USGS Western Ecological Research Center
Publication Brief

Wildfires Impact Carbon Storage Differently Across Sierra Nevada Forest Types

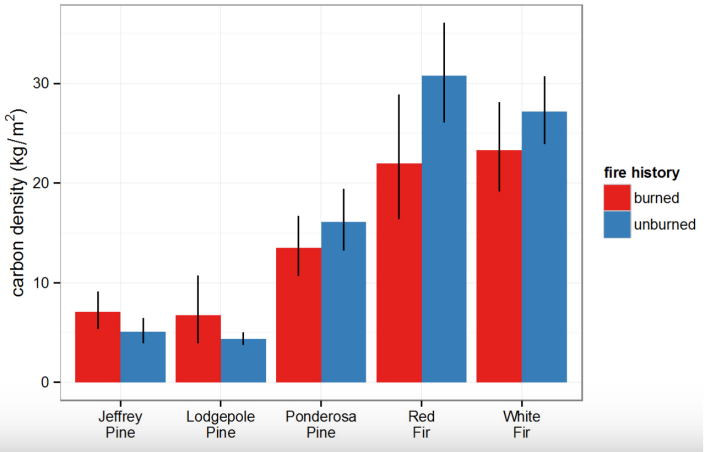
Forest biomass on Sierra Nevada landscapes constitutes one of the largest carbon stocks in California, and research suggests that a history of human activity—including fire suppression, logging, and management practices—have altered the Sierra Nevada's historic fire regimes, and in turn, its historic patterns of landscape carbon storage.

But the effect of recent fire regime changes on Sierra Nevada carbon stocks has not been sufficiently evaluated. To address this gap, a Natural Resource Report authored by USGS, Utah State University, and National Park Service researchers has assessed the influence of recent fire patterns on aboveground tree carbon stocks, using forest plots in Yosemite, Sequoia, and Kings Canyon national parks. Researchers combined a set of 115 newly established plots with an existing set of 1,646 plots from past studies, in order to quantify relationships between aboveground tree carbon and fire history within 5 major forest types.

Accounting for various sources of uncertainty, researchers estimate total aboveground tree carbon in the two parks to be 41 to 48 teragrams (41,000,000 to 48,000,000 metric tons), representing roughly 10 percent of the total standing wood in the Sierra Nevada. The density and concentration of carbon differ across the landscape: large conifers such as giant sequoia individually store high amounts of carbon, while less massive but more populous trees like red fire cumulatively store more carbon.

Researchers found no clear trend for post-fire tree carbon density across forest types. Red fir forests were the most impacted by fire, experiencing 29 percent lower carbon density in burned areas, while the other forest types had only slight and varying changes in carbon density in response to fire history.

This Brief Refers To:
Matchett, JR, JA Lutz, LW Tarnay, DG Smith, KML Becker, ML Brooks. 2015. **Impacts of fire management on aboveground tree carbon stocks in Yosemite and Sequoia & Kings Canyon national parks**. Natural Resource Report NPS/SIEN/NRR—2015/910. National Park Service, Fort Collins, Colorado.
http://www.werc.usgs.gov/ProductDetails.aspx?ID=5177



Aboveground tree carbon densities (means and 95% confidence intervals) for major forest types in Yosemite National Park and Sequoia & Kings Canyon National Park. Figure 5 in Matchett et al. 2015

MANAGEMENT IMPLICATIONS

- Refined forest carbon accounting can help improve carbon emissions assessments and to inform fire management strategies in Sierra Nevada forests.
- There is substantial uncertainty in carbon estimates over large landscapes, and recent burning did not necessarily translate into lost carbon density for all forest types, at least given the scale and resolution of available data.
- Further surveys and studies incorporating burn severity (such as the degree to which a fire consumed forest biomass and altered post-fire vegetation productivity) may be required to refine our understanding of carbon dynamics in forest landscapes, and the data could improve models used to assess carbon dynamics in forests after massive wildfires.

RESEARCH CONTACT

J.R. Matchett and Matt Brooks
Yosemite Field Station
jmatchett@usgs.gov
mlbrooks@usgs.gov
www.werc.usgs.gov/brooks