# Comparing LANDFIRE fuel representation systems & their application in estimating fire effects

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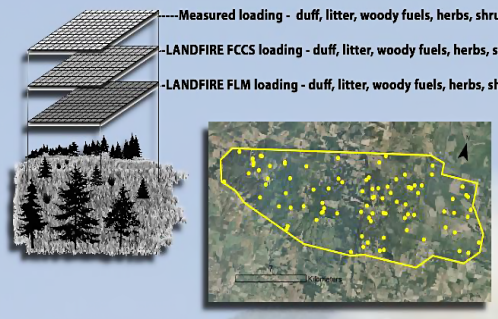
**Abstract:** Managers and researchers are often tasked with estimating the impacts of wildland fire on landscapes. One data source for performing these assessments is the fire effects fuel layers available from LANDFIRE; the Fuels Classification Characterization System (FCCS) and the Fuel Loading Model (FLM) spatial layers. The two spatial layers were developed independently of one another. This study evaluates the differences between LANDFIRE FCCS ($FCCS_L$) and LANDFIRE FLM ($FLM_L$) layers with regards to fuel loading, and the subsequent differences in consumption and fire effects when modeled with the Wildland Fire Assessment Tool (WFAT). A case study in mixed conifer northern Idaho forest is presented. Results indicated estimated duff loading was likely to be higher in the LANDFIRE FCCS fuel layer, estimated 1000 hr fuel loading lower in the FLM layer. Shrub loadings were greater in the FLM layer compared to the FCCS layer.

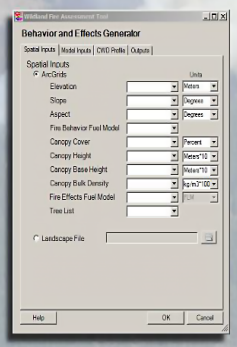
## Methods

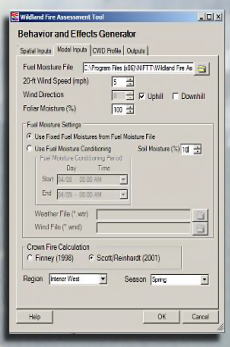
To evaluate the potential differences in WFAT outputs given $FCCS_L$ and $FLM_L$ inputs the authors examined a 700-ha study area centered on Moscow Mountain in Latah County Idaho. The area is dominated by mixed conifer forest tree species including ponderosa pine, Douglas-fir occurring on more xeric southern and western slopes and grand fir and cedar/hemlock habitat types occur on the more mesic northern and eastern aspects (Cooper et al. 1991).




To compare fuel loading, consumption, and fire effects $FCCS_L$ and $FLM_L$ data was compared with measured fuel loadings and estimated shrub loadings from 87 randomly-placed field sampling plots collected in 2009 (Hudak et al. 2012) (*above*). Loading data including woody fuels, litter, duff, herb, and estimated shrub loading using Brown's (1981) methodology.

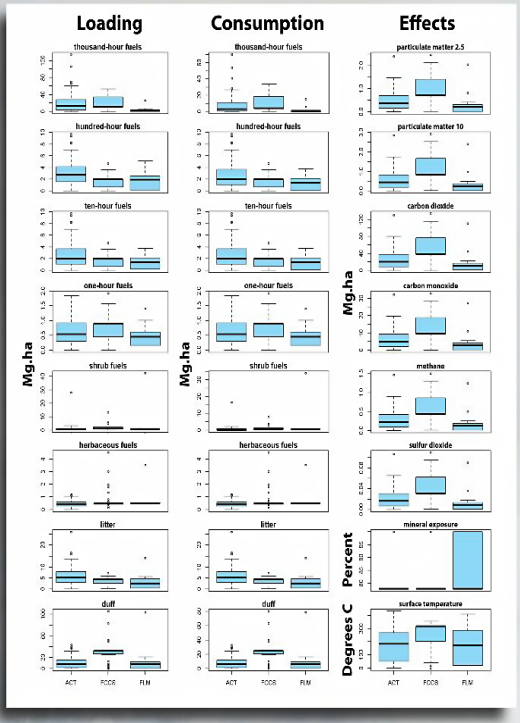
LANDFIRE Refresh 2008 $FCCS_L$ and $FLM_L$ layers were downloaded for the area. The Wildland Fire Assessment Tool (WFAT)( Hamilton et al. 2012) was then used to simulate fuel consumption, emissions, and soil heating. WFAT is a spatial analysis tool employing Flamap (Finney 2006, Nelson 2000, Rothermel 1972, Van Wagner 1977) algorithms for fire behavior, and First Order Fire Effects Model (FOFEM) (Abini and Reinhardt 1995; Albini et al. 1995; Albini and Reinhardt 1997, Reinhardt 2003) algorithms for fire effects. Fuel loading, Consumption, and emissions estimates were compared for the measured fuel data, $FCCS_L$ fuel data, and $FLM_L$ fuel data using analysis of variance (R core Team 2012). Parameters to populate WFAT (*below*) were taken from LANDFIRE.




## Results & Conclusions

- $FCCS_L$ duff loading was greater than either $FLM_L$ or measured data (*below*).
- For litter, 10, and 100-hour fine woody fuels, the measured loading was greater than $FCCS_L$ and $FLM_L$ layers.
- One-hour fine woody fuel loading in the $FCCS_L$ was higher than that of $FLM_L$.
- Thousand-hour fuel loading was less for LANDFIRE $FLM_L$ than $FCCS_L$ or measured data.
- Herbaceous and shrub loadings were greater for $FLM_L$ than measured herb loadings or estimated shrub loadings. The remaining comparisons were not significantly different from each other.
- The higher duff loadings in $FCCS_L$ resulted in more biomass consumed, and subsequently greater emissions and surface temperatures.
- Lower duff and litter loading in the $FLM_L$ resulted in greater mineral soil exposure.
- Fuel loading values for the study site and LANDFIRE layers were within ranges observed by other researcher for of Northwestern Rocky Mountain Fuels with the exception of duff. Duff loadings tended to be lower for our research site and the $FLM_L$ than other observed studies while $FCCS_L$ duff loading was closer to observed values (Hille & Stephens 2005, Youngblood et al. 2008, Reinhardt et al. 1991).
- LANDFIRE FCCS and FLM layers provide fuel information where little or no existing information may be available. However, a customized fuel layer, if data is available, is likely to represent the landscape more accurately than an unaltered $FCCS_L$ or $FLM_L$ layer.

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