



TECHNICAL MEMORANDUM

FUTURE FIRE SCENARIO FOR WILDFIRE USING RANK-ORDERED SIMULATED DATASETS

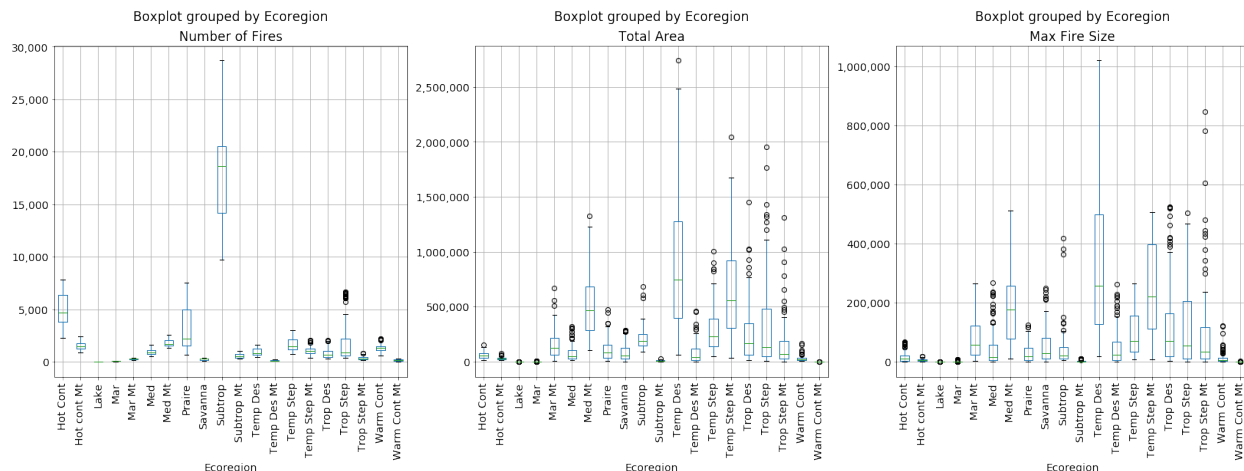
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This memorandum summarizes a proposed method to develop a Future Wildfire scenario based on the results of the Representative Baseline Fire Emissions Inventory (RBFEI). The basic steps to build the RBFEI are reviewed and then extrapolated to the future scenario. Some familiarity is presumed with the concepts of the RBFEI methodology.

RBFEI Steps

The RBFEI wildfire dataset was derived from a set of theoretical probability distributions of fire size vs frequency organized by Bailey ecoregion division. There were two initial steps to build a population of fire events (i.e. a simulated annual fire activity dataset) that were iterated 100 times to create a distribution of virtual years. The result of this is shown in Figure 1, which depicts the range of outcomes in terms of number of events, total acres burned, and largest fire size. To build the RBFEI, one virtual year was selected from each ecoregion that most closely matched the average total recorded acres burned over the period 2012-2015. Subsequent steps then assigned start date, duration, and location of each fire in the virtual year datasets.

Figure 1. Boxplots of annual fire activity simulation population characteristics



Future Wildfire Scenario Development

The proposed process to create a Future Wildfire EI (FWEI) is similar: select a single virtual year from each ecoregion, but this time use a different metric to determine the appropriate datasets. A scalar, based on predictions of increased biomass burning in the Western US by 2040, would be applied to the 2012-2015 recorded average total acres burned by ecoregion, which would then be matched to the closest virtual year.

It is necessary, for Regional Haze modeling scenarios, to preserve wildfire activity in time and space between the RBFEL and the FWEI. To do this, the virtual year datasets for each EI will be mapped, event by event, by rank-ordering the two virtual years for each ecoregion and assigning the time and space metadata characteristics from the RBFEL events to the FWEI events. If there are more FWEI events in a given ecoregion, those will be assigned new data and location characteristics following the steps from the RBFEL methodology. Table 1 illustrates the mapping process for a hypothetical ecoregion with 9 burns in the RBFEL. The selected virtual year dataset has 10 burns. Therefore, after sorting both datasets largest to smallest, the first 9 burns from the future dataset are assigned the date, duration, and location of the burns of corresponding rank from the RBFEL. New metadata characteristics are generated for the extra, tenth burn in the future dataset.

It is evident from the example in Table 1 that, for the largest fires, the intensity of burning (that is, acres burned per day) is increasing. However, based on the nature of selecting fire duration in the RBFEL, which selects from duration distributions organized by ecoregion, federal fire size class, and month, it is an appropriate approach. The largest federal fire size class is $\geq 5,000$ acres, which means it is equally likely that, in a given ecoregion, a 10,000-acre burn will be assigned the same duration as a 100,000 acre burn. This approach is perhaps imperfect, but from the standpoint of probabilities, wholly necessary due to the rarity of the largest events: splitting the size classes into more bins would lead to “distributions” with very few events, or perhaps none at all.

Table 1. Hypothetical Wildfire Activity Data Ranked by Size

Rank Order	RBF EI Activity Data	Future Virtual Year	FW EI Final Dataset
1	Size: 100,000 ac Date: 7/17/14 duration: 34 days	Size: 230,000 ac	Size: 230,000 ac Date: 7/17/14 duration: 34 days
2	Size: 52,000 ac Date: 7/30/14 duration: 14 days	Size: 96,000 ac	Size: 96,000 ac Date: 7/30/14 duration: 14 days
3	Size: 4,000 ac Date: 7/17/14 duration: 9 days	Size: 10,000 ac	Size: 10,000 ac Date: 7/17/14 duration: 9 days
4	Size: 900 ac Date: 8/11/14 duration: 5 days	Size: 500 ac	Size: 500 ac Date: 8/11/14 duration: 5 days
5	Size: 185 ac Date: 6/19/14 duration: 3 days	Size: 120 ac	Size: 120 ac Date: 6/19/14 duration: 3 days
6	Size: 45 ac Date: 9/02/14 duration: 1 day	Size: 50 ac	Size: 50 ac Date: 9/02/14 duration: 1 day
7	Size: 22 ac Date: 7/22/14 duration: 2 days	Size: 35 ac	Size: 35 ac Date: 7/22/14 duration: 2 days
8	Size: 5 ac Date: 5/12/14 duration: 1 day	Size: 10 ac	Size: 10 ac Date: 5/12/14 duration: 1 day
9	Size: 1 ac Date: 9/22/14 duration: 1 day	Size: 1 ac	Size: 1 ac Date: 9/22/14 duration: 1 day
		Size: 1 ac	Size: 1 ac Date: 7/01/14 duration: 1 day