Fire Indices for FSPro in Alaska: A comparison of ERC and BUI on the 2009 Titna River Fire (420)

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The Problem

FSPro uses the Energy Release Component (ERC) for fuel model G to derive fire weather percentiles which are used to bin fuel moisture and other inputs to the model. ERC is part of the National Fire Danger Rating System (NFDRS) which is used in the lower 48 states but does not perform as well as the Canadian Forest Fire Danger Rating System (CFFDRS) Build-up Index (BUI) in Alaska's boreal forest types.

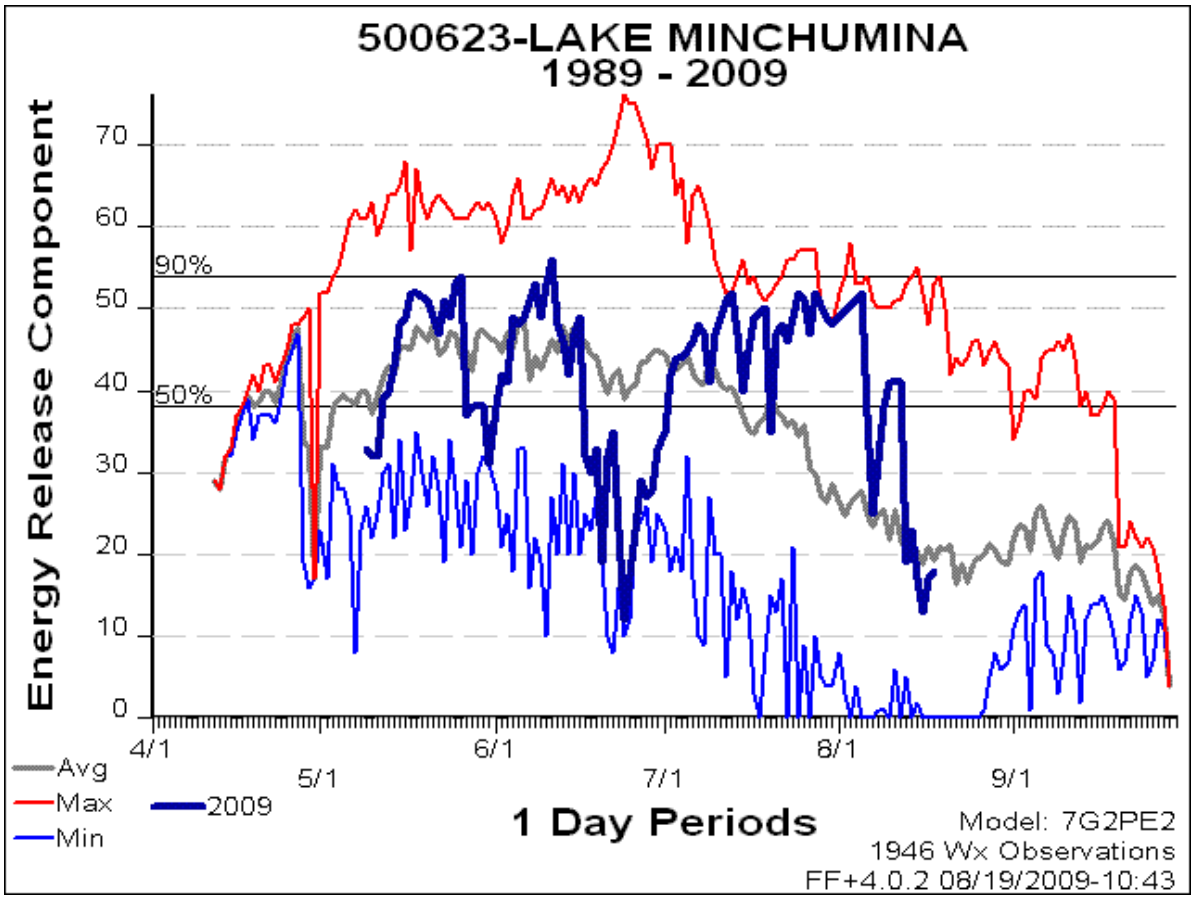
Energy Release Component is the potential available energy per square foot of flaming fire at the head of the fire and is expressed in units of BTUs per square foot. ERC for fuel model G used by FSPro involves moisture inputs for the entire fuel complex, i.e., 1-hr. , 10-hr. , 100-hr. , 1000-hr. , and the live fuel moisture.

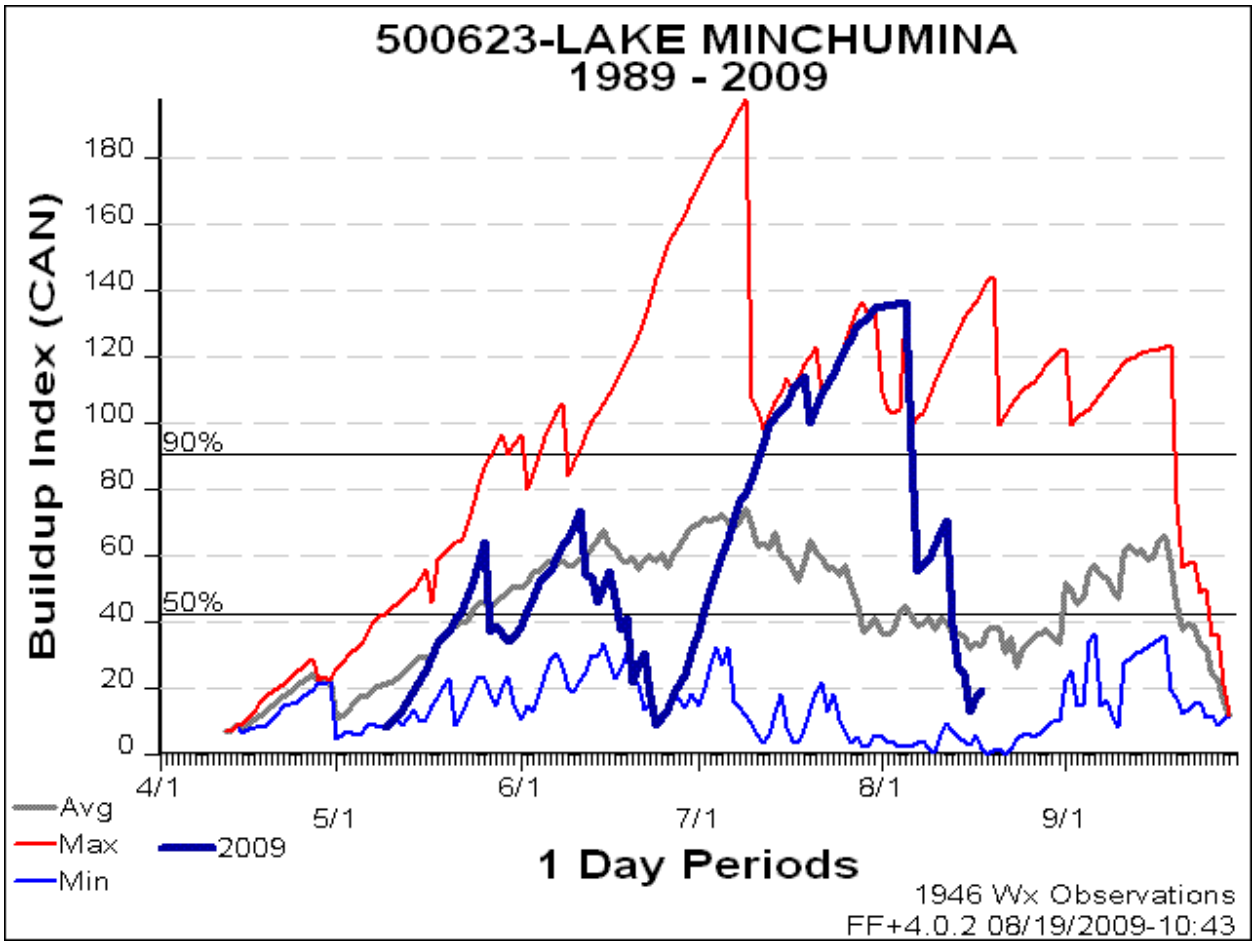
The Buildup Index (BUI) is a numeric rating of the total amount of fuel available for combustion. It describes moisture conditions in the dead moss and upper duff layers, approximately 3-15 cm from the surface.

ERC and BUI perform roughly the same function in their respective fire danger rating systems, representing moisture conditions at the scale of days to weeks. However there are some key differences. ERC is an index designed to track cylindrical fuels particles, e.g., twigs, branches, logs, and live herbaceous and shrub fuels. BUI is an index designed to track stratified layers of fuel: live moss, dead moss, and duff. Previous LTANs in Alaska have expressed some skepticism in using ERC in place of BUI. This analysis provides insight to the overall problem by addressing a specific fire in Alaska, the 2009 Titna River Fire (420) using the Minchumina RAWS (500623).

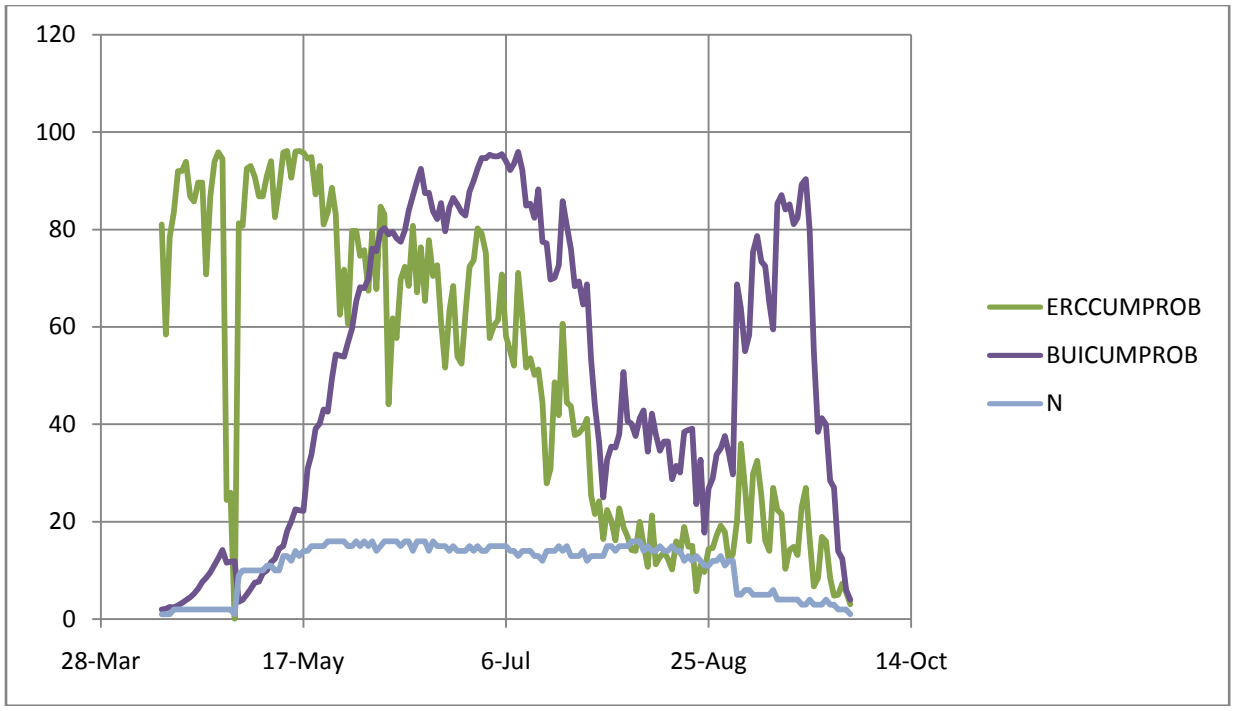
Initial calibration runs on the Titna Fire failed to give a reasonable match between FSPro output and the growth in the fire perimeter between 19 July and 6 August, despite aggressive manipulations of the standard inputs: fuel moisture, spotting, manipulation of canopy attributes and fuel models, and using gust winds (See the companion document "FSPro Calibration on the 2009 Titna River Fire (420)"). The last input I thought to check was the ERC stream.

I found that ERC underestimated BUI by an average of 23.5% percentile points during the analysis period and was related to gross differences in the way the two indices were tracking the season.

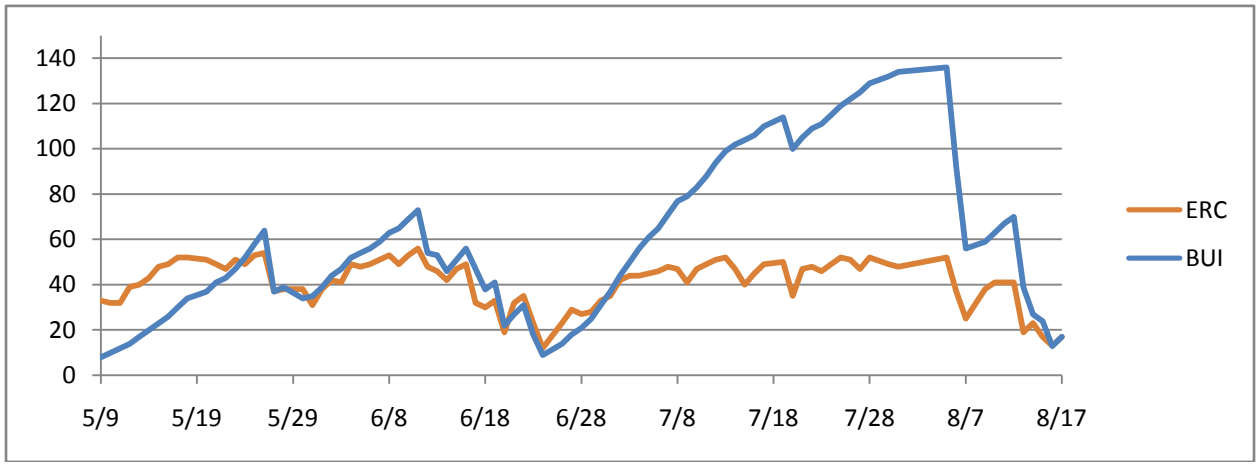

500623-LAKE MINCHUMINA
1989 - 2009
Energy Release Component
70
60
90%
50
50%
40
30
20
10
0
4/1
5/1
6/1
7/1
8/1
9/1
Avg
Max
Min
2009
1 Day Periods
Model: 7G2PE2
1946 Wx Observations
FF+4.0.2 08/19/2009-10:43



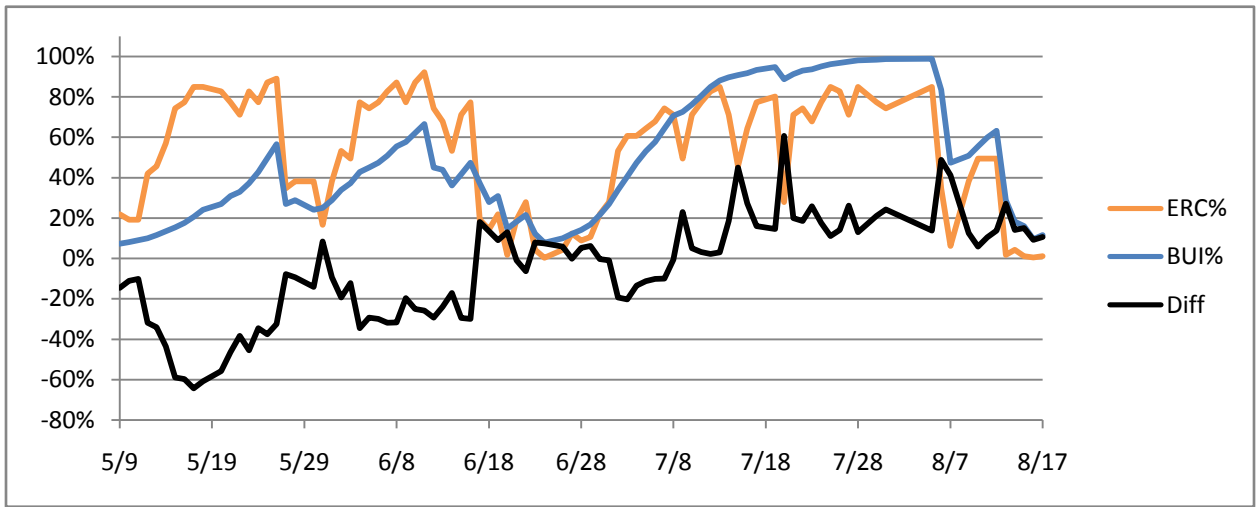
Firefamily Plus plots of ERC (top) and BUI (bottom) for 1989-2009 with 2009 overlain in dark blue. In general ERC tends to damp off as the season progresses.



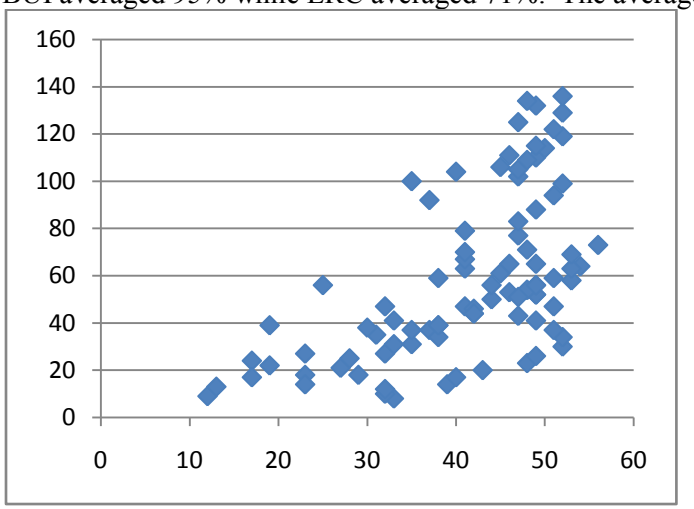
ERC and BUI percentiles for Minchumina RAWS 500623 for the period 1989-2009. In the early and late parts of the season the station suffers from few observations. ERC and BUI require about 40 days to become acclimated from start-up in the spring. ERC declines steadily through the season while BUI builds. Both show declines during August which is the rainiest month. In the middle part of the season, during Alaska's high fire activity months of May-July, ERC generally overestimates moisture conditions and underestimates fire activity.



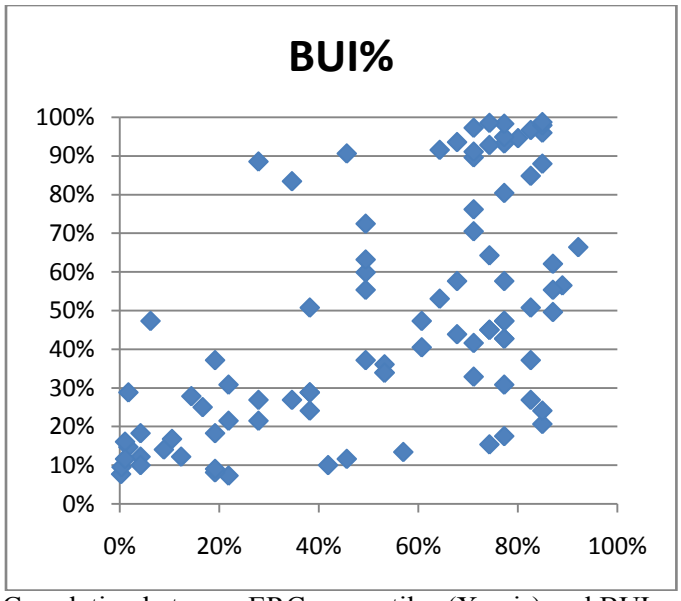
ERC and BUI indices for the 2009 season. The indices tracked well in May and June but de-coupled during the height of fire activity in July.



ERC and BUI percentiles and the difference (black). ERC overestimated BUI in the early part of the season, and underestimated in the latter part. During the Titna Fire analysis period 19 July to 6 August, BUI averaged 95% while ERC averaged 71%. The average difference was 23.5%.



Correlation between ERC (X axis) and BUI (Y axis). The correlation is poor. Scatter at ERC=50 ranges from BUI 20 to 140. The correlation coefficient is 0.58.



Correlation between ERC percentiles (X axis) and BUI percentiles (Y axis). The relationship is better but the correlation is also poor (Correlation coefficient is 0.61).

Conclusions

The assumption that BUI is a better index for Alaska is reasonable given the active 2009 fire season (508 fires, 2,934,666 acres as of 8/19/2009). By using ERC instead of BUI FSPro was operating under approximately the 71st percentile weather conditions at the height of the season instead of the 95th. This conclusion is consistent with my FSPro run on the Titna Fire in which I manipulated the ERC bins to increase fire behavior by 8-10 percentile points to get a reasonable calibration to the actual fire size. FSPro analysts may need to look at both ERC and BUI in Firefamily Plus if reasonable calibrations cannot be run given manipulations to the standard inputs.

Tips

The .fwx weather file can be downloaded straight from FSPro on the ERC Classes tab. At the bottom click the "Download FWX" button. You will still need a station catalog which you can get here. The station catalog may need to be changed to fuel model G if it is listed as something different. FSPro only uses fuel model G because it encompasses many fuel classes and is a general indicator of moisture conditions.