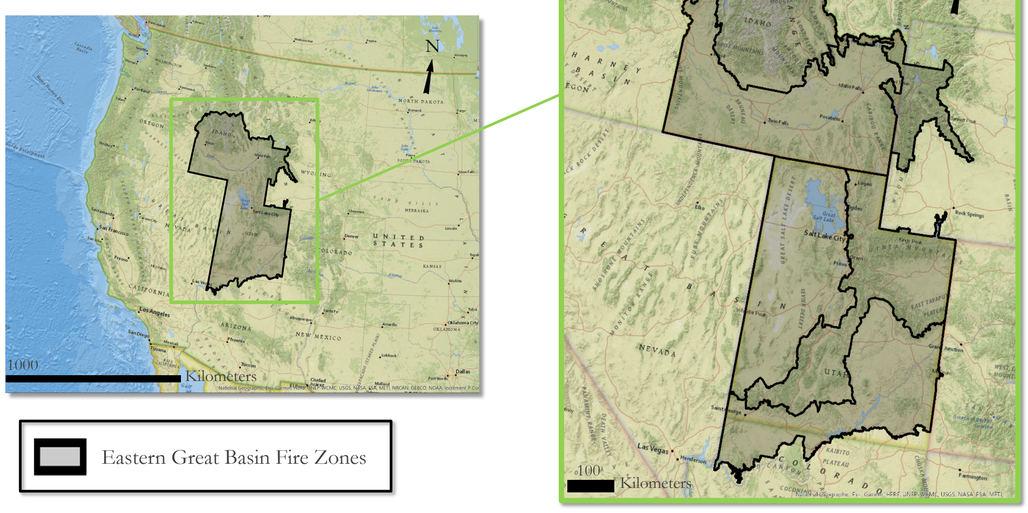
Assessing and Forecasting Live Fuel Moisture Content of Wildfire Fuels for the Eastern Great Basin to Improve Wildfire Timing and Severity Predictions

Abstract

The eastern Great Basin (EGB) extends throughout the states of Arizona, Colorado, Idaho, Utah, and Wyoming, covering approximately 411,000 km². In recent years, wildfires in the EGB have increased in frequency and size, representing a growing concern for our partners at the Bureau of Land Management (BLM), the National Weather Service (NWS), and the Great Basin Coordination Center (GBCC). Live fuel moisture (LFM) is an important factor in predicting wildfire risk, as dry vegetation requires less energy to combust than wet vegetation. Land managers currently derive LFM levels from just 165 in situ sites in the EGB. In order to provide partners with a more accurate assessment of LFM, the team used data from the National Elevation Dataset, Aqua and Terra Moderate Resolution Imaging Spectroradiometer, and Suomi National Polar-orbiting Partnership Visible Infrared Imaging Radiometer Suite. These datasets include vegetation indices, evapotranspiration, and topographic variables, which were used to create biweekly forecasts of LFM throughout the EGB. An accuracy assessment was conducted using historical in situ data from our partners at the BLM and the GBCC. This model allowed our partners to make informed decisions regarding resource allocation in response to the predicted timing and severity of wildfires in the EGB.

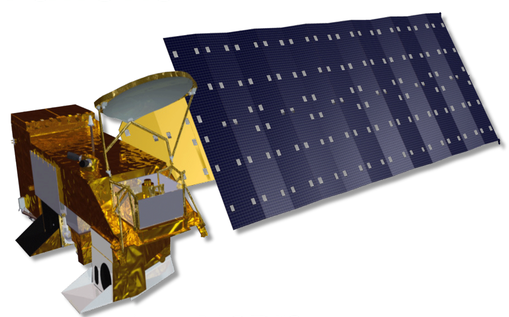
Study Area



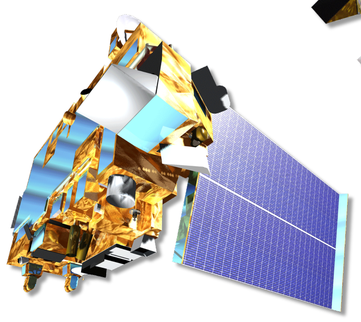
Objectives

- **Determine** which data inputs are best correlated with *in situ* measurements of live fuel moisture (LFM)
- **Produce** a more accurate model to better reflect LFM in the EGB
- **Create** biweekly forecasts of LFM in the EGB to better predict fire risk for the 2020 fire season
- **Produce** a tutorial describing the model that allows partners to replicate the process

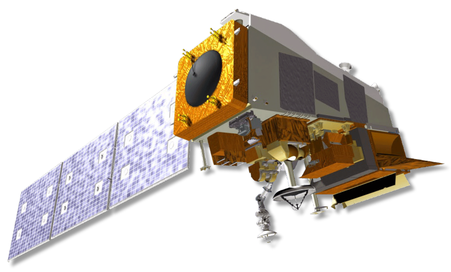
Earth Observations



Terra MODIS



Aqua MODIS



Suomi-NPP VIIRS

Team Members

Gavin Pirrie
Project Lead

Helena Bierly

Avery King

Katherine Mistick

Methodology

Our model is comprised of 9 different input rasters: (1) Elevation, (2) Aspect, (3) Aqua Evapotranspiration (ET), (4) Terra ET, (5) VIIRS Enhanced Vegetation Index 2 (EVI 2), (6) VIIRS Fraction of Photosynthetically Active Radiation (FPAR), (7) VIIRS Leaf Area Index (LAI), (8) VIIRS Normalized Difference Vegetation Index (NDVI), and (9) Terra Normalized Difference Water Index (NDWI).

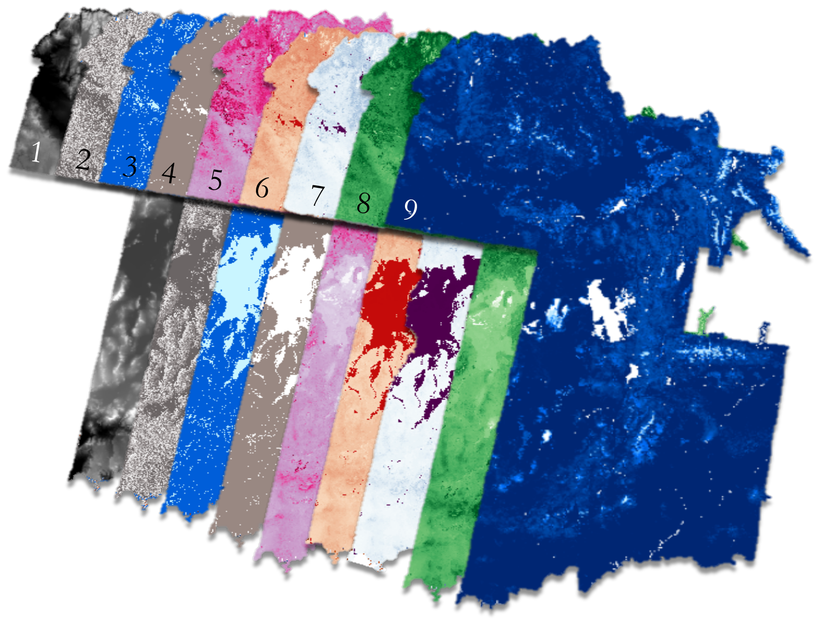


Fig 1. Model Input Rasters

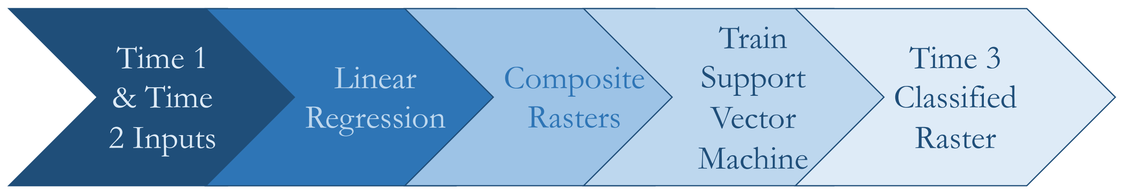


Fig 2. Summary of the LFM forecast model built in Model Builder in ArcGIS Pro 2.5.1. Time 1 and Time 2 inputs include the above rasters (Fig. 1) and the *in situ* historic fuel moisture measurements. Time 3 Classified Raster is the forecasted LFM map.

Maps were generated for the 2019 fire season, which were validated against *in situ* LFM data from 2019. Then, maps were generated to forecast LFM into the future for the 2020 fire season.

Results

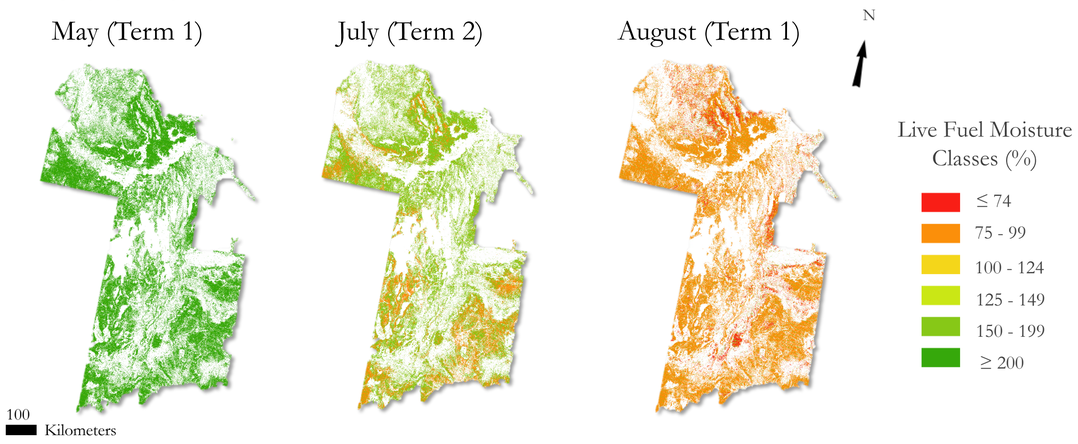


Fig 3. Model-generated LFM forecast maps for May (Term 1), July (Term 2), and August (Term 1) 2019 that depict LFM classes throughout the eastern Great Basin. LFM classification changes significantly during the 2019 fire season.

Conclusions

- Forecasting LFM using Earth observations is feasible for the eastern Great Basin.
- The spatial resolution of the model was roughly ten times higher than that which *in situ* measurements provide.
- Additional *in situ* data would be beneficial to more accurately train and validate the model.
- Further refinement of the model is necessary to improve its accuracy.

Project Partners

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Great Basin Ecological Forecasting II

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