

## **Contiguous United States wildland fire emission estimates during 2003-2015**

[www.nrfirescience.org/resource/18828](http://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

## **Scientists aim to smoke out wildfire impacts**

[www.nrfirescience.org/resource/17915](http://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

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Book or Chapter or Journal Article

## **The role of composition and particle size on the toxicity of wildfire emissions - JFSP Final Report**

[www.nrfirescience.org/resource/18785](http://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

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Type: Document

Technical Report or White Paper

## **NWCG Smoke Management Guide for Prescribed Fire**

[www.nrfirescience.org/resource/17372](http://www.nrfirescience.org/resource/17372)

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

## **The weather conditions for desired smoke plumes at a FASMEE burn site**

[www.nrfirescience.org/resource/18365](http://www.nrfirescience.org/resource/18365)

Weather is an important factor that determines smoke development, which is essential information for planning smoke field measurements. This study identifies the synoptic systems that would favor to

produce the desired smoke plumes for the Fire and Smoke Model Evaluation Experiment (FASMEE). Daysmoke and PB-Piedmont (PB-P) models...

Author(s): Yongqiang Liu, Scott L. Goodrick, Gary Achtemeier

Year Published: 2018

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Book or Chapter or Journal Article

### **Air quality impacts from prescribed fire and wildfire: How do they compare?**

[www.nrfirescience.org/resource/17799](http://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.

Managers avoid smoke-sensitive...

Author(s): Carrie Berger, Stephen A. Fitzgerald, Daniel Leavell, Janice L. Peterson

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Type: Document

Research Brief or Fact Sheet

### **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

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

[www.nrfirescience.org/resource/18327](http://www.nrfirescience.org/resource/18327)

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

### **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](http://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 (PM<sub>2.5</sub>) and precursors to ozone (O<sub>3</sub>); 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, Wyatt Appel, Thomas E. Pierce

Year Published: 2018

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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](http://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

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Book or Chapter or Journal Article

### **Quantifying wildfire growth rates using smoke plume observations derived from weather radar**

[www.nrfirescience.org/resource/18054](http://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

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Book or Chapter or Journal Article

### **Extensible Database of Validated Biomass Smoke Events for Health Research**

[www.nrfirescience.org/resource/18812](http://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

### **A review of community smoke exposure from wildfire compared to prescribed fire in the United States**

[www.nrfirescience.org/resource/17896](http://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

### **Carbon cycle and climate effects of forcing from fire-emitted aerosols**

[www.nrfirescience.org/resource/17419](http://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-Ilari Partanen, H. Damon Matthews

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

### **Wildland fire smoke and human health**

[www.nrfirescience.org/resource/16639](http://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

### **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

### **Wildfire smoke cools summer river and stream water temperatures**

[www.nrfirescience.org/resource/18368](http://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

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

[www.nrfirescience.org/resource/17317](http://www.nrfirescience.org/resource/17317)

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

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

[www.nrfirescience.org/resource/18331](http://www.nrfirescience.org/resource/18331)

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

Author(s): Nikolay Gustenyov, Nelson K. Akafuah, Ahmad Salaimah, Mark A. Finney, Sara S. McAllister, Kozo Saito

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

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

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

Heating from wildfires adds buoyancy to the overlying air, often producing plumes that vertically distribute fire emissions throughout the atmospheric column over the fire. The height of the rising wildfire plume is a complex function of the size of the wildfire, fire heat flux, plume geometry, and atmospheric conditions, which can...

Author(s): Derek V. Mallia, Adam K. Kochanski, Shawn P. Urbanski, John C. Lin

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

### **The health impacts and economic value of wildland fire episodes in the U.S.: 2008-2012**

[www.nrfirescience.org/resource/17239](http://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

### **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 (PM<sub>2.5</sub>). Unfortunately, in model frameworks used for air quality management, the ability to represent PM<sub>2.5</sub> from...

Author(s): Kelley C. Barsanti, Brian K. Lamb, Robert J. Yokelson

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](http://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

### **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 PM<sub>2.5</sub> and ozone, and employ the global Community Earth System Model (CESM) using an unprecedented fine...

Author(s): Maria Val Martin, Jeffrey R. Pierce, Colette L. Heald

Year Published: 2018

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Research Brief or Fact Sheet

### **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](http://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

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

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

Author(s): Andrew T. Hudak, Susan J. Prichard, Robert E. Keane, E. Louise Loudermilk, Russell A. Parsons, Carl A. Seielstad, Eric Rowell, Nick Skowronski

Year Published: 2017

Type: Document

Technical Report or White Paper

### **Aligning smoke management with ecological and public health goals**

[www.nrfirescience.org/resource/15053](http://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

### **Phase dynamics of wildland fire smoke emissions and their secondary organic aerosols**

[www.nrfirescience.org/resource/15581](http://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

### **Emissions from prescribed burning of agricultural fields in the Pacific Northwest**

[www.nrfirescience.org/resource/16554](http://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

### **U.S. EPA Smoke Emissions, Chemistry, and Transport Modeling - Final Report to the Joint Fire Science Program**

[www.nrfirescience.org/resource/17028](http://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 O<sub>3</sub>, 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

### **A large source of dust missing in particulate matter emission inventories? Wind erosion of post-fire landscapes**

[www.nrfirescience.org/resource/16292](http://www.nrfirescience.org/resource/16292)

Wind erosion of soils burned by wildfire contributes substantial particulate matter (PM) in the form of

dust to the atmosphere, but the magnitude of this dust source is largely unknown. It is important to accurately quantify dust emissions because they can impact human health, degrade visibility, exacerbate dust-on-snow issues (...)

Author(s): Natalie S. Wagenbrenner, Serena H. Chung, Brian K. Lamb

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

### **Application of an original wildfire smoke health cost benefits transfer protocol to the western US, 2005-2015**

[www.nrfirescience.org/resource/15529](http://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

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Book or Chapter or Journal Article

### **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](http://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

### **Public use of information about smoke emissions: application of the risk information seeking and processing (RISP) model**

[www.nrfirescience.org/resource/16281](http://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

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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](http://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...



Author(s): Xiaoxi Liu, L. Gregory Huey, Robert J. Yokelson, Vanessa Selimovic, Isobel J. Simpson, Markus Muller, Jose L. Jimenez, Pedro Campuzano-Jost, Andreas J. Beyersdorf, Donald R. Blake, Zachary Butterfield, Yonghoon Choi, John D. Crouse, Douglas A. Day, Glenn S. Diskin, Manvendra K. Dubey, Edward Fortner, Thomas F. Hanisco, Weiwei Hu, Laura E. King, Lawrence Kleinman, Simone Meinardi, Tomas Mikoviny, Timothy B. Onasch, Brett B. Palm, Jeff Peischl, Ilana B. Pollack, Thomas B. Ryerson, Glen W. Sachse, Arthur J. Sedlacek, John E. Shilling, Stephen Springston, Jason M. St. Clair, David J. Tanner, Alexander P. Teng, Paul O. Wennberg, Armin Wisthaler, Glenn M. Wolfe

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Book or Chapter or Journal Article

### **A Low-Cost Sensor Network for Wildfire Smoke Detection and Monitoring - Final Report to the Joint Fire Science Program**

[www.nrfirescience.org/resource/17021](http://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

### **Wildland Fire Smoke Health Effects on Wildland Firefighters and the Public - Final Report to the Joint Fire Science Program**

[www.nrfirescience.org/resource/17009](http://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. Naeher, Michael T. Kleinman, Kathleen M. Navarro, Christopher E. Mackay, Olorunfemi Adetona

Year Published: 2017

Type: Document

Technical Report or White Paper

### **Effectiveness of public health messaging and communication channels during smoke events: a rapid systematic review**

[www.nrfirescience.org/resource/15062](http://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 Sharplin, Nadia Corsini, Marion Eckert

Year Published: 2017

Type: Document

Book or Chapter or Journal Article, Synthesis

### **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](http://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

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

[www.nrfirescience.org/resource/15027](http://www.nrfirescience.org/resource/15027)

Wildfire episodes are becoming more rampant with global warming and climate change. Every year it causes lot 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

## **Smoke in a new era of fire**

[www.nrfirescience.org/resource/17804](http://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

Year Published: 2017

Type: Document

Technical Report or White Paper

## **Wildland firefighter exposure to hydrocarbons**

[www.nrfirescience.org/resource/16582](http://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

## **How smoke from fires can affect your health**

[www.nrfirescience.org/resource/17800](http://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

### **Occupational Exposure to Polycyclic Aromatic Hydrocarbon of Wildland Firefighters at Prescribed and Wildland Fires**

[www.nrfirescience.org/resource/16419](http://www.nrfirescience.org/resource/16419)

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

### **Social media approaches to modeling wildfire smoke dispersion: spatiotemporal and social scientific investigations**

[www.nrfirescience.org/resource/15552](http://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

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

[www.nrfirescience.org/resource/17026](http://www.nrfirescience.org/resource/17026)

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

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

[www.nrfirescience.org/resource/16286](http://www.nrfirescience.org/resource/16286)

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

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

[www.nrfirescience.org/resource/17022](http://www.nrfirescience.org/resource/17022)

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

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

[www.nrfirescience.org/resource/14558](http://www.nrfirescience.org/resource/14558)

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, Georgiana 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**

[www.nrfirescience.org/resource/14375](http://www.nrfirescience.org/resource/14375)

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

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

[www.nrfirescience.org/resource/14886](http://www.nrfirescience.org/resource/14886)

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 (PM<sub>2.5</sub>), black carbon, ultraviolet absorbing PM,...

Author(s): Johanna Aurell, Brian K. Gullett, Dennis Tabor, Nick Yonker

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

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

[www.nrfirescience.org/resource/14538](http://www.nrfirescience.org/resource/14538)

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...

Author(s): Joshua C. Hyde, Jarod Blades, Troy E. Hall, Roger D. Ottmar, Alistair M. S. Smith

Year Published: 2016

Type: Document

Technical Report or White Paper

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

[www.nrfirescience.org/resource/14467](http://www.nrfirescience.org/resource/14467)

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...

Author(s): D.W. Schweizer, Richard Cisneros

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

### **Non-deforestation fire vs. fossil fuel combustion: the source of CO<sub>2</sub> emissions affects the global carbon cycle and climate responses**

[www.nrfirescience.org/resource/14328](http://www.nrfirescience.org/resource/14328)

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 CO<sub>2</sub> perturbation is...

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

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

### **Critical assessment of wildland fire emissions inventories: methodology, uncertainty, effectiveness - Final Report to the Joint Fire Science Program**

[www.nrfirescience.org/resource/15585](http://www.nrfirescience.org/resource/15585)

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, PM<sub>2.5</sub> NAAQS, and...

Author(s): Wei Min Hao, Shawn P. Urbanski, Helen T. Naughton

Year Published: 2016

Type: Document

Technical Report or White Paper

### **Characterizing public tolerance of smoke from wildland fires in communities across the United States**

[www.nrfirescience.org/resource/14813](http://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](http://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. Adetona, Michael T. Kleinman, Roger D. Ottmar, Luke P. Naeher

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](http://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

### **Characterizing large airtanker use in United States fire management**

[www.nrfirescience.org/resource/16152](http://www.nrfirescience.org/resource/16152)

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

### **Wildfire smoke and public health risk**

[www.nrfirescience.org/resource/13562](http://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

### **Modeling study of the contribution of fire emissions on BC concentrations and deposition rates**

[www.nrfirescience.org/resource/15578](http://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....

Author(s): Serena H. Chung, Brian K. Lamb, Farren Herron-Thorpe, Rodrigo Gonzalez-Abraham, Vikram Ravi, Tsengel Nergui, Joseph K. Vaughan, Narasimhan K. Larkin, Tara Strand

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](http://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

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

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

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

Author(s): John D. Horel, Timothy J. Brown

Year Published: 2015

Type: Document

Technical Report or White Paper

### **Strategic operations planning-it's not just for wilderness! How the strategic operations planner can help**

[www.nrfirescience.org/resource/14609](http://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 case study comparison of LANDFIRE fuel loading and emissions on a mixed conifer forest in northern Idaho, USA**

[www.nrfirescience.org/resource/13750](http://www.nrfirescience.org/resource/13750)

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

Book or Chapter or Journal Article

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

[www.nrfirescience.org/resource/13611](http://www.nrfirescience.org/resource/13611)

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

## **Proceedings of the International Smoke Symposium**

[www.nrfirescience.org/resource/18463](http://www.nrfirescience.org/resource/18463)

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

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

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

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

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

Year Published: 2015

Type: Document

Technical Report or White Paper

## **Communicating about smoke from wildland fire: challenges and opportunities for managers**

[www.nrfirescience.org/resource/12982](http://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](http://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

### **Perverse incentives: the case of wildfire smoke regulation**

[www.nrfirescience.org/resource/14235](http://www.nrfirescience.org/resource/14235)

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

### **Mapping day-of-burning with coarse-resolution satellite fire-detection data**

[www.nrfirescience.org/resource/12764](http://www.nrfirescience.org/resource/12764)

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

### **Smoke management of wildland and prescribed fire: understanding public preferences and trade-offs**

[www.nrfirescience.org/resource/13012](http://www.nrfirescience.org/resource/13012)

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

## **The climate-wildfire-air quality system: interactions and feedbacks across spatial and temporal scales**

[www.nrfirescience.org/resource/13698](http://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

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

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

Mega-fires can adversely impact air quality in the United States and the impacts are likely to become more serious in the future due to the possibility of more frequent and intense mega-fires in response to the projected climate change. This study investigated U.S. mega-fires and fuel conditions and their environmental impacts under...

Author(s): Yongqiang Liu, Scott L. Goodrick, John A. Stanturf, Hanqin Tian

Year Published: 2014

Type: Document

Technical Report or White Paper

## **Public perceptions and tolerance of smoke from wildland fire - draft**

[www.nrfirescience.org/resource/13699](http://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

## **Fuel moisture influences on fire-altered carbon in masticated fuels: an experimental study**

[www.nrfirescience.org/resource/12021](http://www.nrfirescience.org/resource/12021)

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

## **Public perceptions of smoke from wildfire, prescribed fire, and fire use**

[www.nrfirescience.org/resource/13483](http://www.nrfirescience.org/resource/13483)

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...

Author(s): Stacey S. Frederick

Year Published: 2013

Type: Document

Dissertation or Thesis

### **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](http://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

### **The merits of prescribed fire outweigh potential carbon emission effects**

[www.nrfirescience.org/resource/12426](http://www.nrfirescience.org/resource/12426)

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

### **Wildfire smoke and health impacts: a closer look at fire attributes and their marginal effects**

[www.nrfirescience.org/resource/12143](http://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

### **Combustion efficiency and emission factors for wildfire-season fires in mixed conifer forests of the northern Rocky Mountains, US**

[www.nrfirescience.org/resource/13481](http://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

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

[www.nrfirescience.org/resource/13476](http://www.nrfirescience.org/resource/13476)

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**

[www.nrfirescience.org/resource/15688](http://www.nrfirescience.org/resource/15688)

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

### **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](http://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

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

[www.nrfirescience.org/resource/12601](http://www.nrfirescience.org/resource/12601)

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

### **Situational awareness: nighttime smoke and fog on prescribed burns**

[www.nrfirescience.org/resource/12440](http://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](http://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...

Author(s): Shawn P. Urbanski, Wei Min Hao, Bryce L. Nordgren

Year Published: 2011

Type: Document

Book or Chapter or Journal Article

### **Emissions of air pollutants by Canadian wildfires from 2000 to 2004**

[www.nrfirescience.org/resource/14707](http://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](http://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

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

[www.nrfirescience.org/resource/14534](http://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

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

[www.nrfirescience.org/resource/8371](http://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

### **Prescribed fire as a means of reducing forest carbon emissions in the western United States**

[www.nrfirescience.org/resource/8328](http://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

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

[www.nrfirescience.org/resource/11086](http://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](http://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

### **A comparison of smoke emissions from prescribed burns and wildfires**

[www.nrfirescience.org/resource/17803](http://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

### **Wildfire smoke: a guide for public health officials**

[www.nrfirescience.org/resource/12451](http://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](http://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

### **Emissions of levoglucosan, methoxy phenols, and organic acids from prescribed burns, laboratory combustion of wildland fuels, and residential wood combustion**

[www.nrfirescience.org/resource/11426](http://www.nrfirescience.org/resource/11426)

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

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

[www.nrfirescience.org/resource/11214](http://www.nrfirescience.org/resource/11214)

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

### **Prescribed fire: what influences public approval?**

[www.nrfirescience.org/resource/8440](http://www.nrfirescience.org/resource/8440)

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

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

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

[www.nrfirescience.org/resource/7957](http://www.nrfirescience.org/resource/7957)

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 signal standard 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**

[www.nrfirescience.org/resource/12014](http://www.nrfirescience.org/resource/12014)

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...

Author(s): U.S. Environmental Protection Agency

Year Published: 2005

Type: Document

Management or Planning Document

### **Smoke produced from residual combustion**

[www.nrfirescience.org/resource/11140](http://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

Technical Report or White Paper

### **Wildland fire in ecosystems: effects of fire on air**

[www.nrfirescience.org/resource/12587](http://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](http://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](http://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](http://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](http://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](http://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](http://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 CO<sub>2</sub>, CO, CH<sub>4</sub>, CH<sub>2</sub>O, NO, NO<sub>2</sub>, NH<sub>3</sub>, and N<sub>2</sub>O**

[www.nrfirescience.org/resource/8301](http://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](http://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

Year Published: 1990

Type: Document

Conference Proceedings

### **Ammonia emissions from biomass burning**

[www.nrfirescience.org/resource/8302](http://www.nrfirescience.org/resource/8302)

Measurements in the plumes from seven forest fires show that the concentrations of NH<sub>3</sub> were considerably in excess of ambient values. Calculation of NH<sub>3</sub> emissions from the fires, based on the ratio of NH<sub>3</sub>/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

### **Airborne measurements on smokes from biomass burning**

[www.nrfirescience.org/resource/8384](http://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. Particle 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

### **Smoke column height related to fire intensity**

[www.nrfirescience.org/resource/11946](http://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](http://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

### **Webinar: Techniques for Wildfire Detection and Monitoring Part 2**

[www.nrfirescience.org/resource/18088](http://www.nrfirescience.org/resource/18088)

This session will provide an overview of the Global Wildfire Information System (GWIS) and a hands-on demonstration on the use of the GWIS viewer. GWIS is an online web application that uses remotely sensed wildfire data. This data includes fire danger, wildfire locations, burned area extent, and burn severity. GWIS also focuses on...

Type: Media

Webinar

**Advancement of smoke emissions models utilizing geospatial and remote sensing data for**

### **wildland fire management and risk reduction**

[www.nrfirescience.org/resource/13058](http://www.nrfirescience.org/resource/13058)

A Southern Fire Exchange webinar presented by Joe Roise of the North Carolina State University, Siamak Khorram of the University of California, Berkeley, and Duncan Lutes with the USDA Forest Service. This webinar presented an introduction to some recent interdisciplinary research attempting to improve wildland fire smoke emission...

Type: Media

Webinar

### **Let's clear the air: protect yourself from wildfire smoke**

[www.nrfirescience.org/resource/15276](http://www.nrfirescience.org/resource/15276)

In 2015 more than 5 million acres burned in Alaska due to wildfires. This educational video gives simple steps for protecting yourself from wildfire smoke. It was produced by the Aleknagik Traditional Council in partnership with the U.S. EPA, ANTHC, Bristol Bay Area Health Corporation, Bristol Bay Native Association, Alaska...

Type: Media

Video

### **Wildland Smoke Series: Webinar 3**

[www.nrfirescience.org/resource/17594](http://www.nrfirescience.org/resource/17594)

This is the third webinar offered in the Air Quality Planning for Wildland Smoke series. For more information, contact Pat Ellsworth at Patricia.Ellsworth@nau.edu. Moderators: Regina Chappell (EPA), introductions by Natasha Fulton (ITEP)

Type: Media

Webinar

### **Smoke Management and Air Quality for Land Managers: An Online Training Resource**

[www.nrfirescience.org/resource/57](http://www.nrfirescience.org/resource/57)

Smoke Management and Air Quality for Land Managers is meant for those who are looking for a tutorial on smoke management and air quality. The refresher is comprised of four lessons, each of which can be completed in about half an hour; however, links and interactions allow further investigation of several topics.

Type: Website

Online Course

### **Indoor Air Quality During Wildland Fires: Experience and Research**

[www.nrfirescience.org/resource/15851](http://www.nrfirescience.org/resource/15851)

Kris Ray from the Air Quality Program of the Confederated Tribes of the Colville Reservation presented his experience monitoring indoor air quality during the 2015 wildfire season, and Dr. Shelly Miller from the University of Colorado shared her findings on the effectiveness of air cleaning devices and weatherization for protecting...

Type: Media

Webinar

### **Wildland Smoke Series: Webinar 5**

[www.nrfirescience.org/resource/17977](http://www.nrfirescience.org/resource/17977)

This is the fifth webinar offered in the Air Quality Planning for Wildland Smoke series.

Type: Media

Webinar

### **Indoor air quality during smoke events**

[www.nrfirescience.org/resource/15071](http://www.nrfirescience.org/resource/15071)

Kris Ray from the Air Quality Program of the Confederated Tribes of the Colville Reservation presented his experience monitoring indoor air quality during the 2015 wildfire season, and Dr. Shelly Miller from the University of Colorado shared her findings on the effectiveness of air cleaning devices and weatherization for protecting...

Type: Media

Webinar

### **Public and agency perceptions of smoke from wild and prescribed fire**

[www.nrfirescience.org/resource/13669](http://www.nrfirescience.org/resource/13669)

Speaker: Christine Olsen, Research Social Scientist, Department of Forest Ecosystems and Society, Oregon State University. Event: Restoring the West Conference 2015 - Restoration and Fire in the Interior West.

Type: Media

Video

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

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

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

Type: Media

Seminar

### **Smoke management: preparing and informing the public**

[www.nrfirescience.org/resource/12859](http://www.nrfirescience.org/resource/12859)

For several months during 2011, wildfires throughout the Southwest Area and Mexico caused air quality impacts on public health across the region, with significant impacts measured hundreds of miles away from individual wildfires. In order to address the emerging issue, a concerted multi-state interagency air quality coordination...

Type: Media

Webinar

### **Wildland Smoke Series: Webinar 1**

[www.nrfirescience.org/resource/17587](http://www.nrfirescience.org/resource/17587)

This 1 1/2 hour webinar entitled "Air quality planning for wildland smoke" is the first webinar offered in the Air Quality Planning for Wildland Smoke series. For more information, contact Pat Ellsworth at [Patricia.Ellsworth@nau.edu](mailto:Patricia.Ellsworth@nau.edu). Moderators: Pat Ellsworth (ITEP) and Regina Chappell (EPA)

Type: Media

Webinar

### **Prescribed Fire: Smoke Management and Regulatory Challenges - Part 2**

[www.nrfirescience.org/resource/16759](http://www.nrfirescience.org/resource/16759)

This webinar addresses additional issues and questions that arose during the original webinar, "Prescribed Fire: Smoke Management and Regulatory Challenges." Moderator: Mike Zupko, Executive Director, Wildland Fire Leadership Council. Panelists: Pete Lahm, Smoke Manager, U.S. Forest Service; Mark Melvin, Chair, Coalition of...

Type: Media

Webinar

### **Emissions and smoke portal: smokepedia**

[www.nrfirescience.org/resource/17819](http://www.nrfirescience.org/resource/17819)

Smokepedia is a continuously updated glossary that defines smoke and air quality terms in the world of wildland fire. The terms and information contained herein come from a variety of sources, including the National Wildfire Coordination Group, Environmental Protection Agency, the American Meteorological Society, U.S. Land...

Type: Website

Website

### **A dataset for the evaluation of smoke models-emissions, plume rise, and dispersion**

[www.nrfirescience.org/resource/12843](http://www.nrfirescience.org/resource/12843)

An overview of the dataset "Airborne and Lidar measurements of smoke plume rise, emissions, and dispersion." The dataset consists of measurements of smoke emissions, plume rise, and dispersion for eight wildfires in the western United States and prescribed fires in California, Idaho, and North Carolina.

Type: Media

Webinar

### **Public perceptions of smoke from wildland and prescribed fires**

[www.nrfirescience.org/resource/14312](http://www.nrfirescience.org/resource/14312)

This webinar touched on stakeholder values and perceptions of restoration.

Type: Media

Webinar

### **Emissions and Smoke Portal**

[www.nrfirescience.org/resource/16628](http://www.nrfirescience.org/resource/16628)

The Smoke and Emissions Portal is the result of collaborative efforts between the National Wildfire Coordinating Group's (NWCG) Smoke Committee, The University of Idaho, and the Fire Research and Management Exchange System (FRAMES). This site is divided into three areas: Educational Resources, Smoke Management Guide, and Perceptions...

Type: Website

Website

### **Wildfire Smoke: Impacts on Public Health and Lived Experience**

[www.nrfirescience.org/resource/18374](http://www.nrfirescience.org/resource/18374)

In the past few decades, wildfire activity has increased in the western United States and Canada, and can be attributed, at least in part, to a changing climate. The air pollution from wildfires has been associated with increased risk of exacerbations of respiratory disease, specifically asthma and chronic obstructive pulmonary...

Type: Media

Webinar

### **Predicting smoke impacts with uncertain emissions and meteorology**

[www.nrfirescience.org/resource/12840](http://www.nrfirescience.org/resource/12840)

Smoke from wildland fires can have adverse impacts on visibility and also on public health. Models are available for simulating the dispersion, long-range transport, and chemical evolution of fire plumes and predicting their impacts on air quality. However, these models are not perfect tools for decision making

purposes. There are...

Type: Media

Webinar

### **Fire Management Lessons Learned when Burning Duff**

[www.nrfirescience.org/resource/17363](http://www.nrfirescience.org/resource/17363)

Presentation by Kevin Hiers of the Tall Timbers Research Station. Presents a review from an experienced manager turned wildland fire scientist, of concerns, strategies and opportunities for burning in sites with duff accumulations. From the October 2017 Southern Fire Exchange Duff Fire Science Workshop at the FSU Coastal and Marine...

Type: Media

Video

### **Nitrogen chemistry in wildfire emissions**

[www.nrfirescience.org/resource/14870](http://www.nrfirescience.org/resource/14870)

Nitrogen compounds can have a large impact on atmospheric chemistry even though they are trace components of wild fire emissions. Oxidized nitrogen compounds are involved in the formation of photochemical ozone and the oxidation of organic compounds. Reduced nitrogen species are involved in the formation of...

Type: Media

Webinar

### **Sub-canopy transport and dispersion of smoke: a unique observation dataset plus model evaluation of the BlueSky Framework**

[www.nrfirescience.org/resource/12837](http://www.nrfirescience.org/resource/12837)

Low intensity prescription burning is used to reduce fuels, improve ecosystem health, and to mimic a natural fire pattern that is otherwise suppressed during the more intense wildfire season. There are many constraints that limit the ability to conduct prescribed burn operations, including (but not limited to) visibility reduction...

Type: Media

Webinar

### **The smoke management challenge and the need for leadership**

[www.nrfirescience.org/resource/14096](http://www.nrfirescience.org/resource/14096)

A 50-minute presentation recorded in February 2009 as part of Effective Communication for Smoke Management in a Changing Air Quality Environment. It briefly outlines the rules, policies, and guidance dictating smoke management. This presentation is still applicable, though some of the maps may no longer be current.

Type: Media

Video

### **Fire and smoke model evaluation experiment (FASMEE)**

[www.nrfirescience.org/resource/14757](http://www.nrfirescience.org/resource/14757)

This webinar provides a background to the FASMEE project, which was designed to provide critical measurement techniques and observational data necessary to evaluate and advance operationally used fire and smoke modeling systems.

Type: Media

Webinar



## **Prescribed Fire: Smoke Management and Regulatory Challenges**

[www.nrfirescience.org/resource/16358](http://www.nrfirescience.org/resource/16358)

Due to an error, the beginning of the webinar "Prescribed Fire: Smoke Management and Regulatory Challenges" was not recorded. The presentation begins with a segment on regulations and includes a Q&A session with the audience and panelists. Visit the WGA website for presentation slides (<https://goo.gl/MLnQ6w>). The session...

Type: Media

Webinar

## **Smoke Dispersion Modeling: A Brief Review and Example of Real-World Application**

[www.nrfirescience.org/resource/17783](http://www.nrfirescience.org/resource/17783)

The Northeast Forest Fire Protection Compact and the North Atlantic Fire Science Exchange held a partners meeting, Igniting Exchange: Bridging the Gap between Science and Management. A true EXCHANGE designed to expose fire managers to useful scientific studies and expose scientists to the implications of their science. Presentations...

Type: Media

Video

## **Uncertainty associated with estimating a short term 1-3 hr particulate matter concentration from a human-sited visual range**

[www.nrfirescience.org/resource/12827](http://www.nrfirescience.org/resource/12827)

Several U.S. state and tribal agencies and other countries implement a methodology developed in the arid intermountain western United States, where short-term (1-3 hr) particulate matter (PM) concentrations are estimated from human-observed visual range (Vr) sightings. These PM2.5 concentration estimates are then linked to a public...

Type: Media

Webinar

## **Emissions composition and human health**

[www.nrfirescience.org/resource/14093](http://www.nrfirescience.org/resource/14093)

A 13-minute presentation recorded in February 2009 as part of Effective Communication for Smoke Management in a Changing Air Quality Environment. This presentation defines and describes the constituents of smoke which impact human health. An example of wildland fire smoke affecting the health of a community is examined.

Type: Media

Video

## **Introduction to smoke management**

[www.nrfirescience.org/resource/14089](http://www.nrfirescience.org/resource/14089)

A 36-minute video recorded in February 2009 as part of the Effective Communication for Smoke Management in a Changing Air Quality Environment workshops. A presentation describing a progressive approach and overreaching principles of smoke management. Also covers the development of basic and enhanced smoke management programs, and...

Type: Media

Video

## **Wildland Fire Air Quality Response**

[www.nrfirescience.org/resource/18174](http://www.nrfirescience.org/resource/18174)

Air Resource Advisors provide a vast array of tools and products to predict and communicate smoke impacts during wildfires. Having a resource solely dedicated to smoke management and effective

messaging improves both internal and external communication.

Type: Media

Video

### **Basic smoke management practices**

[www.nrfirescience.org/resource/13061](http://www.nrfirescience.org/resource/13061)

A Southern Fire Exchange webinar presented by USDA Forest Service Air Resource Specialist Pete Lahm. This webinar presented an introduction to the six components of the USFS-NRCS Basic Smoke Management Practices.

Type: Media

Webinar

### **Smoke Tools and Information for Prescribed Fire and Wildfire**

[www.nrfirescience.org/resource/17595](http://www.nrfirescience.org/resource/17595)

The science of wildland fire smoke modeling and the tools and information available are dramatically different from what they were 10 years ago. Satellite systems, computing power, social media, and investments in basic research and research delivery such as made by the Joint Fire Sciences Program (JFSP) and NASA are some of the...

Type: Media

Webinar

### **Air Quality and Human Health**

[www.nrfirescience.org/resource/15859](http://www.nrfirescience.org/resource/15859)

Roger Ottmar, Research Forester with the USFS Pacific Northwest Fire & Environmental Research Applications Team, gave a talk on air quality, wildfire smoke components and smoke impacts on human health with an eye to how air quality regulations may impact prescribed burn planning. This talk was for Intro to Fire Effects (RX-310)...

Type: Media

Webinar

### **Research insights into effective smoke communication with the public**

[www.nrfirescience.org/resource/15117](http://www.nrfirescience.org/resource/15117)

On November 6-8, 2014, multiple stakeholders gathered to learn about, share and discuss smoke management issues related to wildland fire. The following video is a presentation that occurred during the event, "Wildland fire smoke in the air- What does it mean to ME?" \*Due to videographer limitations during...

Type: Media

Video

### **Global and Western US Smoke Chemistry and Impacts: Recent Progress**

[www.nrfirescience.org/resource/15797](http://www.nrfirescience.org/resource/15797)

No description available. This webinar was presented as part of the RMRS Fire Sciences Laboratory's weekly seminar series for 2016-2017.

Type: Media

Seminar

### **Wildland Smoke Series: Webinar 4**

[www.nrfirescience.org/resource/17973](http://www.nrfirescience.org/resource/17973)

This is the fourth webinar offered in the Air Quality Planning for Wildland Smoke series.

Type: Media

Webinar

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

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

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

Type: Media

Webinar

### **Wildland Smoke Series: Webinar 2**

[www.nrfirescience.org/resource/17590](http://www.nrfirescience.org/resource/17590)

This 1.3 hour video is the second webinar offered in the Air Quality Planning for Wildland Smoke series. For more information, contact Pat Ellsworth at Patricia.Ellsworth@nau.edu. Moderators: Pat Ellsworth (ITEP) and Regina Chappell (EPA)

Type: Media

Webinar

### **High-Resolution Modeling of Environmental Transport Processes in Cities and Complex Terrain**

[www.nrfirescience.org/resource/15786](http://www.nrfirescience.org/resource/15786)

Cities are diverse places with heterogeneous landscapes and are home to complex processes occurring over a wide range of length and time scales. Understanding and modeling these process is critical to improved sustainability related to goals of improving urban microclimate, reducing energy and water usage, increasing clean energy...

Type: Media

Seminar

### **On the causes and movements of smoke-induced fog**

[www.nrfirescience.org/resource/12856](http://www.nrfirescience.org/resource/12856)

Smoke from residual combustion in the aftermath of prescribed burns or wildfires can combine with certain atmospheric conditions usually late at night to produce superfog -- a fog reducing visibility to less than 10 feet, and frequently to less than 3 feet. When this smoke/fog is transported across a major roadway, the results are...

Type: Media

Webinar

### **Evaluation and improvement of smoke plume rise models**

[www.nrfirescience.org/resource/12842](http://www.nrfirescience.org/resource/12842)

Plume height is one of the smoke properties that fire and air quality managers need to estimate in order to determine how much pollutants emitted from a prescribed burn are transported to remote populated areas from the burn site.

Type: Media

Webinar

### **Smoke forecasting tools: a case study in air quality response**

[www.nrfirescience.org/resource/14311](http://www.nrfirescience.org/resource/14311)

This webinar reviews the current options for smoke modeling and tracking.

Type: Media

Webinar

### **Smoke Management Photographic Guide: a visual aid for communicating smoke impacts.**

[www.nrfirescience.org/resource/14881](http://www.nrfirescience.org/resource/14881)

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 Smoke Management...

Type: Media

Webinar

### **Smoke consequences of new wildfire regimes driven by climate change**

[www.nrfirescience.org/resource/12838](http://www.nrfirescience.org/resource/12838)

Smoke from wildfires has adverse biological and social consequences, and various lines of evidence suggest that smoke from wildfires in the future may be more intense and widespread, demanding that methods be developed to address its effects on people, ecosystems, and the atmosphere. Don McKenzie presented webinar on March 19, 2014...

Type: Media

Webinar

### **Wildland fire smoke messaging and perception**

[www.nrfirescience.org/resource/14140](http://www.nrfirescience.org/resource/14140)

The NWCG Smoke Committee (SmoC) hosted this webinar on June 28, 2011. Four presentations and a discussion period examined public perception and messaging about smoke and fire. The webinar was a key initial step in developing needed messaging about wildland fire smoke, and it also served as the Smoke Committee's beginning effort at...

Type: Media

Webinar

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

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

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

Type: Media

Webinar

### **Introduction to air quality regulations**

[www.nrfirescience.org/resource/14095](http://www.nrfirescience.org/resource/14095)

A 42-minute presentation recorded in February 2009 as part of Effective Communication for Smoke Management in a Changing Air Quality Environment. It provides an Introduction to federal regulations which address smoke management in the context of wildland fire.

Type: Media

Video

### **Smoke Management a Photographic Guide a visual aid for communicating smoke impacts**

[www.nrfirescience.org/resource/14735](http://www.nrfirescience.org/resource/14735)

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 Smoke Management...

Type: Media

Webinar

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

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

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

Type: Media

Webinar

### **Current research on public perceptions of smoke from wildland and prescribed fire to inform communication and outreach**

[www.nrfirescience.org/resource/12817](http://www.nrfirescience.org/resource/12817)

This webinar covered two large, multi-region studies of public perceptions of smoke from wildland and prescribed fire funded by the JFSP. A mail/internet survey conducted by the University of Idaho investigated perceptions of urban and rural residents in the northern Rocky Mountains and south-central U.S. Research investigated...

Type: Media

Webinar

### **Fire activity and emissions inventories: their use in smoke management decision making and state implementation plans**

[www.nrfirescience.org/resource/14091](http://www.nrfirescience.org/resource/14091)

A 47-minute presentation recorded in February 2009 as part of Effective Communication for Smoke Management in a Changing Air Quality Environment workshops. This presentation describes fire activity and emission inventories, common sources of error in modeling and examples of current models in use.

Type: Media

Video

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

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

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

Type: Media

Webinar

### **Proposed smoke management framework allows larger prescribed fires with fewer health risks**

[www.nrfirescience.org/resource/15511](http://www.nrfirescience.org/resource/15511)

Before a single drip torch is lit or blade of grass ignited, fire management staff must consult with state or local air quality control officials to negotiate a fine balance between using fire as a restorative tool on the landscape with concerns about smoke and its impacts on public health. For years, these determinations have been...

Type: Media

Webinar

**Fire, Smoke, and Air Quality**

[www.nrfirescience.org/resource/17601](http://www.nrfirescience.org/resource/17601)

This webinar will discuss various agricultural and forestry fires and their impacts on air quality, including smoke and other air emissions. Basic Smoke Management Practices (BSMPs) will be discussed as means to minimize air quality impacts from prescribed fires.

Type: Media

Webinar