D. Vegetative Wildfire Fuels

Photo 11: Chemise

As mentioned previously, all the factors that effect wildland fire behavior can be categorized into three environmental elements: weather, topography, and fuel. Wildland fire fuels refer to all combustible material available to burn within a given area of land. There are four universally agreed upon fuel types as defined by the National Wildfire Coordination Group (NWCG); grass, shrub, timber litter, and logging slash. Each fuel type has its' own set of fuel characteristics dependent upon several inherent factors. NWCG outlines these fuel characteristics as[7]:

- **Chemical Content**: Substances in the fuels which can either retard or increase the rate of combustion, such as high mineral content, oils, resins, wax, or pitch.

- **Compactness:** The spacing between fine particles. This can be especially important in the surface layer of fuels, where the amount of air circulation affects rate of drying, rate of combustion, etc.

- **Fuel Loading**: The oven-dry weight of fuels in a given area, usually expressed in tons per acre. Fuel loading may be referenced to fuel size or timelag categories; and may include surface fuels or total fuels.

- **Fuel Moisture**: The amount of water in a fuel, expresses as percentage of the oven-dry weight of that fuel.

- **Horizontal Continuity**: The horizontal distribution of fuels at various levels or planes. Two categories: patchy or uniform.

- **Size and Shape**: Affects the fuel moisture timelag, the amount of heat required for ignition and to sustain combustion, and the burnout time of fuels. Surface-area-to-volume ratio is a representation of size and shape.

- **Vertical Arrangement**: The relative heights of fuels above the ground and their vertical continuity, which influences fire reaching various levels or strata. (Surface fuels vs. aerial fuels, and their relationships to one another.)

[7] NWCG S-290 Intermediate Fire Behavior NFES 2378 July 1994.

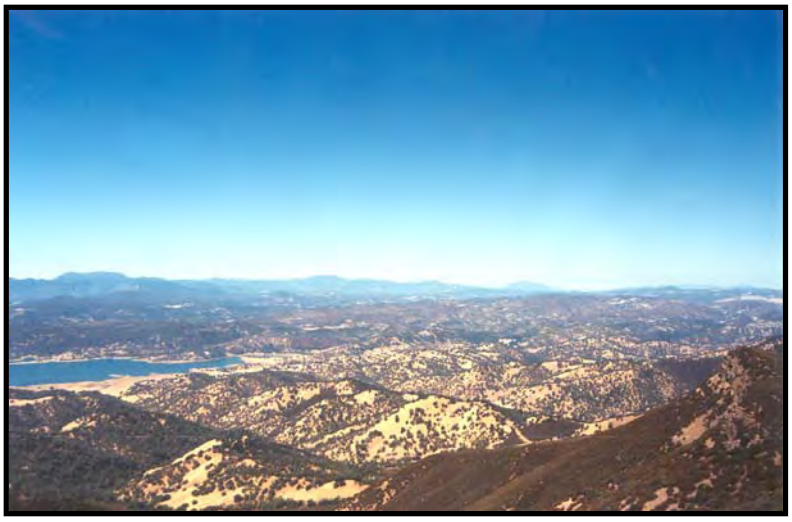


Photo 12: View of Napa and Lake Counties from Berryessa Lookout circa 2001

All of the factors contribute to fire spread, intensity, and threats to assets at risk. And recognizing that it is the only environmental factor we can easily modify, it is important to understand this fact. As an example, consider fire intensity. It is directly related to fuel loading, which is measured in tons per acre. Grass is considered a light fuel at less than one ton per acre, while brush, at up to fifteen tons per acre, is considered a heavy fuel. Some timber stands comprise extremely heavy fuels loads, especially in the coastal conifer type, which may have fuel loadings in excess of fifty tons per acre. Lighter fuels burn with a more rapid rate of spread and are characterized by a relatively short period of intense heat output. Brush and timber, on the other hand, exhibit a somewhat slower rate of spread, but a very high output and longer residual heat production. So, the fuel loading fuel characteristic factor effects fire behavior, and consequently fire suppression strategies and tactics. This in turn dictates resource needs.

The United States Forest Service (USFS) has developed thirteen fuel models that categorize fuels by their "burn" characteristics, for the purpose of estimating fire behavior. They were developed to be used throughout the Nation, and scientifically are a "set of numbers" that when inputted into a computer model, represent how a certain fuel model will burn. There are three grass fuel models, four shrub, three timber litter, and three logging slash. Following is a short description of each fuel model from "Aids to Determining Fuel Models for Estimating Fire Behavior[8]:"

[8] Aids to Determining Fuel Models. Anderson, Hal E. 1982 USDA Forest Service Technical Report INT-122.

Fuel Type	Fuel Model	Description
GRASS	1	This model is used for short; generally below knee level or about one foot tall, fine textured grass that best represents typical grasslands and savannas. Less than one-third of the area has other vegetation like shrubs or trees. No live fuel moisture. Fuel loading ranges from ½ - ¾ of a ton per acre. Fires burn rapidly with flame lengths averaging four feet.
	2	Dominated by grass about one to two feet tall, usually under an open wooded or timber canopy. Four to five tons of fuel is found per acre and the fuel bed depth is one to two feet. Model contains live fuel moisture. Litter from tree canopy and species composition increases fire intensity but reduces fire spread.
	3	Not applicable to LNU.
SHRUB	4	Brush model and is characterized by stands of mature brush six feet or more in height with continuous, interlinking crowns, with fuel load ranging from fifteen to eighty tons per acre. No live fuel moisture. Fires in this fuel model burn intensely and spread very quickly.
	5	Same specie composition as fuel model four, but individual plants are shorter, usually sparser, and less mature with little or no dead component. Contains live fuel moisture. Occurs on poor sites, on recent burns, and may occur under tree canopies. Fires in this fuel model do not burn as intensively, nor rapidly due to higher concentrations of live-to-dead fuel.
	6	Consists of vegetation that is taller and more flammable than that of model five, but not as tall or as dense as model four. Interior live oak, young chemise and manzanita, area all considered species associated with this model. In many instances a fuel model five will evolve into a fuel model six by the latter part of the summer. Fires in this model will burn in the foliage of standing vegetation, but only when wind speeds are greater than eight miles per hour. Fires burn with an average flame length of six feet.
	7	Not applicable to LNU.

Fuel Type	Fuel Model	Description
TIMBER LLITER	8	Mainly needles, leaves, and occasionally twigs because there is little undergrowth below a conifer or hardwood canopy. May contain occasional "jackpots," or heavy accumulations of fuel. Closed canopy stands of short needle conifers or hardwoods that have leafed out support fire in the compact litter layer. No live fuel moisture. Fires in this model burn slowly due to compaction, and do not pose control threat unless there is high temperatures, low relative humidity, and high winds that allow the fire to spread into the canopy. Symbolic of what is created by a shaded fuel break.
	9	Similar to a model eight, except has more fine fuels, about two to four tons per acre, which create a deeper and not as compact layer of leaves and needles. Fires burn with more intensity than fuel model eight with flame lengths from three to six feet.
	10	A shrub, sapling, or immature tree understory with a loading of fine fuels from three to four tons per acre and a "heavy" loading of more than twelve tons per acre. Fires in this model burn with a moderate rate of spread, flame lengths ranging from six to ten feet. There is also occasional individual torching of trees, which can cause embers to be cast and start spot fires. Poses the most control problems of the three timber litter models.
LOGGING SLASH	11	Not applicable to LNU.
	12	Not applicable to LNU.
	13	Not applicable to LNU.

Table 4: Fuel Model Descriptions

In order to analyze where "hazardous" fuels exist that will threaten any assets at risk or cause resistance to fire suppression, the fuel models were used in conjunction with GIS to create "planning belts." Generally speaking, all lands mapped in a particular planning belt will exhibit similar fire behavior characteristics that impact suppression activities, and thus are subject to similar planning consideration. These planning belts are displayed in Figure 14.

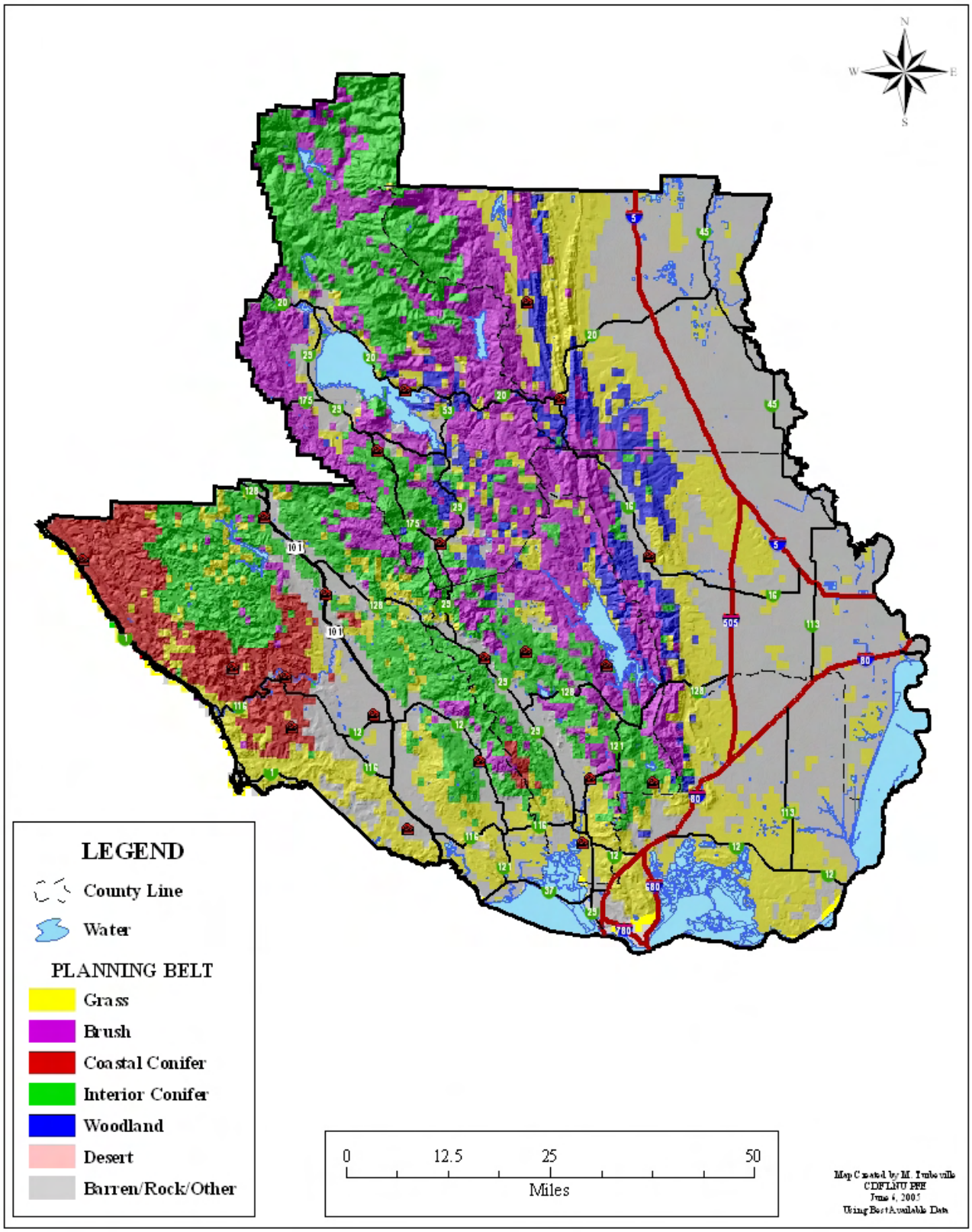


Figure 14: LNU Planning Belts

To derive fuel rank, or fuel hazard ranking, other factors are combined with the fuel type and modeled. The first step in the process is combining the fuel models by their slope location classification. Unique fuel model-slope combinations were created using the fuel models and six slope categories: 0-10%, 11-25%, 26-40%, 41-55%, 56-75%, and over 76%. Using BEHAVE fire modeling software the outputs for each fuel model-slope combination was plotted on a rate of spread vs. heat per unit area graph, and the results were divided into three "surface ranks."

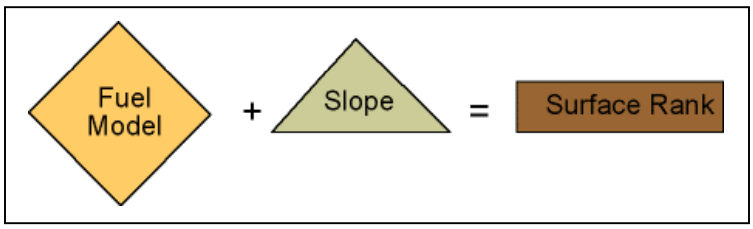


Figure 15: Fuel Assessment Process #1

After the surface rank was determined, the additional fuel factors of ladder and crown index where combined to create a "fuel rank." These factors indicate the probability that torching and crown fire will occur if the vegetation were subjected to a wildfire under adverse fire weather conditions. Thus this ranking includes the hazards of canopy involvement in fire along with the surface fire. The BEHAVE software is used again to complete this step using unique combinations of topography and fuel under given weather conditions.

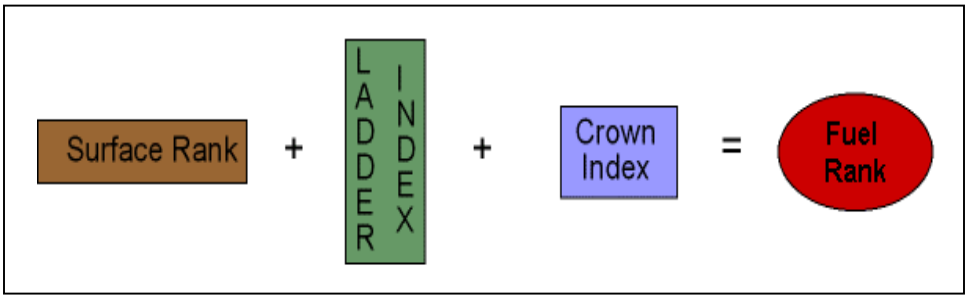


Figure 16: Fuel Assessment Process #2

The potential fire behavior drives the hazard ranking. The resulting fuel rank is assigned to each Q81st within the Unit's SRA to comprise an approximation of the local wildfire hazard. The fuel rank is divided onto three categories: moderate, high, and very high. These results are depicted in Figure 17, the "Fuel Hazard Ranking Map." All fuels, at a minimum, are classified as moderate.

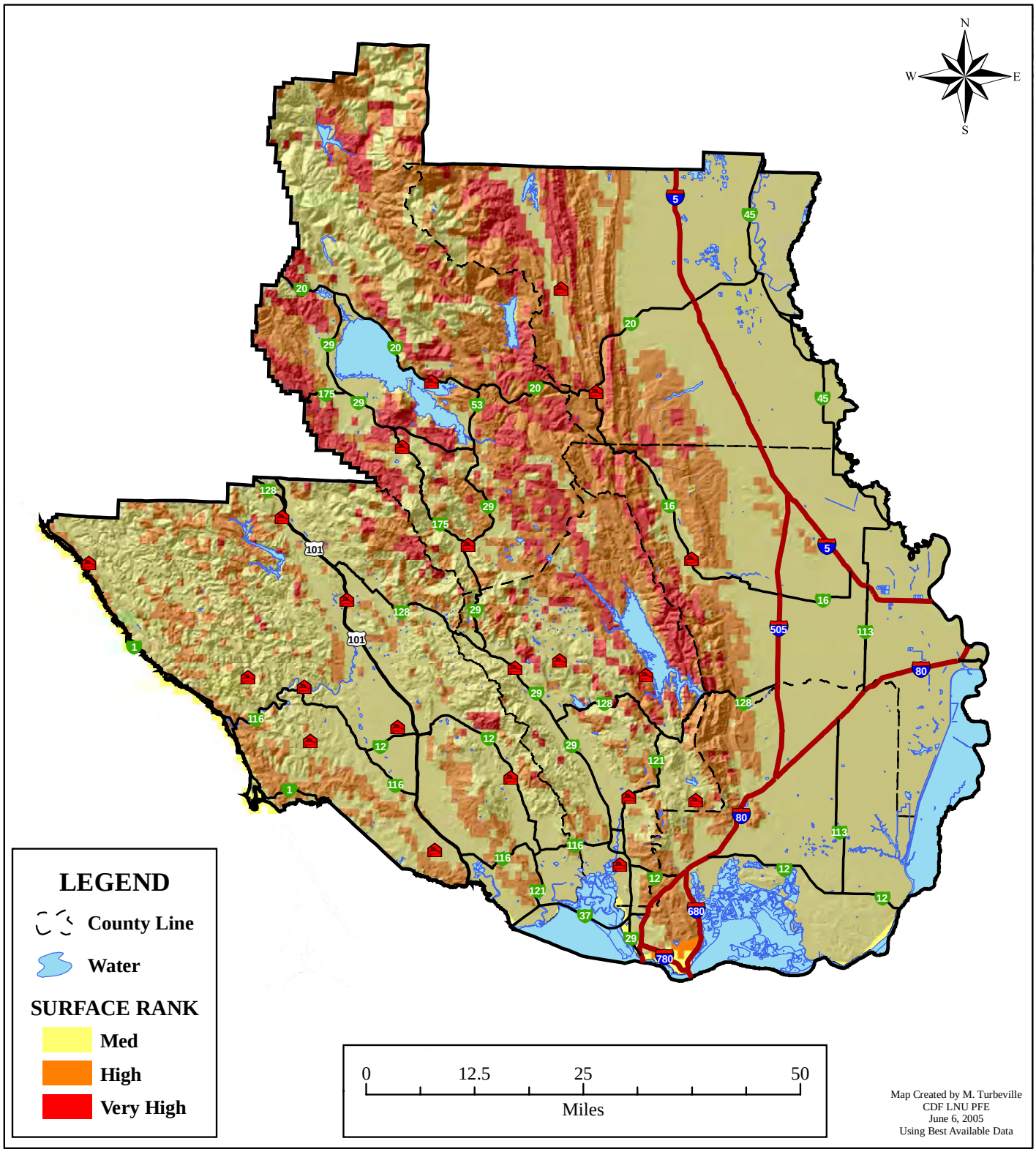


Figure 17: LNU Surface Fuel Ranking

This assessment of wildfire hazard, when combined with the previously described assessment of assets at risk, provide a basis for prioritizing areas for treatment and other forms of pre-fire management. Using this map as a guide, knowledge of fire behavior can be applied to develop pre-fire prescriptions for specific vegetation types and situations. For instance, a community in grass vegetation type may be protected by an annual mowing regimen along roadsides. A brush land community may require a series of prescribed burns implemented systematically, over time, to reduce fuel loads. And a community in the timber type may benefit from a strategic system of shaded fuel breaks. A combination of the aforementioned may be needed in a community that has more than one fuel type. In fact, all of these pre-fire management tools are employed as part of LNU's fire management plan. (These are described in the Project section of this Plan.)

Another fuel factor that isn't considered in the fuel's assessment is the presence of Sudden Oak Death (SOD). SOD has been detected in four of the six counties in LNU: Sonoma, Napa, Solano, and Lake counties. SOD was first noticed in 1995 in the counties of Marin and Santa Cruz, and has caused the death of several species of trees at a landscape level.

Photo 13: Aerial View of Sudden Oak Death in Battalion 1411. April 30th, 2005

SOD is a forest disease caused by the plant pathogen *Phytophthora ramorum*. This pathogen has caused widespread dieback of tanoak and several oak species (coast live oak, California black oak, Shreve's oak, and canyon live oak) in

California's central and northern coastal counties. It has also been found to infect the leaves and twigs of numerous other plants species. While many of these foliar hosts, such as California bay laurel and *Rhododendron* species, do not die from the disease, they do play a key role in the spread of *P. ramorum*, acting as breeding ground for innoculum, which may then be spread through wind-driven rain, water, plant material, or human activity. *P. ramorum* thrives in cool, wet climates. [9]

This gross dieback of native vegetation at such a large level with no solution in sight, will increase the fuel loading available to burn and dramatically increase fire behavior. Because the disease also weakens the trees, there is an increased danger to firefighters working under or near them.

E. Structure Fuels

One incomplete aspect of the previously discussed vegetative wildfire fuels analysis is the consideration of structures located within the wildland areas. To a wildfire, a structure is *just* another fuel. And as mentioned before, the only element of the three environmental elements that influence the behavior of wildfire that we, as humans, can change is fuel. If a structure is in the planning stages, design and construction material recommendations can be made to make the structure less prone to be ignited by a wildfire. However, if the structure is already built, the easiest factor to change may be to implement various fuel modifications around the structures in order to protect them form encroaching wildfires. Public Resources Code (PRC) 4291 addresses fuel modification and the concept of "defensible space." Defensible space can both be thought of for protecting a structure and also providing firefighters with a safe environment to position their fire apparatus and perform the necessary function to prevent the structure from igniting. Unfortunately, the proper building construction and defensible space cannot guarantee that the structure will survive all wildfire possibilities.

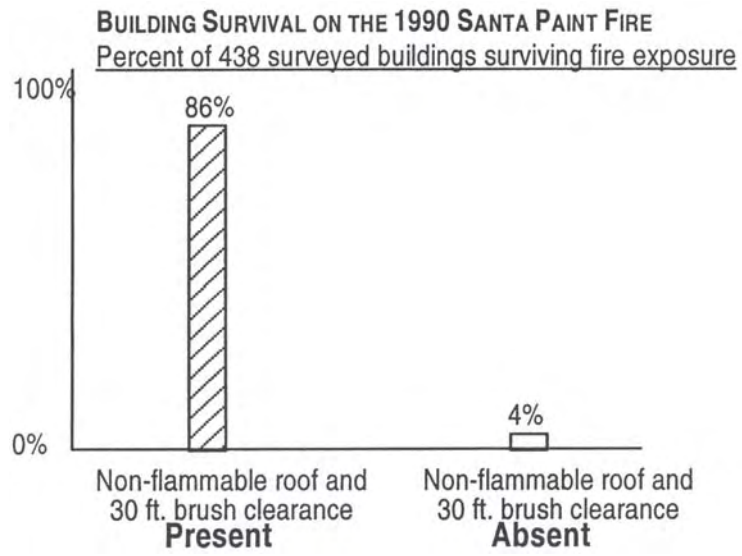
Photo 14: Structures Destroyed by Wildfire During 2004 Fire Season

The following excerpt is from a paper prepared by CDF Battalion Chief Ethan Foote, who is assigned to CDF's Northern Region office in Santa Rosa. Besides writing

[9] California Oak Mortality Task Force website. Accessed June 10th, 2005.

this paper, he was the principal researcher on the study of the Paint fire that is mentioned in this excerpt.

> "One of the major objectives of wildfire control in general, and pre-fire management hazard reduction in particular, is to reduce the loss of life and property. The historical pattern of building loss during interface fires indicates that vegetation fuel management must go hand-in-glove with ignition resistant building construction to maximize the effectiveness of fire loss mitigation measures.
>
> Building loss and survival on the 1961 Bel Air fire, which destroyed 505 houses, was well documented. The report "Decision Analysis of Fire Protection Strategy for the Santa Monica Mountains" found that 71% of the buildings with 26-50 feet of brush clearance survived the fire. However, the survival rate of buildings exposed to the fire increased to 95% for houses that had both brush clearance and ignition resistant building construction (in this case non-wood roof covering). A similar pattern was seen on the 1990 Santa Barbara Paint fire, shown graphically below.



> On the Paint Fire, which destroyed 479 houses and major buildings, the survival rate (above) was 86% for houses with both non-flammable roofing and 30 feet of brush clearance. Only 4% of the 438 houses surveyed in the Paint Fire survived where non-flammable roofing and 30 feet of brush clearance were absent. The modeling of structure loss and survival on the Paint Fire revealed that brush clearance alone only "explained" or accounted for 11% of the variation seen in the structure survival patterns. When brush clearance was combined with roof type in

the model, and the effect of defensive actions was accounted for, the model explained 59% of the variability in structure loss.

This is strong evidence that vegetation management *alone* will not be able to fully explain, nor mitigate, building loss on wildfires. Hence the need for the comprehensive approach in this plan, using a combination of vegetation management and addressing recommendation for ignition resistant building construction. There is also strong evidence that this comprehensive approach will work to significantly reduce interface losses. The "Los Angeles Time" (1 April 2004) reporting on the Southern California conflagrations of October 2003 clearly revealed the need for, and effectiveness of, combining vegetation management and ignition resistant building construction for reducing building loss in wildfires:

> "Amid the ashes of the mostly costly wildfires in California's history lies evidence of a crucial lesson: Fire-resistant construction and vigilant removal of flammable vegetation significantly improved the odds of a home's survival, according to a Times analysis of fire records from more than 2,300 destroyed structures.
>
> The impression left by an out-of-control fire racing through communities can be one of random destruction, with one house, or a whole block, burned to the ground and the next one spared for no apparent reason.
>
> In fact, according to the Times analysis – which covered homes destroyed by the deadliest of the blazes, San Diego County's Cedar Fire – houses built since 1990 were far less likely to burn than those constructed in any previous decade. Houses built during the 1990s were damaged or destroyed at less than half the rate of houses built earlier."

The communities and homeowners covered by this plan have, for the past 40 years, had recommendations that can be (and have been) taken to reduce the ignitability of structures. An outcome of the 1961 Bel Air fire was the publication of the "Fire Safety Guides for California Watersheds" by the County Supervisors Association of California in 1965. These recommendations have been updated through the years. The current version of these "Fire Safe Guides" is "Structural Fire Prevention Field Guide for Mitigation of Wildfires" and can be found at Http://osfm.fire.ca.gov/structural.html.

These recommendations for ignition resistant building construction include:

- Roofing
- Eaves & Balconies
- Exterior Walls
- Rafters
- Windows
- Doors
- Attic Ventilation Openings
- Underfloor Areas
- Decking

In response to the persistent loss of life and property in wildfires the most important of the recommendations is now a requirement. All new buildings, and significant re-roofing of existing buildings, in the communities covered by this plan are required to have ignition resistant roofing (California Building Code § 1503). The State of California is also in the process of promulgating changes to the state building code expanding the interface roof requirements and including new requirements addressing exterior wall construction, vents, and ancillary structures."

At the time of the writing of this Plan, CDF is engaged in creating updated and more accurate maps to depict fire hazard ranking areas. The previous map that is still being used was produced nearly 20 years ago and was based upon personal observation rather than using a modeling program such as what GIS can provide using inputs including fuel models and slope classes. Sonoma and Calaveras were chosen as the two initial test counties for a mapping project that will eventually be completed statewide. Future building codes will reference these maps with the intent that structures will be modified based upon what hazard zone it will be built in. For example, a proposed structure in a medium hazard zone wouldn't need as much construction mitigation as the same structure in very high hazard zone.

Figure 18 was produced to depict the concentrations of structures in the Unit. County parcel data was used, and rankings are done using the Q81st defined areas. The colors represent different housing density classes as described in the table below. The term unit is utilized instead of structures because "large" structures such as multi-family dwelling or condominium are considered to have more units per parcel than using "houses."

Density Class	Housing Density
Very High	Over 1 unit per 5 acres
High	1 unit per 20 acres to 1 unit per 5 acres
Medium	1 unit per 160 acres to 1 unit per 20 acres
Low	Less than 1 unit per 160 acres
Not Ranked	Not Populated (e.g. wilderness areas)

Table 5: Description of Housing Density Classes

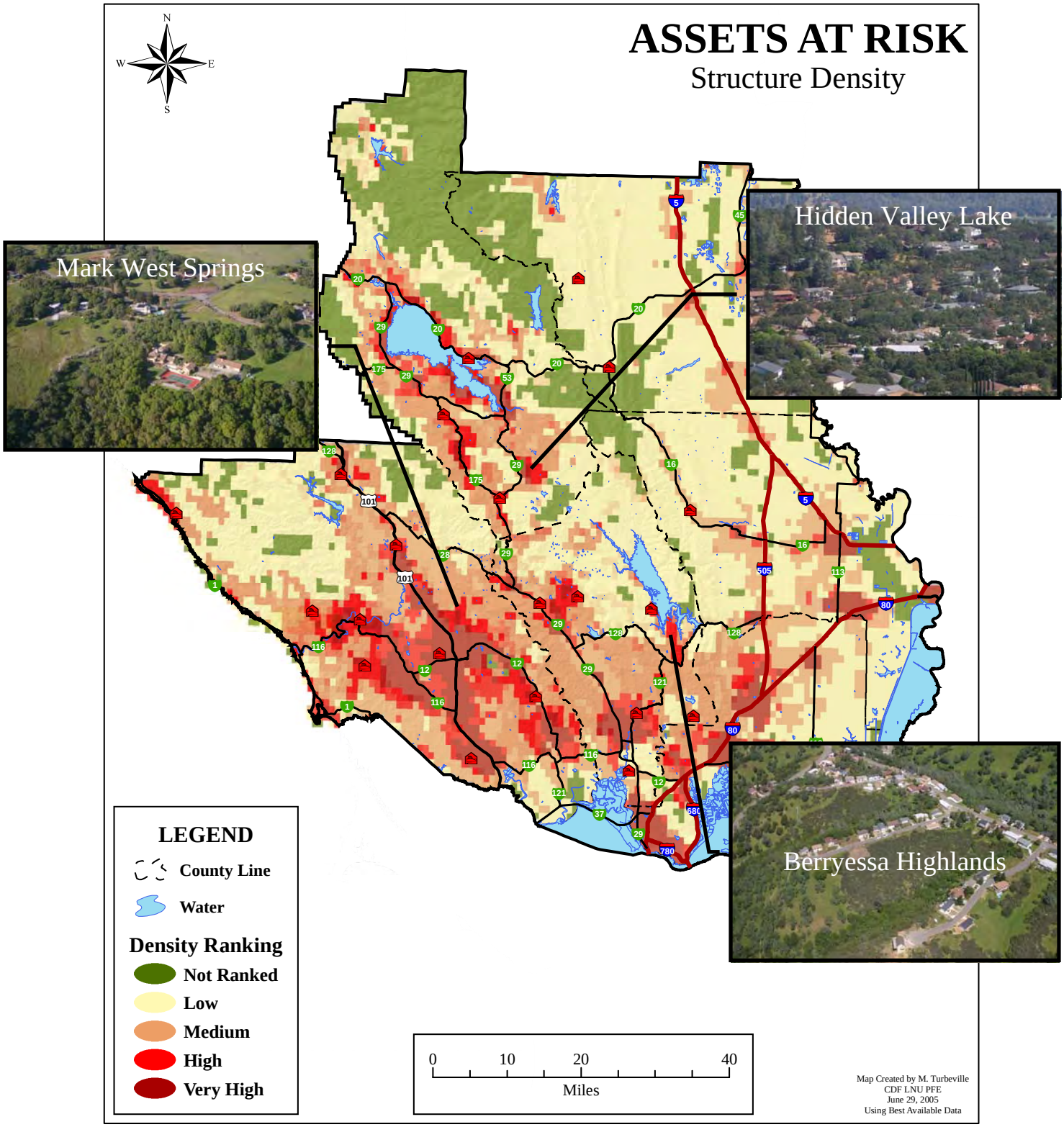


Figure 18: LNU Structure Density Ranking

Besides what was mentioned in Foote's excerpt, there are other considerations outside of what PRC 4291 encompasses. Some of these considerations are included in local "firesafe" ordinances at the county level such as access, water supply, and addressing. Access refers to the road surface, width, grade, and pullouts to allow passing. Water supply describes on-site water storage and delivery systems. Addressing specifies signing standards in order to locate a structure. These additional considerations are inspected when the structure is built, and it is the structure owner/occupant's responsibility to maintain the road, water supply, and address. Too often this maintenance isn't performed.

Photo 15: Wildland Urban Interface Photos

And still yet are other hinderers to firefighting such as locked gates, inadequately constructed bridges, roads blocked by vehicles, heavy accumulation of vegetation along road, and bad addresses provided by 9-1-1 operators.

Photo 16: Wildland Urban Concerns

CDF uses an internal form referred to as "LE-38" for Law Enforcement form number 38 to complete PRC 4291 defensible space inspections. Common terminology for CDF personnel is "LE-38 inspections" or "defensible space" inspections.

Additional information regarding defensible space, PRC 4291, and local ordinances is available at CDF fire stations, and CDF's website (www.fire.ca.gov). An example of available literature is shown on the following page.

Figure 19: Example of Material Available on CDF Website

F. Frequency of Severe Fire Weather

Fire behavior is dramatically influenced by weather conditions. Large, costly fires are frequently, though not always, associated with severe fire weather. Severe fire weather is typified by high temperatures, low relative humidity, and strong surface winds. The State fire plan weather assessment considers the different climates in California. There are also various different climates in LNU. The Pacific Ocean to the west and the San Francisco Bay to the south greatly affect the Unit weather, as does the eastern edge of the Unit being the western edge of the Sacramento Valley. Each of these local climates experiences a different frequency of weather events that lead to severe fire behavior as a result of the weather.

It is easy to state that high temperatures, low relative humidity, and strong winds contribute to extreme fire behavior, but it is difficult to quantify each of them and even more difficult to realize the effects each weather factor has on each other. The state fire plan's weather assessment uses a Fire Weather Index (FWI) that was developed by researches at the USDA Forest Service's Riverside Fire Laboratory. This index combines air temperature, relative humidity, and wind speed into a single value "relative" index. Refer to Figure 20 for the formula.

$$FWI = \eta \sqrt{\frac{1 + U^2}{0.3002}}$$

Where: U = wind speed (miles per hour)

$$\eta = \left(\frac{m}{30}\right) + 1.5\left(\frac{m}{30}\right)^2 - 0.5\left(\frac{m}{30}\right)^3$$

Where: m = equilibrium moisture content and is a function of temperature in degrees Fahrenheit (T) and relative humidity (h) in percent

For h less than 10%: $m = 0.03229 + 0.281073h - 0.000578hT$

For h from 10 – 50%: $m = 2.22749 + 0.160107h - 0.01478T$

For h greater than 50%: $m = 21.0606 + 0.005565h^2 - 0.00035hT - 0.483199h$

Figure 20: Fire Weather Index Formula

Corresponding fire behavior with each FWI values is described in the following table.

FWI Value	Adjective	Description
0 - 5	Very Low	Fires are not likely to start. If started, they spread very slowly or may go out. There is little flaming combustion and generally only the upper portion of the litter is consumed. Control is readily achieved and little or no mop-up is required.
6 – 10	Low	Ignition may take place near prolonged heat sources. Spread is slow in forests, and moderate in open areas. These are light surface fires with low flames; generally, the litter layer is consumed. Control is readily achieved, and some light mop-up will be required.
11 – 15	Moderate	Flaming matches may start fires. Spread is moderate in forests, fast in open areas. Fires burn on the surface with moderate flames, Some of the duff may be consumed on dry sites. Control is not difficult and light to moderate mop-up will be necessary.
16 – 20	High	Flaming matches will probably start fires. Spread may be fast in the forest, though not for sustained periods. These are hot surface fires with some individual tree crowns being consumed. Short range spotting may occur. Much of the diff will be consumed on shallow and dry sites. Control may be difficult, and mop-up will require a moderate effort.
21 – 30	Very High	Ignition can occur readily. Spread will be fast for sustained periods. Fires may be very hot, with local crowning and medium range spotting. Much of the duff will be consumed on moderately deep and normally moist sites. Control will be difficult and mop-up may require an extended effort.
31+	Extreme	Ignition can occur from sparks. Rates of spread will be extremely fast for extended periods. Fires will be very hot, and there may be extensive crowning and long range spotting. Much of the duff will be consumed on deep and normally wet sites. Control may not be possible during the day and mop-up will be difficult and extensive.

Table 6: Fire Weather Index Value and Corresponding Fire Behavior

This index is calculated from ten years of hourly weather readings (COUNTWX) collected at remote activated weather stations (RAWS). The FWI doesn't include fuel factors such as fuel type or fuel moisture, nor does it consider topography other than the topographic features that affect the weather station data collection. Each weather station is assigned a representative weather region. Table 7 describes the RAWS in LNU.

Station	ID	WIMS ID	Owner	Latitude	Longitude	Elevation (feet)
Alder Springs	ADS	041101	USFS	N 39.650	W 122.725	4500
Booneville	BNV	041001	CDF MEU	N 38.950	W 123.340	840
Brooks	BSS	042202	CDF LNU	N 38.718	W 122.135	360
County Line	CYL	041410	BLM	N 39.019	W 122.412	2085
Eel River	EEL	041005	USFS	N 39.825	W 123.083	1500
Knoxville Creek	KNO	041409	BLM	N 38.883	W 122.417	2200
Konocti	KNC	041411	CDF LNU	N 38.917	W 122.717	2100
Lyons Valley	LYO	041408	BLM	N 39.125	W 123.071	3200
McGuires	MGS	041017	CDF MEU	N 39.336	W 123.601	520
Redding	RED	040611	CDF SHU	N 40.516	W 122.291	502
Sac NWR	SWR	041102		N 39.367	W 122.150	95
Santa Rosa	STA	042009	CDF LNU	N 38.470	W 122.703	600

Table 7: LNU Remote Activated Weather Station (RAWS) Attributes

Photo 17: Sample of Unit's Weather

Every day, throughout the year, RAWS observation data is electronically submitted to an electronic national database. Air temperature, relative humidity, and wind speed are extracted from this database to calculate the fire plan's FWI. These collected values are inputted into the FWI formula and compared to a "threshold" FWI value that is derived from average "bad" fire weather conditions of 95°F, 20% relative humidity, and a wind speed of seven miles per hour (MPH) at eye level. This equates to a FWI value of 29.725, and any value above it is considered "severe."

The frequency of severe fire weather is defined as the percentage of time during the budgeted fire season[10] that the representative weather stations recorded observations (WXINSEAS) that when computed equate to, or are greater than 29.725. Non-fire season data is not considered, as the fuels are not in a state in which they readily burn regardless of the severity of weather. Naturally, there are rare exceptions to this; however it is not feasible to factor in all possible contingencies. Moreover, including this data would only serve to weaken the representative impact that severe weather plays in fire behavior.

Since each station may have a different amount of observation then another, a ratio between the number of "severe" observations (SEVEREWX) and the total number of observations (WXINSEAS) needs to be calculated for the purposes of comparison between stations. This ratio or percent is WXSCORE. Ranking is based upon the WXSCORE with values from 0 – 5 classified as low, 5 – 20 as medium, and values greater than 20 as high. Correspondingly, the region represented by the weather station is given the same attribute ranking. Table 8 shows the values for LNU's RAWS, and Figure 21 is a map depicting the geographic areas assigned to each RAWS and the corresponding ranking.

Station	Total Observations (COUNTWX)	Fire Season Observations (WXINSEAS)	Number of "Severe" Observations (SEVEREWX)	Percent of Severe Observations (WXSCORE)	Rank (WXRANK)
Alder Springs	75,523	32,918	249	0.76	Low
Booneville	66,039	29,273	288	0.98	Low
Brooks	67,379	38,062	241	0.63	Low
County Line	56,879	31,921	3011	9.43	Medium
Eel River	89,120	38,883	478	1.23	Low
Knoxville Creek	71,140	38,908	2,244	5.77	Medium
Konocti	68,383	40,405	1,750	4.33	Low
Lyons Valley	66,045	29,339	6,773	23.09	High
McGuires	70,302	31,538	15	0.05	Low
Redding	15,965	7,302	768	10.52	Medium
Sac NWR	16,557	7,228	326	4.51	Low
Santa Rosa	35,360	21,558	208	0.96	Low

Table 8: Fire Weather Index Calculation Inputs

[10] Budgeted fire season refers to a defined period of time when CDF expects that some, but not all, of its' fire protection resources will be needed on a daily basis for the suppression of wildfire. Because LNU was two separate units that were merged in 1996, there are two different budgeted fire seasons.

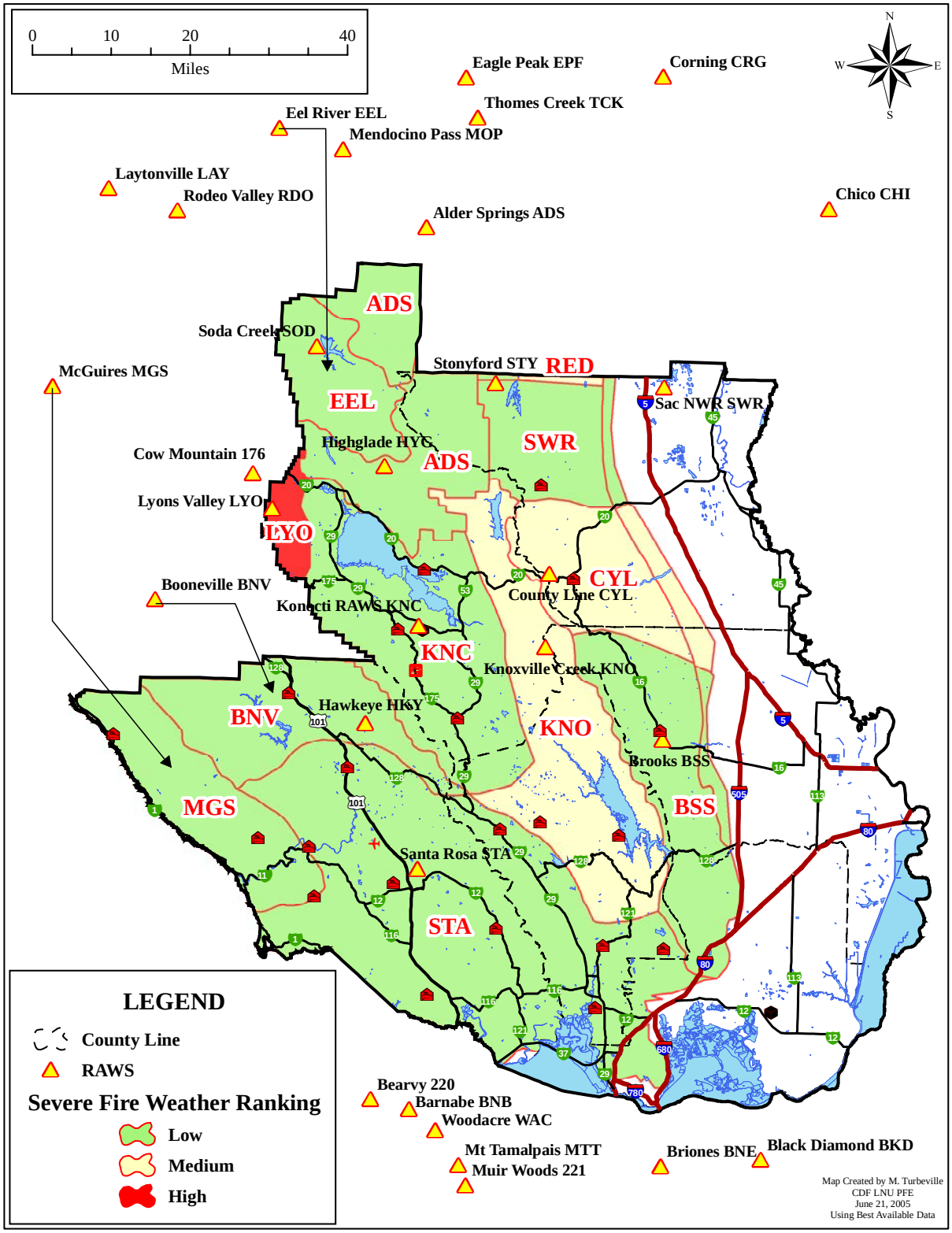


Figure 21: Initial Severe Fire Weather Index Ranking

Unfortunately, statewide there are many voids in RAWS and other weather station data, either because data has not been documented over time, or because the nearest default weather stations are not truly representative of local weather conditions. This latter condition is particularly acute in the southern end of LNU, where fire weather conditions are extremely variable over relative short geographic distances due to the attenuation of coastal influences with distance from the Pacific Ocean and the San Francisco Bay.

Photo 18: View of Fog Filling western Napa and southern Sonoma County as Viewed from Ida Clayton Road looking south.

In areas where there are insufficient weather stations to adequately represent "true" fire weather conditions; the system frequently defaults to using data from weather stations that do no accurately reflect local site-specific conditions. Thus, for example, the Napa Valley and the southern Sonoma County coastline default to the same weather station located in the City of Santa Rosa, despite vast differences in fire weather. On an August afternoon, it is not uncommon for it to be sixty degrees and foggy along the coast, and over one hundred degrees in the Napa Valley, yet for the purposes of determining initial attack success or failure, fires in both locations are presumed to burn with similar intensity and require the same amount of effort to contain.

Another concern is the use of RAWS location outside of the boundaries of LNU such as Eel River and McGuires and the non-use of other RAWS that are in the Unit such as Hawkeye and High Glade. RAWS selection and the area each represent needs to be addressed to bring validity to the FWI analysis. If may be more beneficial to use RAWS

located in Marin County after they become established, calibrated, and their data accepted as being accurate.

Until new or alternative sources of weather station data can be made available, the Unit will rely on observed fire behavior along with fire history data as the best available approximation of severe fire weather. It has been noted that certain areas are prone to wildfire again and again. These "historic wildfire corridors" occur where topography, fuels, and weather combine to channel large and damaging fires in particular locations. (Refer to the Local Fire Problem section of this Plan for further discussion and figure on this topic.) Therefore, as the validation step of the FWI, the low, medium, and high rankings will be modified to correspond with these two factors: observed fire behavior, and fire history data. These changes are reflected in Figure 22 on the following page.

LNU has ordered an additional RAWS that will be delivered during the 2005 Fire Season. This station will most probably be set up to better represent southern Napa County.

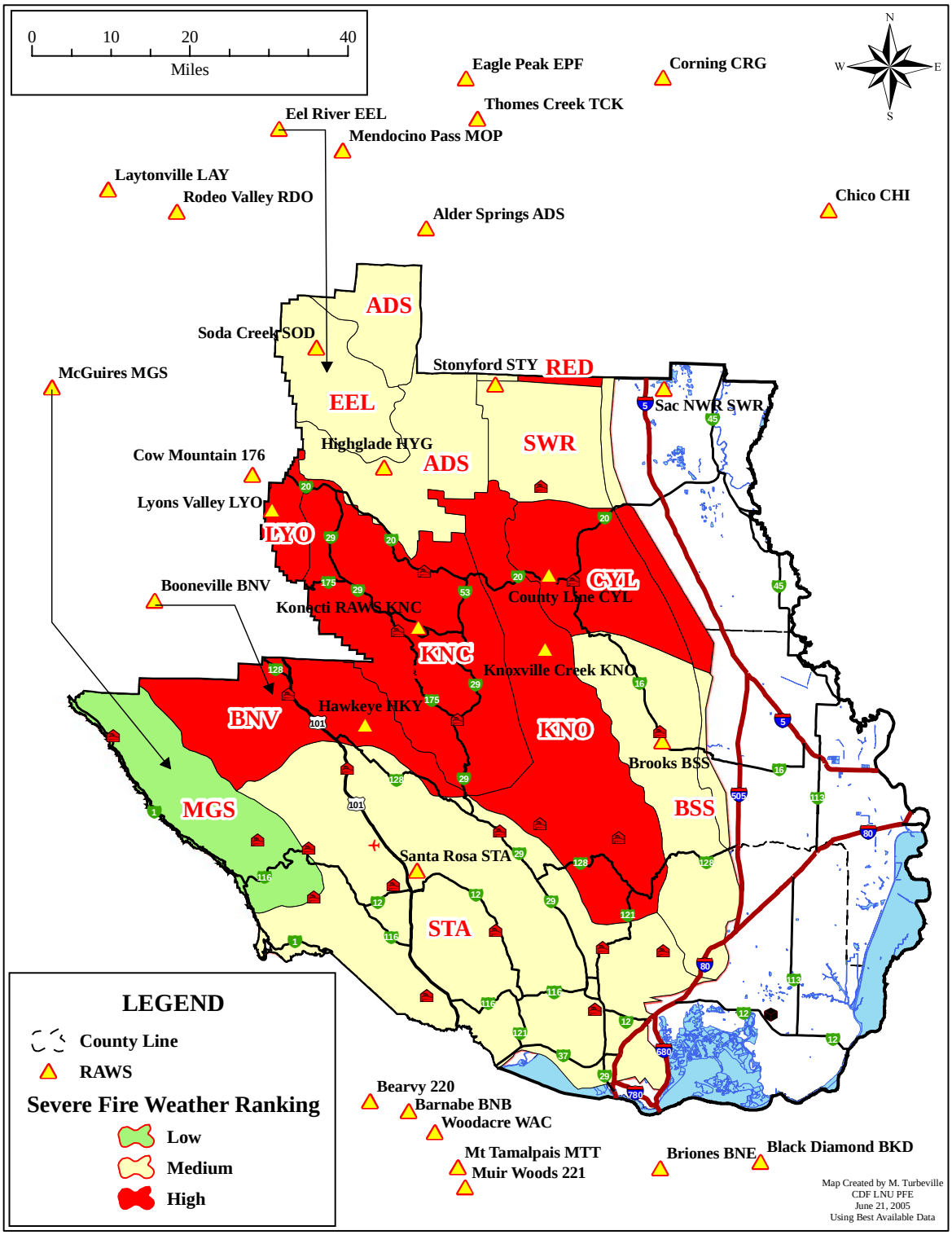


Figure 22: Final FWI Ranking with RAWS Locations