

Low-severity fire as a mechanism of organic matter protection in global peatlands: thermal alteration slows decomposition

www.nrfirescience.org/resource/21649

Worldwide, regularly recurring wildfires shape many peatland ecosystems to the extent that fire-adapted species often dominate plant communities, suggesting that wildfire is an integral part of peatland ecology rather than an anomaly. The most destructive blazes are smoldering fires that are usually initiated in periods of drought...

Author(s): Neal E. Flanagan, Hongjun Wang, Scott Winton, Curtis J. Richardson

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

An added boost in pyrogenic carbon when wildfire burns forest with high pre-fire mortality

www.nrfirescience.org/resource/21933

Background: Wildfires produce pyrogenic carbon (PyC) through the incomplete combustion of organic matter, and its chemical characterization is critical to understanding carbon (C) budgets and ecosystem functions in forests. Across western North American forests, fires are burning through landscapes with substantial tree mortality...

Author(s): Anna C. Talucci, Lauren M. Matosziuk, Jeff A. Hatten, Meg A. Krawchuk

Year Published: 2020

Type: Document

Book or Chapter or Journal Article

From Farms to Forests: Landscape Carbon Balance after 50 Years of Afforestation, Harvesting, and Prescribed Fire

www.nrfirescience.org/resource/20152

Establishing reliable carbon baselines for landowners desiring to sustain carbon sequestration and identify opportunities to mitigate land management impacts on carbon balance is important; however, national and regional assessments are not designed to support individual landowners. Such baselines become increasingly valuable when...

Author(s): Doug P. Aubrey, John I. Blake, Stanley J. Zarnoch

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Aboveground forest carbon shows different responses to fire frequency in harvested and unharvested forests

www.nrfirescience.org/resource/18801

Sequestration of carbon in forest ecosystems has been identified as an effective strategy to help mitigate the effects of global climate change. Prescribed burning and timber harvesting are two common, co-occurring, forest management practices that may alter forest carbon pools. Prescribed burning for forest management, such as...

Author(s): Luke Collins, Ross A. Bradstock, Fabiano de Aquino Ximenes, Bronwyn Horsey, Robert Sawyer, Trent D. Penman

Year Published: 2019

Type: Document

Book or Chapter or Journal Article

Assessing the effects of fire disturbance and timber management on carbon storage in the Greater Yellowstone Ecosystem

www.nrfirescience.org/resource/18043

Accurate characterization of Carbon (C) consequences of forest disturbances and management is critical for informed climate mitigation and adaptation strategies. While research into generalized properties of the forest C cycle informs policy and provides abstract guidance to managers, most management occurs at local scales and...

Author(s): Feng A. Zhao, Sean P. Healey, Chengquan Huang, James P. McCarter, Chris Garrard, Sara A. Goeking, Zhiliang Zhu

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

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

Thinning combined with biomass energy production impacts fire-adapted forests in western United States and may increase greenhouse gas emissions

www.nrfirescience.org/resource/17270

Biomass energy produced as a byproduct of forest clearing is increasingly being advocated in the western United States as a "win-win" for reducing fire risks and replacing fossil fuels. Many assumptions that justify thinning and biomass approaches, however, need to be substantiated to determine whether they are in fact...

Author(s): Dominick A. DellaSala, M. Koopman

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Woody material structural degradation through decomposition

www.nrfirescience.org/resource/16439

Dead woody material (DWM) plays numerous important roles in forest ecosystems; however, through the process of decomposition, it undergoes structural and chemical changes that progressively alter its function in these roles. Much remains unknown about how DWM mechanical strength and structural integrity change through decomposition...

Author(s): Shawn Fraver, Mehdi Tajvidi, Anthony W. D'Amato, Daniel I. Lindner, Jodi A. Forrester, Amy M. Milo

Year Published: 2018

Type: Document

Book or Chapter or Journal Article

Piecing together the fragments: elucidating edge effects on forest carbon dynamics

www.nrfirescience.org/resource/17579

Forest fragmentation is pervasive throughout the world's forests, impacting growing conditions and carbon (C) dynamics through edge effects that produce gradients in microclimate, biogeochemistry, and stand structure. Despite the majority of global forests being <1 km from an edge, our understanding of

forest C dynamics is...

Author(s): Ian A. Smith, Lucy R. Hutyra, Andrew B. Reinmann, Julia K. Marrs, Jonathan Thompson

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

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

A Tree Species Effect on Soil That Is Consistent Across the Species' Range: The Case of Aspen and Soil Carbon in North America

www.nrfirescience.org/resource/17211

Trembling aspen covers a large geographic range in North America, and previous studies reported that a better understanding of its singular influence on soil properties and processes is of high relevance for global change questions. Here we investigate the potential impact of a shift in aspen abundance on soil carbon sequestration...

Author(s): Jérôme Laganière, Antra Božić, Helga Van Miegroet, David Paré

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Decomposition rates of surface and buried forest-floor material

www.nrfirescience.org/resource/16459

Mechanical site preparation is assumed to reduce soil C stocks by increasing the rate at which the displaced organic material decomposes, but the evidence is equivocal. We measured rates of C loss of forest-floor material in mesh bags either placed on the surface or buried in the mineral soil at four sites in different regional...

Author(s): Cindy E. Prescott, Anya Reid, Shu Yao Wu, Marie-Charlotte Nilsson

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Methods to reduce forest residue volume after timber harvesting and produce black carbon

www.nrfirescience.org/resource/16572

Forest restoration often includes thinning to reduce tree density and improve ecosystem processes and function while also reducing the risk of wildfire or insect and disease outbreaks. However, one drawback of these restoration treatments is that slash is often burned in piles that may damage the soil and require further restoration...

Author(s): Deborah S. Page-Dumroese, Matt Busse, Jim Archuleta, Darren McAvoy, Eric Roussel

Year Published: 2017

Type: Document

Book or Chapter or Journal Article

Management impacts on carbon dynamics in a Sierra Nevada mixed conifer forest

www.nrfirescience.org/resource/14230

Forest ecosystems can act as sinks of carbon and thus mitigate anthropogenic carbon emissions. When forests are actively managed, treatments can alter forests carbon dynamics, reducing their sink strength and switching them from sinks to sources of carbon. These effects are generally characterized by fast temporal dynamics. Hence...

Author(s): Sabina Dore, Danny L. Fry, Brandon M. Collins, Rodrigo Vargas, Robert A. York, Scott L. Stephens

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

Replacing time with space: using laboratory fires to explore the effects of repeated burning on black carbon degradation

www.nrfirescience.org/resource/19123

Soil organic matter plays a key role in the global carbon cycle, representing three to four times the total carbon stored in plant or atmospheric pools. Although fires convert a portion of the faster cycling organic matter to slower cycling black carbon (BC), abiotic and biotic degradation processes can significantly shorten BC...

Author(s): Wade T. Tinkham, Alistair M. S. Smith, Philip E. Higuera, Jeff A. Hatten, Nolan W. Brewer, Stefan H. Doerr

Year Published: 2016

Type: Document

Book or Chapter or Journal Article

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

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 CO₂ perturbation is...

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

Year Published: 2016

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

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

Climate change and United States forests

www.nrfirescience.org/resource/12393

This volume offers a scientific assessment of the effects of climatic variability and change on forest resources in the United States. Derived from a report that provides technical input to the 2013 U.S. Global Change Research Program National Climate Assessment, the book serves as a framework for managing U.S. forest resources in...

Author(s): David L. Peterson, James M. Vose, Toral Patel-Weynand

Year Published: 2014

Type: Document

Book or Chapter or Journal Article

Do carbon offsets work? The role of forest management in greenhouse gas mitigation

www.nrfirescience.org/resource/12450

As forest carbon offset projects become more popular, professional foresters are providing their expertise to support them. But when several members of the Society of American Foresters questioned the science and assumptions used to design the projects, the organization decided to convene a task force to examine whether these...

Author(s): Marie Oliver

Year Published: 2013

Type: Document

Research Brief or Fact Sheet

Impacts of disturbance on the terrestrial carbon budget of North America

www.nrfirescience.org/resource/12404

Because it is an important regulator of terrestrial carbon cycling in North America, extensive research on natural and human disturbances has been carried out as part of the North American Carbon Program and the CarboNA project. A synthesis of various components of this research was carried out, and the results are presented in the...

Author(s): Eric S. Kasischke, Brian D. Amiro, Nichole N. Barger, Nancy H. F. French, Scott J. Goetz, Guido Grosse, Mark E. Harmon, Jeffrey A. Hicke, Shuguang Liu, Jeffrey G. Masek

Year Published: 2013

Type: Document

Book or Chapter or Journal Article

Wildfire and fuel treatment effects on forest carbon dynamics in the western United States

www.nrfirescience.org/resource/11981

Sequestration of carbon (C) in forests has the potential to mitigate the effects of climate change by offsetting future emissions of greenhouse gases. However, in dry temperate forests, wildfire is a natural disturbance agent with the potential to release large fluxes of C into the atmosphere. Climate-driven increases in wildfire...

Author(s): Joseph C. Restaino, David L. Peterson

Year Published: 2013

Type: Document

Book or Chapter or Journal Article

Postfire changes in forest carbon storage over a 300-year chronosequence of Pinus contorta-dominated forests

www.nrfirescience.org/resource/13540

A warming climate may increase the frequency and severity of stand-replacing wildfires, reducing carbon (C) storage in forest ecosystems. Understanding the variability of postfire C cycling on heterogeneous landscapes is critical for predicting changes in C storage with more frequent

disturbance. We measured C pools and fluxes for...

Author(s): Daniel M. Kashian, William H. Romme, Daniel B. Tinker, Monica G. Turner, Michael G. Ryan

Year Published: 2013

Type: Document

Book or Chapter or Journal Article

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

www.nrfirescience.org/resource/12442

Fuel consumption specifies the amount of vegetative biomass consumed during wildland fire. It is a two-stage process of pyrolysis and combustion that occurs simultaneously and at different rates depending on the characteristics and condition of the fuel, weather, topography, and in the case of prescribed fire, ignition rate and...

Author(s): Roger D. Ottmar

Year Published: 2013

Type: Document

Book or Chapter or Journal Article, Synthesis

The merits of prescribed fire outweigh potential carbon emission effects

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

Fuel treatment impacts on estimated wildfire carbon loss from forests in Montana, Oregon, California, and Arizona

www.nrfirescience.org/resource/8324

Using forests to sequester carbon in response to anthropogenically induced climate change is being considered across the globe. A recent U.S. executive order mandated that all federal agencies account for sequestration and emissions of greenhouse gases, highlighting the importance of understanding how forest carbon stocks are...

Author(s): Scott L. Stephens, Ralph E. Boerner, Jason J. Moghaddas, Emily E. Y. Moghaddas, Brandon M. Collins, Christopher B. Dow, Carleton B. Edminster, Carl E. Fiedler, Danny L. Fry, Bruce R. Hartsough, Jon E. Keeley, Eric E. Knapp, James D. Mclver, Carl N. Skinner

Year Published: 2012

Type: Document

Book or Chapter or Journal Article

Chapter 2: Effects of climatic variability and change

www.nrfirescience.org/resource/12588

Climate profoundly shapes forests. Forest species composition, productivity, availability of goods and services, disturbance regimes, and location on the landscape are all regulated by climate. Much research attention has focused on the problem of projecting the response of forests to changing climate, elevated atmospheric carbon...

Author(s): Michael G. Ryan, James M. Vose

Year Published: 2012

Type: Document
Synthesis, Technical Report or White Paper

Effects of climatic variability and change on forest ecosystems: a comprehensive science synthesis for the U.S. forest sector

www.nrfirescience.org/resource/12567

This report is a scientific assessment of the current condition and likely future condition of forest resources in the United States relative to climatic variability and change. It serves as the U.S. Forest Service forest sector technical report for the National Climate Assessment and includes descriptions of key regional issues and...

Year Published: 2012

Type: Document
Synthesis, Technical Report or White Paper

A synthesis of current knowledge on forests and carbon storage in the United States

www.nrfirescience.org/resource/12598

Using forests to mitigate climate change has gained much interest in science and policy discussions. We examine the evidence for carbon benefits, environmental and monetary costs, risks and trade-offs for a variety of activities in three general strategies: (1) land use change to increase forest area (afforestation) and avoid...

Author(s): Duncan C. McKinley, Michael G. Ryan, Richard A. Birdsey, Christian P. Giardina, Mark E. Harmon, Linda S. Heath, Richard A. Houghton, Robert B. Jackson, James F. Morrison, Brian C. Murray, Diane E. Pataki, Kenneth E. Skog

Year Published: 2011

Type: Document
Book or Chapter or Journal Article

Can fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions?

www.nrfirescience.org/resource/8300

It has been suggested that thinning trees and other fuel-reduction practices aimed at reducing the probability of high-severity forest fire are consistent with efforts to keep carbon (C) sequestered in terrestrial pools, and that such practices should therefore be rewarded rather than penalized in C-accounting schemes. By evaluating...

Author(s): John L. Campbell, Mark E. Harmon, Stephen R. Mitchell

Year Published: 2011

Type: Document
Book or Chapter or Journal Article, Synthesis

Carbon concentrations and carbon pool distributions in dry, moist, and cold mid-aged forests of the Rocky Mountains

www.nrfirescience.org/resource/8416

Although 'carbon' management may not be a primary objective in forest management, influencing the distribution, composition, growth, and development of biomass to fulfill multiple objectives is; therefore, given a changing climate, managing carbon could influence future management decisions. Also, typically, the conversion from...

Author(s): Theresa B. Jain, Russell T. Graham, David Adams

Year Published: 2010

Type: Document
Conference Proceedings

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

www.nrfirescience.org/resource/8328

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

Author(s): Christine Wiedinmyer, Matthew D. Hurteau

Year Published: 2010

Type: Document

Book or Chapter or Journal Article

Sink or source? Fire and the forest carbon cycle

www.nrfirescience.org/resource/12620

As the size and severity of fires in the western U.S. continue to increase, it has become ever more important to understand carbon dynamics in response to fire. Many subalpine forests experience stand-replacing wildfires, and these fires and subsequent recovery can change the amount of carbon released to the atmosphere...

Author(s): Christine Frame

Year Published: 2010

Type: Document

Research Brief or Fact Sheet

A synthesis of the science on forests and carbon for U.S. forests

www.nrfirescience.org/resource/12589

Forests play an important role in the U.S. and global carbon cycle, and carbon sequestered by U.S. forest growth and harvested wood products currently offsets 12-19% of U.S. fossil fuel emissions. The cycle of forest growth, death, and regeneration and the use of wood removed from the forest complicate efforts to understand and...

Author(s): Michael G. Ryan, Mark E. Harmon, Richard A. Birdsey, Christian P. Giardina, Linda S. Heath, Richard A. Houghton, Robert B. Jackson, Duncan C. McKinley, James F. Morrison, Brian C. Murray, Diane E. Pataki, Kenneth E. Skog

Year Published: 2010

Type: Document

Book or Chapter or Journal Article

Effects of fuel treatments on carbon-disturbance relationships in forests of the Northern Rocky Mountains

www.nrfirescience.org/resource/8188

Fuel treatments alter conditions in forested stands at the time of the treatment and subsequently. Fuel treatments reduce on-site carbon and also change the fire potential and expected outcome of future wildfires, including their carbon emissions. We simulated effects of fuel treatments on 140 stands representing seven major habitat...

Author(s): Elizabeth D. Reinhardt, Lisa M. Holsinger

Year Published: 2010

Type: Document

Book or Chapter or Journal Article

Modeling the effects of fire and climate change on carbon and nitrogen storage in lodgepole pine (*Pinus contorta*) stands

www.nrfirescience.org/resource/13547

The interaction between disturbance and climate change and resultant effects on ecosystem carbon (C) and nitrogen (N) fluxes are poorly understood. Here, we model (using CENTURY version 4.5) how climate change may affect C and N fluxes among mature and regenerating lodgepole pine (*Pinus contorta* var. *latifolia* Engelm. ex S. Wats.)...

Author(s): Erica A. H. Smithwick, Michael G. Ryan, Daniel M. Kashian, William H. Romme, Daniel B. Tinker, Monica G. Turner

Year Published: 2009

Type: Document

Book or Chapter or Journal Article

Charcoal and carbon storage in forest soils of the Rocky Mountain West

www.nrfirescience.org/resource/7920

Charcoal represents a super-passive form of carbon (C) that is generated during fire events and is one of the few legacies of fire recorded in the soil profile; however, the importance of this material as a form of C storage has received only limited scientific attention. Here, we review the formation of charcoal in temperate and...

Author(s): Thomas H. DeLuca, Gregory H. Aplet

Year Published: 2008

Type: Document

Book or Chapter or Journal Article, Synthesis

Landscape heterogeneity following large fires: insights from Yellowstone National Park, USA

www.nrfirescience.org/resource/8198

We characterised the remarkable heterogeneity following the large, severe fires of 1988 in Yellowstone National Park (YNP), in the northern Rocky Mountains, Wyoming, USA, by focussing on spatial variation in post-fire structure, composition and ecosystem function at broad, meso, and fine scales. Ecological heterogeneity at multiple...

Author(s): Tania L. Schoennagel, Erica A. H. Smithwick, Monica G. Turner

Year Published: 2008

Type: Document

Book or Chapter or Journal Article

Carbon storage in coniferous landscapes with stand-replacing fires: effects of fire frequency, post-fire recovery, and ecosystem processes

www.nrfirescience.org/resource/7950

Many conifer forests experience stand-replacing wildfires, and these fires and subsequent recovery can change the amount of carbon released to the atmosphere because conifer forests contain large carbon stores. Stand-replacing fires switch ecosystems to being a net source of carbon as decomposition exceeds photosynthesis - a short...

Author(s): Donald M. Kashian, William H. Romme, Daniel B. Tinker, Monica G. Turner, Michael G. Ryan

Year Published: 2006

Type: Document

Book or Chapter or Journal Article

Carbon cycling at the landscape scale: the effect of changes in climate and fire frequency on age distribution, stand structure, and net ecosystem production - Final Report to the Joint Fire Science Program

www.nrfirescience.org/resource/11151

We are working in Yellowstone National Park to determine how initial post-fire structural heterogeneity controls carbon dynamics over the full cycle of individual forest stands, and how climate-mediated

changes in the fire regime could potentially alter the behavior of the entire Yellowstone ecosystem as a net sink or net source in...

Author(s): Michael G. Ryan, Daniel M. Kashian, Erica A. H. Smithwick, William H. Romme, Monica G. Turner, Daniel B. Tinker

Year Published: 2005

Type: Document

Technical Report or White Paper

Effects of tree density and stand age on carbon allocation patterns in postfire lodgepole pine

www.nrfirescience.org/resource/8263

Validating the components of the carbon (C) budget in forest ecosystems is essential for developing allocation rules that allow accurate predictions of C pools and fluxes. In addition, a better understanding of the effects of natural disturbances on C cycling is critical, particularly in light of alterations to disturbance regimes...

Author(s): Creighton M. Litton, Michael G. Ryan, Dennis H. Knight

Year Published: 2004

Type: Document

Book or Chapter or Journal Article

Climate change, carbon, and forestry in northwestern North America: proceedings of a workshop

www.nrfirescience.org/resource/11203

Interactions between forests, climatic change and the Earth's carbon cycle are complex and represent a challenge for forest managers-they are integral to the sustainable management of forests. In this volume, a number of papers are presented that describe some of the complex relationships between climate, the global carbon cycle and...

Author(s): David L. Peterson, John L. Innes, Kelly O'Brian

Year Published: 2004

Type: Document

Technical Report or White Paper

Mountains, fire, fire suppression, and the carbon cycle in the western United States

www.nrfirescience.org/resource/11044

Most mountain regions in the western United States are covered by forests, which are for the most part recovering from historical harvesting and have been experiencing active fire suppression over approximately the past 100 years (Tilman and others 2000). Whereas many western landscapes are currently perceived as pristine natural...

Author(s): David S. Schimel

Year Published: 2004

Type: Document

Technical Report or White Paper

Are old forests underestimated as global carbon sinks?

www.nrfirescience.org/resource/7916

Old forests are important carbon pools, but are thought to be insignificant as current atmospheric carbon sinks. This perception is based on the assumption that changes in productivity with age in complex, multiaged, multispecies natural forests can be modelled simply as scaled-up versions of individual trees or even-aged stands....

Author(s): Elieen V. Carey, Anna Sala, Robert E. Keane, Ragan M. Callaway

Year Published: 2001

Type: Document

Book or Chapter or Journal Article