Using MODIS ET to Evaluate Wildfire Intensity in the RECOVER Project

Tess Gardner (GardTess@isu.edu), Kayla Zajac, Keith Weber, and George Haskett. Idaho State University GIS Training and Research Center.

Abstract
Using Moderate Resolution Imaging Spectroradiometer (MODIS) evapotranspiration (ET) products from 2000 to 2011, we assessed ET across the Big Desert study area of southeast Idaho. ArcMap 10.1 Zonal Statistics were used to derive total ET estimates throughout the growing season (April 1 to September 30) for the entire dataset. Growing season ET was used as part of the GIS TReC:NASA Rehabilitation Capability Convergence for Ecosystem Recovery project (RECOVER), to evaluate the influence of ET on fire rehabilitation planning relative to fire intensity.

This research focuses on the Big Desert study area of southeast Idaho, a semiarid savanna (figure 1).

Many factors influence the characteristics of a wildfire:
- Precipitation
- Temperature
- Soil moisture
- Evapotranspiration (ET)
- Fuel load, etc.

Watch a video to understand evapotranspiration: Scan Here!

- Fire characteristics can be described using fire severity and fire intensity
- While fire severity indices exist (e.g., Normalized Burn Ratio [NBR]), few geospatial fire intensity models have been developed.
- Fire rehabilitation planning is highly influenced by fire intensity, as seed bank mortality is dependent on the depth to which heat from the wildfire penetrates.

ET and soil moisture are interrelated, forming an important parameter influencing wildfire characteristics. Soil moisture exhibits a positive relationship with fire intensity.

Understanding the interaction between precipitation and temperature (expressed using growing degree days [GDD]) can be a useful tool for understanding the environmental conditions affecting soil moisture (figure 2).

The cumulative and interactive effects of precipitation, temperature, and ET on soil moisture may be described using drought observations (figure 3). However, current drought maps are non-empirical and cannot be derived directly from satellite imagery.

Fire severity maps (figure 4) for the Crystal Fire (2006) and Jefferson Fire 2010 were used for initial investigation into the relationship between ET (figure 5) and fire intensity.

Conclusions
- The Crystal Fire exhibited higher ET values and corresponding lower fire severity (NBR) while the Jefferson Fire had lower ET values and higher fire severity.
- Our results suggest that a quantifiable relationship may exist between soil moisture with fire severity and consequently fire intensity.

Direction: What's Next?
- Further exploration using MODIS ET to better understand the relationship between ET and fire intensity.
- Implement SMAP products (cf. sidebar) to more directly assess soil moisture.

To learn more, visit the RECOVER website at http://giscenter.isu.edu/research/techpg_nasa_RECOVER