A simple metric of landscape fire exposure
www.nrfirescience.org/resource/22900
Context: Proximity of landcover elements to each other will enable or constrain fire spread. Assessments of potential fire propagation across landscapes typically involve empirical or simulation models that estimate probabilities based on complex interactions among biotic and abiotic controls.
Objectives: We developed a metric of...
Author(s): Jennifer L. Beverly, Neal McLoughlin, Elizabeth Chapman
Year Published: 2021
Type: Document
Book or Chapter or Journal Article

Quantifying merging fire behaviour phenomena using unmanned aerial vehicle technology
www.nrfirescience.org/resource/22854
Catastrophic wildfires are often a result of dynamic fire behaviours. They can cause rapid escalation of fire behaviour, increasing the danger to ground-based emergency personnel. To date, few studies have characterised merging fire behaviours outside the laboratory. The aim of this study was to develop a simple, fast and accurate...
Author(s): Alexander I. Filkov, Brett Cirulis, Trent D. Penman
Year Published: 2021
Type: Document
Book or Chapter or Journal Article

Mapping the research history, collaborations and trends of remote sensing in fire ecology
www.nrfirescience.org/resource/22739
A combination of bibliometric and science mapping methods was carried out to explore characteristics of scientific production on the application of orbital remote sensing in fire ecology. The performance analyzes made it possible to identify the main actors responsible for the knowledge (authors, institutions and countries) and the...
Author(s): Mariana M. M. de Santana, Eduardo Mariano-Neto, Rodrigo N. de Vasconcelos, Pavel Dodonov, José M. M. Medeiros
Year Published: 2021
Type: Document
Book or Chapter or Journal Article

Wildland fire emission sampling at Fishlake National Forest, Utah using an unmanned aircraft system
www.nrfirescience.org/resource/22710
Emissions from a stand replacement prescribed burn were sampled using an unmanned aircraft system (UAS, or ‘drone’) in Fishlake National Forest, Utah, U.S.A. Sixteen flights over three days in June 2019 provided emission factors for a broad range of compounds including carbon monoxide (CO), carbon dioxide (CO2), nitric oxide (NO),...
Author(s): Johanna Aurell, Brian K. Gulett, Amara L. Holder, F. Kiros, William Mitchell, Adam C. Watts, Roger D. Ottmar
Year Published: 2021
Type: Document
Book or Chapter or Journal Article

Roles of pre-fire vegetation, soil, and climate in Great Basin ecosystem recovery
www.nrfirescience.org/resource/23477
Great Basin shrublands in the United States are rapidly converting to annual grass- dominated ecosystems, driven primarily by increased wildfire activity. Post-fire vegetation recovery trajectories
vary spatially and temporally and are influenced by the effects of topography, climate, soils, and pre-fire vegetation. Our study...

**Seeing the Big Picture: Long Term Studies at Lick Creek Demonstrate How Fuel Treatments Impact a Changing Forest**

A long-term study at Lick Creek demonstrates how fuel treatments in dry forests provide benefits beyond mitigating the chance of a high-severity fire.

**Decision Support System Development of Wildland Fire: A Systematic Mapping**

Wildland fires have been a rising problem on the worldwide level, generating ecological and economic losses. Specifically, between wildland fire types, uncontrolled fires are critical due to the potential damage to the ecosystem and their effects on the soil, and, in the last decade, different technologies have been applied to fight...

**Monetising the savings of remotely sensed data and information in Burn Area Emergency Response (BAER) wildfire assessment**

We used a value of information approach to demonstrate the cost-effectiveness of using satellite imagery as part of the Burn Area Emergency Response (BAER), a US federal program that identifies imminent post-wildfire threats to human life and safety, property and critical natural or cultural resources. We compared the costs...

**The role of fire in global forest loss dynamics**

Fires, among other forms of natural and anthropogenic disturbance, play a central role in regulating the location, composition and biomass of forests. Understanding the role of fire in global forest loss is crucial in constraining land use change emissions and the global carbon cycle. We analyzed the relationship between forest...
Forest fire fuel through the lens of remote sensing: review of approaches, challenges and future directions in the remote sensing of biotic determinants of fire behaviour
www.nrfirescience.org/resource/22903
Forested environments are subject to large and high intensity unplanned fire events, owing to, among other factors, the high quantity and complex structure of fuel in these environments. Compiling accurate and spatially comprehensive fuel information is necessary to inform various aspects of land management in forested environments...
Author(s): Matthew G. Gale, Geoffrey J. Cary, Albert I. J. M. van Dijk, Marta Yebra
Year Published: 2021
Type: Document
Book or Chapter or Journal Article

High-Resolution Estimates of Fire Severity—An Evaluation of UAS Image and LiDAR Mapping Approaches on a Sedgeland Forest Boundary in Tasmania, Australia
www.nrfirescience.org/resource/22877
With an increase in the frequency and severity of wildfires across the globe and resultant changes to long-established fire regimes, the mapping of fire severity is a vital part of monitoring ecosystem resilience and recovery. The emergence of unoccupied aircraft systems (UAS) and compact sensors (RGB and LiDAR) provide new...
Year Published: 2021
Type: Document
Book or Chapter or Journal Article

The U.S. EPA wildland fire sensor challenge: performance and evaluation of solver submitted multi-pollutant sensor systems
www.nrfirescience.org/resource/22763
Wildland fires can emit substantial amounts of air pollution that may pose a risk to those in proximity (e.g., first responders, nearby residents) as well as downwind populations. Quickly deploying air pollution measurement capabilities in response to incidents has been limited to date by the cost, complexity of implementation, and...
Author(s): Matthew S. Landis, Russell W. Long, Jonathan Krug, Maribel Colón, Robert Vanderpool, Andrew Habel, Shawn P. Urbanski
Year Published: 2021
Type: Document
Book or Chapter or Journal Article

Mapping soil burn severity at very high spatial resolution from unmanned aerial vehicles
www.nrfirescience.org/resource/22715
The evaluation of the effect of burn severity on forest soils is essential to determine the impact of wildfires on a range of key ecological processes, such as nutrient cycling and vegetation recovery. The main objective of this study was to assess the potentiality of different spectral products derived from RGB and multispectral...
Author(s): David Beltrán-Marcos, Susana Suárez-Seeane, José Manuel Fernández-Guisuraga, Víctor Fernández-Garcia, Rayo Pinto, Paula García-Llamas, Leonor Calvo
Year Published: 2021
Type: Document
Book or Chapter or Journal Article
Small fires, frequent clouds, rugged terrain and no training data: a methodology to reconstruct fire history in complex landscapes
www.nrfirescience.org/resource/22685
An automated burned area extraction routine that attempts to overcome the particular difficulties of remote sensing applications in complex landscapes is presented and tested in the mountainous region of northwest Yunnan, China. In particular, the lack of burned samples to use for training and testing, the rugged relief, the small...
Author(s): David Fornacca, Guopeng Ren, Wen Xiao
Year Published: 2021
Type: Document
Book or Chapter or Journal Article

Full-scale video-based detection of smoke from forest fires combining ViBe and MSER algorithms
www.nrfirescience.org/resource/23400
Smoke, as a prominent character of combustion, is widely regarded as a signal of forest fire. Existing in a video-based smoke root detection methods on rely the distance between smoke and the lens, which is one of the most challenging parts. In relatively close distances, the dynamic region extraction method not only presents...
Author(s): Yu Gao, Pengle Cheng
Year Published: 2021
Type: Document
Book or Chapter or Journal Article

TreeMap, a tree-level model of conterminous US forests circa 2014 produced by imputation of FIA plot data
www.nrfirescience.org/resource/22563
A 30 × 30m-resolution gridded dataset of forest plot identifiers was developed for the conterminous United States (CONUS) using a random forests machine-learning imputation approach. Forest plots from the US Forest Service Forest Inventory and Analysis program (FIA) were imputed to gridded c2014 landscape data provided by the...
Author(s): Karen L. Riley, Isaac C. Grenfell, Mark A. Finney, Jason M. Wiener
Year Published: 2021
Type: Document
Book or Chapter or Journal Article

Mapping smouldering fire potential in boreal peatlands and assessing interactions with the wildland–human interface in Alberta, Canada
www.nrfirescience.org/resource/23360
Treed peatlands exhibit both crown and smouldering fire potential; however, neither are included in Canadian wildfire management models and, as such, they are not formally represented in management decision-making. The lack of smouldering fire risk assessment is a critical research gap as these fires can represent heavy resource...
Author(s): Sophie L. Wilkinson, A. K. Furukawa, B. Mike Wotton, James M. Waddington
Year Published: 2021
Type: Document
Book or Chapter or Journal Article

The DLR FireBIRD small satellite mission: evaluation of infrared data for wildfire assessment
Wildfires significantly influence ecosystem patterns and processes on a global scale. In many cases, they pose a threat to human lives and property. Through greenhouse gas emissions, wildfires also directly contribute to climate change. The monitoring of such events and the analysis of acquired data is crucial for understanding...

Author(s): Michael Nolde, Simon Plank, Rudolf Richter, Doris Klein, Torsten Riedlinger
Year Published: 2021
Type: Document
Book or Chapter or Journal Article

**Mapping forest canopy fuels in the western United States with LiDAR-Landsat Covariance**

Comprehensive spatial coverage of forest canopy fuels is relied upon by fire management in the US to predict fire behavior, assess risk, and plan forest treatments. Here, a collection of light detection and ranging (LiDAR) datasets from the western US are fused with Landsat-derived spectral indices to map the canopy fuel attributes...

Author(s): Christopher J. Moran, Van R. Kane, Carl A. Seielstad
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

**Evaluating post-wildfire logging-slash cover treatment to reduce hillslope erosion after salvage logging using ground measurements and remote sensing**

Continuing long and extensive wildfire seasons in the Western US emphasize the need for better understanding of wildfire impacts including post-fire management scenarios. Advancements in our understanding of post-fire hillslope erosion and watershed response such as flooding, sediment yield, and debris flows have recently received...

Author(s): Peter R. Robichaud, Sarah A. Lewis, Robert E. Brown, Edwin D. Bone, Erin S. Brooks
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

**An adaptive and extensible system for satellite-based, large scale burnt area monitoring in near-real time**

In the case of ongoing wildfire events, timely information on current fire parameters is crucial for informed decision making. Satellite imagery can provide valuable information in this regard, since thermal sensors can detect the exact location and intensity of an active fire at the moment the satellite passes over. This...

Author(s): Michael Nolde, Simon Plank, Torsten Riedlinger
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

**An overview of in situ digital canopy photography in forestry**

Since the 1960s, canopy photography has been widely used in forestry. Hemispherical photography has been the most widely used technique, but a great drawback of this method is its perceived sensitivity to hemispherical image acquisition and processing. Over the last decade, several alternative photographic approaches using...
Unitemporal approach to fire severity mapping using multispectral synthetic databases and Random Forests
www.nrfirescience.org/resource/22304
Fire severity assessment is crucial for predicting ecosystem response and prioritizing post-fire forest management strategies. Although a variety of remote sensing approaches have been developed, more research is still needed to improve the accuracy and effectiveness of fire severity mapping. This study proposes a unitemporal...
Author(s): Raquel Montorio Llovería, Fernando Pérez-Cabello, Daniel Borini Alves, Alberto García-Martín
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Effects of scale for assessing fuel treatment effectiveness and recovery post-fire in ponderosa pine
www.nrfirescience.org/resource/21596
With the past century of fire suppression in ponderosa pine (Pinus ponderosa) forests, there has been an accumulation of surface fuels, causing decreases in understory vegetation and increasing high severity fire risk. However, fire size and location can make it costly and unsafe to obtain ground measurements of understory...
Author(s): Eva K. Strand, Jessie M. Dodge
Year Published: 2020
Type: Document
Technical Report or White Paper

Biogeography of fire regimes in western U.S. conifer forests: A trait-based approach
www.nrfirescience.org/resource/20869
Aim: Functional traits are a crucial link between species distributions and the ecosystem processes that structure those species’ niches. Concurrent increases in the availability of functional trait data and our ability to model species distributions present an opportunity to develop functional trait biogeography (i.e., the...
Author(s): Jens T. Stevens, Matthew M. Kling, Dylan W. Schwilk, J. Morgan Varner, Jeffrey M. Kane
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Experimental fire measurement with UAV multimodal stereovision
www.nrfirescience.org/resource/22131
In wildfire research, systems that are able to estimate the geometric characteristics of fire, in order to understand and model the behavior of this spreading and dangerous phenomenon, are required. Over the past decade, there has been a growing interest in the use of computer vision and image processing technologies. The majority...
Author(s): Vito Ciullo, Lucile Rossi, Antoine Pieri
Year Published: 2020
Type: Document
Book or Chapter or Journal Article
Satellite remote sensing contributions to wildland fire science and management
www.nrfirescience.org/resource/21475
Purpose: This paper reviews the most recent literature related to the use of remote sensing (RS) data in wildland fire management. Recent Findings: Studies dealing with pre-fire assessment, active fire detection, and fire effect monitoring are reviewed in this paper. The analysis follows the different fire management categories:...
Author(s): Emilio Chuvieco, Inmaculada Aguado, Javier Salas, Mariano Garcia, Marta Yebra, Patricia Oliva
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Identifying and protecting wildfire refugia in a warmer, drier Pacific Northwest - Final Report to the Joint Fire Science Program
www.nrfirescience.org/resource/22814
Wildfires are common across the Pacific Northwest, however climate change is projected to cause increases in wildfire activity and severity. Wildfires create a heterogeneous pattern across the landscape from severely burned areas to unburned patches. Unburned areas that are associated with critical habitat where biota can persist (e... 
Author(s): Arjan J. H. Meddens, Andrew T. Hudak, Crystal A. Kolden
Year Published: 2020
Type: Document
Technical Report or White Paper

www.nrfirescience.org/resource/20804
Within the realms of both wildland and prescribed fire, an understanding of how fire severity and forest structure interact is critical for improving fuels treatment effectiveness, quantifying the ramifications of wildfires, and improving fire behavior modeling. We integrated high resolution estimates of fire severity with multi-...
Author(s): Nick Skowronski, Michael R. Gallagher, Timothy A. Warner
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

FIRED (Fire Events Delineation): an open, flexible algorithm and database of US fire events derived from the MODIS Burned Area Product (2001-2019)
www.nrfirescience.org/resource/22123
Harnessing the fire data revolution, i.e., the abundance of information from satellites, government records, social media, and human health sources, now requires complex and challenging data integration approaches. Defining fire events is key to that effort. In order to understand the spatial and temporal characteristics of fire, or...
Author(s): Jennifer Balch, Lise A. St. Denis, Adam L. Mahood, Nathan Mietkiewicz, Travis M. Williams, Joe McGlinchy, Maxwell C. Cook
Year Published: 2020
Type: Document
Book or Chapter or Journal Article
Towards spatially explicit quantification of pre- and postfire fuels and fuel consumption from traditional and point cloud measurements

Methods to accurately estimate spatially explicit fuel consumption are needed because consumption relates directly to fire behavior, effects, and smoke emissions. Our objective was to quantify sparkleberry (Vaccinium arboretum Marshall) shrub fuels before and after six experimental prescribed fires at Fort Jackson in South Carolina...

Author(s): Andrew T. Hudak, Akira Kato, Benjamin C. Bright, E. Louise Loudermilk, Christie M. Hawley, Joseph C. Restaino, Roger D. Ottmar, Gabriel A. Prata, Carlos Cabo, Susan J. Prichard, Eric Rowell, David R. Weise
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

LiDAR technology to map forest continuity: A municipality tool to prevent forest fires in a Wildland–Urban interface

Highlights: • LiDAR technology is a municipality tool to map forest continuity in a wildland–urban interface. • Mapping forest continuity of urban parcels permits prioritisation of intervention efforts to prevent forest fires. • Moran's I permits determination of spatial autocorrelation of the Canopy Fraction Cover of...

Author(s): Anna Badia, Meritxell Gisbert
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Burn severity mapping from Landsat MESMA fraction images and land surface temperature

Forest fires are incidents of great importance in Mediterranean environments. Landsat data have proven to be suitable for evaluating post-fire vegetation damage and determining different levels of burn severity, which is crucial for planning post-fire rehabilitation. This study assessed the utility of combined Multiple Endmember...

Author(s): Carmen Quintano, Alfonso Fernández-Manso, Dar A. Roberts
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Modelling suppression difficulty: Current and future applications

Improving decision processes and the informational basis upon which decisions are made in pursuit of safer and more effective fire response have become key priorities of the fire research community. One area of emphasis is bridging the gap between fire researchers and managers through development of application-focused,...

Author(s): Francisco Rodriguez y Silva, Christopher D. O'Connor, Matthew P. Thompson, Juan Ramón Molina Martínez, David E. Calkin
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Still standing: recent patterns of post-fire conifer refugia in ponderosa pine-dominated forests of the Colorado Front Range
Forested fire refugia (trees that survive fires) are important disturbance legacies that provide seed sources for post-fire regeneration. Conifer regeneration has been limited following some recent western fires, particularly in ponderosa pine (Pinus ponderosa) forests. However, the extent, characteristics, and predictability of...

**Reclassifying the wildland-urban interface using fire occurrences for the United States**

The wildland-urban interface (WUI) occurs at the intersection of houses and undeveloped wildlands, where fire is a safety concern for communities, motivating investment in planning, protection, and risk mitigation. Because there is no operational definition of WUI based on where fires in fact have occurred, I used fire occurrences...

**A satellite data driven approach to monitoring and reporting fire disturbance and recovery across boreal and temperate forests**

The regular and consistent measurements provided by Earth observation satellites can support the monitoring and reporting of forest indicators. Although substantial scientific literature espouses the capabilities of satellites in this area, the techniques are under-utilised in national reporting, where there is a preference for...

**SAR-enhanced mapping of live fuel moisture content**

Assessing wildfire risk presents several challenges due to uncertainty in fuel flammability and ignition potential. Live fuel moisture content (LFMC) - the mass of water per unit dry biomass in vegetation - exerts a direct control on fuel ignitability, fuel availability and fire spread, and is thus an important parameter in...

**Corrigendum to: Modelling suppression difficulty: current and future applications**

Improving decision processes and the informational basis upon which decisions are made in pursuit of safer and more effective fire response have become key priorities of the fire research community. One area of emphasis is bridging the gap between fire researchers and managers through development of application-focused,...
Introducing spatially distributed fire danger from earth observations (FDEO) using satellite-based data in the contiguous United States
www.nrfirescience.org/resource/21107
Wildfire danger assessment is essential for operational allocation of fire management resources; with longer lead prediction, the more efficiently can resources be allocated regionally. Traditional studies focus on meteorological forecasts and fire danger index models (e.g., National Fire Danger Rating System-NFDRS) for predicting...
Author(s): Alireza Farahmand, E. Natasha Stavros, John T. Reager, Ali Behrangi
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Building Loss in WUI Disasters: Evaluating the Core Components of the Wildland–Urban Interface Definition
www.nrfirescience.org/resource/22399
Accurate maps of the wildland-urban interface (WUI) are critical for the development of effective land management policies, conducting risk assessments, and the mitigation of wildfire risk. Most WUI maps identify areas at risk from wildfire by overlaying coarse-scale housing data with land cover or vegetation data. However, it is...
Author(s): Michael D. Caggiano, Todd J. Hawbaker, Benjamin Gannon, Chad M. Hoffman
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

3D video semantic segmentation for wildfire smoke
www.nrfirescience.org/resource/21698
Wildfires are a serious threat to ecosystems and human life. Usually, smoke is generated before the flame, and due to the diffusing nature of the smoke, we can detect smoke from a distance, so wildfire smoke detection is especially important for early warning systems. In this paper, we propose a 3D convolution-based encoder—...
Author(s): Guodong Zhu, Zhenxue Chen, Chengyun Liu, Xuewen Rong, Weikai He
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Assessing the shape accuracy of coarse resolution burned area identifications
www.nrfirescience.org/resource/20953
Accuracy assessment of burned area maps has been traditionally performed using pixel-based metrics, with the objective of assessing the accuracy and precision of burned area estimates at local and regional scales. While these assessments are helpful for obtaining consistent estimates of the burned area across many fires and over...
Author(s): Michael L. Humber, Luigi Boschetti, Louis Giglio
Year Published: 2020
Type: Document
Book or Chapter or Journal Article
Increasing temperatures and irregular precipitation associated with climate change, along with increasing frequency and severity of wildfires, contribute to increased downstream transport of sediment and total organic carbon (TOC), with potential impacts

Monitoring ecosystem events such as wildfires with remote sensing is fundamental to natural resources management. However, precisely delineating burned areas with remote sensing remains a challenge for post-fire ecological assessment. Burned area mapping methods with spectral indices are affected by several interferences such as...

Author(s): Kudzai Shaun Mpakairi, Shamiso Lynette Kadzunge, Henry Ndaimani
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

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

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

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

Effects of post-fire management on vegetation and fuels following successive wildfires in mixed conifer forests - Final Report to the Joint Fire Science Program

In the face of changing climatic regimes and increases in extreme fire events, many western forests are poised to burn, not only once but multiple times, sometimes in short succession. As such, land managers have limited opportunities to effectively alter post-fire vegetation and fuels to make them more resilient to future...

Author(s): Michelle Coppoletta, Brandon M. Collins, Scott H. Markwith, Kyle E. Merriam
Year Published: 2020
Type: Document
Technical Report or White Paper

Mapping Fuels for Regional Smoke Management and Emissions Inventories

Fuels are highly variable and dynamic in space and time, and fuel loading can vary considerably even within fine spatial scales and within specific fuel types, such as downed wood or organic soils. Given this inherent variability in fuel loadings, it is not good practice to represent all instances of a fuel type by the same set of...

Author(s): Nancy H. F. French, Michael Billmire, Susan J. Prichard, Maureen C. Kennedy, Donald McKenzie, Narasimhan K. Larkin, Roger D. Ottmar
Year Published: 2020
Type: Document
Technical Report or White Paper
Image similarity metrics suitable for infrared video stabilization during active wildfire monitoring: a comparative analysis

www.nrfirescience.org/resource/20838

Aerial Thermal Infrared (TIR) imagery has demonstrated tremendous potential to monitor active forest fires and acquire detailed information about fire behavior. However, aerial video is usually unstable and requires inter-frame registration before further processing. Measurement of image misalignment is an essential operation for...

Author(s): M.M. Valero, Steven Verstockt, Christian Mata, Daniel M. Jimenez, Lloyd P. Queen, O. Rios, Elsa Pastor, Eulalia Planas
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Exploring a convection-diffusion-reaction model of the propagation of forest fires: computation of risk maps for heterogeneous environments

www.nrfirescience.org/resource/22129

The propagation of a forest fire can be described by a convection–diffusion–reaction problem in two spatial dimensions, where the unknowns are the local temperature and the portion of fuel consumed as functions of spatial position and time. This model can be solved numerically in an efficient way by a linearly implicit-explicit...

Author(s): Raimund Bürger, Elvis Gavilán, Daniel Inzunza, Pep Mulet, Luis Miguel Villada
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Development of post-fire vegetation response-ability model in grassland mountainous ecosystem using GIS and remote sensing

www.nrfirescience.org/resource/21458

The mountainous grassland ecosystem in Golden Gate National Park (South Africa) has post-fire ecological resilience. However, vegetation species composition and structure can alter when the ecosystem continually has uncontrolled fires. This study developed a vegetation response-ability model by integrating environmental factors (...)

Author(s): Efosa G. Adagbasa, Samuel A. Adelabu, Tom W. Okello
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Object-based post-fire aerial image classification for building damage, destruction and defensive actions at the 2012 Colorado Waldo Canyon Fire

www.nrfirescience.org/resource/20778

We compare the use of post-fire aerial imagery to ground-based assessment for identifying building destruction and damage at the 2012 Colorado Waldo Canyon Fire. We also compare active-fire defensive actions identified via manual and automated post-fire image classification to defensive actions documented from ground-based...

Author(s): Derek McNamara, William E. Mell, Alexander Maranghides
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Terrestrial Image-Based Point Clouds for Mapping Near-Ground Vegetation Structure: Potential
and Limitations

Site-specific information concerning fuel hazard characteristics is needed to support wildfire management interventions and fuel hazard reduction programs. Currently, routine visual assessments provide subjective information, with the resulting estimate of fuel hazard varying due to observer experience and the rigor applied in...

Author(s): Luke Wallace, Bryan Hally, Samuel Hillman, Simon D. Jones, Karin J. Reinke
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Changes to the Monitoring Trends in Burn Severity program mapping production procedures and data products

Background: The Monitoring Trends in Burn Severity (MTBS) program has been providing the fire science community with large fire perimeter and burn severity data for the past 14 years. As of October 2019, 22,969 fires have been mapped by the MTBS program and are available on the MTBS website (https://www.mtbs.gov(link is external))....

Author(s): Joshua J. Picotte, Krishna Bhattarai, Danny Howard, Jennifer Lecker, Justin Epting, Brad Quayle, Nathan C. Benson, Kurtis J. Nelson
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Investigation of wildfire impacts on land surface phenology from MODIS time series in the western US forests

Land surface phenology (LSP) characterizes the timing and greenness of seasonal vegetation growth in satellite pixels and it has been widely used to associate with climate change. However, wildfire, causing considerable land surface changes, exerts abrupt changes on the LSP magnitudes and great influences on the LSP long-term trends...

Author(s): Jianmin Wang, Xiaoyang Zhang
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Influence of satellite sensor pixel size and overpass time on undercounting of cerrado/savannah landscape-scale fire radiative power (FRP): an assessment using the MODIS airborne simulator

The fire radiative power (FRP) of active fires (AFs) is routinely assessed with spaceborne sensors. MODIS is commonly used, and its 1 km nadir pixel size provides a minimum per-pixel FRP detection limit of ~5-8 MW, leading to undercounting of AF pixels with FRPs of less than around 10 MW. Since most biomes show increasing AF pixel...

Author(s): Samuel Sperling, Martin J. Wooster, Bruce D. Malamud
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Fire and land cover change in the Palouse Prairie–forest ecotone, Washington and Idaho, USA

Background: Prairie-forest ecotones are ecologically important for biodiversity and ecological
processes. While these ecotones cover small areas, their sharp gradients in land cover promote rich ecological interaction and high conservation value. Our objective was to understand how historical and current fire occurrences and human...
Author(s): Penelope Morgan, Emily K. Heyerdahl, Eva K. Strand, Stephen C. Bunting, James P. Riser, John T. Abatzoglou, Max W. Nielsen-Pincus, Mara Johnson
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Development of a Severe Fire Potential map for the contiguous United States
www.nrfirescience.org/resource/21829
Burn severity is the ecological change resulting from wildland fires. It is often mapped by using prefire and postfire satellite imagery and classified as low, moderate, or high. Areas burned with high severity are of particular concern to land managers and others because postfire vegetation, soil, and other important ecosystem...
Author(s): Gregory K. Dillon, Matthew Panunto, Brett Davis, Penelope Morgan, Donovan Birch, William Matt Jolly
Year Published: 2020
Type: Document
Technical Report or White Paper

Training data requirements for fire severity mapping using Landsat imagery and random forest
www.nrfirescience.org/resource/21781
The ability to map fire severity is a requirement for fire management agencies worldwide. The development of repeatable methods to produce accurate and consistent fire severity maps from satellite imagery is necessary to document fire regimes, to set priorities for post-fire management responses, and for research applications....
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Using a statistical model of past wildfire spread to quantify and map the likelihood of fire reaching assets and prioritise fuel treatments
www.nrfirescience.org/resource/21155
We present a method to quantify and map the probability of fires reaching the vicinity of assets in a wildfire-prone region, by extending a statistical fire spread model developed on historical fire patterns in the Sydney region, Australia. It calculates the mean probability of fire spreading along sample lines around assets....
Author(s): Owen F. Price, Michael Bedward
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Microwave retrievals of soil moisture improve grassland wildfire predictions
www.nrfirescience.org/resource/22465
Statistical analyses of wildfires demonstrate that vapor pressure deficit (VPD) allows for skillful predictions, likely because it reflects fuel moisture content. Soil moisture provides a potentially complimentary measure of water availability but has been less explored because of sparse measurements. Using measurements from the...
Author(s): Angela J. Ridgen, Robert S. Powell, Aleyda Trevino, Kaighin A. McColl, Peter Huybers
Fire and rain are one: extreme rainfall events predict wildfire extent in an arid grassland
www.nrfirescience.org/resource/21749
Assessing wildfire regimes and their environmental drivers is critical for effective land management and conservation. We used Landsat imagery to describe the wildfire regime of the north-eastern Simpson Desert (Australia) between 1972 and 2014, and to quantify the relationship between wildfire extent and rainfall. Wildfires...
Author(s): Elise M. Verhoeven, Brad R. Murray, Christopher R. Dickman, Glenda M. Wardle, Aaron C. Greenville
Year Published: 2020
Type: Document
Book or Chapter or Journal Article

Deriving Fire Behavior Metrics from UAS Imagery
www.nrfirescience.org/resource/19743
The emergence of affordable unmanned aerial systems (UAS) creates new opportunities to study fire behavior and ecosystem pattern-process relationships. A rotor-wing UAS hovering above a fire provides a static, scalable sensing platform that can characterize terrain, vegetation, and fire coincidently. Here, we present methods for...
Author(s): Christopher J. Moran, Carl A. Seielstad, Matthew R. Cunningham, Valentijn Hoff, Russell A. Parsons, Lloyd P. Queen, Katie Sauerbrey, Tim Wallace
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Integrating anthropogenic factors into regional-scale species distribution models - a novel application in the imperiled sagebrush biome
www.nrfirescience.org/resource/20486
Species distribution models (SDMs) that rely on regional-scale environmental variables will play a key role in forecasting species occurrence in the face of climate change. However, in the Anthropocene, a number of local-scale anthropogenic variables, including wildfire history, land-use change, invasive species, and...
Author(s): Juan M. Requena-Mullor, Kaitlin C. Maguire, Douglas J. Shinneman, T. Trevor Caughlin
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Examining post-fire vegetation recovery with Landsat time series analysis in three western North American forest types
www.nrfirescience.org/resource/19436
Background: Few studies have examined post-fire vegetation recovery in temperate forest ecosystems with Landsat time series analysis. We analyzed time series of Normalized Burn Ratio (NBR) derived from LandTrendr spectral-temporal segmentation fitting to examine post-fire NBR recovery for several wildfires that occurred in three...
Author(s): Benjamin C. Bright, Andrew T. Hudak, Robert E. Kennedy, Justin D. Braaten, Azad Henareh Khalyani
Year Published: 2019
Type: Document
**Integrated fire severity–land cover mapping using very-high-spatial-resolution aerial imagery and point clouds**

www.nrfirescience.org/resource/20369

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

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

Year Published: 2019

Type: Document

**Fire and burn severity assessment: calibration of Relative Differenced Normalized Burn Ratio (RdNBR) with field data**

www.nrfirescience.org/resource/19414

The assessment of burn severity is highly important in order to describe and measure the effects of fire on vegetation, wildlife habitat and soils. The estimation of burn severity based on remote sensing is a powerful tool that, to be useful, needs to be related and validated with field data. The present paper explores the...

Author(s): Adrián Cardil, Blas Mola-Yudego, Ángela Blázquez-Casado, José Ramón González-Olabarria

Year Published: 2019

Type: Document

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

www.nrfirescience.org/resource/20259

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

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

Year Published: 2019

Type: Document

**LiDAR-Based Wildfire Prevention in WUI: The Automatic Detection, Measurement and Evaluation of Forest Fuels**

www.nrfirescience.org/resource/19311

This paper describes a methodology using LiDAR point clouds with an ultra-high resolution in the characterization of forest fuels for further wildfire prevention and management. Biomass management strips were defined in three case studies using a particular Spanish framework. The data were acquired through a UAV platform. The...
Satellite-derived spectral indices such as the relativized burn ratio (RBR) allow fire severity maps to be produced in a relatively straightforward manner across multiple fires and broad spatial extents. These indices often have strong relationships with field-based measurements of fire severity, thereby justifying their widespread use.

Author(s): Sean A. Parks, Lisa M. Holsinger, Michael J. Koontz, Luke Collins, Ellen Whitman, Marc-André Parisien, Rachel A. Loehman, Jennifer L. Barnes, Jean-François Bourdon, Jonathan Boucher, Yan Boucher, Anthony C. Caprio, Adam Collingwood, Ronald J. Hall, Jane Park, Lisa B. Saperstein, Charlotte Smetanka, Rebecca J. Smith, Nicholas O. Soverel

Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Large wildfires can cover millions of hectares of forest every year worldwide, causing losses in ecosystems and assets. Fire simulation and modeling provides an analytical scheme to characterize and predict fire behavior and spread in several and complex environments. Spatial dynamics of large wildfires can be analyzed using satellite active fire data.

Author(s): Adrián Cardil, Santiago Monedero, Joaquin Ramírez, Alberto Silva

Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Three-dimensional point data acquired by Terrestrial Lidar Scanning (TLS) is used as ground observation in comparisons with fire severity indices computed from Landsat satellite multi-temporal images through Google Earth Engine (GEE). Forest fires are measured by the extent and severity of fire. Current methods of assessing fire severity are assessed.

Author(s): Akira Kato, L. Monika Moskal, Jonathan L. Batchelor, David Thau, Andrew T. Hudak

Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Forest ecosystems are subject to recurring fires as one of their most significant disturbances. Accurate mapping of burn severity is crucial for post-fire land management and vegetation regeneration monitoring. Remote-sensing-based monitoring of burn severity faces new challenges when forests experience both fire and non-fire events.

Author(s): Yinan HE, Gang Chen, Angela De Santis, Dar A. Roberts, Yuyu Zhou, Ross K. Meentemeyer

Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Mapping coarse woody debris with random forest classification of centimetric aerial imagery
Coarse woody debris (CWD; large parts of dead trees) is a vital element of forest ecosystems, playing an important role in nutrient cycling, carbon storage, fire fuel, microhabitats, and overall forest structure. However, there is a lack of effective tools for identifying and mapping both standing (snags) and downed (logs) CWD in...

Differing sensitivities to fire disturbance result in large differences among remotely sensed products of vegetation disturbance

Recent advances in high-performance computing (HPC) have promoted the creation of standardized remotely sensed products that map annual vegetation disturbance through two primary methods: (1) conventional approaches that integrate remote sensing-derived vegetation indices with field data and other data on disturbance events reported...

Incorporating biophysical gradients and uncertainty into burn severity maps in a temperate fire-prone forested region

As forest fire activity increases worldwide, it is important to track changing patterns of burn severity (i.e., degree of fire-caused ecological change). Satellite data provide critical information across space and time, yet how satellite indices relate to individual measures of burn severity on the ground (e.g., tree mortality or...

Assessing Landscape Fire Hazard by Multitemporal Automatic Classification of Landsat Time Series Using the Google Earth Engine in West-Central Spain

Annual Land Use and Land Cover (LULC) maps are needed to identify the interaction between landscape changes and wildland fires. Objectives: In this work, we determined fire hazard changes in a representative Mediterranean landscape through the classification of annual LULC types and fire perimeters, using a dense Landsat Time...

Validating a time series of annual grass percent cover in the sagebrush ecosystem

We mapped yearly (2000–2016) estimates of annual grass percent cover for much of the sagebrush ecosystem of the western United States using remotely sensed, climate, and geophysical data in
regression-tree models. Annual grasses senesce and cure by early summer and then become beds of fine fuel that easily ignite and spread fire...
Author(s): Stephen P. Boyte, Bruce K. Wylie, Donald J. Major
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Partitioned by process: measuring post-fire debris-flow and rill erosion with structure from motion photogrammetry
www.nrfirescience.org/resource/20574
After wildfire, hillslope and channel erosion produce large amounts of sediment and can contribute significantly to long-term erosion rates. However, pre-erosion high-resolution topographic data (e.g. lidar) is often not available and determining specific contributions from post-fire hillslope and channel erosion is...
Author(s): Nicholas G. Ellett, Jennifer L. Pierce, Nancy F. Glenn
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Detection of coarse woody debris using airborne light detection and ranging (LiDAR)
www.nrfirescience.org/resource/19024
Coarse woody debris (CWD) is an essential component of forest ecosystems that provides habitat for diverse species, functions in water and nutrient cycling, and can be a potential surface fuel in wildfires. CWD detection and mapping would enhance forestry and wildlife research and management but passive remote sensing technologies...
Author(s): Michael J. Joyce, John D. Erb, Barry A. Sampson, Ron A. Moen
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

LANDFIRE Remap Prototype Mapping Effort: Developing a New Framework for Mapping Vegetation Classification, Change, and Structure
www.nrfirescience.org/resource/19747
LANDFIRE (LF) National (2001) was the original product suite of the LANDFIRE program, which included Existing Vegetation Cover (EVC), Height (EVH), and Type (EVT). Subsequent refinements after feedback from data users resulted in updated products, referred to as LF 2001, that now served as LANDFIRE’s baseline datasets and are the...
Author(s): Joshua J. Picotte, Daryn Dockter, Jordan Long, Brian Tolk, Anne Davidson, Birgit Peterson
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

A review of the applications of remote sensing in fire ecology
www.nrfirescience.org/resource/20491
Wildfire plays an important role in ecosystem dynamics, land management, and global processes. Understanding the dynamics associated with wildfire, such as risks, spatial distribution, and effects is important for developing a clear understanding of its ecological influences. Remote sensing technologies provide a means to study fire...
Author(s): David M. Szpakowski, Jennifer L. Rooker Jensen
Year Published: 2019
Type: Document
Wildfire, a natural part of many ecosystems, has also resulted in significant disasters impacting ecology and human life in Australia. This study proposes a prototype of fire propagation prediction as an extension of preceding research; this system is called “Cloud computing based bushfire prediction”, the computational...

Author(s): Mitsuhiro Ozaki, Jagannath Aryal, Paul Fox-Hughes
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Understanding the factors that influence vegetation responses to disturbance is important because vegetation is the foundation of food resources, wildlife habitat, and ecosystem properties and processes. We integrated vegetation cover data derived from field plots and remotely sensed Landsat images in two focal areas over a 37?yr...

Author(s): Brittany S. Barker, David S. Pilliod, Matthew Rigge, Collin Homer
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Fire severity mapping is conventionally accomplished through the interpretation of aerial photography or the analysis of moderate- to coarse-spatial-resolution pre- and post-fire satellite imagery. Although these methods are well established, there is a demand from both forest managers and fire scientists for higher-spatial-...

Author(s): Jeremy Arkin, Nicholas C. Coops, Txomin Hermosilla, Lori D. Daniels, Andrew Plowright
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Lidar is an established tool for mapping forest structure, but its sparse spatial and temporal coverage often preclude its use in studying forest disturbance. In contrast, aerial imagery has been and continues to be regularly collected in many regions, and advances in stereo image matching have automated the creation of dense...

Author(s): Steven K. Filippelli, Michael A. Lefsky, Monique E. Rocca
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Modeling and mapping dynamic vulnerability to better assess WUI evacuation performance
Wildland?urban interface (WUI) fire incidents are likely to become more severe and will affect more and more people. Given their scale and complexity, WUI incidents require a multidomain approach to assess their impact and the effectiveness of any mitigation efforts. The authors recently produced a specification for a simulation...

Author(s): Steven M. V. Gwynne, Enrico Ronchi, Noureddine Bénichou, Max Kinateder, Erica D. Kuligowski, Islam Gomaa, Masoud Adelzadeh
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Object-based classification of forest disturbance types in the contiguous United States

Forest ecosystems provide critical ecosystem goods and services, and any disturbance-induced changes can have cascading impacts on natural processes and human socioeconomic systems. Forest disturbance frequency, intensity, and spatial and temporal scale can be altered by changes in climate and human activity, but without baseline...

Author(s): Lian-Zhi Huo, Luigi Boschetti, Aaron M. Sparks
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

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

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

Author(s): Joshua C. Hyde, Eva K. Strand, Andrew T. Hudak, Dale Hamilton
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Historical background and current developments for mapping burned area from satellite Earth observation

Fire has a diverse range of impacts on Earth's physical and social systems. Accurate and up to date information on areas affected by fire is critical to better understand drivers of fire activity, as well as its relevance for biogeochemical cycles, climate, air quality, and to aid fire management. Mapping burned areas was...

Author(s): Emilio Chuvieco, Florent Mouillot, Guido R. Van der Werf, Jesus San Miguel, Mihai A. Tanase, Nikos Koutsias, Mariano Garcia, Marta Yebra, Marc Padilla, Ioannis Z. Gitas, Angelika Heil, Todd J. Hawbaker, Louis Giglio
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Escape Route Index: A Spatially-Explicit Measure of Wildland Firefighter Egress Capacity

For wildland firefighters, the ability to efficiently evacuate the fireline is limited by terrain, vegetation,
and fire conditions. The impacts of terrain and vegetation on evacuation time to a safety zone may not be apparent when considering potential control locations either at the time of a wildfire or during pre-suppression...

Author(s): Michael J. Campbell, Wesley G. Page, Philip E. Dennison, Bret W. Butler
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Incorporating biophysical gradients and uncertainty into burn severity maps in a temperate fire-prone forested region
www.nrfirescience.org/resource/19096
As forest fire activity increases worldwide, it is important to track changing patterns of burn severity (i.e., degree of fire-caused ecological change). Satellite data provide critical information across space and time, yet how satellite indices relate to individual measures of burn severity on the ground (e.g., tree mortality or...

Author(s): Brian J. Harvey, Robert A. Andrus, Sean C. Anderson
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Deriving forest fire probability maps from the fusion of visible/infrared satellite data and geospatial data mining
www.nrfirescience.org/resource/19818
Information on fire probability is of vital importance to environmental and ecological studies as well as to fire management. This study aimed at comparing two forest fire probability mapping techniques, one based primarily on freely distributed EO (Earth observation) data from Landsat imagery, and another one based purely on GIS...

Author(s): Prashant K. Srivastava, George P. Petropoulos, Manika Gupta, Sudhir K. Singh, Tanvir Islam, Dimitra Loka
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Standardized process to generate mapping of priority areas for protection against wildfires
www.nrfirescience.org/resource/19082
In the field of geographic information systems (GIS) there are certain tasks that are performed repetitively and are thus sometimes monotonous, where it is necessary to structure, integrate and analyze a series of georeferenced information, which, however, always carries the same sequence. Therefore, we developed a sequential model...

Author(s): José G. Flores Garnica, Uri David Casillas Díaz, Alejandra Macías Muro
Year Published: 2019
Type: Document
Conference Proceedings

Estimating canopy fuel attributes from low-density LiDAR
www.nrfirescience.org/resource/19789
Simulations of wildland fire risk are dependent on the accuracy and relevance of spatial data inputs describing drivers of wildland fire, including canopy fuels. Spatial data are freely available at national and regional levels. However, the spatial resolution and accuracy of these types of products often are insufficient for...

Author(s): Peder S. Engelstad, Michael J. Falkowski, Peter T. Wolter, Aaron J. Poznanovic, Patty
High fire disturbance in forests leads to longer recovery, but varies by forest type
www.nrfirescience.org/resource/20584
Across the world, millions of hectares of forest are burn by wildfires each year. Satellite remote sensing, particularly when used in time series, can describe complex disturbance?recovery processes, but is underutilized by ecologists. This study examines whether a greater disturbance magnitude equates to a longer recovery...
Author(s): Samuel Hislop, Simon D. Jones, Mariela Soto-Berelov, Andrew K. Skidmore, Andrew Haywood, Trung H. Nguyen
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Wildfire activity and land use drove 20th?century changes in forest cover in the Colorado front range
www.nrfirescience.org/resource/19049
Recent shifts in global forest area highlight the importance of understanding the causes and consequences of forest change. To examine the influence of several potential drivers of forest cover change, we used supervised classifications of historical (1938-1940) and contemporary (2015) aerial imagery covering a 2932?km2 study area...
Author(s): Kyle Rodman, Thomas T. Veblen, Sara Saraceni, Teresa B. Chapman
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Prototype Downscaling Algorithm for MODIS Satellite 1 km Daytime Active Fire Detections
www.nrfirescience.org/resource/19763
This work presents development of an algorithm to reduce the spatial uncertainty of active fire locations within the 1 km MODeerate resolution Imaging Spectroradiometer (MODIS Aqua and Terra) daytime detection footprint. The algorithm is developed using the finer 500 m reflective bands by leveraging on the increase in 2.13 ?m...
Author(s): Sanath S. Kumar, Joshua J. Picotte, Birgit Peterson
Year Published: 2019
Type: Document
Book or Chapter or Journal Article

Efficiency of remote sensing tools for post-fire management along a climatic gradient
www.nrfirescience.org/resource/19019
Forest managers require reliable tools to evaluate post-fire recovery across different geographic/climatic contexts and define management actions at the landscape scale, which might be highly resource-consuming in terms of data collection. In this sense, remote sensing techniques allow for gathering environmental data over large...
Author(s): José Manuel Fernández-Guisuraga, Leonor Calvo, Víctor Fernández-García, Elena Marcos-Porras, Angela Taboada, Susana Suárez-Seoane
Year Published: 2019
Type: Document
Book or Chapter or Journal Article
Digital soil mapping for fire prediction and management in rangelands
www.nrfirescience.org/resource/18782
Background: Soil properties have important effects on fire occurrence and spread, but soils are often overlooked in fire prediction models. Quantifying soil-fire linkages is limited by information in conventional soil maps, but digital soil mapping products (e.g., detailed soil property maps) could improve both wildfire prediction...
Author(s): Matthew R. Levi, Brandon T. Bestelmeyer
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

How vegetation recovery and fuel conditions in past fires influences fuels and future fire management in five western U.S. ecosystems - JFSP Final Report
www.nrfirescience.org/resource/18062
Mixed severity wildfires burn large areas in western North America forest ecosystems in most years and this is expected to continue or increase with climate change. Little is understood about vegetation recovery and changing fuel conditions more than a decade post-fire because it exceeds the duration of most studies of fire effects...
Author(s): Andrew T. Hudak, Beth A. Newingham, Eva K. Strand, Penelope Morgan
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Improved prediction of stream flow based on updating land cover maps with remotely sensed forest change detection
www.nrfirescience.org/resource/17965
The water balance in a watershed can be disrupted by forest disturbances such as harvests and fires. Techniques to accurately and efficiently map forest cover changes due to disturbance are evolving quickly, and it is of interest to ask how useful maps of different types of disturbances over time can be in the prediction of water...
Author(s): Alexander J. Hernandez, Sean P. Healey, Hongsheng Huang, R. Douglas Ramsey
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Mean composite fire severity metrics computed with Google Earth engine offer improved accuracy and expanded mapping potential
www.nrfirescience.org/resource/17913
Landsat-based fire severity datasets are an invaluable resource for monitoring and research purposes. These gridded fire severity datasets are generally produced with pre- and post-fire imagery to estimate the degree of fire-induced ecological change. Here, we introduce methods to produce three Landsat-based fire severity metrics...
Author(s): Sean A. Parks, Lisa M. Holsinger, Morgan A. Voss, Rachel A. Loehman, Nathaniel P. Robinson
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

A VIIRS direct broadcast algorithm for rapid response mapping of wildfire burned area in the
western United States

We present a direct broadcast (DB) rapid response burned area mapping algorithm for Visible Infrared Imaging Radiometer Suite (VIIRS) data that combines products driven by the spectral signal of fire-affected areas from both emissive and reflective spectral bands. The algorithm processes VIIRS infrared M-bands (750 m) using...

Author(s): Shawn P. Urbanski, Bryce L. Nordgren, Carl Albury, Brenna Schwert, David Peterson, Brad Quayle, Wei Min Hao
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

A World in Pixels: How New Research Is Helping to Predict Probability of High-Severity Fire

With drought across much of the southern and western States, it’s shaping up to be another record year for wildfires. According to the National Oceanic and Atmospheric Administration, May 2018 was the fourthworst May since 2000 in terms of U.S. acres burned by wildfires. The year 2000 is a significant measuring point, since the...

Author(s): Sean A. Parks
Year Published: 2018
Type: Document
Research Brief or Fact Sheet

Detection of Annual Spruce Budworm Defoliation and Severity Classification Using Landsat Imagery

Spruce budworm (SBW) is the most destructive forest pest in eastern forests of North America. Mapping annual current-year SBW defoliation is challenging because of the large landscape scale of infestations, high temporal/spatial variability, and the short period of time when detection is possible. We used Landsat-5 and Landsat-MSS...

Author(s): Parinaz Rahimzadeh-Bajgiran, Aaron R. Weiskittel, Daniel Kneeshaw, David A. MacLean
Year Published: 2018
Type: Document
Book or Chapter or Journal Article

Towards improved quantification and prediction of post-fire recovery in conifers: Expanding laboratory fire radiative energy-tree physiology experiments to a mature forest stand - JFSP Final Report

Current assessments of the ecological impacts of fires, termed burn severity, investigate the degree to which an ecosystem has changed due to a fire and typically encompass both vegetation and soil effects. Burn severity assessments at local to regional scales are typically achieved using spectral indices (such as the difference...

Author(s): Crystal A. Kolden, Aaron M. Sparks
Year Published: 2018
Type: Document
Technical Report or White Paper

Quantifying post-wildfire hillslope erosion with lidar
Following a wildfire, flooding and debris- flow hazards are common and pose a threat to human life and
infrastructure in steep burned terrain. Wildfire enhances both water runoff and soil erosion, which ultimately shape the debris flow potential. The erosional processes that route excess sediment from hillslopes to debris-flow...

Title: Prediction of forest canopy and surface fuels from lidar and satellite time series data in a bark beetle-affected forest
Year Published: 2017
Type: Book or Chapter or Journal Article

Wildfire behavior depends on the type, quantity, and condition of fuels, and the effect that bark beetle outbreaks have on fuels is a topic of current research and debate. Remote sensing can provide estimates of fuels across landscapes, although few studies have estimated surface fuels from remote sensing data. Here we predicted and.

Title: Landscape-scale quantification of fire-induced change in canopy cover following mountain pine beetle outbreak and timber harvest
Year Published: 2017
Type: Book or Chapter or Journal Article

Across the western United States, the three primary drivers of tree mortality and carbon balance are bark beetles, timber harvest, and wildfire. While these agents of forest change frequently overlap, uncertainty remains regarding their interactions and influence on specific subsequent fire effects such as change in canopy cover....

Title: Selecting Control Sites for Post-Fire Ecological Studies Using Biological Criteria and MODIS Time Series Data
Year Published: 2017
Type: Book or Chapter or Journal Article

Wildland fires play a key role in the functioning and structure of vegetation. The availability of sensors aboard satellites, such as Moderate Resolution Imaging Spectroradiometer (MODIS), makes possible the construction of a time series of vegetation indices (VI) and the monitoring of post-fire vegetation recovery. One of the...

Title: Estimating ladder fuels: a new approach combining field photography with LiDAR
Year Published: 2017
Type: Book or Chapter or Journal Article

Forests historically associated with frequent fire have changed dramatically due to fire suppression and past harvesting over the last century. The buildup of ladder fuels, which carry fire from the surface of
the forest floor to tree crowns, is one of the critical changes, and it has contributed to uncharacteristically large and...

Author(s): Heather A. Kramer, Brandon M. Collins, Frank K. Lake, Marek K. Jakubowski, Scott L. Stephens, Maggi Kelly
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Measuring radiant emissions from entire prescribed fires with ground, airborne, and satellite sensors - RxCADRE 2012
www.nrfirescience.org/resource/13855
Characterising radiation from wildland fires is an important focus of fire science because radiation relates directly to the combustion process and can be measured across a wide range of spatial extents and resolutions. As part of a more comprehensive set of measurements collected during the 2012 Prescribed Fire Combustion and...
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Development and validation of fuel height models for terrestrial lidar - RxCADRE 2012
www.nrfirescience.org/resource/13846
Terrestrial laser scanning (TLS) was used to collect spatially continuous measurements of fuelbed characteristics across the plots and burn blocks of the 2012 RxCADRE experiments in Florida. Fuelbeds were scanned obliquely from plot/block edges at a height of 20 m above ground. Pre-fire blocks were scanned from six perspectives and...
Author(s): Eric Rowell, Carl A. Seielstad, Roger D. Ottmar
Year Published: 2016
Type: Document
Book or Chapter or Journal Article

Modifying LANDFIRE geospatial data for local applications
www.nrfirescience.org/resource/15167
LANDFIRE's suite of spatial data layers are a valuable resource for land managers because they stretch “wall-to-wall” across the US, are created with a consistent methodology and are updated over time. These data are designed to support broad-scale land management activities, and users are encouraged to critique and modify...
Author(s): Don Helmbrecht, Kori Blankenship
Year Published: 2016
Type: Document
Technical Report or White Paper

Automated integration of lidar into the LANDFIRE product suite
www.nrfirescience.org/resource/13609
Accurate information about three-dimensional canopy structure and wildland fuel across the landscape is necessary for fire behaviour modelling system predictions. Remotely sensed data are invaluable for assessing these canopy characteristics over large areas; lidar data, in particular, are uniquely suited for quantifying three-...
Exploring how alternative mapping approaches influence fireshed assessment and human community exposure to wildfire
www.nrfirescience.org/resource/13949
Attaining fire-adapted human communities has become a key focus of collaborative planning on landscapes across the western United States and elsewhere. The coupling of fire simulation with GIS has expanded the analytical base to support such planning efforts, particularly through the "fireside" concept that identifies areas where...
Author(s): Joe H. Scott, Matthew P. Thompson, Julie W. Gilbertson-Day
Year Published: 2015
Type: Document
Book or Chapter or Journal Article

Spraycan: A PPGIS for capturing imprecise notions of place
www.nrfirescience.org/resource/22844
It is increasingly common for participatory data to be collected from the public via a PPGIS, in order to gain a greater understanding both of the world around us, and people's experience of it. The place-based thoughts and feelings of an individual do not, however, always fit well with the space-based points and polygons into which...
Author(s): J. J. Huck, Duncan Whyatt, Paul Coulton
Year Published: 2014
Type: Document
Book or Chapter or Journal Article

Wildfire, wildlands, and people: understanding and preparing for wildfire in the wildland-urban interface - a forests on the edge report
www.nrfirescience.org/resource/16861
Fire has historically played a fundamental ecological role in many of America's wildland areas. However, the rising number of homes in the wildland-urban interface (WUI), associated impacts on lives and property from wildfire, and escalating costs of wildfire management have led to an urgent need for communities to become “fire-...
Author(s): Susan M. Stein, Sara J. Comas, James P. Menakis, Mary A. Carr, Susan I. Stewart, Helene Cleveland, Lincoln Bramwell, Volker C. Radeloff
Year Published: 2013
Type: Document
Technical Report or White Paper

Place Mapping and the Role of Spatial Scale in Understanding Landowner Views of Fire and Fuels Management
www.nrfirescience.org/resource/21885
Place mapping is emerging as a way to understand the spatial components of people’s relationships with particular locations and how these relate to support for management proposals. But despite the spatial focus of place mapping, scale is rarely explicitly examined in such exercises. This is particularly problematic since scalar...
Author(s): Michael A. Cacciapaglia, Laurie Yung, Michael E. Patterson
Year Published: 2012
Beyond fire behavior and fuels: learning from the past to help guide us in the future
https://www.nrfirescience.org/resource/18397
The third IAWF Fire Behavior and Fuels Conference was held in Spokane, Washington, October 25-29, 2010, and commemorated the 100th anniversary of the 1910 fires in the Northern Rocky Mountains. The theme of the conference was appropriately titled ‘Beyond Fire Behavior and Fuels: Learning from the Past to Help Guide Us in the...

Year Published: 2011
Type: Document
Conference Proceedings

Mapping and estimating forest fuel with radar remote sensing
https://www.nrfirescience.org/resource/11084
With an increase in the risk of large fires across much of the Western United States, along with a growing variety of fuel types that result from changes in the landscape and management strategies, there has never been a more pressing need for accurate, cost-efficient, large scale forest fuel maps. Emerging remote sensing...

Author(s): Rachel Clark
Year Published: 2009
Type: Document
Research Brief or Fact Sheet

From the ground up, way up: measuring live fuel moisture with satellite imagery to fine-tune fire modeling in western ecosystems
https://www.nrfirescience.org/resource/11431
Remote sensing from space may well become one of the world's most effective, accurate, and efficient ways to assess fire risk and thus manage large landscapes. The technology is evolving quickly, and researchers are busy keeping up. Some major western U.S. landscapes are just now being assessed for integrating remote sensing data...

Author(s): Rachel Clark
Year Published: 2009
Type: Document
Research Brief or Fact Sheet

A Computational Method for Optimizing Fuel Treatment Locations
https://www.nrfirescience.org/resource/20526
Modelling and experiments have suggested that spatial fuel treatment patterns can influence the movement of large fires. On simple theoretical landscapes consisting of two fuel types (treated and untreated), optimal patterns can be analytically derived that disrupt fire growth efficiently (i.e. with less area treated than random...

Author(s): Mark A. Finney
Year Published: 2007
Type: Document
Book or Chapter or Journal Article

Fuels Management - How to Measure Success: Conference Proceedings
https://www.nrfirescience.org/resource/18399
Fuels management programs are designed to reduce risks to communities and to improve and maintain
ecosystem health. The International Association of Wildland Fire initiated the 1st Fire Behavior and Fuels Conference to address development, implementation, and evaluation of these programs. The focus was on how to measure success....

Author(s): Patricia L. Andrews, Bret W. Butler
Year Published: 2006
Type: Document
Conference Proceedings

Regression modeling and mapping of coniferous forest basal area and tree density from discrete-return lidar and multispectral satellite data
www.nrfirescience.org/resource/13131
We compared the utility of discrete-return light detection and ranging (lidar) data and multispectral satellite imagery, and their integration, for modeling and mapping basal area and tree density across two diverse coniferous forest landscapes in north-central Idaho. We applied multiple linear regression models subset from a suite...

Author(s): Andrew T. Hudak, Nicholas L. Crookston, Jeffrey S. Evans, Michael J. Falkowski, Alistair M. S. Smith, Paul E. Gessler, Penelope Morgan
Year Published: 2006
Type: Document
Book or Chapter or Journal Article

Accuracy and precision of two indirect methods for estimating canopy fuels
www.nrfirescience.org/resource/11036
We compared the accuracy and precision of digital hemispherical photography and the LI-COR LAI-2000 plant canopy analyzer as predictors of canopy fuels. We collected data on 12 plots in western Montana under a variety of lighting and sky conditions, and used a variety of processing methods to compute estimates. Repeated measurements...

Author(s): Abran Steele-Feldman, Elizabeth D. Reinhardt, Russell A. Parsons
Year Published: 2006
Type: Conference Proceedings

Characterizing and mapping forest fire fuels using ASTER imagery and gradient modeling
www.nrfirescience.org/resource/7925
Land managers need cost-effective methods for mapping and characterizing forest fuels quickly and accurately. The launch of satellite sensors with increased spatial resolution may improve the accuracy and reduce the cost of fuels mapping. The objective of this research is to evaluate the accuracy and utility of imagery from the...

Author(s): Michael J. Falkowski, Paul E. Gessler, Penelope Morgan, Andrew T. Hudak, Alistair M. S. Smith
Year Published: 2005
Type: Document
Book or Chapter or Journal Article

The use of Landsat 7 (ETM+) and AVIRIS data to map fuel characteristic classes in western ecosystems - Final Report to the Joint Fire Science Program
www.nrfirescience.org/resource/11174
Summary of Findings: (1) Satellite imagery has the potential to map fuel models at the national and local levels: (a) Landsat. The Landfire project has shown that Landsat 7 (ETM+) data are useful for mapping fuels at the national level. Critical to developing accurate maps are data collected in the field on fuels and vegetation. At...
Demonstration and integration of systems for fire remote sensing, ground-based fire measurement, and fire modeling - Final Report to the Joint Fire Science Program
www.nrfirescience.org/resource/11158
Proof-of-concept research is being conducted to: compare airborne and in situ, ground-based fire measurement systems; begin evaluation of two fire-behavior simulation models with these data; test approaches to incorporating improved wind-field and weather data in these models; test the utility of the airborne remote sensing for...

Author(s): Colin C. Hardy, Philip J. Riggan
Year Published: 2005
Type: Document
Technical Report or White Paper

Mapping relative fire regime condition class for the western United States
www.nrfirescience.org/resource/10991
In 1999, a coarse-scale map of Fire Regime Condition Classes (FRCC) was developed for the conterminous United States (US) to help address contemporary fire management issues and to quantify changes in fuels from historical conditions. This map and its associated data have been incorporated into national policies (National Fire Plan... 

Author(s): James P. Menakis, Melanie Miller, Thomas Thompson
Year Published: 2004
Type: Document
Conference Proceedings

Evaluating the ASTER sensor for mapping and characterizing forest fire fuels in northern Idaho
www.nrfirescience.org/resource/8437
Land managers need cost-effective methods for mapping and characterizing fire fuels quickly and accurately. The advent of sensors with increased spatial resolution may improve the accuracy and reduce the cost of fuels mapping. The objective of this research is to evaluate the accuracy and utility of imagery from the Advanced...

Author(s): Michael J. Falkowski, Paul E. Gessler, Penelope Morgan, Alistair M. S. Smith, Andrew T. Hudak
Year Published: 2004
Type: Document
Conference Proceedings

Using airborne laser altimetry to determine fuel models for estimating fire behavior
www.nrfirescience.org/resource/8348
Airborne laser altimetry provides an unprecedented view of the forest floor in timber fuel types and is a promising new tool for fuels assessments. It can be used to resolve two fuel models under closed canopies and may be effective for estimating coarse woody debris loads. A simple metric-obstacle density-provides the necessary...

Author(s): Carl A. Seielstad, Lloyd P. Queen
Year Published: 2003
Type: Document
Book or Chapter or Journal Article
Effects of fire on landscape heterogeneity in Yellowstone National Park, Wyoming

A map of Yellowstone National Park (YNP) was derived from Landsat Thematic Mapper (TM) imagery and used to assess the isolation of burned areas, the heterogeneity that resulted from fires burning under moderate and severe burning conditions, and the relationship between heterogeneity and fire size. The majority of severely burned...

Author(s): Monica G. Turner, William W. Hargrove, Robert H. Gardner, William H. Romme
Year Published: 1994
Type: Document
Book or Chapter or Journal Article

Airborne infrared forest fire detection system: final report

This work was undertaken because of a mutual interest of the Department of Defense, Advanced Research Projects Agency (ARPA), and the USDA Forest Service in the problems of detecting hot targets against natural terrain backgrounds using airborne infrared (IR) line scanning instrumentation. The study objectives were broadly defined...

Author(s): Ralph A. Wilson, Stanley N. Hirsch, Forrest H. Madden, John B. Losensky
Year Published: 1971
Type: Document
Technical Report or White Paper

Project Fire Scan fire mapping final report, April 1962 to December 1966

Information about a fire's perimeter is a prerequisite for the control of large fires, whether caused by nuclear war, lightning, or man's carelessness. Visual aerial reconnaissance is usually limited by smoke. Location of a fire's perimeter with respect to surrounding terrain is difficult to determine at night by visual means. The...

Author(s): Stanley N. Hirsch
Year Published: 1968
Type: Document
Technical Report or White Paper

Project fire scan: fire detection interim report, April 1962 to December 1964

The original program objectives were to develop and test a heat-sensitive system capable of: (1) locating small fires, (2) mapping fire perimeters, and (3) measuring rates of fire spread. The usefulness of infrared mappers was to be examined by surveillance of fire sources in forest environments. The capability for locating fire...

Author(s): Ralph A. Wilson, Nonan V. Noste
Year Published: 1966
Type: Document
Technical Report or White Paper