USGS
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Geographic Analysis and Monitoring Program

United States Geological Survey Fire Science—Fire Danger Monitoring and Forecasting

The convergence of large amounts of dry wildland fuels and weather favorable for fire ignition and spread signifies high potential for uncharacteristically large and dangerous fires. The ability to characterize the potential for hazardous fire activity requires measurements of fuel condition combined with information from weather forecasts. The availability of long fire histories adds a third dimension, fire probability, which can improve the ability to develop weekly forecasts of the location and number of large fires over a given region (Preisler and others, 2008).

The United States Geological Survey (USGS) uses moderate resolution satellite data to assess live fuel condition for estimating fire danger. Using 23 years of vegetation condition measurements, we are able to determine the relative greenness of current live fuels. High relative greenness values indicate the vegetation is healthy and vigorous; low greenness values indicate the vegetation is under stress, dry (possibly from drought), behind in annual development, or dead. Forest, shrub, and grassland vegetation with low relative greenness are susceptible to fire ignition during the fire season. The relative greenness for July 16, 2012, is shown in figure 1.

The fire potential index (FPI) integrates weather information from the National Digital Forecast Database (*http://www.nws.noaa.gov/ndfd/*) and satellite-derived vegetation condition information, and is used to identify the areas most susceptible to fire ignition (Burgan et.al., 1998). The combination of relative greenness and weather information provides an estimate of the moisture condition of the live and dead vegetation. The FPI provides local and regional fire planners with a quantitative measure of fire ignition risk. The FPI for July 16, 2012, is shown in figure 2.

Each day, the USGS, in collaboration with the U.S. Forest Service, produces 7-day forecasts for all Federal lands of the distributions of number of ignitions, number of fires above a given size, and conditional probabilities of fires growing larger than a specified size (figure 3).

The large fire probability map is an estimate of the likelihood that ignitions will become large fires, given existing levels of the fire danger variables. The large fire forecast map is a probability estimate of the number of fires on Federal

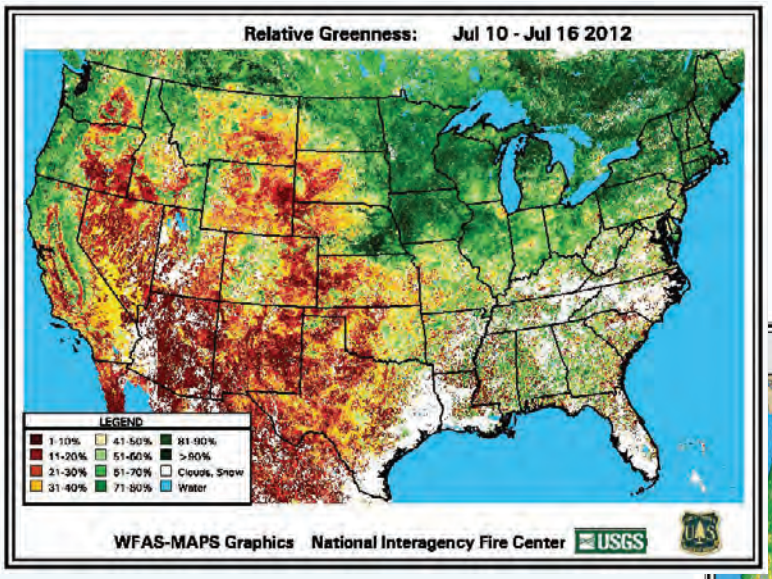

Figure 1. This relative greenness image for July 10–16, 2012, shows how green this time period is relative to the maximum greenness over the course of a year. High relative greenness percentages indicate substantial amounts of green and healthy vegetation. Low percentages indicate vegetation that has not yet grown to its full seasonal potential, or vegetation that has already reached its maximum and is now drying up. Relative greenness images can be obtained from the U.S. Department of Agricultural Forest Service, Wildland Fire Assessment System (WFAS-MAPS).

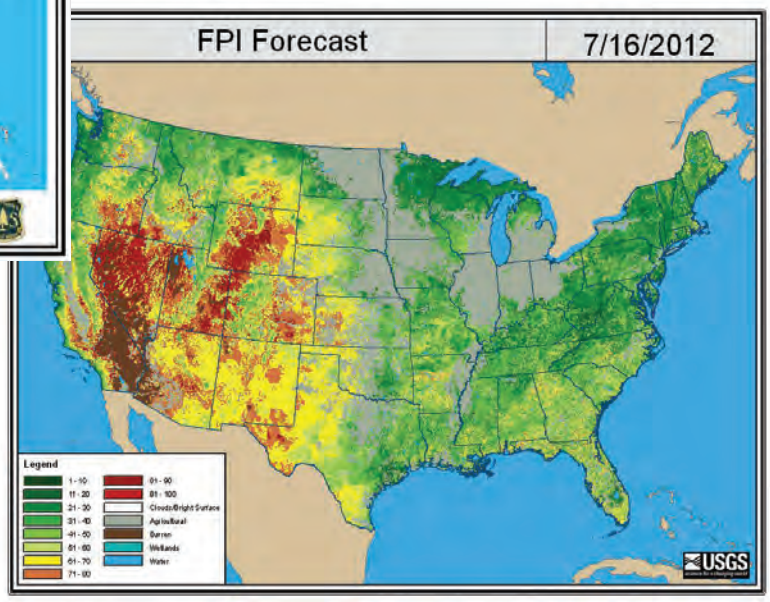

Figure 2. The fire potential index (FPI) image for July 16, 2012, shows the areas most susceptible to fire ignition. The FPI index is scaled from 1–100, where 1 is the lowest potential and 100 is the highest potential.

lands exceeding 100 acres in the forthcoming week. The ignition forecast map is a probability estimate of the number of fires on Federal land greater than 1 acre in the forthcoming week. The extreme event forecast is the probability estimate of the number of fires on Federal land that may exceed 5,000 acres in the forthcoming week.

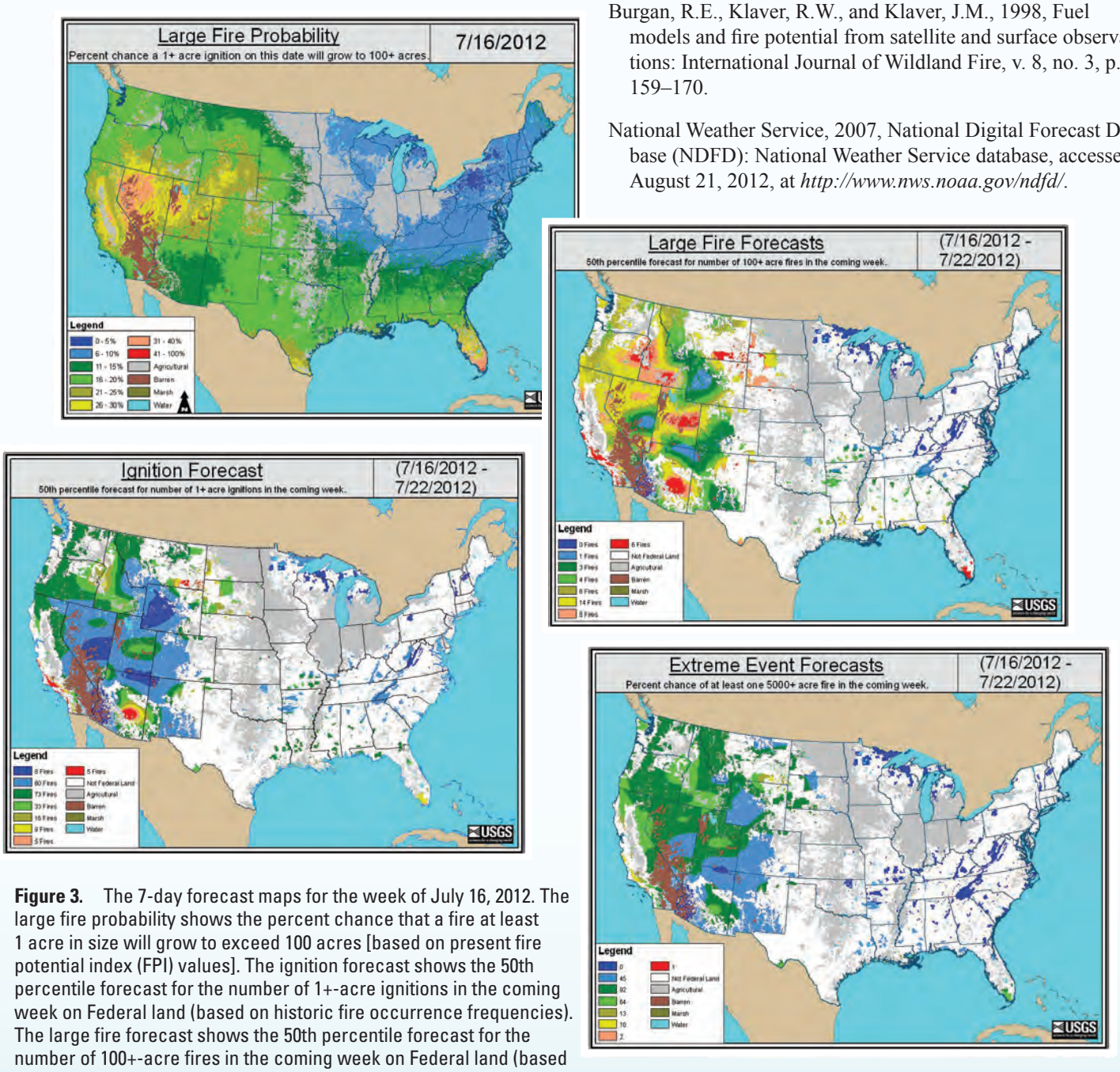

Figure 3. The 7-day forecast maps for the week of July 16, 2012. The large fire probability shows the percent chance that a fire at least 1 acre in size will grow to exceed 100 acres [based on present fire potential index (FPI) values]. The ignition forecast shows the 50th percentile forecast for the number of 1+-acre ignitions in the coming week on Federal land (based on historic fire occurrence frequencies). The large fire forecast shows the 50th percentile forecast for the number of 100+-acre fires in the coming week on Federal land (based on present FPI values and historic occurrence frequencies). The extreme event forecast shows the percent chance of at least one 5000+-acre fire in the coming week on Federal land (based on present FPI values and historic occurrence frequencies).

References

Preisler, H., Burgan, R., Eidenshink, J., and Klaver, J., 2008, Estimation and mapping of large wildfire probabilities based on satellite and gridded weather information: International Journal of Wildland Fire, v. 18, no. 5, p. 508–516.

Burgan, R.E., Klaver, R.W., and Klaver, J.M., 1998, Fuel models and fire potential from satellite and surface observations: International Journal of Wildland Fire, v. 8, no. 3, p. 159–170.

National Weather Service, 2007, National Digital Forecast Database (NDFD): National Weather Service database, accessed August 21, 2012, at *http://www.nws.noaa.gov/ndfd/*.

For more information

Fire Science Web site:
http://eros.usgs.gov/#/Science/Landscape_Dynamics/Fire_Science

Fire Danger Monitoring and Forecasting Web site:
http://firedanger.cr.usgs.gov/

For more specific fire danger project information

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