CALIFORNIA AIR RESOURCES BOARD

Introduction

The California Air Resources Board (CARB) staff has conducted preliminary estimates of the annual amount of CO_2 emitted to the atmosphere due to wildfire on all forests and shrublands throughout California. These estimates are derived using the First Order Fire Effects Model (FOFEM) model developed by the U.S. Forest Service (USFS) and using fire perimeter raster datasets published by California Department of Forestry and Fire Protection (CAL FIRE).

Sources and Methods

Emissions were estimated using Geographic Information Systems (GIS) format input data on the containment date fire perimeters, vegetation fuels composition, fuel load (tons/acre), and fuel moisture. The geospatial data were used to develop inputs to a wildland fire emission model. Modeled emissions in flaming and smoldering phases (lbs/ac) by vegetation fuel type were integrated over vegetation type areas to calculate area-total emissions. Flaming and smoldering emissions are summed for reporting including every fire reported in the calendar year.

Results

Shrub and forest vegetation types determine the fuel loads within fire perimeters, with loads ranging from < 1 up to over 100 tons/acre, averaging approximately 40 tons/acre. Model estimates tend to be high as the FOFEM model assumes near complete consumption of litter, shrubs, 1-hr, 10-hr and 100-hr fuels and high rates for large-diameter fuels. High levels of pollutant emissions associated with fuel consumption in the smoldering phase include PM10, PM2.5, CO, CH4 and total non-methane hydrocarbons (TNMHC). Emissions associated with the flaming phase include NOx, CO2, and N2O.

Uncertainty

Large uncertainties associated with mapped vegetation types, fuel loading (tons/acre by fuel size category), fuel moisture, burned area, modeled fuel consumption in flaming and smoldering phases, and emission factors (mass of pollutant species/unit mass fuel consumed) contribute to wildfire emissions uncertainties. Emission estimates reported here may have an uncertainty of between a factor of 2 to 3. The wildfire emission estimates reported here are developed using sources and methods that are independent from those used for the statewide natural and working lands inventory of ecosystem carbon stocks and stock-change. Large uncertainties associated with the fire emissions estimates and the lack of yearly data in the natural and working lands inventory preclude an accurate assessment.

Reference Material

- Ottmar, R. D., D. V. Sandberg, C. L. Riccardi, and S. J. Prichard (2007), An overview of the Fuel Characteristic Classification System - Quantifying, classifying, and creating fuelbeds for resource planning, Can. J. For. Res.-Rev. Can. Rech. For., 37(12), 2383-2393, doi:10.1139/x07077.
- Fuel Characteristic Classification Fuelbeds (FCCS) https://www.landfire.gov/fccs.php
- USFS Wildland Fire Assessment System (WFAS). Dead Fuel Moisture. http://wfas.net/
- First Order Fire Effects Model (FOFEM) https://www.fs.usda.gov/ccrc/tools/fofem

Updates to Estimates Since Its Initial Release

CARB staff is continuing to improve the estimates of wildfire emissions based on newer information about data and geoprocessing steps. Wildfire emission estimates for 2000-2017 were updated on February 22, 2019 to improve the way fire footprint data were handled at local jurisdictional boundaries.