FIRESEV East: Mapping Severe Fire Potential in the Eastern U.S.

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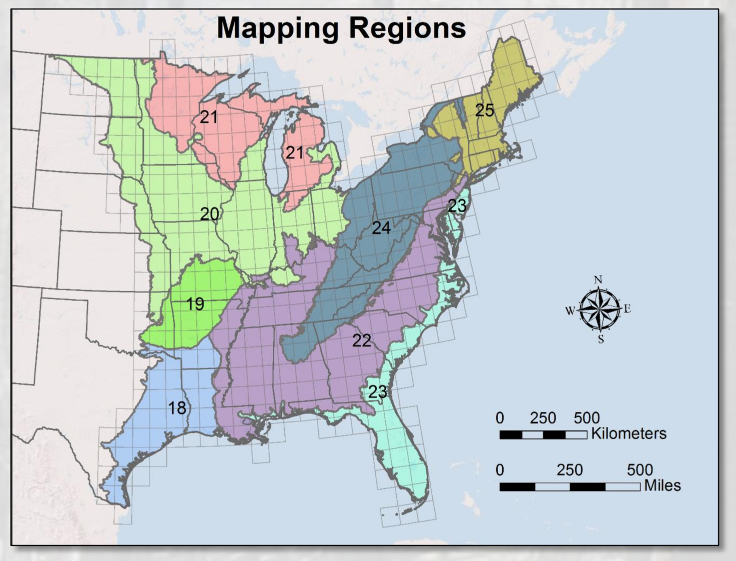
Objective

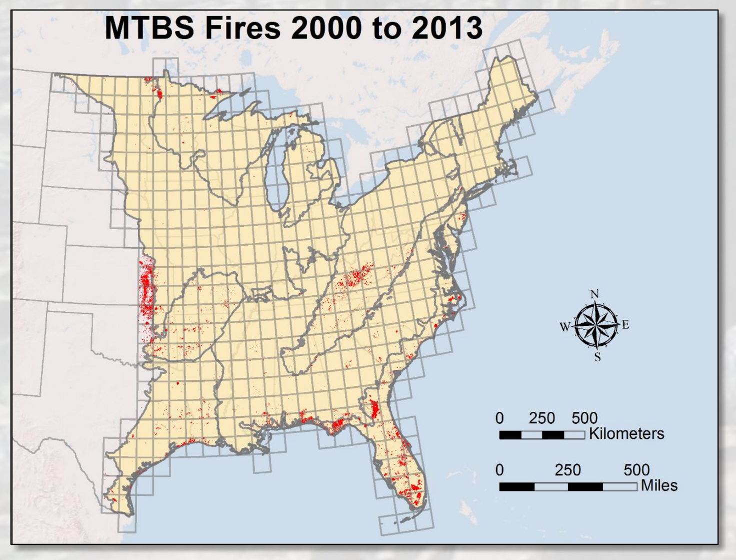
- Produce a seamless, wall-to-wall, 30-meter raster geospatial layer covering all lands in the Eastern United States that:
  - Is generated from a series of statistical models, created separately for each region to capture differences in predictor variable importance.
  - Builds on Monitoring Trends in Burn Severity (MTBS) data to make predictions.
  - Depicts the potential for severe fire at each 30-m cell, based on empirical observations and statistical modeling;
  - Is useful to inform the decision making process for fire and fuel management
  - Will be made available for managers and scientists to download.

Inputs

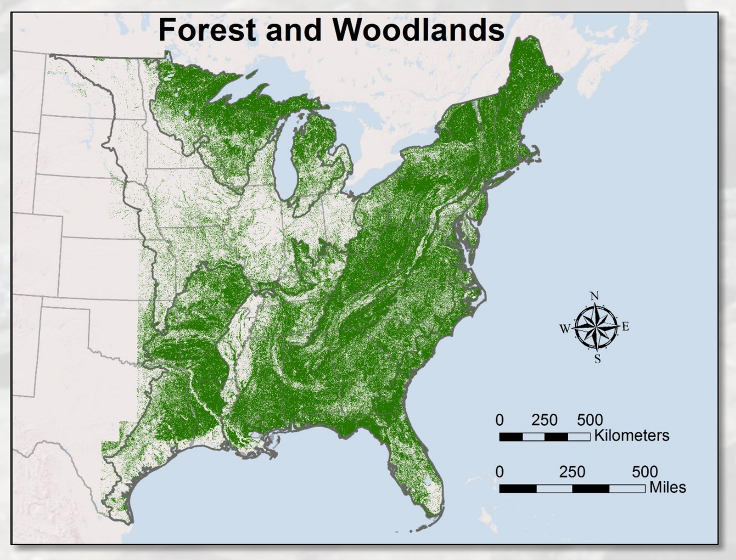
- We used 8 mapping regions to stratify statistical modeling.
- Mapping regions were based on US EPA Ecoregions.
- Raster spatial data for most predictors used in modeling were stored and processed in 1-degree tiles.

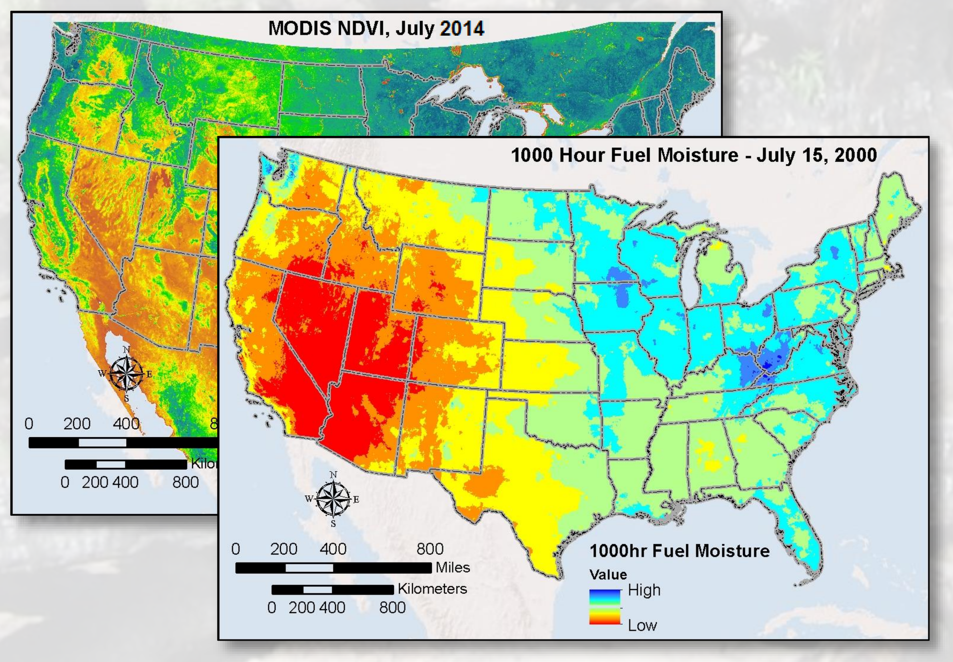


- Satellite-derived burn severity observations came from over 5,000 fires that burned between 2000 and 2013.
- We used continuous measures of burn severity (dNBR and NBR) mapped by MTBS and classified them as "severe" vs. "not severe" using a variety of techniques.

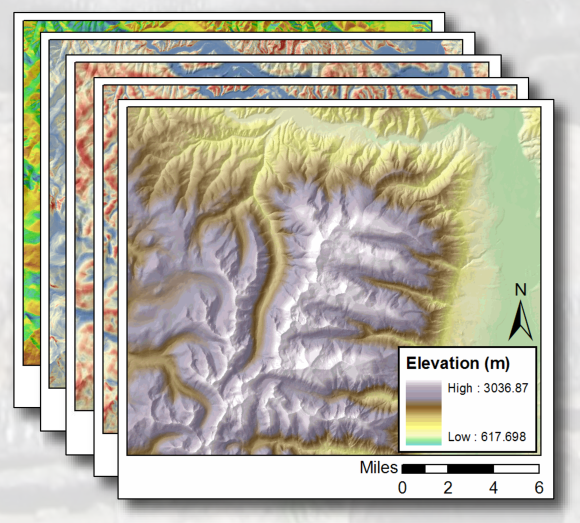


- Burn severity measurement and interpretation are very different in forest and woodland vs. non-forest settings; therefore, we kept them separate for modeling and mapping.
- We used a forest mask based on potential vegetation to stratify input data for modeling to capture pre-fire setting.
- We used a forest mask based on LANDFIRE Existing Vegetation Cover for making spatial predictions.





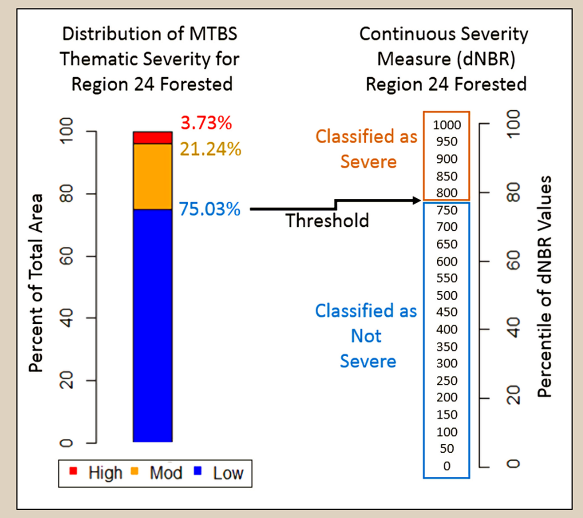
- Temporally-specific predictor data:
  - Normalized Differenced Vegetation Index (NDVI) from 250m MODIS used for both pre-fire condition and current prediction
  - 1000-hour fuel moisture from 4km downscaled NARR data (time-of-fire); set to 90th percentile conditions for current prediction



- Topographic predictor data:
  - 30m digital elevation from the National Elevation Dataset
  - 13 topographic derivatives including slope, topographic position, hierarchical slope position, topographic complexity indices, and solar radiation

Thresholding

- Threshold values calculated separately for each region and forest/non-forest setting from distributions of MTBS's thematically classified severity rasters,
- Using thresholds, continuous measures of burn severity (dNBR and NBR) are classified into binary groups.
- The resulting "Severe" classification reflects an aggregate of MTBS's moderate and high severities.



Modeling and Mapping

- Within each mapping region, we applied the following steps separately for forest and woodland vs. non-forest settings:
  - Draw a spatially-balanced, random sample of 1% of burned pixels; extract values for all input layers at sample points.
  - Develop Random Forest classification tree models with binary severity response (severe vs. not severe).
  - Use Random Forest models to predict for every 30m pixel across the entire landscape the probability of burning severely.
  - Each Random Forest model calculates 1,500 classification trees. For each pixel, map the percentage of those trees that predicted the pixel to burn severely.

Results

- Cross-validated classification accuracies for individual models ranged from 70% to 87% for forest and woodland models, and 69% to 85% for non-forest models.
- Elevation, 1000-hour fuel moisture, and NDVI were generally in the top four predictor variables.
- Solar radiation often rounded out the top four predictors.

Applications

- Integration into national spatial decision support tools such as the Wildland Fire Decision Support System (WFDSS)
- Planning for future wildfires – pre-existing product can inform managers as to whether an ignition may lead to desirable or undesirable ecological impacts
- Planning prescribed burns – informs potential ecological consequences of prescribed fire
- Fuel treatment planning – helps managers focus on areas where fire may burn with an undesirable severity
- Post-fire rehabilitation – identifying those areas most likely to need treatment

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