Descriptive Document (Fox, A.D.). Virtual Poster: North and Central California Fire Weather Forecasts for Timber Industry: Revisit Fire Spread and Stability Indices. May 3, 2023

This companion document gives a brief description of the procedure Fox Weather, LLC uses for forecast briefings. These products include the Haines Index (now referred as LAsi Index in this paper), and Fox Weather's Fire Spread Index (fxFSI). We also include a brief presentation of the fxFSRI™ (Fire Severity Risk Index), an emerging product that combines the LAsi and fxFSI into a single illustration.

The most important point to communicate is that both Fox Weather's original Fire Spread Index (fxFSI), built in 2008, and the LAsi Index product (beginning in 2020) now form the basis for Fox Weather's briefings to our Timber clients. During 2010-2019, and prior to introduction of our Haines (LAsi) product, the Fire Spread Index maps was our main Fire Weather briefing product, along with our MtnRT maps of wind vector, and relative humidity (RH), and the site specific spot forecasts.

The fxFSI™ (Fire Spread Index) has been Fox Weather LLC's operational briefing product, which we have used since 2010. An example is in Figure 1. For Fire Weather we serve primarily the Forest Products Industry in California. The fxFSI system uses the National Fire Danger Rating System (NFDRS) fuel moisture as input into the calculation of our spread index (Nelson, 1964). The fxFSRI is a product under development, and currently uses inputs from both the LAsi and fxFSI.

The concept plan is for the final fxFSRI product to use both the old and the new: a) the simple basic format of the Haines index (which we refer as "Lower Atmosphere Stability Index", or LAsi). The LAsi is useful to predict the general environment fire activity risk, based on atmospheric stability in the lower atmosphere region (below the 3000m ASL (700 hPa). The final fxFSRI also uses b) the fxFSI values currently used, and c) inputs from the HDWI input parameters of wind speed (WS) at 50m above ground level (from Fox Weather's MtnRT® system, and VPD at the 50m height. Finally, the reason for using both the FSI and the HWDI's VPD are intended to include the vapor pressure difference. FSI uses relative humidity (RH) but also includes Nelson's (1964) NFDRS fuel moisture that is specified via RH.

We provided seasonal trends studies of the FSI parameter mapped in the fxFSI operational products.

The studies were prepared for Humboldt and Mendocino Redwood Companies (Fox, 2018a and Fox, 2018b). The study showed differences over a three year period between FSI at two near-surface levels. The FSI mean maps basically showed FSI seasonally averaged values at the surface and near canopy top. The elevations are based on wind at 10m height, and T and Td at 2m height, representing surface conditions. The canopy top was nominally placed at 50m height, and representing 50m conditions of these parameters. The 50m value is assumed to be at or above the top of all but the tallest forests. The model wind speed and direction are assumed, therefore, to represent conditions at the canopy top, i.e. unobstructed wind, and outside the microclimatic region of forest canopy, except for the tallest forest stands. Tallest redwood trees are 80 to 84 m (262-275 feet), tallest oaks are around 60m (200 ft). Tallest spruce and eucalyptus are in the 60-90m range (200-295 feet).

Our studies showed that FSI means were most consistent in northwest California for the months of May and June, and showed the greatest variability during September and October for the years 2015-2017.

Basic Concept

Fox Weather LLC's best practice thus far is: Encourage foresters to use maps of concurrent FSI and LAsi together to determine their risk of fire activity for each day, Day1-Day6 inclusive. Currently this is done with two maps. There may be an advantage to producing this as a single map (fxFSRI) once the critical danger threshold of fxFSRI has been recommended.

Next Steps

Our goal is to take the best of the 'old' technology, i.e. Haines Index, and update it as we have already done for the coastal zones of California. Then we will add the better science of using the true vapor pressure deficit and wind speed in the units recommended by Srock, et.al., 2018.

Update the fxFSRI system to replace the current FSRI calculation algorithm. The new fxFSRI will include inputs from FSI(50m), (WS x VPD)50m, and LAsi.

There will be a period of testing and documentation, producing the maps, then documenting fire growth and intensity with satellite imagery.

Acknowledgments

The author wishes to thank Dr. Cajun James, Sierra Pacific Industries (SPI) for support of our forecasts that contributed to this research, and for many good suggestions. I also thank Dennis Thibeault of Mendocino Redwood Company and Mike Miles of Humboldt Redwood Company for their support and suggestions.

I also appreciate the assistance of Leonard Montenegro, modeler and programmer, and Kelly Gearhart, programmer (GIS) for their valuable assistance in the programming and development of visualization products for the forecasts, and inputs into this study.

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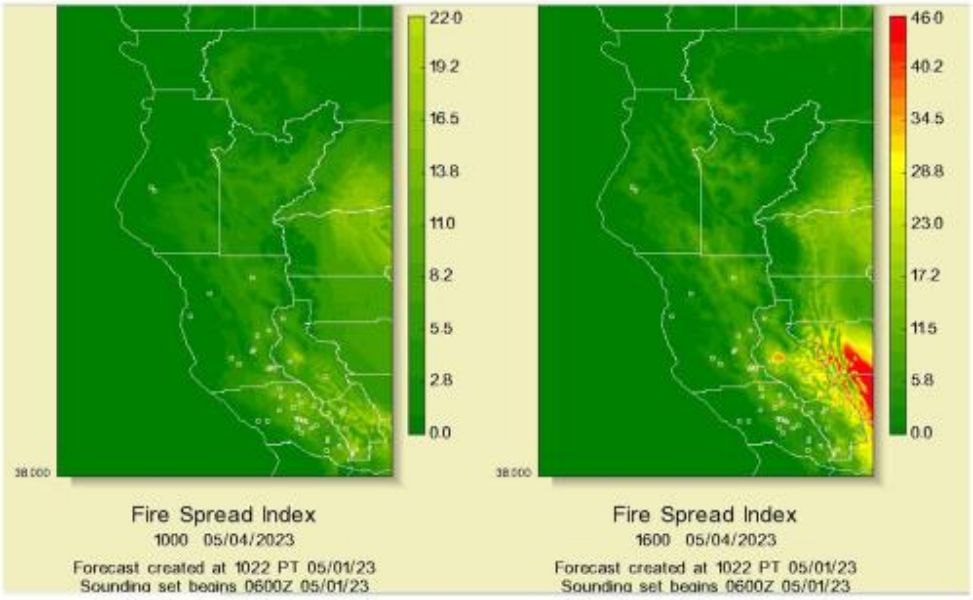
Figure 1. Example of Fox Weather's fxFSI maps.



Northern California Coast, May 1, 2023