

Development and use of the Wildland Fire Emissions Information System for quantifying and mapping fire emissions for North America

Nancy HF French, Don McKenzie, Tyler Erickson

Poster # 301 with on-line demo – Wednesday



www.mtri.org



GFED: The global amount of carbon combusted through fires is about 2.0 Pg C year⁻¹, or about 22% of global fossil fuel emissions.

van der Werf et al. 2010. Atmos. Chem. Phys. Discuss.,10:16153-16230, www.atmos-chem-phys-discuss.net/10/16153/2010/

CBM-CFS3: From 1990 to 2006 Canada's managed forest was a **Carbon Sink** on average, but it was a **Carbon Source** in years with large burned area. *Kurz, W.A. et al.* 2008. *PNAS 105:1551-1555.*



Purpose:

- Improve access to emissions model inputs and results for targeted users
- Provide best estimates of total carbon emissions and some emission components to user community
 - Geospatially at 1km resolution
 - At daily to annual temporal resolution
 - For recent fire years (1980's to 2009)
- Result:
- Improvement in data sets & model for emissions estimation
- Development of a prototype web-based system (WFEIS)
- Regional-scale estimates of emissions based on two burn area data sets



Supported by a 3-year grant from NASA Carbon Cycle Science Program – Applied Sciences Program



WFEIS Estimation of Fire Emissions







Nancy French, Mike Billmire Tyler Erickson, Ben Koziol



Don McKenzie Roger D. Ottmar Ernesto Alvarado

Pacific Northwest Research Station, USDA Forest Service



William de Groot

Great Lakes Forestry Centre, Canadian Forest Service

Eric S. Kasischke

Department of Geography, University of Maryland







WFEIS Web-accessible Framework

The WFEIS website allows for two approaches for making fuel consumption and emissions estimates





WFEIS Framework





WFEIS Output





Comparison of Models

Other fire emissions models:

- -- CONSUME 3.0 (USFS)
- -- FOFEM 5.7 (USFS)
- -- CanFIRE -- Canadian FBP
 - -- GFED (NASA)
 - -- FINN (NOAA)
- Non-spatial, plot-level (Consume 3.0, FOFEM 5.7)
- Semi- or Pseudo-spatial (Canadian FBP, CanFIRE)
- Global-scale (GFED)
- Active fire estimates of burn area (FINN) vs. burn area

WFEIS uses moderate resolution data of burn area and biomass to make regional-scale fire emissions estimates





Comparison of Models

Five fire events:

- -- 2002 Biscuit fire in southern Oregon
- -- 2003 Montreal Lake central Saskatchewan
- -- 2004 Boundary fire in interior Alaska
- -- San Diego County, California 2003 and 2007



<u>Results:</u>

- -- Models generally agree (within 25% of each other) but vary due to model assumptions
- -- Vegetation fuel density, structure, and condition (fuel moisture) are important drivers of emissions variability
- -- Global-scale GFED modeled emissions are consistent with landscape/regional-scale estimates

French, N.H.F. et al. (2011), "Model comparisons for estimating carbon emissions from North American wildland fire," *Journal of Geophysical Research*, *116*, *G00K05*.





Effect of Burned Area on Carbon Emissions

- For the Biscuit fire case, the WFEIS model was run with two burn area maps.
- The burn area and total carbon emitted is higher with the Landsatderived map by about 16%
- Area normalized emissions were very similar, but vary due to use of daily weather information and the type of vegetation in the burn



Landsat-derived Perimeter

MODIS-derived Perimeter

Landsat: 200,400 ha 3.10 kgC/m² 6.20 TgC MODIS: 170,000 ha 3.07 kgC/m² 5.22 TgC