Additional description of Data and associated R script for

Zald HSJ, Dunn CJ Data from: Severe fire weather and intensive forest management increase fire severity in a multi-ownership landscape. Ecological Applications

DATA SET ABSTRACT

RData file and associated R script for 2013 Douglas Complex, Oregon USA. RData file contains two dataframes (douglas.fire.progression.rdnbdr.wx, blm.pi.sample.allvars.xy.df) douglas.fire.progression.rdnbdr.wx contains data on daily hectares burned, daily mean Relative difference Normalized Burn Ratio (RdNBR), and daily fire weather variables for Douglas Complex. blm.pi.sample.allvars.xy.df contains plot data of RdNBR, ownwrship class, topographic variables, fire weather, and pre-fire forest biomass. Douglas.R is R script for conducting the following statistical analyses on the two dataframes: 1. regressions of daily mean RdNBR in relation to individual fire weather (Wx) variables. 2. summary stats (mean and standard deviation) of response and predictor variables by ownership class. 3. Mann-Whitney-Wilcoxon Test of differences in distributions of response and predictor variables between ownership classes. 4. Random forest models of RdNBR in relation to predictor variables 5. Generalized least squares model of RdNBR in relation to predictor variables

TEMPORAL COVERAGE OF DATA

Start Date: 2013 07 03

Stop Date: 2014 07 07

SPATIAL COVERAGE OF DATA

Geographic Description: The Douglas Complex burned at elevations ranging from 213 – 1188 m in mountainous terrain of the Klamath Mountains Ecoregion.

Coordinates (in Degrees, Minutes and Seconds):

Northwest lat/long pair:

 Latitude North/South Longitude West/East

42 53' 17" N 123 39' 49" W

Southeast lat/long pair:

Latitude North/South Longitude West/East

42 39' 08" N 123 27' 11" W

DATA COLLECTION METHODS

We quantified fire severity using the Relative differenced Normalized Burn Ratio (RdNBR), a satellite imagery based metric of pre- to post-fire change. Cloud-free pre-fire (July 3, 2013) and post-fire (July 7, 2014) images came from the Landsat 8 Operational Land Imager. Normalized Burn Ratio (NBR), which combines near-infrared and mid-infrared bands of Landsat imagery, was calculated for pre- and post-fire images. Differenced Normalized Burn Ratio (dNBR) was calculated by subtracting NBRpost-fire from NBRpre-fire values, and RdNBR was then calculated where: [1] RdNBR = dNBR / SquareRoot (Absolute Value (NBRpre-fire / 1000)) Elevation and other topographic variables were derived from the National Elevation dataset 30 m digital elevation model. We generated 30 m rasters of elevation (m), slope (%), topographic position index (TPI), and heat load (MJ cm2 yr-1). TPI was calculated as the difference between elevation in a given cell and mean elevation of cells within an annulus around that cell, calculated at fine and coarse scales (TPI-fine and TPI-coarse) with 150 – 300 m and 1850 – 2000 m annuli, respectively. Heat load was calculated by least-squares multiple regression using trigonometric functions of slope, aspect, and latitude. Rasters of daily fire weather conditions were generated by extrapolating weather station data to a daily fire progression map. We obtained hourly weather data for the duration of active fire spread (July 7 - August 20, 2013) from the Calvert Peak Remote Automatic Weather Station (NWS ID 352919, 42°46'40" N 123°43'46"W, 1165 m), approximately 30 km west-southwest of the Douglas Complex. We then subset each 24-hour period of weather data to the daily burn period (10 am – 6 pm) when fire behavior is typically most active. We then calculated the daily burn period minimum wind speed (km/h), maximum temperature (°C), and minimum relative humidity (%). For each daily burn period we also calculated the mean energy release component (ERC), spread component (SC), and burning index (BI) using FireFamilyPlus Version 4.1. ERC is an index of fuel dryness related to the maximum energy release at the flaming front of a fire, as measured from temperature, relative humidity, and moisture of 1 – 1000 hour dead fuels. SC is a rating of the forward rate of spread of a head fire, and is calculated from wind speed, slope, and moisture of live fine and woody fuels (Bradshaw et al. 1983). BI is proportional to the flame length at the head of a fire (Bradshaw et al. 1983), calculated using ERC and SC, thus incorporating wind speed and providing more information than ERC and SC individually. ERC, SC and BI vary by broadly categorized fuel types. We calculated ERC, SC, and BI using the National Fire Danger Rating System Fuel Model G, which represents short-needled conifer stands with heavy dead fuel loads. Daily fire weather variables were then spatially extrapolated to the daily area burned based on daily fire progression geospatial data captured during the fire. Forest ownership was derived from geospatial data representing fee land title and ownership in Oregon. We grouped ODF and BLM lands as a single ownership type, because ODF lands were a small component of the area burned, and have management objectives closer to federal versus private industrial forests. Pre-fire forest conditions were represented with 30 m rasters of live biomass (Mg ha-1) and stand age, derived from a regional 2012 map of forest composition and structural attributes developed for the Northwest Forest Plan Monitoring Program. These maps were developed using the gradient nearest neighbor method (GNN), relating multivariate response variables of forest composition and structure attributes from approximately 17,000 federal forest inventory plots to gridded predictor variables (satellite imagery, topography, climate, etc.) using canonical correspondence analysis and nearest neighbor imputation. Biomass values are directly from the GNN maps, while we quantified forest age as a two-step process. First, we calculated pre-fire forest age in 2013 based on years since each pixel was disturbed in the Landsat time series (1985-2014) from a regional disturbance map generated for the Northwest Forest Plan Monitoring Program using the LandTrendr segmentation algorithm. Second, for pixels where no disturbance had occurred within the Landsat time series, we amended forest age derived from the Landsat time series using dominant and codominant tree age from the GNN maps.

Extent of Study Description: In the summer of 2013, the Douglas Complex burned 19,760 ha of forestland in southwestern Oregon, USA. Starting from multiple lightning ignitions, individual small fires coalesced into two large fires (Dads Creek and Rabbit Mountain) managed as the Douglas Complex. The Douglas Complex burned at elevations ranging from 213 – 1188 m in mountainous terrain of the Klamath Mountains Ecoregion. Climate in the ecoregion is characterized by hot dry summers and wet winters, with greater winter precipitation at higher elevations and western portions of the ecoregion. Vegetation types within the region include oak woodlands and mixed hardwood/evergreen forests at low to mid elevations, transitioning into mixed-conifer forests at higher elevations. Forests within the Douglas Complex are dominated by Douglas-fir, ponderosa pine (Pinus ponderosa), and white fir (Abies concolor). Other conifer tree species present include incense cedar (Calocedrus decurrens), sugar pine (Pinus lambertiana), Jeffery pine (Pinus jefferyi), and knobcone pine (Pinus attenuata). Hardwood species include Oregon white oak (Quercus garryana), big-leaf maple (Acer macrophyllum), Pacific dogwood (Cornus nuttallii), Pacific madrone (Arbutus menziesii), canyon live oak (Quercus chrysolepis), California black oak (Quercus kelloggii), golden chinkapin (Chrysolepis chrysophylla), and tanoak (Lithocarpus densiflourus). Douglas-fir is the primary commercial timber species managed on private and public lands, while fire exclusion and historical management practices have expanded the density and dominance of Douglas-fir across much of the ecoregion.

Sampling Description: The Douglas complex geospatial data was sampled using a spatially constrained stratified random design, from which response and predictor variables were extracted for analysis. Sample points had to be at least 200 m apart to minimize short distance spatial autocorrelation of response and predictor variables. Additionally, point locations had to be at least 100 m away from ownership boundaries to minimize inter-ownership edge effects. Within these spatial constraints, sample points were located in a stratified random design, with the number of points proportional to area of ownership within the fire perimeter, resulting in 571 and 519 points located in BLM and private industrial forests, respectively. Mean response and predictor variables were extracted within a 90 x 90 m plot (e.g. 3 x 3 pixels) centered on each sample point location to minimize the effects of potential georeferencing errors across data layers, and maintain a plot size comparable to the original inventory plots used as source data in GNN maps.