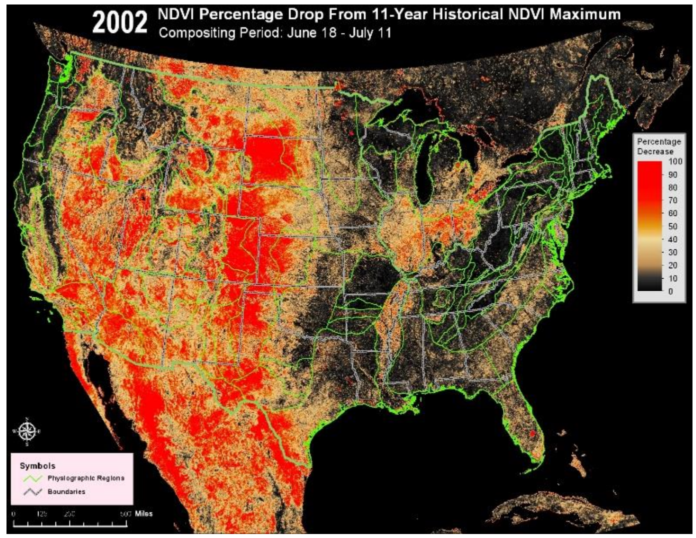
WWETAC: DROUGHT IN THE WEST

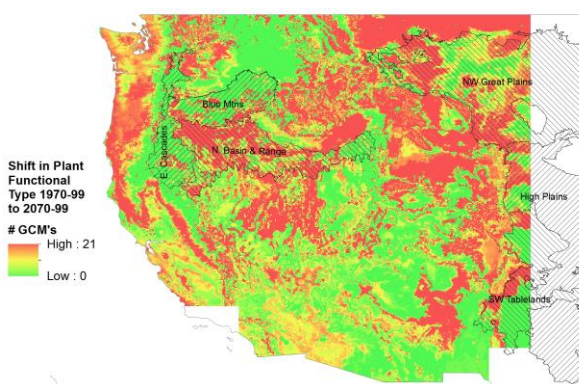
WESTERN WILDLANDS ENVIRONMENTAL THREATS ASSESSMENT CENTER

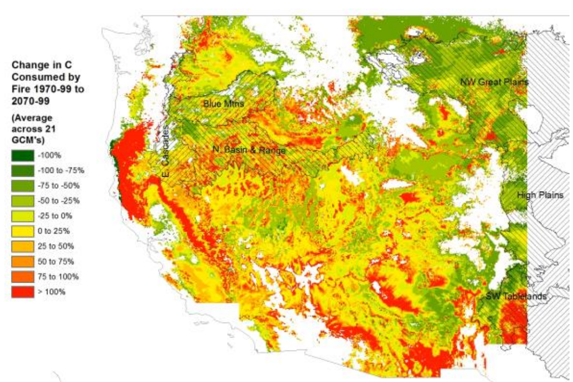
US Forest Service, Pacific Northwest Research Station



In the western US, drought is becoming unexpectedly more frequent and severe. WWETAC provides mapped output from state-of-the-science models, and remote sensing tools that detect and attribute disturbance to forests and grasslands to drought stress and insect attack. In California, drought in 2002 and 2007 resulted in tree mortality from drought alone and secondary effects of drought on tree susceptibility to insect attack. In the northern Rocky Mountains, 2004 was an exceptional drought year, whereas in the central Rockies, 2005 and 2008 had significant drought. With drought in 2014 and 2015 in northern California and in southern Oregon, an increase in insect attack was observed, but also an increase in mortality of old growth trees. WWETAC analysis shows drought alone plus secondary effects of insect attack are clear landscape-scale threats.

Projected effects of environmental change on forest and grasslands:
Staff scientist John Kim has completed predictions of shifts in vegetation types, and carbon and water balance for the western US. He selected an ensemble of statistically appropriate general circulation models (GCMs) to drive a FS-supported vegetation model (MC2) to predict expected changes in vegetation type, ecosystem carbon balance and dynamics, as well as water balance at the end of the century. On the left is the level of agreement among 21 GCMs that there will be significant shifts in vegetation types. On the right is the likelihood that fire will alter carbon balance. The level of drought expected is incorporated into this projection.





Contact ngrulke@fs.fed.us; google 'WWETAC'

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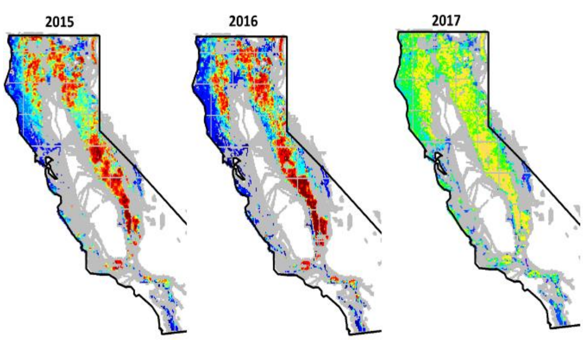
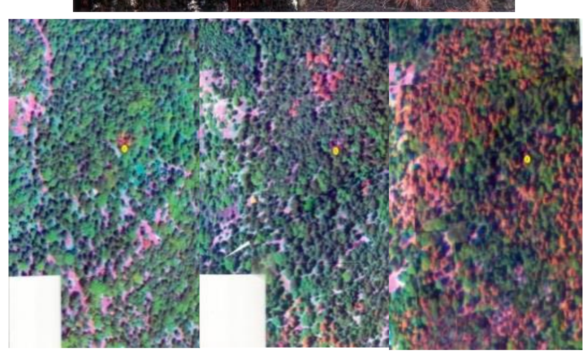
Within-year and out-year prediction of insect outbreaks:
A tool was developed from FHTET's Aerial Detection Survey to predict within-year likelihood of tree mortality from bark beetles and wood borers in California, with corresponding measures of uncertainties. Mortality in the same and adjacent cells due to insect attack were the best predictors, but minimum winter temperature averaging warmer than -5ºC, low precipitation (ppt) 2 yr prior to prediction, and high ppt 4 yr prior to year of prediction also contributed to increased tree mortality. These maps were delivered to R5 RHP and CalFire.



Near-real-time detection and reporting of change in range productivity:
If weather were 'as-usual,' our best source of information about when and where to permit grazing or remove cattle would come from long-time ranchers. However, with unusual weather patterns and extremes, traditional wisdom is boosted by remote sensing. Using MODIS satellite imagery, the current level of range productivity is compared to prior years on the same date in the same location to best gage when to release range permits. This tool is being calibrated on four National Grasslands in 2016, and will be available for all National Grasslands next year.

High resolution remote sensing tool for detection and causality of forest tree decline:
Land management agencies rely on satellite imagery (MODIS or LandSat) to rapidly detect change in productivity, and the FS is among them. However, multi-spectral, high resolution imagery mounted under fixed-wing planes or helicopters can detect and attribute the source of forest disturbances. In general, insects and pathogens tend to dry out and kill branches at the top of the tree first (upper left); drought affects the lower branches first (upper right). This difference can be used to help determine the cause of tree mortality by sampling the spectral signature of upper canopy, as well as the upper part of mid canopy. This tool will be used to help identify trees already at risk of dying for removal in forest restoration activities.



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