

Global Carbon Consumption Database for Wildland Fire

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Abstract

Fire plays a significant role on both national and global scales, profoundly impacting landscapes shaped by human activity as well as those left wild. Even though fire can be devastating, wildland fire is a natural and integral force on our landscapes and can also serve to reduce fuels to mitigate wildfire. However, the smoke produced by fires, regardless of their size or purpose, can pose adverse effects on human health when inhaled downwind. Understanding the influence of smoke on air quality and health necessitates the quantification of emissions that fires release into the atmosphere. In response to this need, we have developed a comprehensive global consumption database directly linked to distinct fuels within various fire danger categories. This ~300 meter resolution database builds upon the foundations of the Pettinari, M. Lucrecia (2015) Global Fuelbed database, a global fuel map with standardized Fuel Characteristic Classification System (FCCS) biomass parameters. Consumption is broken down into five Fire Danger categories (Low, Moderate, High, Very High, Extreme), for both 'new' and 'residual' burning. We define 'residual burning' as area burning in a region that has burned on a previous day for the same fire season, and 'new burning' as area burning in a region that hasn't recently burned. This product serves as a valuable tool when used in conjunction with burned area data to rapidly estimate the carbon consumed and released into the atmosphere. Previously, we developed a similar emissions method utilizing satellite information, in conjunction with the FCCS 30-meter United States fuelbed dataset. We implemented this approach on fires, documented during the 2019 Fire Influence on Regional to Global Environments and Air Quality (FIREX-AQ) campaign to estimate daily carbon emissions. Our emissions estimates were rigorously compared against in-situ measurements of CO₂, CO, and black carbon aerosols, revealing a robust agreement between the datasets.

Early Career Scientist

YES, I am an early career scientist.