Generation of a global fuel dataset using the Fuel Characteristic Classification System

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Regional Fuel Type Maps

EFFIS NFFL fuel models
- Short grass
- Timber (grass & understory)
- Tail grass
- Chaparral
- Southern rough
- Brush
- Closed timber litter
- Dormant brush
- Hardwood litter
- Timber (litter & understory)

Landfire NFFL Fuel Models
- Short grass
- Timber (grass & understory)
- Tail grass
- Chaparral
- Southern rough
- Brush
- Dormant brush
- Hardwood litter
- Timber (litter & understory)
- Light logging slash
- Medium logging slash
- Non-forest

Landfire FCCS fuel map

Canada
**Objective:** Develop a global fuel type map that could be used for fire danger and effects assessment.

- Use a uniform methodology worldwide
- Use as many global information as possible
- Include parameters for fire behavior and effects estimation

### Fuel types classifications

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<th>Classification</th>
<th>Fire Behavior</th>
<th>Fire Risk</th>
<th>Fire Effects</th>
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Fuel Characteristic Classification System (FCCS)

- As many classes as desired
- Parameters not only for fire behavior but also for fire potential and effects
- Software that calculates fire behavior and potentials
Methodology

Global Land Cover Map
Regional Land Cover Maps
Crops Maps
Biomes Map
Canopy Cover Map
Canopy Height Map
Species database
FCCS or Photo Series parameters

Global Fuelbeds Map
Global Fuelbeds Parameters (spreadsheet)
FCCS run

Mapped FCCS outputs
Generation of the fuelbeds

Globcover 2005 V2.2 (Arino et al. 2007)

Map of Terrestrial Ecoregions (Olson et al. 2008)
Generation of the fuelbeds

- Minimum area:
  - 0.01%
  - 14,900 km²

Major vegetation groups in Australia V3.0
(www.environment.gov.au)

Harvested Area and Yield of 175 crops
(Monfreda et al. 2008)
Parameterization of the fuelbeds

- Subdivision of FBs:
  - >0.01% area
- Mean values

Canopy height map (Simard et al. 2011)  MODIS VCF Collection 5 (Carroll et al. 2011)
Parameterization of the fuelbeds

1. Plant species:
   - From the existing FCCS database
   - Representative species from the WWF database

2. Rest of parameters:
   - FCCS fuelbeds: USA
   - PhotoSeries: Mexico and Brazil
   - Mean values from different fuel data
Global Fuelbed map

- 274 fuelbeds (359 with sub-fuelbeds)
Global Fuelbed Spreadsheet

- 62 parameters for each fuelbed or sub-fuelbed

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Fuelbeds Assessment: Biomass

- Aggregated to 0.5 degree cells
- Comparison of biomass results of homogeneous LC (>80%)

- Highest biomass (>200 Mg/ha):
  - Tree biomass: in Temperate and Mediterranean biomes
  - Ground fuels: in Mangroves, Temperate ND and Boreal biomes
Biomass products compared

(Baccini et al. 2012) (Saatchi et al. 2011)

LiDAR data from ICESat GLAS

(Thurner et al. 2014) (Yue et al. 2015)

Biomasar II - ENVISAT ASAR data

ORCHIDEE Dynamic Global Vegetation Model
Biomass Comparisons

Tropical Forests

Boreal Forests

Temperate Forests

Crops

Savanna + Shrub

Grasses

\[ \rho = 0.79 \]

\[ \rho = 0.77 \]

\[ \rho = 0.42 \]

\[ \rho = 0.40 \]

\[ \rho = 0.66 \]

\[ \rho = 0.20 \]
Conclusions

- First global fuel dataset
- Reasonable agreement between biomass outputs and other biomass products

Limitations:
- FBs and PSs represent American ecosystems
- Simplification of fuelbeds
- Uncertainties of input maps

Possible applications:
- Include fuel component in fire risk assessment
- Estimate fuel consumption and emissions
Generation of a global fuel data set using the Fuel Characteristic Classification System

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Abstract. This study presents the methods for the generation of the first global fuel data set, containing all the parameters required to be input in the Fuel Characteristic Classification System (FCCS). The data set was developed from different spatial variables, both based on satellite Earth observation products and fuel databases, and is comprised by a global plant types while promoting others, thus creating flammable ecosystems where other vegetation would exist based solely on climate or soil (Pausas and Keeley, 2009). Fire is also an important source of atmospheric gases and aerosol particles, including gasses such as CO₂, CO, and CH₄ (Schultz et al., 2008).