Carbon Calculator Fire Regime Historical Parameterization

Introduction

A wildfire regime is defined by the frequency, severity, and spatial pattern of fires characteristic of a given area or region. In the Forest Sector Carbon Calculator, the wildfire scheduler determines these wildfire regime attributes (fire frequency, severity, and size) of simulated wildfires. These simulated wildfire attributes are then used by the wildfire module of LANDCARB 3.0 to determine the effect of wildfire on various carbon pools. All three wildfire regime attributes representing a given area or region are quantified as probability distributions, rather than mean or median values, to portray the variability in fire regimes inherent in any given landscape.

Fire Frequency

To characterize fire frequency, we used the mean fire return interval (mFRI), which quantifies the average number of years between fires under the presumed historical fire regime. We used gridded (30m cell size) simulated mFRI data from LANDFIRE (http://www.landfire.gov/). LANDFIRE is an interagency vegetation, fire, and fuel characteristics mapping program, sponsored by the United States Department of the Interior (DOI) and the United States Department of Agriculture, Forest Service. Gridded mFRI was extracted from LANDFIRE for the modeling region of interest, and a probability distribution of mFRI was created from this gridded data (Figure 1).

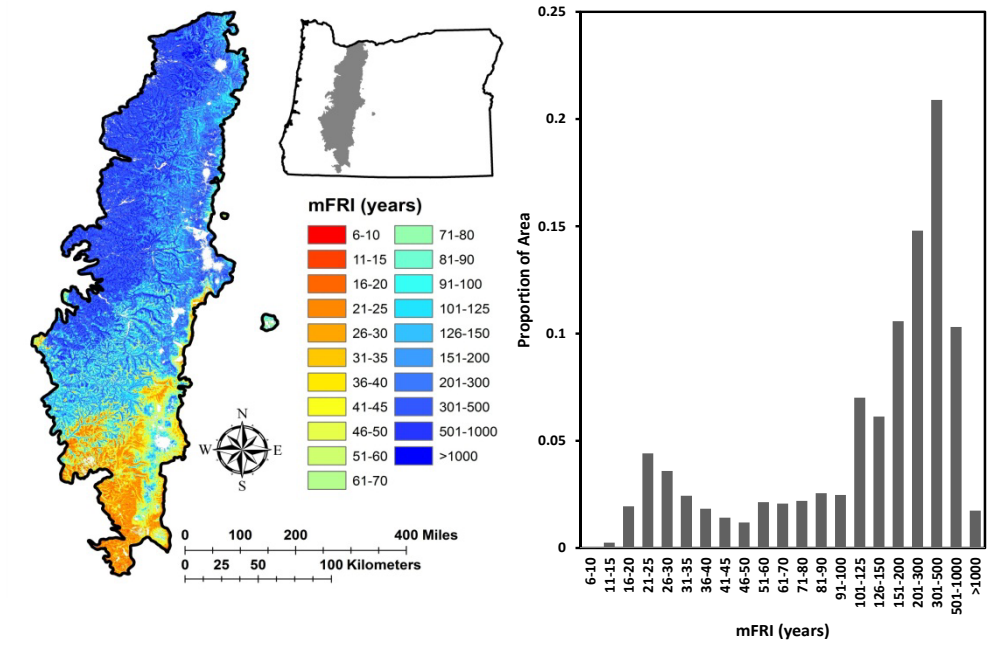

Figure 1. Map and probability distribution of historical mean fire return interval (mFRI) for the west Cascades ecoregion of Oregon.

Fire Severity

Fire severity was defined has the percentage of overstory mortality within a typical fire perimeter given a vegetation type. Severity is grouped into three classes, low (0-25 percent mortality, moderate (25-75 percent mortality), and high (75-100 percent mortality). As with mFRI, fire severity data comes from LANDFIRE, in the form of three gridded datasets representing the probability a cell would burn in a given fire severity class, relative to the other two severity classes. Gridded severity probability maps were extracted from LANDFIRE for the modeling region of interest, and the mean probability of each severity class calculated (Figure 2).

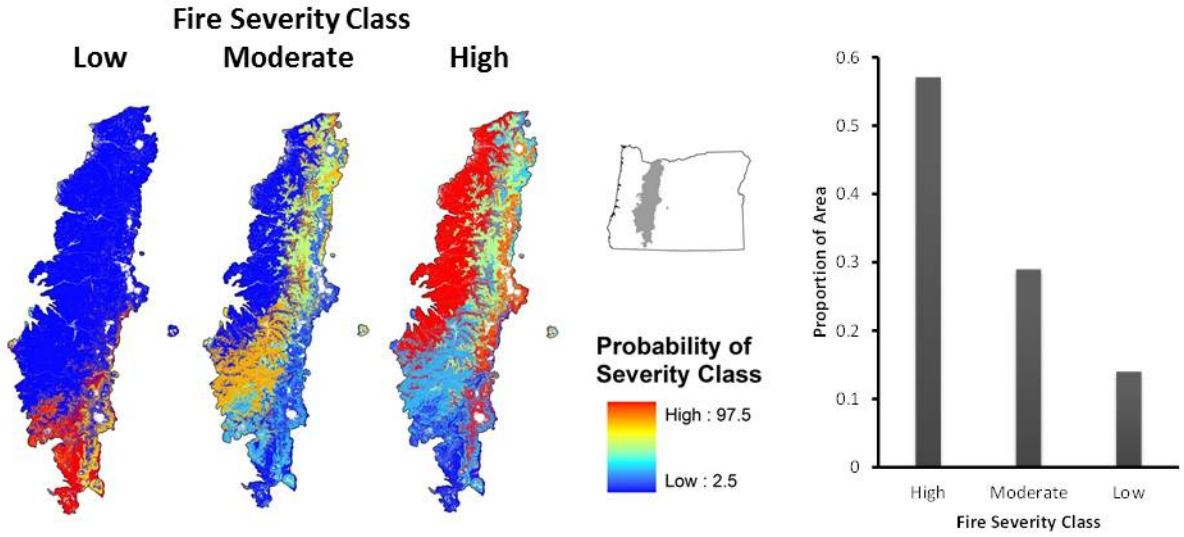

Figure 2. Probability maps by fire severity class, and overall probability distribution of severity classes, for the west Cascades ecoregion of Oregon.

Fire Area

The third attribute of fire regime we parameterized is the distribution of fire sizes (area). To represent the west Cascades ecoregion of Oregon, we extract fire records from the 1970 – 2010 time period for three National Forests (Mount Hood NF, Willamette NF, and Umpqua NF). Fire records were extracted from the National Interagency Fire Management Integrated Database (NIFMID) using the KCFast (http://fam.nwcg.gov/fam-web/kcfast/mnmenu.htm) and FireFamilyPlus (http://www.firemodels.org/index.php/national-systems/firefamilyplus) software suites. From these fire records the distribution of fire sizes was calculated (Figure 3). The probability distribution of fires in relation to fire area was then modeled as a reverse Weibull function (Figure 4)

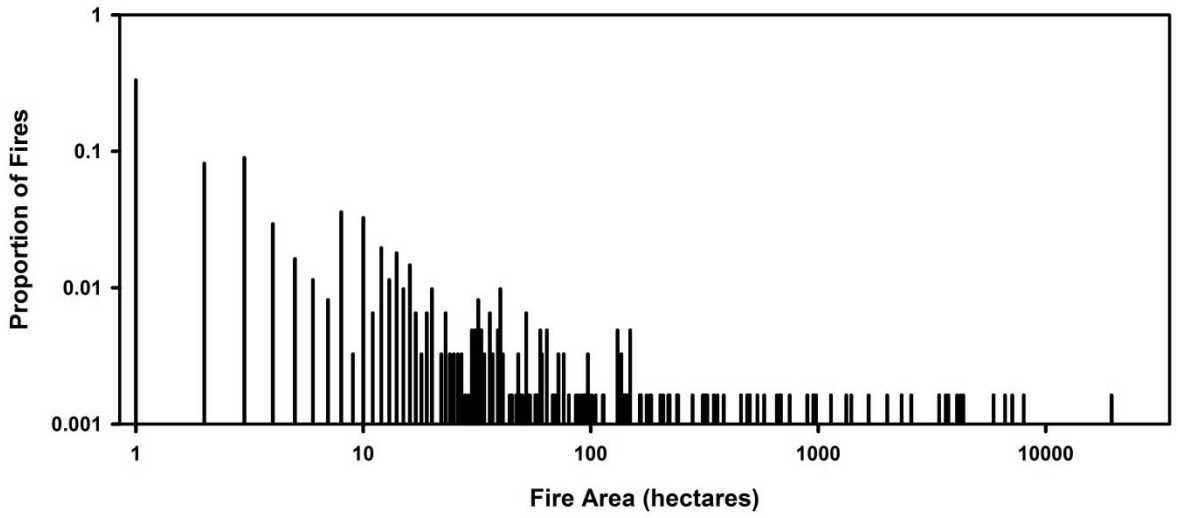

Figure 3. Probability distribution of fires in relation to fire size over the 1970 – 2010 time period for the Mount Hood, Willamette and Umpqua National Forests in the west Cascades ecoregion of Oregon. Note that both fire area and proportion of fires are plotted in log scale.

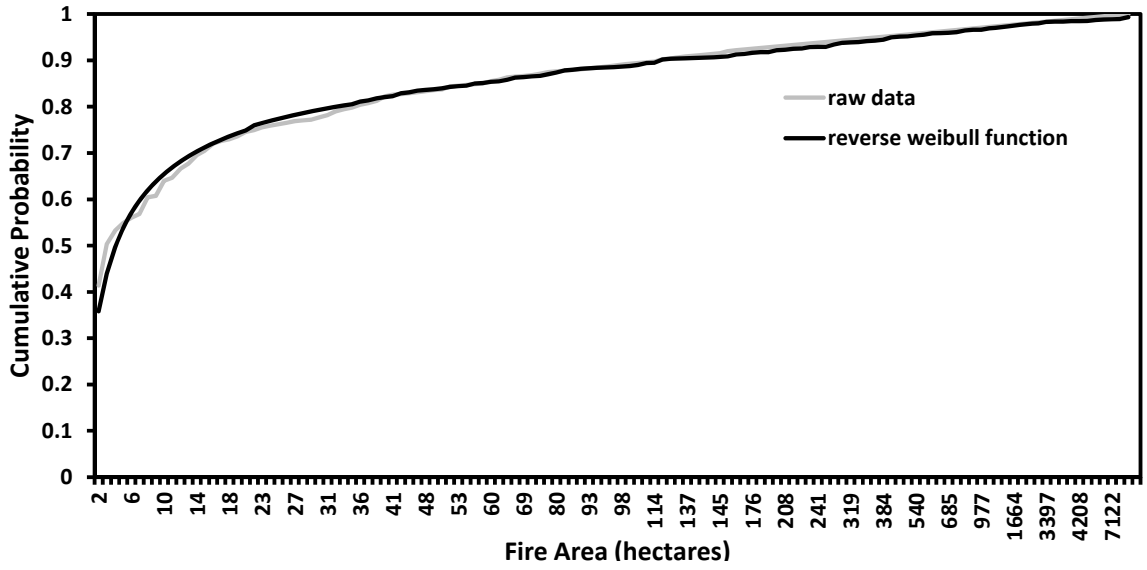

Figure 4. Cumulative probability distributions for raw fire data and reverse weibull function for recorded fires in the west Cascades ecoregion of Oregon from 1970 – 2010.

The wildfire scheduler generates wildfires consistent with the historical fire regime for an area of interest by applying a random number generator to the probability distributions of fire frequency, severity, and size as presented above. This creates simulated fires of the desired frequency, severity and size that are used by the wildfire module of LANDCARB 3.0 to determine the effect of wildfire on various carbon pools.