

# North and Central California Fire Weather Forecasts for Timber Industry: Revisit FireSpread/Stability Indices

## Our Approach

- Fire Spread Index (fxFSI™, abbreviated to FSI) + Lower Atmosphere Stability Index (LAsi)
- Original Haines Lower Atmosphere Severity Index (LASI) (Haines, 1988) is renamed here to LAsi (Stability Index) to avoid confusion
- We refined LAsi index to include extra layer for Marine Layer detection near coast
- Improved LAsi in 2019 to improve Marine Layer and low level inversion variations across near-coastal terrain. It makes our LAsi (Haines) index product more useful for detecting low level inversions, and realistically depicting marine layer influences.
- FSI originally based on T, RH, and NFDRS fuel moisture parameter-based calculation. Standard Atmosphere vertical resolution in meters at 25 hPa intervals is ~218 at 900 hPa to 287m at 700 hPa and 290m at 675 hPa for general guidance. Therefore, we can expect the vertical resolution of FSI to be about 220-290m, compared with 500m in the HDW index.
- Adding Vapor Pressure Difference  $VPD=(VP(T)-VP(Td))$  similar Srock, Potter et.al. 2018 suggested approach used in HDW Index.
- MtnRT® system and FSI algorithm written in 2008. 15 year performance record.

## Concepts: Using FSI and LAsi together in an operational setting.

- Produced ability to anticipate Red Flag conditions by as much as 7 days in the future during the past six years (since 2017).
- Best practice thus far: Foresters use maps of concurrent FSI and LAsi together to determine their potential risk of fire severity out one week based on evolving warm-dry-windy events in our daily forecasts for Sierra Pacific Industries (Anderson, CA).
- This practice has worked well to corroborate and anticipate NWS Red Flag warnings.
- The practice is similar in principle to the Hot-Dry-Windy (HDW) pattern (Srock, et.al., 2018). The HDW Index can provide a single-parameter map (of HDWI)
- Description of Fox Weather's fxFSI™ system (Fire Severity Risk Index).

## Findings

- Combining the FSI and LAsi into a single-parametered map (fxFSRI) Fire Severity Risk Index. Initial results with fxFSRI are shown here as concept slides.
- Preliminary results:
  - In preliminary testing, fxFSRI performed well in calculating potential for higher fire severity risk than the FSI or wind vector maps for the same period and event.
  - The original fxFSRI algorithm needs revision before it can be used operationally. We are working on this. We are implementing tests with  $wspd \times (VPD)$  as an option for fxFSRI.

## fxFSRI Illustrations from June 2019 in Central and N California Forestry Areas

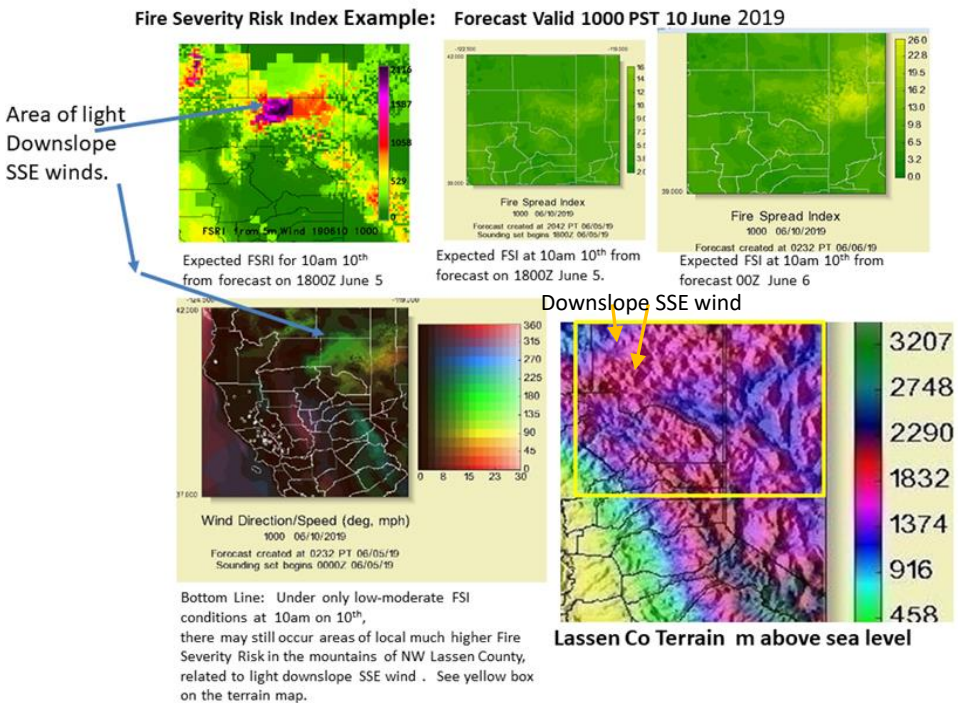
- June 10 10am: see upper right side of this page.
- A few other illustrations of fxFSRI will be included in materials uploaded to the web site, including this presentation.

## Seasonal Trend Study of Fire Spread Index for Humboldt/Mendocino Redwood Companies, 2015-2017.

- Compared means of FSI for surface 2m T, Td, and windspeed 10m, versus FSI from all three parameters 50m above terrain (~canopy top) FSI\_50.



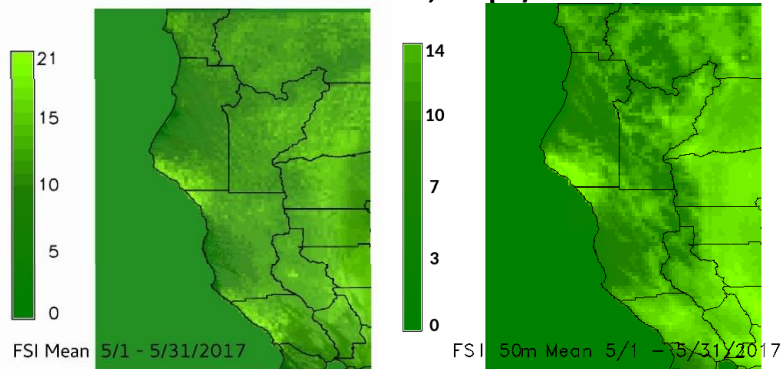
Alan D. Fox  
Fox Weather, LLC  
May 3, 2023



## Difference in Means for FSI vs. FSI\_50m:

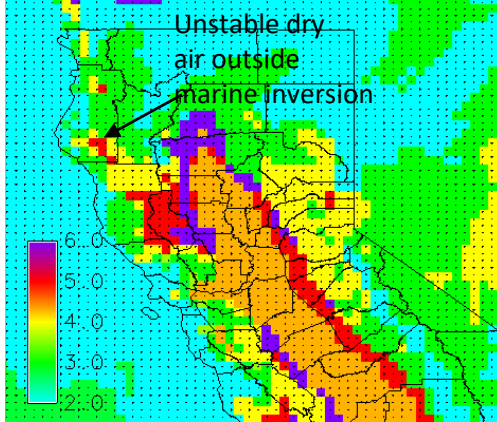
### FSI vs. FSI\_50m for 2017

- FSI: T,Td at 2m, WSpd 10m
- FSI\_50m: T,Td at 50m, WSpd/Wdir 50m

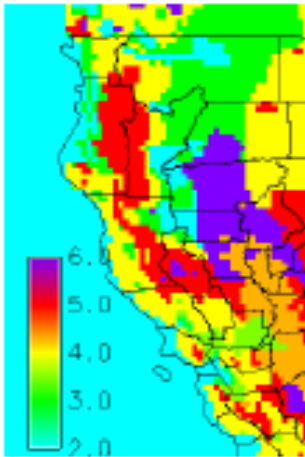


## Poster Slide 2

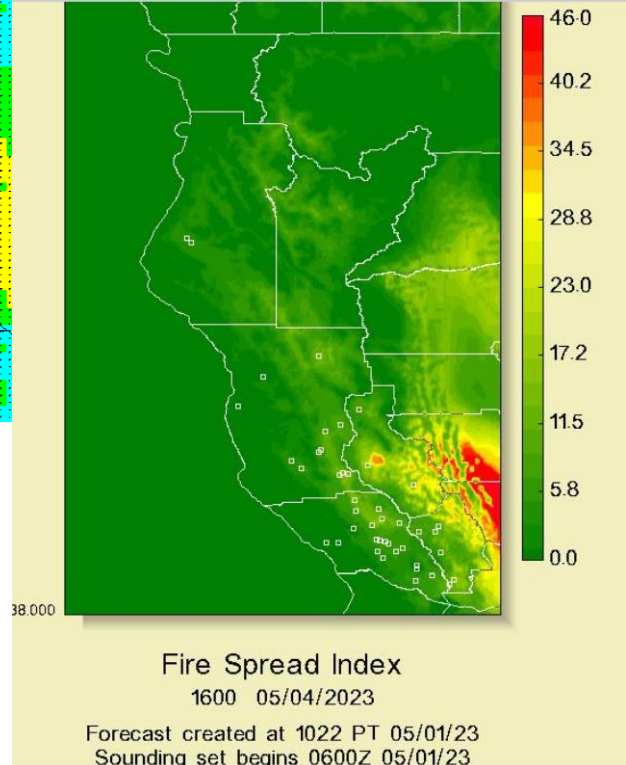
- Improvement to the Fox Weather, LLC Haines Index Maps product (LAsi): good handling of marine layer moisture (light blue). Former version did not handle marine layer conditions.



Initialized 23-04-10 06:00 UTC,  
valid 23-04-15 1600 PST, T+138 h



Initialized 21-05-26 00:00 UTC 6km grid.  
Forecast valid 21-06-02 at 1600 PST (T+168 h)



**SSW Downslope Flow from  
Vaca Mountains on E edge of  
Napa and Lake Counties in red  
High FSI Region.**

## References

- Fox, A.D., 2018a: Fire Weather Reconstruction for Counties of Santa Clara and Santa Cruz, Septembers and Octobers 2017, 2019 and 2020. Fox Weather Technical Report No. 211115, November 15, 2021, 15 pp.
- Fox, A.D., 2021: Specific Fire Weather Reconstruction for Sonoma and Marin Counties in Septembers and Octobers 2017, 2019, and 2020: Fox Weather Technical Report No. 210130, 11 pp.
- Tukman, Mark, 2022: Santa Clara, Santa Cruz, and San Mateo County Wildfire Risk to Structures and Classified Wildfire Hazard Maps Final Report, Tukman Geospatial, inc., November 7, 2022. Report was provided to the Fire Prevention Planning, Santa Cruz Mountains Stewardship Network, et al, 65 pp. Fox Weather, LLC provided input raster grids for this report including Fire Spread Index maps for each day of the three year sample period. The project task was: "2020 Santa Clara, Santa Cruz, San Mateo Counties Wildfire Risk to Structures and Classified Wildfire Hazard Maps for Fire Prevention Planning, Santa Cruz Mountains Stewardship Network".
- Nelson, R.M., 1964: The National Fire Danger Rating System: Derivation of Spread Index for Eastern and Southern States. U.S. Forest Service Research Paper SE-13. September, 1964, pp. 1-37. Pages of relevance for this report are pp. 26-34.
- Fox, A., 2018b: Maps of Mean Fire Spread Index at two elevations above terrain for assessing Fire Hazard Risk across coastal northwest California. Fox Weather Technical Report No. 180519, 47 pp.
- Fox, A.D., 2019: Mean Fire Spread Index Maps for Humboldt and Mendocino Counties for August- October 2015-2017 with description of MtnRT calculation of Fire Spread Index. Final Report July 18, 2019, 50 pp.
- Srock, A.F., J.J. Charney, B.E. Potter, and S.L. Goodrick, 2018: The Hot Dry Windy Index: A New Fire Weather Index, Atmosphere 2018, 9, 279, doi: 10.3390/atmos9070279. Section 2 of this report was particularly useful.

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