EnKF), which avoids using 'perturbed observations' to eliminate additional sampling errors. This paper demonstrates the capability of ETKF algorithm for sequentially correcting dynamically evolving fire perimeter positions at regular time intervals to...
Author(s): Tengjiao Zhou, Long Ding, Jie Ji, Lin Li, Weiwei Huang
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Response of simulated burned area to historical changes in environmental and anthropogenic factors: a comparison of seven fire models

Understanding how fire regimes change over time is of major importance for understanding their future impact on the Earth system, including society. Large differences in simulated burned area between fire models show that there is substantial uncertainty associated with modelling global change impacts on fire regimes. We draw here...
Author(s): Lina Teckentrup, Stijn Hantson, Angelika Heil, Joe R. Melton, Matthew Forrest, Fang Li, Chao Yue, Almut Arneth, Thomas Hickler, Stephen Sitch, Gitta Lasslop
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

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

Wildfire evacuation triggers refer to prominent geographic features used in wildfire evacuation practices, and when a fire crosses a feature, an evacuation warning is issued to the communities or firefighters in the path of the fire. The existing wildfire trigger modeling methods consider evacuation time as an input from a decision...
Author(s): Dapeng Li, Thomas J. Cova, Philip E. Dennison
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

A web-based wildfire simulator for operational applications

Wildfire simulators and decision support systems can assist the incident command teams in charge of tactical wildfire suppression. This paper presents a web-based wildfire simulator developed to provide real-time support for wildfire management. The paper describes the overall software architecture, the modelling chain...
Author(s): Bachisio Arca, Tiziano Ghisu, Marcello Casula, Michele Salis, Pierpaolo Duce
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

User guide to the FireCLIME Vulnerability Assessment (VA) tool: A rapid and flexible system for assessing ecosystem vulnerability to climate-fire interactions

Decision makers need better methods for identifying critical ecosystem vulnerabilities to changing climate and fire regimes. Climate-wildfire-vegetation interactions are complex and hinder classification

and projection necessary for development of management strategies. One such vulnerability assessment (VA) is FireCLIME VA, which...
Author(s): Megan Friggens, Rachel A. Loehman, Andrea E. Thode, William T. Flatley, A. Evans, C. Wilcox, S. Mueller, Larissa L. Yocom, Donald A. Falk
Year Published: 2019
Type: Document
Technical Report or White Paper

Investigating the application of a hybrid space discretisation for urban scale evacuation simulation

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

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

One approach to increase community resilience to wildfire impacts is the enhancement of residential construction standards in an effort to provide protective shelters for families within their own homes. Current wildfire models reviewed in this study assume fire growth is unrestricted by vegetation fuel bed geometry; the head fire...
Author(s): Greg Penney, Steven Richardson
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

A review of a new generation of wildfire–atmosphere modeling

One of the first significant developments in wildfire modeling research was to introduce heat flux as wildfire line intensity (kW·m–1). This idea could be adapted to using weather station measurements, topography, and fuel properties to estimate rate of fire spread, shape, and intensity. This review will present, in an accessible...
Author(s): A. Bakhshaii, E. A. Johnson
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

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

Fire simulators allow predicting fire spread and behavior and some of which in real-time. Both strategies and tactics to suppress wildland fires depend on fire analysis which is generally based on fire simulations that need to be accurate for a proper decision making. However, limitations and assumptions of the fire models and...
Author(s): Adrián Cardil, Santiago Monedero, C. A. Silva, Joaquin Ramírez
Year Published: 2019
Type: Document

Book or Chapter or Journal Article

Development and Evaluation of a Reynolds-Averaged Navier-Stokes Solver in WindNinja for Operational Wildland Fire Applications

An open source computational fluid dynamics (CFD) solver has been incorporated into the WindNinja modeling framework widely used by wildland fire managers as well as researchers and practitioners in other fields, such as wind energy, wind erosion, and search and rescue. Here we describe incorporation of the CFD solver and evaluate...

Author(s): Natalie S. Wagenbrenner, Jason M. Forthofer, Wesley G. Page, Bret W. Butler

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

A Cautionary Note Regarding the Use of Cumulative Burnt Areas for the Determination of Fire Danger Index Breakpoints

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

Author(s): F. Pimont, Julien Ruffault, Nicolas K. Martin-StPaul, Jean-Luc Dupuy

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

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

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

Author(s): Melanie Häusler, João Pedro Nunes, João M. N. Silva, Jan J. Keizer, Thorsten Warneke, Jose M. C. Pereira

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

A landscape model of variable social-ecological fire regimes

Fire regimes are now recognized as the product of social processes whereby fire on any landscape is the product of human-generated drivers: climate change, historical patterns of vegetation manipulation, invasive species, active fire suppression, ongoing fuel management efforts, prescribed burning, and accidental ignitions. We...

Author(s): Robert M. Scheller, Alec Kretchun, Todd J. Hawbaker, Paul D. Henne

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Climate seasonality as an essential predictor of global fire activity

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

Author(s): Michael V. Saha, Todd M. Scanlon, Paolo D'Odorico

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Wildland Fire Spread Modeling Using Convolutional Neural Networks

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

Author(s): Jonathan L. Hodges, Brian Y. Lattimer

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Evaluating ecological resilience across wildfire suppression levels under climate and fuel treatment scenarios using landscape simulation modelling

Continued suppression of wildfires may allow more biomass to accumulate to foster even more intense fires. Enlightened fire management involves explicitly determining concurrent levels of suppression, wildland fire use (allowing some fires to burn) and fuel treatments to manage landscapes for ecological resilience. This study used...

Author(s): Robert E. Keane, Kathy L. Gray, Brett Davis, Lisa M. Holsinger, Rachel A. Loehman

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Predictive modeling of wildfires: a new dataset and machine learning approach

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

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

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Exposure Complexity and Community Capacity to Manage Wildfire Risk: A Coupled Biophysical and Social Analysis of 60 Communities in the Western United States

Coordinated approaches to wildfire risk mitigation strategies that cross-ownership and management boundaries are found in many policies and programs worldwide. The 'all lands' approach of the United States (US) National Cohesive Strategy, for example, attempts to address the mismatches between

biophysical risk and the social...
Author(s): Max W. Nielsen-Pincus, Cody Evers, Alan A. Ager
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

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

www.nrfirescience.org/resource/19770

Human activities threaten the effectiveness of protected areas (PAs) in achieving their conservation goals across the globe. In this study, we contrast the influence of human and macro-environmental factors driving fire activity inside and outside PAs. Using area burned between 1984 and 2014 for 11 ecoregions in Canada and the...
Author(s): Nicolas Mansuy, Carol Miller, Marc-Andre Parisien, Sean A. Parks, Enric Batllori, Max A. Moritz
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Assessing and reinitializing wildland fire simulations through satellite active fire data

www.nrfirescience.org/resource/19103

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

Simulation of forest fires based on a two-dimensional three-phase model

www.nrfirescience.org/resource/20458

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

Optimizing smoke and plume rise modeling approaches at local scales

www.nrfirescience.org/resource/17793

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

Modeling Fire Pathways in Montane Grassland?Forest Ecotones

www.nrfirescience.org/resource/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

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

www.nrfirescience.org/resource/17610

A newer generation of models that interactively couple the atmosphere with fire behavior have shown an increased potential to understand and predict complex, rapidly changing fire behavior. This is possible if they capture intricate, time-varying microscale airflows in mountainous terrain and fire-atmosphere feedbacks. However, this...

Author(s): Janice L. Coen

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Modeling thinning effects on fire behavior with STANDFIRE

www.nrfirescience.org/resource/18335

Key message: We describe a modeling system that enables detailed, 3D fire simulations in forest fuels. Using data from three sites, we analyze thinning fuel treatments on fire behavior and fire effects and compare outputs with a more commonly used model. Context: Thinning is considered useful in altering fire behavior, reducing fire...

Author(s): Russell A. Parsons, F. Pimont, Lucas Wells, Greg M. Cohn, William Matt Jolly, Francois P. deColigny, Eric Rigolot, Jean-Luc Dupuy, William E. Mell, Rodman Linn

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

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

www.nrfirescience.org/resource/17379

It is generally accepted that year-to-year variability in moisture conditions and drought are linked with increased wildfire occurrence. However, quantifying the sensitivity of wildfire to surface moisture state at seasonal lead-times has been challenging due to the absence of a long soil moisture record with the appropriate...

Author(s): Daniel Jensen, John T. Reager, Brittany Zajic, Nick Rousseau, Matthew Rodell, Everett Hinkley

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Advancing the Science of Wildland Fire Dynamics Using Process-Based Models

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

Framework for submodel improvement in wildfire modeling

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. Lamorlette, D. Morvan, Rory Hadden, Albert Simeoni
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

A model-based framework to evaluate alternative wildfire suppression strategies

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

Modeling Fire Pathways in Montane Grassland?Forest Ecotones

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

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

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

Incorporating convective feedback in wildfire simulations using pyrogenic potential

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

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

Local wind fields that account for topographic interaction are a key element for any wildfire spread simulator. Currently available tools to generate near-surface winds with acceptable accuracy do not meet the tight time constraints required for data-driven applications. This article presents the specific problem of data-driven...
Author(s): O. Rios, W. Jahn, Elsa Pastor, M.M. Valero, E. Planas
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Wildfire fuel management: network-based models and optimization of prescribed burning

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

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

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

Effect of woody debris on the rate of spread of surface fires in forest fuels in a combustion wind tunnel

www.nrfirescience.org/resource/17730

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

Author(s): Andrew L. Sullivan, N. C. Surawski, Daniel A. Crawford, Richard J. Hurley, Liubov Volkova, Christopher J. Weston, Carl P. Meyer

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

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

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

www.nrfirescience.org/resource/18337

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

Author(s): Natalie S. Wagenbrenner, Jason M. Forthofer, Chris Gibson, Abby Indreland, Brian K. Lamb, Bret W. Butler

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

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

An Empirical Model for the Effect of Wind on Fire Spread Rate

www.nrfirescience.org/resource/18138

Predicting wind-driven rate of fire spread (RoS) has been the aim of many studies. Still, a field-tested model for general use, regardless of vegetation type, is currently lacking. We develop an empirical model for wind-aided RoS from laboratory fires (n = 216), assuming that it depends mainly on fire-released energy and on the...

Author(s): Carlos G. Rossa, Paulo M. Fernandes

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

An improved non-equilibrium model for the ignition of living fuel

www.nrfirescience.org/resource/17342

This paper deals with the modelling of living fuel ignition, suggesting that an accurate description using a multiphase formulation requires consideration of a thermal disequilibrium within the vegetation particle, between the solid (wood) and the liquid (sap). A simple model at particle scale is studied to evaluate the flux...

Author(s): A. Lamorlette, M. El Houssami, D. Morvan

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Quantile regression: an alternative approach to modelling forest area burned by individual fires

www.nrfirescience.org/resource/18056

Components of a fire regime have long been estimated using mean-value-based ordinary least-squares regression. But, forest and fire managers require predictions beyond the mean because impacts of small and large fires on forest ecosystems and wildland–urban interfaces are different. Therefore, different action plans are required...

Author(s): Baburam Rijal

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

A comparison of the US National Fire Danger Rating System (NFDRS) with recorded fire occurrence and final fire size

www.nrfirescience.org/resource/17126

Most previous research has assessed the ability of the National Fire Danger Rating System (NFDRS) to portray fire activity at either single sites or on small spatial scales, despite it being a nation-wide system. This study seeks to examine the relationships between a set of NFDRS fire danger indices (Fire Danger Ratings, Staffing...

Author(s): Nicholas G. Walding, Hywel T. P. Williams, Scott McGarvie, Claire M. Belcher

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Random subset feature selection for ecological niche models of wildfire activity in western North America

www.nrfirescience.org/resource/17909

Variable selection in ecological niche modelling can influence model projections to a degree comparable to variations in future climate scenarios. Consequently, it is important to select feature (variable) subsets for optimizing model performance and characterizing variability. We utilize a novel

random subset feature selection...
Author(s): James L. Tracy, Antonio Trabucco, A. Michelle Lawing, J. Tomasz Giermakowski, Maria D. Tchakerian, Gail M. Drus, Robert N. Coulson
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Existence of solution of a forest fire spread model

We consider a wildfire spread model represented by the system (1). We use results from the theory of Hamilton-Jacobi equations to prove that there exists a classical solution of (1) for any $(?,t)?R\times(0,T)(?,t)?R\times(0,T)$ and some $T>0T>0$ and satisfies particular initial conditions. We also use the method of characteristics...
Author(s): Michal Fe?kan, Július Pa?uta
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Modeling support for FASMEE experimental design using WRF-SFIRECHEM - Final Report to the Joint Fire Science Program

Recent advancements in fire-atmosphere numerical modeling have increased the number of physical processes integrated into these coupled models. This greater complexity allows for more comprehensive representation of the coupled interactions and feedbacks between the fire and the atmosphere. However, as a consequence of these...
Author(s): Adam K. Kochanski, Jan Mandel, Aimé Fournier, Mary Ann Jenkins
Year Published: 2017
Type: Document
Technical Report or White Paper

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

The primary theme of our study is the cost-effectiveness of fuel treatment at multiple scales, addressing the question of whether fuel treatments can be justified on the basis of saved suppression costs. Our study was designed to track the influence of a dollar invested in fuel treatments on final fire outcomes, and to quantify this...
Author(s): Matthew P. Thompson, Karen L. Riley, Dan R. Loeffler, Jessica R. Haas
Year Published: 2017
Type: Document
Technical Report or White Paper

Network analysis of wildfire transmission and implications for risk governance

We characterized wildfire transmission and exposure within a matrix of large land tenures (federal, state, and private) surrounding 56 communities within a 3.3 million ha fire prone region of central Oregon US. Wildfire simulation and network analysis were used to quantify the exchange of fire among land tenures and communities and...
Author(s): Alan A. Ager, Cody Evers, Michelle A. Day, Haiganoush K. Preisler, Ana M. G. Barros, Max W. Nielsen-Pincus
Year Published: 2017

Spatially explicit measurements of forest structure and fire behavior following restoration treatments in dry forests

www.nrfirescience.org/resource/15044

Restoration treatments in dry forests of the western US often attempt silvicultural practices to restore the historical characteristics of forest structure and fire behavior. However, it is suggested that a reliance on non-spatial metrics of forest stand structure, along with the use of wildland fire behavior models that lack the...

Author(s): J. Ziegler, Chad M. Hoffman, Michael A. Battaglia, William E. Mell
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

Simulated fire behaviour in young, postfire lodgepole pine forests

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

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

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

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
Type: Document
Technical Report or White Paper

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

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

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

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

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Predicting post-fire tree mortality for 12 western US conifers using the First-Order Fire Effects Model (FOFEM)

www.nrfirescience.org/resource/16493

Accurate prediction of fire-caused tree mortality is critical for making sound land management decisions such as developing burning prescriptions and post-fire management guidelines. To improve efforts to predict post-fire tree mortality, we developed 3-year post-fire mortality models for 12 Western conifer species—white fir (...

Author(s): Sharon M. Hood, Duncan C. Lutes

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

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

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

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

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

www.nrfirescience.org/resource/16267

Wildland fire suppression practices in the western United States are being widely scrutinized by policymakers and scientists as costs escalate and large fires increasingly affect social and ecological values. One potential solution is to change current fire suppression tactics to intentionally increase the area burned under...
Author(s): Alan A. Ager, Ana M. G. Barros, Haiganoush K. Preisler, Michelle A. Day, Thomas A. Spies, John D. Bailey, John P. Bolte
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

Incorporating resource protection constraints in an analysis of landscape fuel-treatment effectiveness in the northern Sierra Nevada, CA, USA

www.nrfirescience.org/resource/14012

Finding novel ways to plan and implement landscape-level forest treatments that protect sensitive wildlife and other key ecosystem components, while also reducing the risk of large-scale, high-severity fires, can prove to be difficult. We examined alternative approaches to landscape-scale fuel-treatment design for the same landscape...
Author(s): Christopher B. Dow, Brandon M. Collins, Scott L. Stephens
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

STANDFIRE: an IFT-DSS module for spatially explicit, 3D fuel treatment analysis - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/15584

Managers are increasingly called upon to implement fuel treatments to alter potential fire behavior, in order to mitigate threats to firefighters and communities, or to maintain or restore healthy ecosystems. While some case studies have shown positive results, many questions remain about how effective certain kinds of fuel...
Author(s): Russell A. Parsons, Lucas Wells, F. Pimont, William Matt Jolly, Rodman Linn, William E. Mell
Year Published: 2016
Type: Document
Technical Report or White Paper

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

www.nrfirescience.org/resource/13856

Wildland fire radiant energy emission is one of the only measurements of combustion that can be made at wide spatial extents and high temporal and spatial resolutions. Furthermore, spatially and temporally explicit measurements are critical for making inferences about fire effects and useful for examining

patterns of fire spread. In...
Author(s): Joseph J. O'Brien, E. Louise Loudermilk, Benjamin Hornsby, Andrew T. Hudak, Benjamin C. Bright, Matthew B. Dickinson, J. Kevin Hiers, Casey Teske, Roger D. Ottmar
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

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

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

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

In response to increasing wildfire severity and extent across the dry forests of the western United States in the last several decades, federal policy initiatives have encouraged joint vegetation management and fuels treatments to restore ecosystem composition, structure and function and reduce the potential for extreme fire...
Author(s): Chad M. Hoffman, Michael A. Battaglia, Tony S. Cheng, Yvette Dickinson, Frederick W. Smith
Year Published: 2016
Type: Document
Technical Report or White Paper

A stochastic mixed integer program to model spatial wildfire behavior and suppression placement decisions with uncertain weather

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

Development of the rangeland vegetation simulator: a module for FVS

The escalating awareness of non-forested landscapes and realization that more emphasis is needed for an all lands approach to management increasingly requires timely information to improve management effectiveness. The Forest Vegetation Simulator (FVS) has been used in a large number of studies to project future vegetation...
Author(s): Matthew C. Reeves

Year Published: 2016
Type: Document
Technical Report or White Paper

Evaluation and optimization of fuel treatment effectiveness with an integrated experimental/modeling approach - Final Report to the Joint Fire Science Program

The effectiveness of a hazardous fuel reduction treatment must take into account both the physical change on fuel loading and structure and the effect that this change may have on wildland fire behavior. We first took a remote sensing and field measurement approach to quantify the effects of an aggressive fuel treatment program on...
Author(s): Nick Skowronski, Albert Simeoni, Kenneth L. Clark, William E. Mell, Rory Hadden
Year Published: 2016
Type: Document
Technical Report or White Paper

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

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

Attaining fire-adapted human communities has become a key focus of collaborative planning on landscapes across the western United States and elsewhere. The coupling of fire simulation with GIS has expanded the analytical base to support such planning efforts, particularly through the "fireside" concept that identifies areas where...
Author(s): Joe H. Scott, Matthew P. Thompson, Julie W. Gilbertson-Day
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

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

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

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

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

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

Author(s): Patrick H. Freeborn, Mark A. Cochrane, William Matt Jolly

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

Modeling fuel treatment impacts on fire suppression cost savings: a review

High up-front costs and uncertain return on investment make it difficult for land managers to economically justify large-scale fuel treatments, which remove trees and other vegetation to improve conditions for fire control, reduce the likelihood of ignition, or reduce potential damage from wildland fire if it occurs. In the short-...

Author(s): Matthew P. Thompson, Nathaniel Anderson

Year Published: 2015

Type: Document

Book or Chapter or Journal Article, Synthesis

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

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

Author(s): Philip E. Higuera, John T. Abatzoglou, Jeremy S. Littell, Penelope Morgan

Year Published: 2015

Type: Document

Book or Chapter or Journal Article

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

In this project, we developed a Forest Vegetation Simulator (FVS, JFSP Project #) post-processor (FVS2FCCS) to convert FVS simulated treelist and surface fuel data into Fuel Characteristics Classification System (FCCS, JFSP Project #98-1-1-06) fuelbed format (.xml) that can be read and processed by the FCCS to create estimates of...
Author(s): Morris C. Johnson, Sarah J. Beukema, Stephanie A. Rebain, Paige C. Eagle, Kjell Swedin, Maria Petrova, Susan J. Prichard
Year Published: 2015
Type: Document
Technical Report or White Paper

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

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

Warning signals for eruptive events in spreading fires

Spreading fires are noisy (and potentially chaotic) systems in which transitions in dynamics are notoriously difficult to predict. As flames move through spatially heterogeneous environments, sudden shifts in temperature, wind, or topography can generate combustion instabilities, or trigger self-stabilizing feedback loops, that...
Author(s): Jerome M. Fox, George M. Whitesides
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

Modeling very large-fire occurrences over the continental United States from weather and climate forcing

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

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

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

Representation and evaluation of wildfire propagation simulations
www.nrfirescience.org/resource/12390
This paper provides a formal mathematical representation of a wildfire simulation, reviews the most common scoring methods using this formalism, and proposes new methods that are explicitly designed to evaluate a forest fire simulation from ignition to extinction. These scoring or agreement methods are tested with synthetic cases in...
Author(s): Jean-Baptiste Filippi, Vivien Mallet, Bahaa Nader
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

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

A comparison of three approaches for simulating fine-scale surface winds in support of wildland fire management. Part II. An exploratory study of the effect of simulated winds on fire growth simulations
www.nrfirescience.org/resource/16922
The effect of fine-resolution wind simulations on fire growth simulations is explored. The wind models are (1) a wind field consisting of constant speed and direction applied everywhere over the area of interest; (2) a tool based on the solution of the conservation of mass only (termed mass-conserving model) and (3) a tool based on...
Author(s): Jason M. Forthofer, Bret W. Butler, Charles W. McHugh, Mark A. Finney, Larry S. Bradshaw, Richard D. Stratton, Kyle S. Shannon, Natalie S. Wagenbrenner
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

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

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

Understanding stochastic wildfire simulation results

www.nrfirescience.org/resource/12758

Stochastic simulations of wildfire occurrence and growth have become an integral part of both wildfire incident management and land management planning applications. The FSPro simulation system, implemented in the online Wildland Fire Decision Support System (WFDSS), acknowledges that weather inputs to wildfire growth...

Author(s): Joe H. Scott
Year Published: 2014
Type: Document
Technical Report or White Paper

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

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

www.nrfirescience.org/resource/18905

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

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

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

Optimising fuel treatments over time and space

Fuel treatments have been widely used as a tool to reduce catastrophic wildland fire risks in many forests around the world. However, it is a challenging task for forest managers to prioritise where, when, and how to implement fuel treatments across a large forest landscape. In this study, an optimisation model was developed for...

Author(s): Woodam Chung, J. Greg Jones, Kurt Krueger, Jody Bramel, Marco A. Contreras

Year Published: 2013

Type: Document

Book or Chapter or Journal Article

Wildfire exposure and fuel management on western US national forests

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

Author(s): Alan A. Ager, Michelle A. Day, Charles W. McHugh, Karen C. Short, Julie W. Gilbertson-Day, Mark A. Finney, David E. Calkin

Year Published: 2013

Type: Document

Book or Chapter or Journal Article

Modelling conditional burn probability patterns for large wildland fires

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

Author(s): Pamela S. Ziesler, Douglas B. Rideout, Robin Reich

Year Published: 2013

Type: Document

Book or Chapter or Journal Article

Quantifying the potential impacts of fuel treatments on wildfire suppression costs

Modeling the impacts and effects of hazardous fuel reduction treatments is a pressing issue within the wildfire management community. Prospective evaluation of fuel treatment effectiveness allows for comparison of alternative treatment strategies in terms of socioeconomic and ecological impacts and facilitates analysis of tradeoffs...

Author(s): Matthew P. Thompson, Nicole M. Vaillant, Jessica R. Haas, Krista M. Gebert, Keith Stockmann

Year Published: 2013

Type: Document

Book or Chapter or Journal Article

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

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

Current status and future needs of the BehavePlus Fire Modeling System

The BehavePlus Fire Modeling System is among the most widely used systems for wildland fire prediction. It is designed for use in a range of tasks including wildfire behaviour prediction, prescribed fire planning, fire investigation, fuel hazard assessment, fire model understanding, communication and research. BehavePlus is based on...
Author(s): Patricia L. Andrews
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Combustibility of a mixture of live and dead fuel components

The problem of predicting the rate of spread of a linear fire front in a fuel bed composed of one live and one dead fuel component in no-slope and no-wind conditions is addressed. Two linear models based on the mass fraction of each fuel component are proposed to predict the rate of spread of a fire front as a function of the mass...
Author(s): Domingos Xavier Viegas, J. Soares, Miguel Almeida
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Surface fire intensity influences simulated crown fire behavior in lodgepole pine forests with recent mountain pine beetle-caused tree mortality

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

A polygon-based modeling approach to assess exposure of resources and assets to wildfire

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

The relationship of large fire occurrence with drought and fire danger indices in the western USA, 1984-2008: the role of temporal scale

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

Effect of suppression strategies on federal wildland fire expenditures

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

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

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

Spatial variability in wildfire probability across the western United States

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

Author(s): Marc-Andre Parisien, Susan Snetsinger, Jonathan A. Greenberg, Cara R. Nelson, Tania L. Schoennagel, Solomon Z. Dobrowski, Max A. Moritz

Year Published: 2012

Type: Document

Book or Chapter or Journal Article

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

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

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

Entrainment regimes and flame characteristics of wildland fires

www.nrfirescience.org/resource/16925

This paper reports results from a study of the flame characteristics of 22 wind-aided pine litter fires in a laboratory wind tunnel and 32 field fires in southern rough and litter–grass fuels. Flame characteristic and fire behaviour data from these fires, simple theoretical flame models and regression techniques are used to...
Author(s): Ralph M. Nelson, Bret W. Butler, David R. Weise
Year Published: 2012
Type: Document
Book or Chapter or Journal Article

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

www.nrfirescience.org/resource/8325

Quantifying the effects of mountain pine beetle (MPB)-caused tree mortality on potential crown fire hazard has been challenging partly because of limitations in current operational fire behavior models. Such models are not capable of accounting for fuel heterogeneity resulting from an outbreak. Further, the coupled interactions...
Author(s): Chad M. Hoffman, Penelope Morgan, William E. Mell, Russell A. Parsons, Eva K. Strand, Stephen Cook
Year Published: 2012
Type: Document
Book or Chapter or Journal Article

A method for ensemble wildland fire simulation

www.nrfirescience.org/resource/12732

An ensemble simulation system that accounts for uncertainty in long-range weather conditions and two-dimensional wildland fire spread is described. Fuel moisture is expressed based on the energy release

component, a US fire danger rating index, and its variation throughout the fire season is modeled using time series analysis of...
Author(s): Mark A. Finney, Isaac C. Grenfell, Charles W. McHugh, Robert C. Seli, D. Trethewey, Richard D. Stratton, Stuart Brittain
Year Published: 2011
Type: Document
Book or Chapter or Journal Article

Linking 3D spatial models of fuels and fire: effects of spatial heterogeneity on fire behavior
www.nrfirescience.org/resource/14161
Crownfire endangers fire fighters and can have severe ecological consequences. Prediction of fire behavior in tree crowns is essential to informed decisions in fire management. Current methods used in fire management do not address variability in crown fuels. New mechanistic physics-based fire models address convective heat transfer...
Author(s): Russell A. Parsons, William E. Mell, Peter McCauley
Year Published: 2011
Type: Document
Book or Chapter or Journal Article

A simulation of probabilistic wildfire risk components for the continental United States
www.nrfirescience.org/resource/12734
This simulation research was conducted in order to develop a large-fire risk assessment system for the contiguous land area of the United States. The modeling system was applied to each of 134 Fire Planning Units (FPUs) to estimate burn probabilities and fire size distributions. To obtain stable estimates of these quantities, fire...
Author(s): Mark A. Finney, Charles W. McHugh, Isaac C. Grenfell, Karen L. Riley, Karen C. Short
Year Published: 2011
Type: Document
Book or Chapter or Journal Article

Simulating fuel treatment effects in dry forests of the western United States: testing the principles of a fire-safe forest
www.nrfirescience.org/resource/8275
We used the Fire and Fuels Extension to the Forest Vegetation Simulator (FFE-FVS) to simulate fuel treatment effects on 45,162 stands in low- to midelevation dry forests (e.g., ponderosa pine (Pinus ponderosa Dougl. ex. P....
Author(s): Morris C. Johnson, Maureen C. Kennedy, David L. Peterson
Year Published: 2011
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
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

A comparison of landscape fuel treatment strategies to mitigate wildland fire risk in the urban interface and preserve old forest structure

We simulated fuel reduction treatments on a 16,000 ha study area in Oregon, US, to examine tradeoffs between placing fuel treatments near residential structures within an urban interface, versus treating stands in the adjacent wildlands to meet forest health and ecological restoration goals. The treatment strategies were evaluated...
Author(s): Alan A. Ager, Nicole M. Vaillant, Mark A. Finney
Year Published: 2010
Type: Document
Book or Chapter or Journal Article

Evaluating the ecological benefits of wildfire by integrating fire and ecosystem simulation models

Fire managers are now realizing that wildfires can be beneficial because they can reduce hazardous fuels and restore fire-dominated ecosystems. A software tool that assesses potential beneficial and detrimental ecological effects from wildfire would be helpful to fire management. This paper presents a simulation platform called...
Author(s): Robert E. Keane, Eva C. Karau
Year Published: 2010
Type: Document
Book or Chapter or Journal Article

Wildfire risk and hazard: procedures for the first approximation

This report was designed to meet three broad goals: (1) evaluate wildfire hazard on Federal lands; (2) develop information useful in prioritizing where fuels treatments and mitigation measures might be proposed to address significant fire hazard and risk; and (3) develop risk-based performance measures to document the effectiveness...
Author(s): David E. Calkin, Alan A. Ager, Julie W. Gilbertson-Day
Year Published: 2010
Type: Document
Technical Report or White Paper

Fine fuel heating by radiant flux

Experiments were conducted wherein wood shavings and Ponderosa pine needles in quiescent air were subjected to a steady radiation heat flux from a planar ceramic burner. The internal temperature of these particles was measured using fine diameter (0.076 mm diameter) type K thermocouples. A narrow angle radiometer was used to...
Author(s): David Frankman, Brent W. Webb, Bret W. Butler, Donald J. Latham
Year Published: 2010
Type: Document
Book or Chapter or Journal Article

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

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

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

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

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

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

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

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

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 prÃ©cis 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

Testing the modeled effectiveness of an operational fuel reduction treatment in a small western Montana interface landscape using two spatial scales

Much of the coniferous zones in the Western United States where fires were historically frequent have seen large increases in stand densities and associated forest fuels due to 20th century anthropogenic influences. This condition is partially responsible for contemporary large, uncharacteristically severe wildfires. Therefore,...

Author(s): Michael G. Harrington, Erin Noonan-Wright, Mitchell Doherty
Year Published: 2007
Type: Document
Conference Proceedings

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

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

Author(s): Wesley G. Page, Michael J. Jenkins
Year Published: 2007
Type: Document
Book or Chapter or Journal Article

A physics-based approach to modelling grassland fires

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

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

www.nrfirescience.org/resource/11166

Guide to Fuel Treatments analyzes a range of fuel treatments for representative dry forest stands in the Western United States with overstories dominated by ponderosa pine (Pinus ponderosa), Douglas-fir (Pseudotsuga menziesii), and pinyon pine (Pinus edulis). Six silvicultural options (no thinning; thinning from below to 50 trees...

Author(s): Morris C. Johnson, David L. Peterson, Crystal L. Raymond

Year Published: 2007

Type: Document

Technical Report or White Paper

Simulation of long-term landscape-level fuel treatment effects on large wildfires

www.nrfirescience.org/resource/8166

A simulation system was developed to explore how fuel treatments placed in topologically random and optimal spatial patterns affect the growth and behaviour of large fires when implemented at different rates over the course of five decades. The system consisted of a forest and fuel dynamics simulation module (Forest Vegetation...

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

Effects of alternative treatments on canopy fuel characteristics in five conifer stands

www.nrfirescience.org/resource/11129

A detailed study of canopy fuel characteristics in five different forest types provided a unique dataset for simulating the effects of various stand manipulation treatments on canopy fuels. Low thinning, low thinning with commercial dbh limit, and crown thinning had similar effects on canopy bulk density (CBD) and canopy fuel load (...

Author(s): Joe H. Scott, Elizabeth D. Reinhardt

Year Published: 2007

Type: Document

Conference Proceedings, Technical Report or White Paper

Windwizard: a new tool for fire management decision support

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

An Overview of FlamMap Fire Modeling Capabilities

www.nrfirescience.org/resource/20069

Computerized and manual systems for modeling wildland fire behavior have long been available (Rothermel 1983, Andrews 1986). These systems focus on one-dimensional behaviors and assume the

fire geometry is a spreading line-fire (in contrast with point or area-source fires). Models included in these systems were developed to...
Author(s): Mark A. Finney
Year Published: 2006
Type: Document
Conference Proceedings

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

www.nrfirescience.org/resource/11200

The relative behavior of surface-crown fire spread rate modeling systems used in three fire management applications-CFIS (Crown Fire Initiation and Spread), FlamMap and NEXUS- is compared using fire environment characteristics derived from a dataset of destructively measured canopy fuel and associated stand characteristics. Although...
Author(s): Joe H. Scott
Year Published: 2006
Type: Document
Technical Report or White Paper

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

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

Fuel Treatment Evaluator 3.0

www.nrfirescience.org/resource/11078

The Fuel Treatment Evaluator (FTE) 3.0 is a web-based tool that simulates uneven-aged and even-aged silvicultural treatments on timberland in 12 western states. This tool simulates treatments to reduce forest fire hazard to specific target levels and identifies the volume of biomass removed, harvesting costs, and estimated biomass...
Author(s): U.S. Department of Agriculture, Forest Service
Year Published: 2006
Type: Document
Research Brief or Fact Sheet

Cumulative effects of fuel management on landscape-scale fire behavior and effects - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/11157

The project is concerned with modeling the long-term effects of landscape fuel treatment patterns on wildfire sizes and severity. The work was initiated based on theoretical fuel treatment patterns that appeared effective at changing fire growth across large landscapes, thus reducing the acreage burned and the chances that large...
Author(s): Mark A. Finney
Year Published: 2005

Type: Document
Technical Report or White Paper

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

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

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

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

www.nrfirescience.org/resource/7948

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

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

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

www.nrfirescience.org/resource/11155

The objective of this project is to conduct a diagnostic analysis of the variations in climate that govern the characteristics of the fire season in the western United States on intra-annual through decadal and longer time scales. We propose a retrospective, model-based analysis to understand better the role of climate as a control...

Author(s): Steven W. Hostetler, Patrick J. Bartlein, Allen M. Solomon, J. O. Holman, Richard T. Busing, Sarah L. Shafer
Year Published: 2005
Type: Document
Technical Report or White Paper

Predicting cumulative watershed effects of fuel management with improved WEPP technology

www.nrfirescience.org/resource/8436

The increase in severe wildfires in recent years is due in part to an abundance of fuels in forests. In an effort to protect values at risk, and decrease the severity of wildfires, forest managers have embarked on a major program of fuel reduction. Past research has shown that such fuel reduction may have minimal impact at a...

Author(s): William J. Elliot, Joan Q. Wu

Year Published: 2005

Type: Document

Conference Proceedings

Demonstration and integration of systems for fire remote sensing, ground-based fire measurement, and fire modeling - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/11158

Proof-of-concept research is being conducted to: compare airborne and in situ, ground-based fire measurement systems; begin evaluation of two fire-behavior simulation models with these data; test approaches to incorporating improved wind-field and weather data in these models; test the utility of the airborne remote sensing for...

Author(s): Colin C. Hardy, Philip J. Riggan

Year Published: 2005

Type: Document

Technical Report or White Paper

Landscape fire simulation and fuel treatment optimization

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

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

Evaluating ASTER imagery and gradient modeling for mapping wildland fire fuels

www.nrfirescience.org/resource/11280

Land managers need cost-effective methods for mapping and characterizing fire fuels quickly and accurately. The advent of sensors with increased spatial resolution may improve the accuracy and reduce the cost of fuels mapping. The objective of this research is to evaluate the accuracy and utility of

imagery from the Advanced...
Author(s): Michael J. Falkowski
Year Published: 2004
Type: Document
Research Brief or Fact Sheet

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

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

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

www.nrfirescience.org/resource/10993

Across North America, decades of fire suppression and recent patterns of human settlement have combined to increase the risks that wildland fires pose to human life, property, and natural resource values. Various methods can be used to reduce fuel hazards and mitigate these risks, but funding and other constraints require that these...
Author(s): Carol Miller
Year Published: 2003
Type: Document
Conference Proceedings, Technical Report or White Paper

Reaction times and burning rates for wind tunnel headfires

www.nrfirescience.org/resource/8211

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

An initial analysis of relationships between 2- and 10-minute averaged winds at 10, 6, and 1.8 meters: implications for fire behavior and danger applications

www.nrfirescience.org/resource/8424

Recently there has been discussion in the National Wildland Fire Coordination Group (NWCG) fire danger and fire weather working teams about the impact of observations from different anemometer heights and more importantly, averaging times, on inputs to fire management systems such as National Fire Danger Rating System (Deeming and...
Author(s): Larry S. Bradshaw, Eugene Petrescu, Isaac C. Grenfell
Year Published: 2003
Type: Document
Conference Proceedings

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

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

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

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

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

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

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

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

Sequential use of simulation and optimization in analysis and planning
www.nrfirescience.org/resource/11045
Management activities are analyzed at landscape scales employing both simulation and optimization. SIMPPLLE, a stochastic simulation modeling system, is initially applied to assess the risks associated with a specific natural process occurring on the current landscape without management treatments, but with fire suppression. These...
Author(s): Hans R. Zuuring, Jimmie D. Chew, J. Greg Jones
Year Published: 2000
Type: Document
Conference Proceedings

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

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

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

Stevensville West Central Study

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

Applying simulation and optimization to plan fuel treatments at landscape scales

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

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

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

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

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

The Haines Index and Idaho fire growth

[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

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

Modeling behavior of prescribed fires in Yosemite National Park
www.nrfirescience.org/resource/8313
The National Fire Danger Rating System and the Fire Behavior Prediction System were tested on prescribed fires burning uderneath canopies in six fuel types in Yosemite National Park, California. The mea 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

Predicting slash depth for fire modeling
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\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
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

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

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

Calculating the National Fire-Danger Rating spread index by computer
www.nrfirescience.org/resource/11918
Changeover from use of the Intermountain Model-8 Burning Index Meter to use of the Spread Index of the National Fire-Danger Rating System required a comparative analysis of both systems. This note describes a program written in SPS to calculate various indexes of both systems on an IBM 1620 computer.
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
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