Comparing modeled emissions from wildfire and prescribed burning of post-thinning fuel: A case study of the 2016 Pioneer Fire
www.nrfirescience.org/resource/19649
Prescribed fire is often used by land managers as an effective means of implementing fuel treatments to achieve a variety of goals. Smoke generated from these activities can put them at odds with air quality regulations. We set out to characterize the emission tradeoff between wildfire and prescribed fire in activity fuels from...
Author(s): Joshua C. Hyde, Eva K. Strand
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Wildland firefighter smoke exposure and risk of lung cancer and cardiovascular disease mortality
www.nrfirescience.org/resource/19471
Wildland firefighters are exposed to wood smoke, which contains hazardous air pollutants, by suppressing thousands of wildfires across the U. S. each year. We estimated the relative risk of lung cancer and cardiovascular disease mortality from existing PM2.5 exposure-response relationships using measured PM4 concentrations from...
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

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

Forest fire smoke detection based on visual smoke root and diffusion model
www.nrfirescience.org/resource/19141
The damage caused by forest fire to forestry resources and economy is quite serious. As one of the most important characters of early forest fire, smoke is widely used as a signal of forest fire. In this paper, we propose a novel forest fire smoke detection method based on computer vision and diffusion model. Unlike the video-based...
Author(s): Yu Gao, Pengle Cheng
Year Published: 2019
Type: Document
Book or Chapter or Journal Article
Will landscape fire increase in the future? A systems approach to climate, fire, fuel, and human drivers
www.nrfirescience.org/resource/19068
The extent of the Earth’s surface burned annually by fires is affected by a number of drivers, including but not limited to climate. Other important drivers include the amount and type of vegetation (fuel) available and human impacts, including fire suppression, ignition, and conversion of burnable land to crops. Prior to the...
Author(s): Karen L. Riley, A. Park Williams, Shawn P. Urbanski, David E. Calkin, Karen C. Short, Christopher D. O'Conner
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

The impact of wildfires on particulate carbon in the western U.S.A
www.nrfirescience.org/resource/20164
Most of the previous investigations on the relationship between PM2.5 chemical characteristics and wildfire focused on the predictions of particle components concentrations or future pollution scenarios. Little research has focused on trends analyses based on large temporal datasets. Our research addresses this gap by quantifying...
Author(s): Weeberb J. Requia, Brent A. Coull, Petros Koutrakis
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Associations between respiratory health and ozone and fine particulate matter during a wildfire event
www.nrfirescience.org/resource/20034
Wildfires have been increasing in frequency in the western United States (US) with the 2017 and 2018 fire seasons experiencing some of the worst wildfires in terms of suppression costs and air pollution that the western US has seen. Although growing evidence suggests respiratory exacerbations from elevated fine particulate matter (... Author(s): Colleen Reid, Ellen M. Considine, Gregory L. Watson, Donatello Telesca, Gabriele G. Pfister, Michael Jerrett
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Laboratory and numerical modeling of the formation of superfog from wildland fires
www.nrfirescience.org/resource/19897
Smoke from human-induced fires such as prescribed fires can occasionally cause significant reduction in visibility on highways in the southern United States. Visibility reduction to less than three meters has been termed ‘superfog’ and environmental conditions that lead to its formation have been proposed previously. Accurate...
Author(s): Christian Bartolome, M. Princevac, David R. Weise, Shankar M. Mahalingam, Masoud Ghasemian, Akula Venkatram, Henry Vu, Guillermo Aguilar
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Estimating fire smoke related health burden and novel tools to manage impacts on urban populations - Final Report to the Joint Fire Science Program
Fire smoke is a major contributor to both particulate matter (PM) and ozone exposure in urban centers. Epidemiological, clinical, and toxicological studies have demonstrated a casual relationship between these pollutants and cardiovascular and respiratory related deaths and illnesses. Given the expected increase in fire events due...

Author(s): Brian J. Reich, Ana G. Rappold, Fay H. Johnston, Geoffrey G. Morgan, Neal L. Fann, Martin E. Cope, Richard A. Broome
Year Published: 2019
Type: Document
Technical Report or White Paper

Assessing relative differences in smoke exposure from prescribed, managed, and full suppression wildland fire

A novel approach is presented to analyze smoke exposure and provide a metric to quantify health-related impacts. Our results support the current understanding that managing low-intensity fire for ecological benefit reduces exposure when compared to a high-intensity full suppression fire in the Sierra Nevada of California. More...

Author(s): D.W. Schweizer, Haiganoush K. Preisler, Ricardo Cisneros
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

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

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

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

Contribution of wildland-fire smoke to US PM2.5 and its influence on recent trends

Seasonal-mean concentrations of particulate matter with diameters smaller than 2.5 μm (PM2.5) have been decreasing across the United States (US) for several decades, with large reductions in spring and summer in the eastern US. In contrast, summertime-mean PM2.5 in the western US has not significantly decreased. Wildfires, a large...

Author(s): Katelyn O'Dell, Bonne Ford, Emily V. Fischer, Jeffrey R. Pierce
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Measuring light absorption by freshly emitted organic aerosols: Optical artifacts in traditional solvent-extraction-based methods

Recent studies have shown that organic aerosol (OA) could have a nontrivial role in atmospheric light absorption at shorter visible wavelengths. Good estimates of OA light absorption are therefore
necessary to better estimate radiative forcing due to these aerosols in climate models. One of the
common techniques used to measure OA...

Correction to: A case study comparison of LANDFIRE fuel loading and emissions generation on
a mixed conifer forest in Northern Idaho, USA

Following publication of the original article (Hyde et al., 2015), the authors have noticed two errors in
the summarizing of our results and wish to point out the following corrections: – The LANDFIRE-FCCS
layer showed a 200% higher duff loading relative to measured loadings, not the “300%” stated in the
abstract – The 200...

Fire behaviour and smoke modelling: model improvement and measurement needs for next-
generation smoke research and forecasting systems

There is an urgent need for next-generation smoke research and forecasting (SRF) systems to meet
the challenges of the growing air quality, health and safety concerns associated with wildland fire
emissions. This review paper presents simulations and experiments of hypothetical prescribed burns
with a suite of selected fire...

A Multipollutant Smoke Emissions Sensing and Sampling Instrument Package for Unmanned
Aircraft Systems: Development and Testing

Poor air quality arising from prescribed and wildfire smoke emissions poses threats to human health
and therefore must be taken into account for the planning and implementation of prescribed burns for
reducing contemporary fuel loading and other management goals. To better understand how smoke
properties vary as a function of fuel...

Scaling nonreactive cross flow over a heated plate to simulate forest fires

The paper reports visualization of the flow of smoke over a flat surface inside of a low-speed wind
tunnel. A heating plate flush mounted on the wind tunnel floor simulated a spreading line fire that produces uniform heat flux under constant wind speed condition. A paper-thin cloth was soaked with commercially available Vaseline and...

Author(s): Nikolay Gustenyov, Nelson K. Akafuah, Ahmad Salaimeh, Mark A. Finney, Sara S. McAllister, Kozo Saito
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

**Fire intensity impacts on post-fire temperate coniferous forest net primary productivity**

[www.nrfirescience.org/resource/17364](http://www.nrfirescience.org/resource/17364)

Fire is a dynamic ecological process in forests and impacts the carbon (C) cycle through direct combustion emissions, tree mortality, and by impairing the ability of surviving trees to sequester carbon. While studies on young trees have demonstrated that fire intensity is a determinant of post-fire net primary productivity, wildland...

Author(s): Aaron M. Sparks, Crystal A. Kolden, Alistair M. S. Smith, Luigi Boschetti, Daniel M. Johnson, Mark A. Cochrane
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

**Synthesis of comprehensive emissions measurements and multi-scale modeling for understanding secondary organic aerosol chemistry in wildland smoke plumes - Final Report to the Joint Fire Science Program**

[www.nrfirescience.org/resource/18254](http://www.nrfirescience.org/resource/18254)

The air quality and fire management communities are faced with increasingly difficult decisions regarding critical fire management activities, given the potential contribution of wildland fires to fine particulate matter (PM2.5). Unfortunately, in model frameworks used for air quality management, the ability to represent PM2.5 from...

Author(s): Kelley C. Barsanti, Brian K. Lamb, Robert J. Yokelson
Year Published: 2018
Type: Document
Technical Report or White Paper

**Developing an online tool for identifying at-risk populations to wildfire smoke hazards**

[www.nrfirescience.org/resource/17263](http://www.nrfirescience.org/resource/17263)

Wildfire episodes pose a significant public health threat in the United States. Adverse health impacts associated with wildfires occur near the burn area as well as in places far downwind due to wildfire smoke exposures. Health effects associated with exposure to particulate matter arising from wildfires can range from mild eye and...

Author(s): Ambarish Vaidyanathan, Fuyuen Yip, Paul Garbe
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

**Studying the effects of a changing climate on wildfires and the impacts to the United States’ air quality**

[www.nrfirescience.org/resource/18179](http://www.nrfirescience.org/resource/18179)

Under the scope of a 2014 Joint Fire Science Program Grant, we are currently investigating future wildfire activity and consequences on air quality over the United States. In this study, we focus on major air pollutants, such as PM2.5 and ozone, and employ the global Community Earth System Model
Scientists aim to smoke out wildfire impacts

www.nrfirescience.org/resource/17915

Scientists this summer are taking to the air in an ambitious effort to better understand the chemistry, behavior, and health impacts of wildfire smoke. The flights in an instrument-packed C-130 airplane belonging to the National Science Foundation will be followed in 2019 by flights on a NASA DC-8 research jet by scientists with...

Author(s): Warren Cornwall
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Extensible Database of Validated Biomass Smoke Events for Health Research

www.nrfirescience.org/resource/18812

The extensible Biomass Smoke Validated Events Database is an ongoing, community driven, collection of air pollution events which are known to be caused by vegetation fires such as bushfires (also known as wildfire and wildland fires), or prescribed fuel reduction burns, and wood heaters. This is useful for researchers of health...

Author(s): Ivan C. Hanigan, Geoffrey G. Morgan, Grant J. Williamson, Farhad Salimi, Sarah B. Henderson, Murray R. Turner, David M. J. S. Bowman, Fay H. Johnston
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Optimizing smoke and plume rise modeling approaches at local scales

www.nrfirescience.org/resource/17793

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

Review of emissions from smouldering peat fires and their contribution to regional haze episodes

www.nrfirescience.org/resource/17692

Smouldering peat fires, the largest fires on Earth in terms of fuel consumption, are reported in six continents and are responsible for regional haze episodes. Haze is the large-scale accumulation of smoke at low altitudes in the atmosphere. It decreases air quality, disrupts transportation and causes health emergencies. Research on...

Author(s): Yuqi Hu, Nieves Fernandez-Anez, Thomas E. L. Smith, Guillermo Rein
Year Published: 2018
Type: Document
Book or Chapter or Journal Article
The weather conditions for desired smoke plumes at a FASMEE burn site

Weather is an important factor that determines smoke development, which is essential information for planning smoke field measurements. This study identifies the synoptic systems that would favor to produce the desired smoke plumes for the Fire and Smoke Model Evaluation Experiment (FASMEE). Daysmoke and PB-Piedmont (PB-P) models...

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

NWCG Smoke Management Guide for Prescribed Fire

The NWCG Smoke Management Guide for Prescribed Fire contains information on prescribed fire smoke management techniques, air quality regulations, smoke monitoring, modeling, communication, public perception of prescribed fire and smoke, climate change, practical meteorological approaches and smoke tools. The primary focus of this...

Author(s): Janice L. Peterson, Peter Lahm, Mark Fitch, Michael H. George, Dennis V. Haddow, Mark A. Melvin, Joshua C. Hyde, Ellen Eberhardt
Year Published: 2018
Type: Document
Technical Report or White Paper

Can air quality management drive sustainable fuels management at the temperate wildland-urban interface?

Sustainable fire management has eluded all industrial societies. Given the growing number and magnitude of wildfire events, prescribed fire is being increasingly promoted as the key to reducing wildfire risk. However, smoke from prescribed fires can adversely affect public health. We propose that the application of air quality...

Author(s): David M. J. S. Bowman, Lori D. Daniels, Fay H. Johnston, Grant J. Williamson, William Matt Jolly, Sheryl Magzamen, Ana G. Rappold, Michael Brauer, Sarah B. Henderson
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Human impacts on 20th century fire dynamics and implications for global carbon and water trajectories

Fire is a fundamental Earth system process and the primary ecosystem disturbance on the global scale. It affects carbon and water cycles through changing terrestrial ecosystems, and at the same time, is regulated by weather and climate, vegetation characteristics, and, importantly, human ignitions and suppression (i.e., the direct...

Author(s): Fang Li, David M. Lawrence, Ben Bond-Lamberty
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

The impact of US wildland fires on ozone and particulate matter: a comparison of
measurements and CMAQ model predictions from 2008 to 2012
www.nrfirescience.org/resource/18246
Wildland fire emissions are routinely estimated in the US Environmental Protection Agency’s National Emissions Inventory, specifically for fine particulate matter (PM2.5) and precursors to ozone (O3); however, there is a large amount of uncertainty in this sector. We employ a brute-force zero-out sensitivity method to estimate the...
Author(s): Joseph L. Wilkins, George A. Pouliot, Kristen Foley, Wyat Appel, Thomas E. Pierce
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

The health impacts and economic value of wildland fire episodes in the U.S.: 2008-2012
www.nrfirescience.org/resource/17239
Wildland fires degrade air quality and adversely affect human health. A growing body of epidemiology literature reports increased rates of emergency departments, hospital admissions and premature deaths from wildfire smoke exposure. Objective: Our research aimed to characterize excess mortality and morbidity events, and the economic...
Author(s): Neal L. Fann, Breanna Alman, Richard A. Broome, Geoffrey G. Morgan, Fay H. Johnston, George A. Pouliot, Ana G. Rappold
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Quantifying wildfire growth rates using smoke plume observations derived from weather radar
www.nrfirescience.org/resource/18054
Fast-moving wildfires can result in substantial losses of infrastructure, property and life. During such events, real-time intelligence is critical for managing firefighting activities and public safety. The ability of fixed-site weather radars to detect the plumes from fires has long been recognized; however, quantitative methods...
Author(s): Thomas J. Duff, Derek M. Chong, Trent D. Penman
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

A review of community smoke exposure from wildfire compared to prescribed fire in the United States
www.nrfirescience.org/resource/17896
Prescribed fire, intentionally ignited low-intensity fires, and managed wildfires—wildfires that are allowed to burn for land management benefit—could be used as a land management tool to create forests that are resilient to wildland fire. This could lead to fewer large catastrophic wildfires in the future. However, we must...
Author(s): Kathleen M. Navarro, D.W. Schweizer, John R. Balmes, Ricardo Cisneros
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Contiguous United States wildland fire emission estimates during 2003-2015
www.nrfirescience.org/resource/18828
Wildfires are a major source of air pollutants in the United States. Wildfire smoke can trigger severe pollution episodes with substantial impacts on public health. In addition to acute episodes, wildfires can have a marginal effect on air quality at significant distances from the source, presenting significant
challenges to air...
Author(s): Shawn P. Urbanski, Matthew C. Reeves, Rachel E. Corley, Robin P. Silverstein, Wei Min Hao
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Air quality impacts from prescribed fire and wildfire: How do they compare?
www.nrfirescience.org/resource/17799
Prescribed fires are regulated by states and are always subject to strict air-quality standards. Their use must be planned carefully to keep the smoke they produce at acceptable levels. Managers can predict the direction of smoke plumes by relying on meteorological reports and using computer models.

Author(s): Carrie Berger, Stephen A. Fitzgerald, Daniel Leavell, Janice L. Peterson
Year Published: 2018
Type: Document
Research Brief or Fact Sheet

The role of composition and particle size on the toxicity of wildfire emissions - JFSP Final Report
www.nrfirescience.org/resource/18785
Acute and chronic exposure to wildfire smoke can cause numerous documented cardiopulmonary effects, although determining the casual components within the thousands of different chemicals found in both the particle and gas phases remains a toxicological challenge. Specifically, little work has been done to evaluate and predict...

Author(s): M. Ian Gilmour
Year Published: 2018
Type: Document
Technical Report or White Paper

Joint Fire Science Program Smoke Science Plan, 2010–2016: Results and Impacts
www.nrfirescience.org/resource/17755
The Smoke Science Plan (SSP) was built upon personal interviews and an extensive web-based needs identification with scientists, fire managers, and air quality managers using online questionnaires (Riebau and Fox 2010a, 2010b). It is structured around four themes, which are conceptualized as complementary investigative areas to...

Author(s): Allen R. Riebau, Douglas G. Fox, Cindy Huber
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Wildland fire smoke and human health
www.nrfirescience.org/resource/16639
The natural cycle of landscape fire maintains the ecological health of the land, yet adverse health effects associated with exposure to emissions from wildfire produce public health and clinical challenges. Systematic reviews conclude that a positive association exists between exposure to wildfire smoke or wildfire particulate...

Author(s): Wayne E. Cascio
Year Published: 2018
Type: Document
Book or Chapter or Journal Article
Wildfire smoke cools summer river and stream water temperatures
www.nrfirescience.org/resource/18368
To test the hypothesis that wildfire smoke can cool summer river and stream water temperatures by attenuating solar radiation and air temperature, we analyzed data on summer wildfire smoke, solar radiation, air temperatures, precipitation, river discharge, and water temperatures in the lower Klamath River Basin in Northern...
Author(s): Aaron T. David, J. Eli Asarian, Frank K. Lake
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Carbon cycle and climate effects of forcing from fire-emitted aerosols
www.nrfirescience.org/resource/17419
Aerosols emitted by landscape fires affect many climatic processes. Here, we combined an aerosol–climate model and a coupled climate-carbon model to study the carbon cycle and climate effects caused by fire-emitted aerosols (FEA) forcing at the top of the atmosphere and at the surface. This forcing ('best guess' present-day values...
Author(s): Jean-Sebastien Landry, Antti-Illari Partanen, H. Damon Matthews
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Emissions from prescribed burning of agricultural fields in the Pacific Northwest
www.nrfirescience.org/resource/16554
Prescribed burns of winter wheat stubble and Kentucky bluegrass fields in northern Idaho and eastern Washington states (U.S.A.) were sampled using ground-, aerostat-, airplane-, and laboratory-based measurement platforms to determine emission factors, compare methods, and provide a current and comprehensive set of emissions data for...
Author(s): Amara L. Holder, Brian K. Gullett, Shawn P. Urbanski, Robert Elleman, Susan M. O'Neill, Dennis Tabor, William Mitchell, Kirk R. Baker
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

Aligning smoke management with ecological and public health goals
www.nrfirescience.org/resource/15053
Past and current forest management affects wildland fire smoke impacts on downwind human populations. However, mismatches between the scale of benefits and risks make it difficult to proactively manage wildland fires to promote both ecological and public health. Building on recent literature and advances in modeling smoke and health...
Author(s): Jonathan Long, Leland W. Tarnay, Malcolm P. North
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

A large source of dust missing in particulate matter emission inventories? Wind erosion of post-fire landscapes
www.nrfirescience.org/resource/16292
Wind erosion of soils burned by wildfire contributes substantial particulate matter (PM) in the form of
Public use of information about smoke emissions: application of the risk information seeking and processing (RISP) model
www.nrfirescience.org/resource/16281
In the last few decades, the number of people living in fire-prone ecosystems has increased, placing more people and private property at risk to future fire events. Substantial research has demonstrated consistent public support for the use of prescribed fires in fuel-reduction efforts; however, continuing public concern regarding... 
Author(s): Kathleen M. Rose, Eric Toman, Christine Olsen 
Year Published: 2017 
Type: Document 
Book or Chapter or Journal Article

U.S. EPA Smoke Emissions, Chemistry, and Transport Modeling - Final Report to the Joint Fire Science Program
www.nrfirescience.org/resource/17028
Photochemical grid models such as the Community Multiscale Air Quality Model (CMAQ) are used to estimate local to continental scale O3, PM, and haze for scientific and regulatory assessments. Field data from specific and well characterized wildland fires is critically important to improve wildland fire emissions estimation... 
Author(s): Kirk R. Baker, Thomas E. Pierce 
Year Published: 2017 
Type: Document 
Technical Report or White Paper

Development of a comprehensive plume dynamics and meteorology study plan for FASMEE - Final Report to the Joint Fire Science Program
www.nrfirescience.org/resource/17025
The goal of this project was to develop the Plume Dynamics and Meteorology portion of the Study Plan for the Fire and Smoke Model Evaluation Experiment (FASMEE). The Investigators participated in regular meetings with the other discipline leads, modeling leads, and the science leadership team; field trips to examine potential sites... 
Author(s): Brian E. Potter, Craig B. Clements 
Year Published: 2017 
Type: Document 
Technical Report or White Paper

Smoke in a new era of fire
www.nrfirescience.org/resource/17804
Smoke from fire can sharply reduce air quality by releasing particulate matter, one of the most dangerous types of air pollution for human health. A third of U.S. households have someone sensitive to smoke. Minimizing the amount and impact of smoke is a high priority for land managers and regulators. One tool for achieving that goal... 
Author(s): Rachel White, Paul F. Hessburg, Narasimhan K. Larkin, J. Morgan Varner
Phase dynamics of wildland fire smoke emissions and their secondary organic aerosols
www.nrfirescience.org/resource/15581
Biomass burning is an important source to the atmosphere of carbonaceous particulate matter that impacts air quality, climate, and human health. The semivolatile nature of directly emitted organic particulate matter can result in particle evaporation as smoke plumes dilute. Further, oxidation of emitted and volatilized precursors can...
Author(s): Sonia M. Kreidenweis, Jeffrey R. Pierce
Year Published: 2017
Type: Document
Technical Report or White Paper

A Low-Cost Sensor Network for Wildfire Smoke Detection and Monitoring - Final Report to the Joint Fire Science Program
www.nrfirescience.org/resource/17021
Wildfires and prescribed fires produce emissions that are harmful to human health. These health effects, however, are difficult to quantify, likely in part due to sparse data on exposure. The ability to measure fire emissions as they reach sensitive areas is critical to ensuring the protection of public health. Ground level...
Author(s): John Volckens, Scott Kelleher
Year Published: 2017
Type: Document
Technical Report or White Paper

How smoke from fires can affect your health
www.nrfirescience.org/resource/17800
Smoke is made up of a complex mixture of gases and fine particles produced when wood and other organic materials burn. The biggest health threat from smoke is from fine particles. These microscopic particles can penetrate deep into your lungs. They can cause a range of health problems, from burning eyes and a runny nose to...
Year Published: 2017
Type: Document
Research Brief or Fact Sheet

Wildland Fire Smoke Health Effects on Wildland Firefighters and the Public - Final Report to the Joint Fire Science Program
www.nrfirescience.org/resource/17009
Wildland fire smoke is a complex mixture of air contaminants that have the potential cause adverse health effects. Individuals can be exposed occupationally if they work as wildland firefighters or public exposure from ambient air that is contaminated with smoke from a nearby or distant wildland fire. Previous studies of public...
Author(s): Joe Domitrovich, George Broyles, Roger D. Ottmar, Timothy E. Reinhardt, Luke P. Naheer, Michael T. Kleinman, Kathleen M. Navarro, Christopher E. Mackay, Olorunfemi Adetona
Year Published: 2017
Type: Document
Technical Report or White Paper
Estimating the Effects of Changing Climate on Fires and Consequences for U.S. Air Quality, Using a Set of Global and Regional Climate Models - Final Report to the Joint Fire Science Program
www.nrfirescience.org/resource/16995
Emissions of aerosols and gases from fires have been shown to adversely affect US air quality at local to regional scales as well as downwind regions far away from the source. In addition, smoke from fires negatively affects humans, ecosystems, and climate. Recent observations have shown an upward trend of area burned over western...
Author(s): Jeffrey R. Pierce, Maria Val Martin, Colette L. Heald
Year Published: 2017
Type: Document
Technical Report or White Paper

Application of an original wildfire smoke health cost benefits transfer protocol to the western US, 2005-2015
www.nrfirescience.org/resource/15529
Recent growth in the frequency and severity of US wildfires has led to more wildfire smoke and increased public exposure to harmful air pollutants. Populations exposed to wildfire smoke experience a variety of negative health impacts, imposing economic costs on society. However, few estimates of smoke health costs exist and none for...
Author(s): Benjamin A. Jones, Robert P. Berrens
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

Wildland firefighter exposure to hydrocarbons
www.nrfirescience.org/resource/16582
Wildland firefighters suppressing wildland fires or conducting prescribed fires work long shifts and are exposed to high levels of smoke with no respiratory protection. Inhalation of smoke is a safety concern for wildland firefighters and can potentially impair their performance and cause short and long term health impacts.
Author(s): Kathleen M. Navarro, Stacey S. Frederick
Year Published: 2017
Type: Document
Research Brief or Fact Sheet

Effectiveness of public health messaging and communication channels during smoke events: a rapid systematic review
www.nrfirescience.org/resource/15062
Exposure to smoke emitted from wildfire and planned burns (i.e., smoke events) has been associated with numerous negative health outcomes, including respiratory symptoms and conditions. This rapid review investigates recent evidence (post-2009) regarding the effectiveness of public health messaging during smoke events. The...
Author(s): Jennifer A. Fish, Micah D. J. Peters, Imogen Ramsey, Greg Sharpfin, Nadia Corsini, Marion Eckert
Year Published: 2017
Type: Document
Book or Chapter or Journal Article, Synthesis

Occupational Exposure to Polycyclic Aromatic Hydrocarbon of Wildland Firefighters at Prescribed and Wildland Fires
Wildland firefighters suppressing wildland fires or conducting prescribed fires work long shifts during which they are exposed to high levels of wood smoke with no respiratory protection. Polycyclic aromatic hydrocarbons (PAHs) are hazardous air pollutants formed during incomplete combustion. Exposure to PAHs was measured for 21...

Author(s): Kathleen M. Navarro, Ricardo Cisneros, Elizabeth M. Noth, John R. Balmes, Katharine Hammond
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

Impact of wildfires on some greenhouse gases over continental USA: a study based on satellite data

Wildfire episodes are becoming more rampant with global warming and climate change. Every year it causes lots of damage in terms of burnt acres and also impacts the air quality and climate through emission of various trace greenhouse gases. As emissions from large fires increase with time, it is essential to monitor the extent and...

Author(s): Bokhwa Kim, Sudipta Sarkar
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

Wildfire smoke exposure and human health: significant gaps in research for a growing public health issue

Understanding the effect of wildfire smoke exposure on human health represents a unique interdisciplinary challenge to the scientific community. Population health studies indicate that wildfire smoke is a risk to human health and increases the healthcare burden of smoke-impacted areas. However, wildfire smoke composition is complex...

Author(s): Carolyn Black, Yohannes Tesfaigzi, Jed A. Bassein, Lisa A. Miller
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

Accelerating awareness, understanding, and adoption of wildland fire science information - Final Report to the Joint Fire Science Program

Smoke from wildland fires has a significant impact on public health and transportation safety and presents a serious complication for air regulators seeking to design effective and efficient emission control strategies to meet and maintain air quality standards. Wildland fires produce numerous hazardous air pollutants and criteria...

Author(s): Shawn P. Urbanski
Year Published: 2017
Type: Document
Technical Report or White Paper

FIRETEC and WFDS modeling of fire behavior and smoke in support of FASMEE - Final Report to the Joint Fire Science Program

The objective of FASMEE is to obtain measurements that can be used to evaluate and advance
operational smoke models. Among the focus areas listed in the FON task statements are the modeling of fire growth, fire behavior, and plume development. In current operational models, the physical processes driving fire growth, fire behavior,...

Author(s): William E. Mell, Rodman Linn
Year Published: 2017
Type: Document
Technical Report or White Paper

**Application of Daysmoke and PB-P Models in Phase I of the Fire and Smoke Model Evaluation Experiment - Final Report to the Joint Fire Science Program**
www.nrfirescience.org/resource/17016
This proposed study was in response to the Joint Fire Sciences FA-FON0016-0004 Fire and Smoke Model Evaluation Experiment (FASMEE) Task 5 - Modeling leads. The purpose was to evaluate Daysmoke and PB-Piedmont (PB-P) models to provide information for the FASMEE Phase 2 design. Daysmoke is a local smoke plume dispersion and transport...

Author(s): Yongqiang Liu, Scott L. Goodrick, Gary Achtemeier
Year Published: 2017
Type: Document
Technical Report or White Paper

**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

**Social media approaches to modeling wildfire smoke dispersion: spatiotemporal and social scientific investigations**
www.nrfirescience.org/resource/15552
Wildfires have significant effects on human populations, economically, environmentally, and in terms of their general well-being. Smoke pollution, in particular, from either prescribed burns or uncontrolled wildfires, can have significant health impacts. Some estimates suggest that smoke dispersion from fire events may affect the...

Author(s): Sonya Sachdeva, Sarah M. McCaffrey, Dexter Locke
Year Published: 2017
Type: Document
Book or Chapter or Journal Article

**Airborne measurements of western U.S. wildfire emissions: Comparison with prescribed burning and air quality implications**
www.nrfirescience.org/resource/15367
Wildfires emit significant amounts of pollutants that degrade air quality. Plumes from three wildfires in the western U.S. were measured from aircraft during the Studies of Emissions and Atmospheric Composition, Clouds and Climate Coupling by Regional Surveys (SEAC4RS) and the Biomass Burning
**Observation Project (BBOP), both in...**

**Emissions from prescribed burning of timber slash piles in Oregon**

Emissions from burning piles of post-harvest timber slash (Douglas-fir) in Grande Ronde, Oregon were sampled using an instrument platform lofted into the plume using a tether-controlled aerostat or balloon. Emissions of carbon monoxide, carbon dioxide, methane, particulate matter (PM2.5), black carbon, ultraviolet absorbing PM,...

**Smoke management photographic guide: a visual aid for communicating impacts**

Communicating emissions impacts to the public can sometimes be difficult because quantitatively conveying smoke concentrations is complicated. Regulators and land managers often refer to particulate-matter concentrations in micrograms per cubic meter, but this may not be intuitive or meaningful to everyone. The primary purpose of...

**Forest fire policy: change conventional thinking of smoke management to prioritize long-term air quality and public health**

Wildland fire smoke is inevitable. Size and intensity of wildland fires are increasing in the western USA. Smoke-free skies and public exposure to wildland fire smoke have effectively been postponed through suppression. The historic policy of suppression has systematically both instilled a public expectation of a smoke-free...

**Non-deforestation fire vs. fossil fuel combustion: the source of CO2 emissions affects the global carbon cycle and climate responses**

Non-deforestation fire – i.e., fire that is typically followed by the recovery of natural vegetation – is arguably the most influential disturbance in terrestrial ecosystems, thereby playing a major role in...
carbon exchanges and affecting many climatic processes. The radiative effect from a given atmospheric CO2 perturbation is...

Author(s): Jean-Sebastien Landry, H. Damon Matthews
Year Published: 2016
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

Air-quality impacts and intake fraction of PM2.5 during the 2013 RimMegafire
www.nrfirescience.org/resource/19466
The 2013 Rim Fire was the third largest wildfire in California history and burned 257 314 acres in the Sierra Nevada Mountains. We evaluated air-quality impacts of PM2.5 from smoke from the Rim Fire on receptor areas in California and Nevada. We employed two approaches to examine the air-quality impacts: (1) an evaluation of PM2....
Author(s): Kathleen M. Navarro, Ricardo Cisneros, Susan M. O'Neil, Narasimhan K. Larkin, Don Schweizer, John R. Balmes
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Characterizing public tolerance of smoke from wildland fires in communities across the United States
www.nrfirescience.org/resource/14813
Little is known about public tolerance of smoke from wildland fires. By combining data from two household surveys, we sought to determine whether tolerance of smoke from wildland fires varies with its origin or managerial rationale, to describe geographical variation in tolerance of smoke, and to describe the relationship between...
Author(s): Jesse M. Engebretson, Troy E. Hall, Jarod Blades, Christine Olsen, Eric Toman, Stacey S. Frederick
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Review of the health effects of wildland fire smoke on wildland firefighters and the public
www.nrfirescience.org/resource/14633
Each year, the general public and wildland firefighters in the US are exposed to smoke from wildland fires. As part of an effort to characterize health risks of breathing this smoke, a review of the literature was conducted using five major databases, including PubMed and MEDLINE Web of Knowledge, to identify smoke components that...
Author(s): Olorunfemi Adetona, Timothy E. Reinhardt, Joe Domitrovich, George Broyles, Anna M.
Critical assessment of wildland fire emissions inventories: methodology, uncertainty, effectiveness - Final Report to the Joint Fire Science Program

The project addressed the following tasks: 1) Review and summarize the technical details of major FEIS. 2) Quantify the uncertainty of the components of burned area, fuel loading, and emission factors of each FEIS. 3) Quantify the uncertainty of emissions estimated by each FEIS at scales relevant to modeling ozone, PM2.5 NAAQS, and...

Author(s): Wei Min Hao, Shawn P. Urbanski, Helen T. Naughton
Year Published: 2016
Type: Document
Technical Report or White Paper

Particulate air pollution from wildfires in the western US under climate change

Wildfire can impose a direct impact on human health under climate change. While the potential impacts of climate change on wildfires and resulting air pollution have been studied, it is not known who will be most affected by the growing threat of wildfires. Identifying communities that will be most affected will inform development...

Author(s): Jia Coco Liu, Loretta J. Mickley, Melissa P. Sulprizio, Francesca Dominici, Xu Yue, Keita Ebisu, Georgian Brooke Anderson, Rafi F.A. Khan, Mercedes Bravo, Michelle L. Bell
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Toward an integrated system for fire, smoke and air quality simulations

In this study, WRF-Sfire is coupled with WRF-Chem to construct WRFSC, an integrated forecast system for wildfire behaviour and smoke prediction. WRF-Sfire directly predicts wildfire spread, plume and plume-top heights, providing comprehensive meteorology and fire emissions to chemical transport model WRF-Chem, eliminating the need...

Author(s): Adam K. Kochanski, Mary Ann Jenkins, Kara M. Yedinak, Jan Mandel, Jonathan Beezley, Brian K. Lamb
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

A case study comparison of LANDFIRE fuel loading and emissions on a mixed conifer forest in northern Idaho, USA

The use of fire as a land management tool is well recognized for its ecological benefits in many natural systems. To continue to use fire while complying with air quality regulations, land managers are often tasked with modeling emissions from fire during the planning process. To populate such models, the Landscape Fire...

Author(s): Joshua C. Hyde, Eva K. Strand, Andrew T. Hudak, Dale Hamilton
Year Published: 2015
Type: Document
Wildfire smoke and public health risk
www.nrfirescience.org/resource/13562
Wildfire activity is predicted to increase with global climate change, resulting in longer fire seasons and larger areas burned. The emissions from fires are highly variable owing to differences in fuel, burning conditions and other external environmental factors. The smoke that is generated can impact human populations spread over...
Author(s): Fabienne Reisen, Sandra M. Duran, Michael D. Flannigan, Catherine Elliott, Karen Rideout
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

Strategic operations planning-it's not just for wilderness! How the strategic operations planner can help
www.nrfirescience.org/resource/14609
The Strategic Operational Planner (SOPL) wildland fire management position was created in the United States in 2009 to reflect updated terminology. SOPL merges the former Fire Use Manager positions (FUM1 and FUM2) and is now an established position within the Incident Command System. Traditionally, the FUM positions and the SOPL...
Author(s): Charles W. McHugh, Stu Hoyt, Brett Fay
Year Published: 2015
Type: Document
Technical Report or White Paper

A systematic review of the physical health impacts from non-occupational exposure to wildfire smoke
www.nrfirescience.org/resource/13262
Climate change is likely to increase the threat of wild fires, and little is known about how wild fires affect health in exposed communities. A better understanding of the impacts of the resulting air pollution has important public health implications for the present day and the future. Method: We performed a systematic search to...
Author(s): Jia C. Liu, Gavin Pereira, Sarah A. Uhl, Mercedes Bravo, Michelle L. Bell
Year Published: 2015
Type: Document
Synthesis

Modeling study of the contribution of fire emissions on BC concentrations and deposition rates
www.nrfirescience.org/resource/15578
Regional air quality simulations were performed to evaluate the contributions of wildland fires to inter-annual variability of black carbon (BC) concentrations and to assess the contributions of wildfires vs. prescribed fires to BC concentrations and deposition rates to glacier areas and snow-covered surfaces in the western US....
Year Published: 2015
Type: Document
Technical Report or White Paper

Verification of Spot Fire Weather Forecasts
Software was developed to evaluate National Weather Service (NWS) spot forecasts. Fire management officials request spot forecasts from the NWS to provide detailed guidance as to atmospheric conditions in the vicinity of planned prescribed burns as well as wildfires that do not have incident meteorologists on site. A multi-year set...

Author(s): John D. Horel, Timothy J. Brown
Year Published: 2015
Type: Document
Technical Report or White Paper

Proceedings of the International Smoke Symposium

The International Smoke Symposium was held in Hyattsville, Maryland at the University of Maryland University College, USA, October 21-24, 2013. The objective of this symposium was to bring together air quality, fire, and smoke specialists from the research community, non-governmental organizations (NGOs), local/state/federal...

Year Published: 2015
Type: Document
Conference Proceedings

Determination of the smoke-plume heights and their dynamics with ground-based scanning LIDAR

Lidar-data processing techniques are analyzed, which allow determining smoke-plume heights and their dynamics and can be helpful for the improvement of smoke dispersion and air quality models. The data processing algorithms considered in the paper are based on the analysis of two alternative characteristics related to the smoke...

Author(s): Vladimir A. Kovalev, Alexander P. Petkov, Cyle E. Wold, Shawn P. Urbanski, Wei Min Hao
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

Characterizing large airtanker use in United States fire management

The appropriate role of large airtankers (LATs) in federal fire suppression in the United States has been the source of much debate and discussion in recent years as the U.S. Forest Service (USFS) has faced impending decisions about how best to address an aging fleet of contracted aircraft. Questions of fleet efficiency are...

Author(s): Crystal S. Stonesifer, Matthew P. Thompson, David E. Calkin, Charles W. McHugh
Year Published: 2015
Type: Document
Conference Proceedings

Future mega-fires and smoke impacts

"Megafire" events, in which large high-intensity fires propagate over extended periods, can cause both immense damage to the local environment and catastrophic air quality impacts on cities and towns downwind. Increases in extreme events associated with climate change (e.g., droughts, heat waves) are projected to result in more...

Author(s): Narasimhan K. Larkin, John T. Abatzoglou, Donald McKenzie, Brian E. Potter, E. Ashley Steel, Brian J. Stocks
The climate-wildfire-air quality system: interactions and feedbacks across spatial and temporal scales
www.nrfirescience.org/resource/13698
Future climate change and its effects on social and ecological systems present challenges for preserving valued ecosystem services, including local and regional air quality. Wildfire is a major source of air-quality impact in some locations, and a substantial contributor to pollutants of concern, including nitrogen oxides and...
Author(s): E. Natasha Stavros, Donald McKenzie, Narasimhan K. Larkin
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Communicating about smoke from wildland fire: challenges and opportunities for managers
www.nrfirescience.org/resource/12982
Wildland fire and associated management efforts are dominant topics in natural resource fields. Smoke from fires can be a nuisance and pose serious health risks and aggravate pre-existing health conditions. When it results in reduced visibility near roadways, smoke can also pose hazardous driving conditions and reduce the scenic...
Author(s): Christine Olsen, Danielle K. Mazzotta, Eric Toman, A. Paige Fischer
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Six basic smoke management practices for prescribed burning
www.nrfirescience.org/resource/12384
Smoke management has become one of the leading challenges facing prescribed fire practitioners in the Southeast and the continued use of prescribed fire in the region may depend on effective smoke and emission mitigation practices. While not a comprehensive list of smoke management strategies, the 2011 USFS-NRCS guide to Basic Smoke...
Author(s): David R. Godwin, Alan J. Long, Peter Lahm
Year Published: 2014
Type: Document
Research Brief or Fact Sheet

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

Smoke management of wildland and prescribed fire: understanding public preferences and
Smoke from forest fires is a serious and increasing land management concern. However, a paucity of information exists that is specific to public perceptions of smoke. This study used conjoint analysis, a multivariate technique, to evaluate how four situational factors (i.e., smoke origin, smoke duration, health impact, and advanced...)

Author(s): Jarod Blades, Steven R. Shook, Troy E. Hall
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Wildfire is on the rise. The United States is witnessing a spectacular increase in acres lost to catastrophic wildfires, a phenomenon fed by the generally hotter and dryer conditions associated with climate change. In addition to losses in lives, property, and natural resources, wildfires contribute thousands of tons of air...

Author(s): Kirsten H. Engel
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Evaluating the influence of observed daily weather on observed fire-related effects (e.g. smoke production, carbon emissions and burn severity) often involves knowing exactly what day any given area has burned. As such, several studies have used fire progression maps - in which the perimeter of an actively burning fire is mapped at...

Author(s): Sean A. Parks
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

While North American ecosystems vary widely in their ecology and natural historical fire regimes, they are unified in benefitting from prescribed fire when judiciously applied with the goal of maintaining and restoring native ecosystem composition, structure, and function. On a modern landscape in which historical fire regimes...

Author(s): Association for Fire Ecology, International Association of Wildland Fire, Tall Timbers Research Station, The Nature Conservancy
Year Published: 2013
Type: Document
Technical Report or White Paper

Managers and policy-makers across broad disciplines and organizations are calling for a better understanding of public opinion on natural resource issues. One such issue is that of fire and its role in the management of our forests and rangelands. Public perceptions of fuel reduction techniques, with a particular emphasis on using...
Wildfire smoke and health impacts: a closer look at fire attributes and their marginal effects
www.nrfirescience.org/resource/12143
Existing studies on the economic impact of wildfire smoke have focused on single fire events or entire seasons without considering the marginal effect of daily fire progression on downwind communities. In addition, neither approach allows for an examination of the impact of even the most basic fire attributes, such as distance and...
Author(s): K. Moeltner, Man-Kuen Kim, E. Zhu, W. Yang
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Bridging natural resource communication boundaries: public perceptions of smoke from wildland fires and forest managers' perspectives of climate change science
www.nrfirescience.org/resource/13479
Land managers of the northern Rocky Mountains and south-central U.S. are challenged with numerous social and ecological changes, many of which are linked to climate change. The work presented here focuses on two important research gaps: 1) managers do not understand public opinions toward smoke from prescribed fires (a necessary...
Author(s): Jarod Blades
Year Published: 2013
Type: Document
Dissertation or Thesis

Public perceptions and tolerance of smoke from wildland fire - draft
www.nrfirescience.org/resource/13699
Land managers and officials need to understand the diverse public opinions toward smoke from wildland fires; however, a very limited amount of research has been conducted on this topic. Hence, land and fire managers are largely uncertain about society's willingness to tolerate smoke in the short-term for long-term benefits, and they...
Author(s): Jarod Blades, Troy E. Hall, Sarah M. McCaffrey
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Combustion efficiency and emission factors for wildfire-season fires in mixed conifer forests of the northern Rocky Mountains, US
www.nrfirescience.org/resource/13481
In the US, wildfires and prescribed burning present significant challenges to air regulatory agencies attempting to achieve and maintain compliance with air quality regulations. Fire emission factors (EF) are essential input for the emission models used to develop wildland fire emission inventories. Most previous studies quantifying...
Author(s): Shawn P. Urbanski
Year Published: 2013
Type: Document
Book or Chapter or Journal Article
Fuel moisture influences on fire-altered carbon in masticated fuels: an experimental study

Biomass burning is a significant contributor to atmospheric carbon emissions, but may also provide an avenue in which fire-affected ecosystems can accumulate carbon over time, through the generation of highly resistant fire-altered carbon. Identifying how fuel moisture, and subsequent changes in the fire behavior, relates to the...

Author(s): Nolan W. Brewer, Alistair M. S. Smith, Jeff A. Hatten, Philip E. Higuera, Andrew T. Hudak, Roger D. Ottmar, Wade T. Tinkham
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Gas-particle partitioning of primary organic aerosol emissions: 3. Biomass burning

Atmospheric organic aerosol concentrations depend in part on the gas-particle partitioning of primary organic aerosol (POA) emissions. Consequently, heating and dilution were used to investigate the volatility of biomass-burning smoke particles from combustion of common North American trees/shrubs/grasses during the third Fire Lab...

Author(s): Andrew A. May, Ezra Levin, Christopher J. Hennigan, Ilona Riipinen, Taehyoung Lee, Jeffrey L. Collett, Jose L. Jimenez, Sonia M. Kreidenweis, Allen L. Robinson
Year Published: 2013
Type: Document
Book or Chapter or Journal Article

Climate and vegetation influences on fire impacts in Alaskan boreal forest: implications for carbon and fire management

Boreal forest fires are an important source of terrestrial carbon emissions, particularly during years of widespread wildfires. Most carbon emission models parameterize wildfire impacts and carbon flux to area burned by fires, therein making the assumption that fires consume a spatiotemporally homogeneous landscape composed of...

Author(s): Crystal A. Kolden, John T. Abatzoglou
Year Published: 2012
Type: Document
Book or Chapter or Journal Article

Research perspectives on the public and fire management: a synthesis of current social science on eight essential questions

As part of a Joint Fire Science Program project, a team of social scientists reviewed existing fire social science literature to develop a targeted synthesis of scientific knowledge on the following questions: 1. What is the public's understanding of fire's role in the ecosystem? 2. Who are trusted sources of information about fire...

Author(s): Sarah M. McCaffrey, Christine Olsen
Year Published: 2012
Type: Document
Synthesis

Influencing public perceptions of smoke management and prescribed burning programs: an analysis of opportunities existing in communication tactics, community-based partnerships and
interagency decision making
www.nrfirescience.org/resource/13507
Historical fire suppression efforts have led to the alteration of forest structure and fuel conditions across the United States. Correspondingly, managers are now faced with higher fuel loads and denser vegetation as well as growing forest communities and wildland-urban interface. While managers recognize the ecological benefits of...
Author(s): Danielle K. Mazzotta
Year Published: 2012
Type: Document
Dissertation or Thesis

Emissions of air pollutants by Canadian wildfires from 2000 to 2004
www.nrfirescience.org/resource/14707
A wildfire emission model, based on the Canadian Forest Fire Behaviour Prediction System and the Canadian weather forecast Global Environmental Multiscale model, was applied to forest fires that occurred in Canada between 2000 and 2004. Emissions of 21 chemical species and injection heights were calculated hourly for a regular 0.4...
Author(s): David Lavoue, Brian J. Stocks
Year Published: 2011
Type: Document
Book or Chapter or Journal Article

The combustion of sound and rotten coarse woody debris: a review
www.nrfirescience.org/resource/13132
Coarse woody debris serves many functions in forest ecosystem processes and has important implications for fire management as it affects air quality, soil heating and carbon budgets when it combusts. There is relatively little research evaluating the physical properties relating to the combustion of this coarse woody debris with...
Author(s): Joshua C. Hyde, Alistair M. S. Smith, Roger D. Ottmar, Ernesto Alvarado, Penelope Morgan
Year Published: 2011
Type: Document
Book or Chapter or Journal Article

Situational awareness: nighttime smoke and fog on prescribed burns
www.nrfirescience.org/resource/12440
Nighttime smoke dispersal from most prescribed fires is critical for public health and safety. For this reason, prescribed fire training and guidelines include detailed information about smoke management and remind burn managers to be constantly aware of weather, fuel, and other situations that might lead to smoke dispersion...
Author(s): Anthony Matthews, Vince Carver
Year Published: 2011
Type: Document
Research Brief or Fact Sheet

The wildland fire emission inventory: western United States emission estimates and an evaluation of uncertainty
www.nrfirescience.org/resource/8356
Biomass burning emission inventories serve as critical input for atmospheric chemical transport models that are used to understand the role of biomass fires in the chemical composition of the atmosphere, air quality, and the climate system. Significant progress has been achieved in the development of regional and global biomass...
Prescribed fire as a means of reducing forest carbon emissions in the western United States

www.nrfirescience.org/resource/8328

Carbon sequestration by forested ecosystems offers a potential climate change mitigation benefit. However, wildfire has the potential to reverse this benefit. In the western United States, climate change and land management practices have led to increases in wildfire intensity and size. One potential means of reducing carbon...

Author(s): Christine Wiedinmyer, Matthew D. Hurteau
Year Published: 2010
Type: Document
Book or Chapter or Journal Article

The validity and utility of MODIS data for simple estimation of area burned and aerosols emitted by wildfire events

www.nrfirescience.org/resource/8371

Wildfire emissions are challenging to measure and model, but simple and realistic estimates can benefit multiple disciplines. We evaluate the potential of MODIS (Moderate Resolution Imaging Spectroradiometer) data to address this objective. A total of 11,004 fire pixels detected over 92 days were clustered into 242 discrete fire...

Author(s): Sarah B. Henderson, Charles Ichoku, Benjamin J. Burkholder, Michael Brauer, Peter L. Jackson
Year Published: 2010
Type: Document
Book or Chapter or Journal Article

The economic cost of adverse health effects from wildfire: a review

www.nrfirescience.org/resource/14534

The economic costs of adverse health effects associated with exposure to wildfire smoke should be given serious consideration in determining the optimal wildfire management policy. Unfortunately, the literature in this research area is thin. In an effort to better understand the nature of these economic costs, we review and...

Author(s): Ikuho Kochi, Geoffrey H. Donovan, Patricia A. Champ, John B. Loomis
Year Published: 2010
Type: Document
Book or Chapter or Journal Article

Filling in the blanks for prescribed fire in shrublands: developing information to support improved fire planning

www.nrfirescience.org/resource/11086

By collecting information on fuel loading, fuel consumption, fuel moisture, site conditions and fire weather on fires in a variety of shrubland types, researchers are developing a fuller knowledge of shrubland fire effects. Results are being integrated into the software package CONSUME, a user-friendly software tool for predicting...

Author(s): Jake Delwiche
Year Published: 2009
Type: Document
Research Brief or Fact Sheet
A MODIS direct broadcast algorithm for mapping wildfire burned area in the western United States

www.nrfirescience.org/resource/8191

Improved wildland fire emission inventory methods are needed to support air quality forecasting and guide the development of air shed management strategies. Air quality forecasting requires dynamic fire emission estimates that are generated in a timely manner to support real-time operations. In the regulatory and planning realm,...

Author(s): Shawn P. Urbanski, J. Meghan Salmon, Bryce L. Nordgren, Wei Min Hao
Year Published: 2009
Type: Document
Book or Chapter or Journal Article

Wildfire smoke: a guide for public health officials

www.nrfirescience.org/resource/12451

Smoke rolls into town, blanketing the city, turning on streetlights, creating an eerie and choking fog. Switchboards light up as people look for answers. Citizens want to know what they should do to protect themselves. School officials want to know if outdoor events should be cancelled. The news media want to know how dangerous the...

Author(s): Michael Lipsett, Barbara Materna, Susan Lyon Stone, Shannon Therriault, Robert Blaisdell, Jeff Cook
Year Published: 2008
Type: Document
Technical Report or White Paper

Real time monitoring of the three dimensional distribution of smoke aerosol levels from prescribed fires and wildfires - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/11168

Particulates emitted by wildfires and prescribed fires can severely affect visibility and air quality resulting in car accidents, airport and road closures, and public health problems. Researchers have developed a new remote-sensing instrument (lidar) and are now calibrating and testing this and auxiliary instrumentation and new...

Author(s): Wei Min Hao, Vladimir A. Kovalev
Year Published: 2008
Type: Document
Technical Report or White Paper

A comparison of smoke emissions from prescribed burns and wildfires

www.nrfirescience.org/resource/17803

This thesis describes a means of comparing the potential smoke impacts from prescribed burning versus the possible smoke impacts of a wildfire as if it had occurred in the same given area. The methodology of evaluating these impacts is based on the results of available computer models designed for determining smoke production and...

Author(s): David Frisbey
Year Published: 2008
Type: Document
Dissertation or Thesis

Emissions of levoglucosan, methoxy phenols, and organic acids from prescribed burns, laboratory combustion of wildland fuels, and residential wood combustion
Biomass combustion emissions make a significant contribution to the overall particulate pollution in the troposphere. Wildland or prescribed burns and residential wood combustion emissions can vary due to differences in fuel, season, time of day, and the nature of the combustion. Inadequate understanding of the relevance of these...

Author(s): Lynn R. Mazzoleni, Barbara Zielinska, Hans Moosmuller
Year Published: 2007
Type: Document
Book or Chapter or Journal Article

Prescribed fire: what influences public approval?

Except in remote areas, most prescribed fires will have some effect on members of the public. It is therefore important for land managers to work with the public before, during, and after a prescribed burn. To do this effectively, managers need to have an accurate idea of what people do and do not think about prescribed fire and...

Author(s): Sarah M. McCaffrey
Year Published: 2006
Type: Document
Technical Report or White Paper

Using focus groups to involve citizens in resource management - investigating perceptions of smoke as a barrier to prescribed forest burning

Participants in a series of focus groups discussed how their tolerance for smoke varied by the source of the smoke and found their opinions changing as they talked with other participants. Even those opposed to smoke from agricultural burning eventually found smoke from prescribed forest burning would be acceptable under appropriate...

Author(s): Brad R. Weisshaupt, Matthew S. Carroll, Keith A. Blatner, Pamela J. Jakes
Year Published: 2006
Type: Document
Technical Report or White Paper

Simple algorithm to determine the near-edge smoke boundaries with scanning lidar

We propose a modified algorithm for the gradient method to determine the near-edge smoke plume boundaries using backscatter signals of a scanning lidar. The running derivative of the ratio of the signalstandard deviation (STD) to the accumulated sum of the STD is calculated, and the location of the global maximum of this function is...

Author(s): Vladimir A. Kovalev, Cyle E. Wold, Jenny O. Newton, Wei Min Hao
Year Published: 2005
Type: Document
Book or Chapter or Journal Article

Federal Implementation Plans Under the Clean Air Act for Indian Reservations in Idaho, Oregon and Washington; Final Rule

The Environmental Protection Agency (EPA) is taking final action on these Federal Implementation Plans (FIPs) under the Clean Air Act (CAA) for Indian reservations in Idaho, Oregon, and Washington. The FIPs put in place basic air quality regulations to protect health and welfare on Indian reservations located in the Pacific...
Automated forecasting of smoke dispersion and air quality using NASA terra and aqua satellite data (Task 5) - Final Report to the Joint Fire Science Program
www.nrfirescience.org/resource/11150
This document contains a description of the air quality forecasting system in operation at the Missoula Fire Science Laboratory. This air quality forecasting system has been steadily assimilating new techniques and algorithms as they have been developed over the past four years. Individual components as well as assemblies of...
Author(s): Wei Min Hao, Shawn P. Urbanski
Year Published: 2005
Type: Document
Technical Report or White Paper

Near real-time emissions of trace gases and aerosol particles from biomass burning based on MODIS direct broadcast data
www.nrfirescience.org/resource/10961
Biomass burning is an important source of many atmospheric trace gases and aerosol particles. Quantitative characterization of biomass burning emissions is critical for modeling atmospheric chemistry and assessing the impact of fires on air quality, tropospheric ozone chemistry, and global climate. However, advancement in...
Author(s): Wei Min Hao, J. Meghan Salmon, Bryce L. Nordgren, Shawn P. Urbanski
Year Published: 2005
Type: Document
Conference Proceedings

Acceptability of smoke from prescribed forest burning in the northern inland west: a focus group approach
www.nrfirescience.org/resource/8393
Focus groups were used to gauge tolerance of smoke from broadcast prescribed forest burning in the wildland-urban interface of the northern Inland West. Focus group participants worked through issues surrounding prescribed burning as a management tool to determine if the origin of smoke made a difference in the acceptance of that...
Author(s): Brad R. Weisshaupt, Matthew S. Carroll, Keith A. Blatner, William D. Robinson, Pamela J. Jakes
Year Published: 2005
Type: Document
Book or Chapter or Journal Article

Smoke produced from residual combustion
www.nrfirescience.org/resource/11140
Considerable research has been carried out to estimate the chemical composition and the amount of trace gases and particulate matter emitted during short-duration flaming and smoldering combustion of fuels in the fire-prone forest and grassland ecosystems. For other forest ecosystems, where long-duration residual smoldering...
Author(s): Ronald E. Babbitt, Wei Min Hao
Year Published: 2004
Type: Document
Wildland fire in ecosystems: effects of fire on air
www.nrfirescience.org/resource/12587
This state-of-knowledge review about the effects of fire on air quality can assist land, fire, and air resource managers with fire and smoke planning, and their efforts to explain to others the science behind fire-related program policies and practices to improve air quality. Chapter topics include air quality regulations and fire;...
Author(s): David V. Sandberg, Roger D. Ottmar, Janice L. Peterson, John Core
Year Published: 2002
Type: Document
Technical Report or White Paper

Using a MODIS direct broadcast system to monitor fires and smoke, and forecast air quality
www.nrfirescience.org/resource/10960
The MODIS instrument on the NASA Terra satellite has been conducting routine global measurements of active fires and aerosol optical depths since late 2000. Currently, it takes more than 4 days to acquire MODIS data from the NASA DAAC Center, making it difficult to use the results to understand air quality and the extent of fire and...
Author(s): Wei Min Hao, Yoram J. Kaufman, Jacques Descloitres, Christopher O. Justice, Robert Sohlberg, Thomas Bobbe
Year Published: 2002
Type: Document
Conference Proceedings

Real-time smoke particulate sampling; fire storm 2000
www.nrfirescience.org/resource/11202
Reports the findings of a study comparing the results of instruments measuring smoke particulate in real time to gravimetric samplers in Missoula and Hamilton, Montana, during the summer of 2000. Real-time, particulate monitoring instruments were evaluated to determine their accuracy when measuring smoke particulate concentrations...
Author(s): Andy Trent, Mary A. Davies, Richard Karsky, Richard W. Fisher
Year Published: 2001
Type: Document
Technical Report or White Paper

Smoke exposure at western wildfires
www.nrfirescience.org/resource/11193
Smoke exposure measurements among firefighters at wildfires in the Western United States between 1992 and 1995 showed that altogether most exposures were not significant, between 3 and 5 percent of the shift-average exposures exceeded occupational exposure limits for carbon monoxide and respiratory irritants. Exposure to benzene and...
Author(s): Timothy E. Reinhardt, Roger D. Ottmar
Year Published: 2000
Type: Document
Technical Report or White Paper

Interim air quality policy on wildland and prescribed fires
www.nrfirescience.org/resource/12446
This policy statement has been prepared in response to plans by some Federal, tribal and State...
wildland owners/managers to significantly increase the use of wildland and prescribed fires to achieve resource benefits in the wildlands. Many wildland ecosystems are considered to be unhealthy as a result of past management strategies.

Author(s): U.S. Environmental Protection Agency
Year Published: 1998
Type: Document
Technical Report or White Paper

Open-path Fourier transform infrared studies of large-scale laboratory biomass fires
www.nrfirescience.org/resource/8401
A series of nine large-scale, open fires was conducted in the Intermountain Fire Sciences Laboratory (IFSL) controlled-environment combustion facility. The fuels were pure pine needles or sagebrush or mixed fuels simulating forest-floor, ground fires; crown fires; broadcast burns; and slash pile burns. Mid-infrared spectra of the...
Author(s): Robert J. Yokelson, David W. T. Griffith, Darold E. Ward
Year Published: 1996
Type: Document
Book or Chapter or Journal Article

Comparisons of particulate-emissions and smoke impacts from presettlement, full suppression, and prescribed natural fire period in the Selway-Bitterroot Wilderness
www.nrfirescience.org/resource/8216
Total particulate matter (PM) emissions were estimated for recent fires (1979-1990) and the presettlement period (prior to 1935) in the Selway-Bitterroot Wilderness (SBW) in Idaho and Montana. Recent period emissions were calculated by 10-day periods for surface fire and crown fire based on estimates of percentage fuel consumption...
Author(s): James K. Brown, Larry S. Bradshaw
Year Published: 1994
Type: Document
Book or Chapter or Journal Article

FTIR remote sensing of biomass burning emissions of CO2, CO, CH4, CH2O, NO, NO2, NH3, and N2O
www.nrfirescience.org/resource/8301
This work introduces remote sensing of biomass burning emissions using high-resolution Fourier transform infrared (FTIR) absorption spectroscopy over open paths in smoke plumes from biomass fires. There are several advantages to this type of smoke composition measurement, which address some of the disadvantages of previous...
Author(s): David W. T. Griffith, William G. Mankin, Michael T. Coffey, Darold E. Ward, Allen R. Riebau
Year Published: 1991
Type: Document
Book or Chapter or Journal Article

Hydrocarbon and biomass fuel fire field tests
www.nrfirescience.org/resource/11021
Biomass and hydrocarbon fuel fires are two common sources of obscuring smoke which present significant operational challenges over a broad range of possible viewing wavelengths. This is especially true of very large fires where the primary smoke particles (approx. 0.1-0.3 um diameter) obscure vision by both scattering and absorption...
Author(s): Lawrence F. Radke, Dean A. Hegg, J. David Nance, Jaime H. Lyons, Krista K. Laursen, R. J. Ferek, Peter V. Hobbs, Raymond E. Weiss
Airborne measurements on smokes from biomass burning
www.nrfirescience.org/resource/8384
Airborne measurements have been made in the smokes from large fires of standing coniferous trees and logging debris, standing chaparral, fallen jack pine, and wheat stubble. Panicle emission factors, particle size distributions, optical properties of the smokes, and trace gas concentrations in the emissions are derived from the...
Author(s): Lawrence F. Radke, Dean A. Hegg, Jaime H. Lyons, Charles A. Brock, Peter V. Hobbs, Raymond E. Weiss, Rei A. Rasmussen
Year Published: 1988
Type: Document
Book or Chapter or Journal Article

Ammonia emissions from biomass burning
www.nrfirescience.org/resource/8302
Measurements in the plumes from seven forest fires show that the concentrations of NH3 were considerably in excess of ambient values. Calculation of NH3 emissions from the fires, based on the ratio of NH3/CO in the plumes and emissions of CO from biomass burning, suggest that biomass burning may be a significant source of...
Author(s): Dean A. Hegg, Lawrence F. Radke, Peter V. Hobbs, Philip J. Riggan
Year Published: 1988
Type: Document
Book or Chapter or Journal Article

Smoke column height related to fire intensity
www.nrfirescience.org/resource/11946
Height of slash fire smoke columns, commonly thought to be a function of atmospheric conditions alone, through a series of 10-acre experimental fires is shown to be strongly related to fire intensity. By conducting intense fires, land managers can possibly burn forest debris and still maintain air quality when atmospheric conditions...
Author(s): Rodney A. Norum
Year Published: 1974
Type: Document
Technical Report or White Paper

Fire and smoke in Montana forests
www.nrfirescience.org/resource/13133
The concept of forest fire is especially difficult to deal with in an objective manner because fire has deep psychological associations for most animals, especially man. Moreover, attitudes toward forest fires have been greatly conditioned by what has been called the most effective advertising campaign in history...
Author(s): William R. Beaufait
Year Published: 1971
Type: Document
Book or Chapter or Journal Article