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# APPENDIX E — BACKGROUND FOR WILDFIRE ENVIRONMENT

## E.1 FIRE BEHAVIOR TERMS

The following text provides an introductory definition to some common fire behavior terms.

### Surface Fires

On flat or moderate terrain (<30% slopes) in light fuels, fires usually burn as a surface fire; meaning the flames stay near the ground. Surface fires may advance quickly with short or long residence time and a range of heat output and, as such, they respond well to suppression. A manageable fire, such as occurs more frequently with surface fires, is one of the desired results of fuel modifications.

### Crown-Fire Potential

Crowning activity happens where fire is expected to travel into and possibly consume the crowns—or tops—of trees. Crown fires typify a fire of high intensity and exhibit high heat output and rates of spread. These attributes challenge suppression efforts. When a fire burns through tree crowns, countless embers are produced and distributed, sometimes over long distances. These embers can start new fires (known as spot fires), which can each grow and confound the finest fire suppression forces.

Crown fire initiation (or torching) occurs when ladder fuels are present, providing a connection between the surface fuels and the crown fuels. The higher the base (the bottom) of the tree canopy away from surface fuels, the more difficult it is for crown fires to ignite. Once in the tree canopy, crown fires are more likely to spread in dense canopies and conditions involving high wind speeds.

### Fire Intensity

Fire intensity describes the amount of heat that is released by flaming combustion in a specific unit of time (BTU/ft./sec.[1]). This measurement captures the energy of a fire in any location; it is often confused with fire severity, which is a term describing fire effects (see below).

### Fire Severity

Fire severity describes the resulting effects of a fire, based on the amount of soil damage and tree mortality. It is determined by observing vegetation and soil conditions after a fire. The relationship between predicted fire behavior characteristics (flame length, heat per unit area, fireline intensity, etc.) and fire severity are being explored, but are not yet well established. Long flame lengths, large amounts of torching, crown fire presence, high fireline intensity, and high heat per unit area are all indicators of potentially severe fires.

### Flame Length

Flame length is the span of the flame from the base to the tip, irrespective of its tilt. This factor most influences the probability of structure damage and ease of fire suppression. Flame length is highly correlated with fire intensity, which can help predict fire severity. Flame lengths less than four feet long are associated with fires that are more easily controlled—generally with hand crews[2]—and are also associated with the widespread low-intensity fires prevalent prior to European settlement. In contrast, flame lengths longer than twelve feet often thwart suppression efforts, and are associated with crown

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[1] BTU: British Thermal Units (heat)/feet/second.

[2] Hand crews are diverse teams of career and temporary wildland firefighters.

fires seen on the front pages of newspapers. Typically, fuel-management goals aim for conditions in which flame lengths are less than four feet.

### Rate of Spread

The rate of spread measures how fast the leading edge of a fire advances. A rate of spread that is faster than fireline-building capacity will challenge fire-suppression efforts. High spread rates also indicate the potential for quick changes in fire spread direction, which could endanger firefighters and increase potential damages. High rates of spread in grass can exceed three hundred feet per minute. In rare crown fires, rates of spread can exceed one hundred feet per minute. A more acceptable rate of spread would be one that is slower than the line-building capacity of fire-suppression forces to encircle the fire. Slow-burning fires in forested fuel types spread at a rate of two-to-eight feet per minute.

### Residence Time

The residence time of a fire defines how long the leading edge of the fire burns in any one location. Usually, grass fires are consumed quickly and have a short residence time (e.g. 30 seconds), in contrast to the residence time of fires in a deep duff layer, which can burn for hours. Foliage and suspended dead material are usually consumed in less than 90 seconds. Residence time is useful in predicting tree mortality and potential for fire-induced hydrophobic soils.

### Heat Per Unit Area

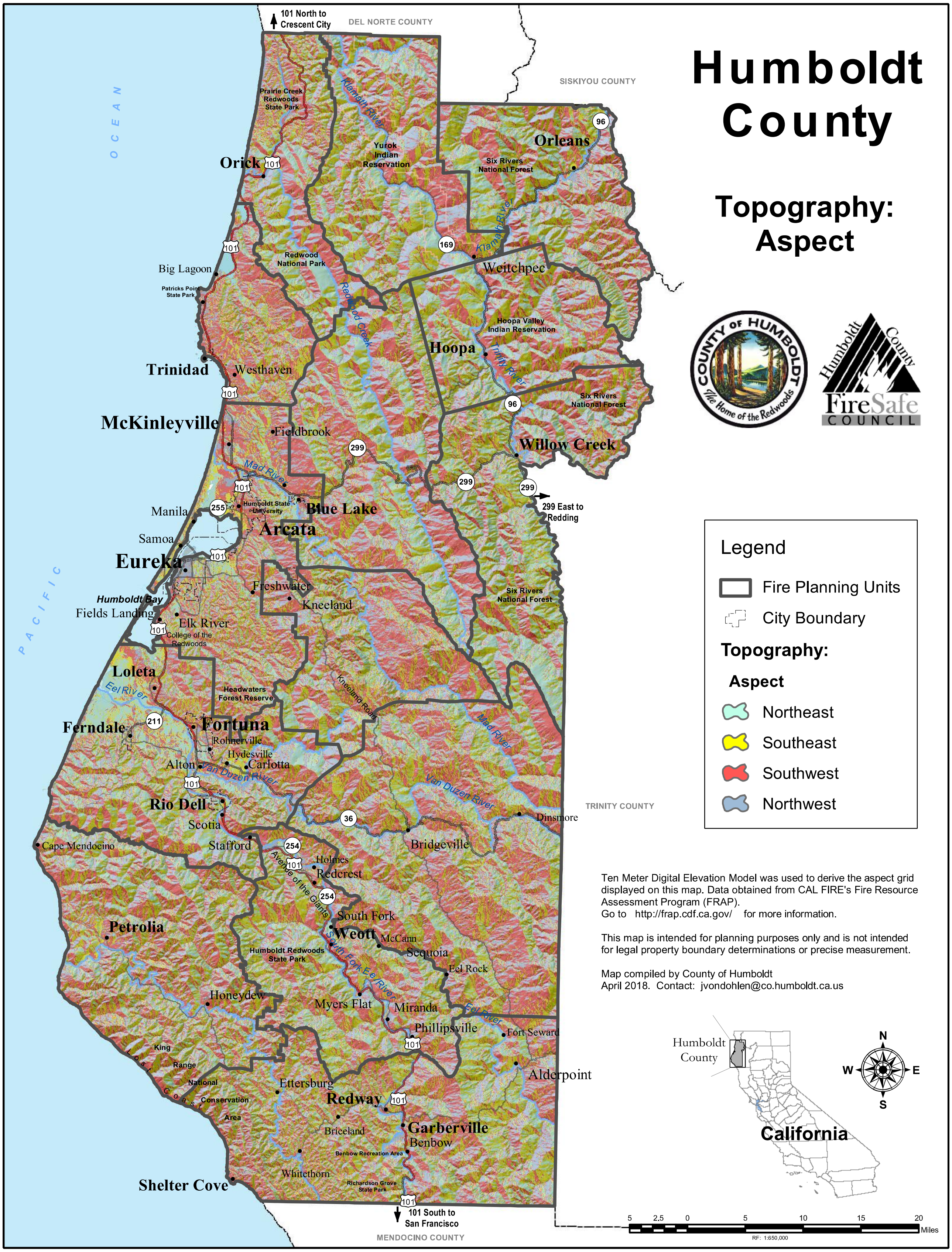
Heat per unit area is defined as the total heat produced by flaming combustion in any one location. This does not include long burn-out times and smoldering. This factor is especially important in determining soil heating and is a fairly good predictor of potential root damage and cambium heating, all indicators of fire severity. Smoldering produces the vast majority of smoke in a fire, but most fire behavior models don’t include smoldering combustion.

## E.2 GENERAL WILDFIRE ENVIRONMENT DESCRIPTION AND MAPS

### Topography

Topographic features such as slope and aspect, as well as the overall form of the land, have a profound effect on fire behavior. Topography directly and indirectly affects the intensity, direction, and rate of spread of wildfire. Fires burning in flat or gently sloping areas tend to burn more slowly, and to spread in a wider ellipse than fires on steep slopes. Streams, rivers, and canyons tend to channel local diurnal and general winds, which can accelerate the fire’s speed and affect its direction, especially during foehn (warm, dry, and usually strong) wind events. Local winds are greatly affected by topography, which “bend the wind” as it flows around or over landforms. Topography also causes daily upslope and downslope winds. The topographic features of aspect and elevation affect vegetation. Solar exposure affects fuel moisture.

## Map E.1 Topography: Aspect

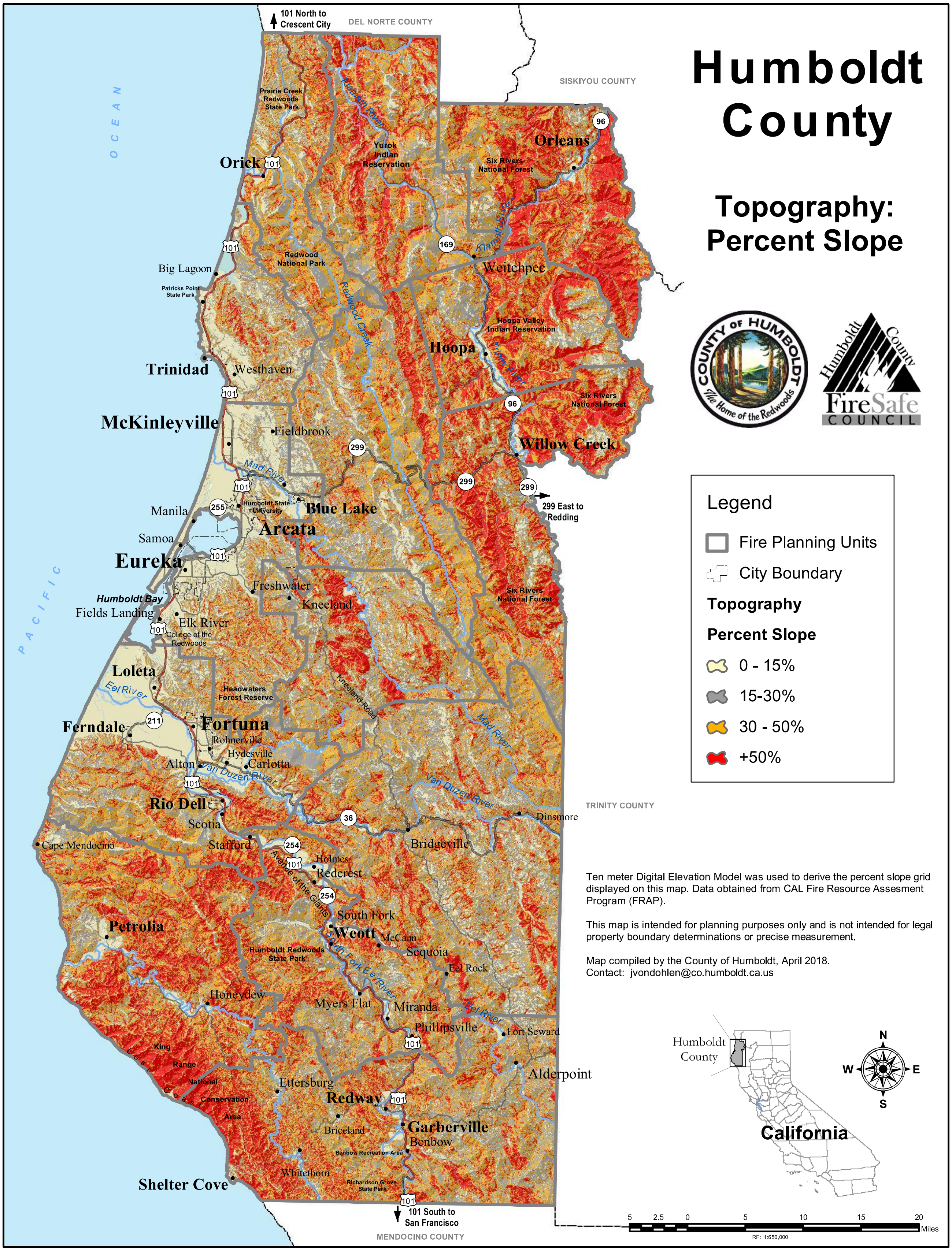


Ten Meter Digital Elevation Model was used to derive the aspect grid displayed on this map. Data obtained from CAL FIRE's Fire Resource Assessment Program (FRAP).
Go to http://frap.cdf.ca.gov/ for more information.

This map is intended for planning purposes only and is not intended for legal property boundary determinations or precise measurement.

Map compiled by County of Humboldt
April 2018. Contact: jvondohlen@co.humboldt.ca.us

## Map E.2 Topography: Percent Slope



Ten meter Digital Elevation Model was used to derive the percent slope grid displayed on this map. Data obtained from CAL Fire Resource Assesment Program (FRAP).

This map is intended for planning purposes only and is not intended for legal property boundary determinations or precise measurement.

Map compiled by the County of Humboldt, April 2018.
Contact: jvondohlen@co.humboldt.ca.us

## Weather

Weather conditions significantly impact the potential for fire ignition, as well as rates of spread, intensity, and the direction(s) a fire burns. Wind, temperature, and relative humidity are the weather variables used to predict fire behavior.[3] Fire weather refers to weather elements that influence fire ignition, behavior, and suppression; these elements include temperature, relative humidity, wind speed and direction, precipitation, atmospheric stability, and the presence of aloft (or upper-level) winds.

Wind is considered the most variable and difficult weather element to predict. It increases the flammability of fuels (live or dead vegetation, as well as human-built structures) by removing moisture through evaporation, by pre-heating fuels in a fire's path, and by increasing spotting distances (the distance at which a spot fire might be ignited by a flying ember). Wind velocities and directions may vary across vertical gradients, with somewhat different impacts on fire behavior. The direction and velocity of surface winds can directly control the direction and rate at which the fire spreads. Winds that blow more than 20 ft. above the ground can carry embers and firebrands downwind, causing spot fires to precede the primary front.

Weather conditions can change rapidly as upper-level wind currents and pressure systems in the western states shift locations, and both dry and wet frontal systems move through the mountainous terrain. Frontal winds associated with low-pressure systems moving across the area can create hazardous fire conditions. Winds in advance of the frontal system can reach speeds exceeding 60 mph over ridges. Winds associated with thunderstorms are particularly erratic, radiating in all directions from the center of the storm. Atmospheric instability dilutes and disperses smoke but also tends to increase fire intensity, analogous to opening the damper on a stovepipe. Wind in general is an important factor in initiating and maintaining crown fires.

The local marine influence can reduce fire hazards to those areas of the county affected by moist air.

> ‘The interesting relationship between fog-stratus and regional temperature is known to those who have lived on the redwood coast for any length of time. Cool water upwells offshore as the California current flows southward. Warmer air moving over this humid surface is chilled and condenses. When interior temperatures rise, this marine layer of air is pulled inland and gets forced against the coastal mountains and is vertically contained under an inversion associated regional high pressure. Given this persistence of this pattern during most years’ fire season, the local occurrence probability of fog-stratus helps define the fire hazard as well as the vegetation that is found there.
>
> The incidence of coastal fog-stratus varies over time. Less fog was recorded during the fire seasons during the 1920s and 1930s and 1950s, while fog was common during the 1890s, 1910s, 1940s and 1970s. It is common to observe the strongest fire activity in the interior Klamath mountains on days when this coastal fog-stratus pattern is best developed. Variation in fog-stratus over centuries can alter the fire occurrence probabilities which affect the importance of seeding trees, such as Douglas fir and patterns of biodiversity.[4]’

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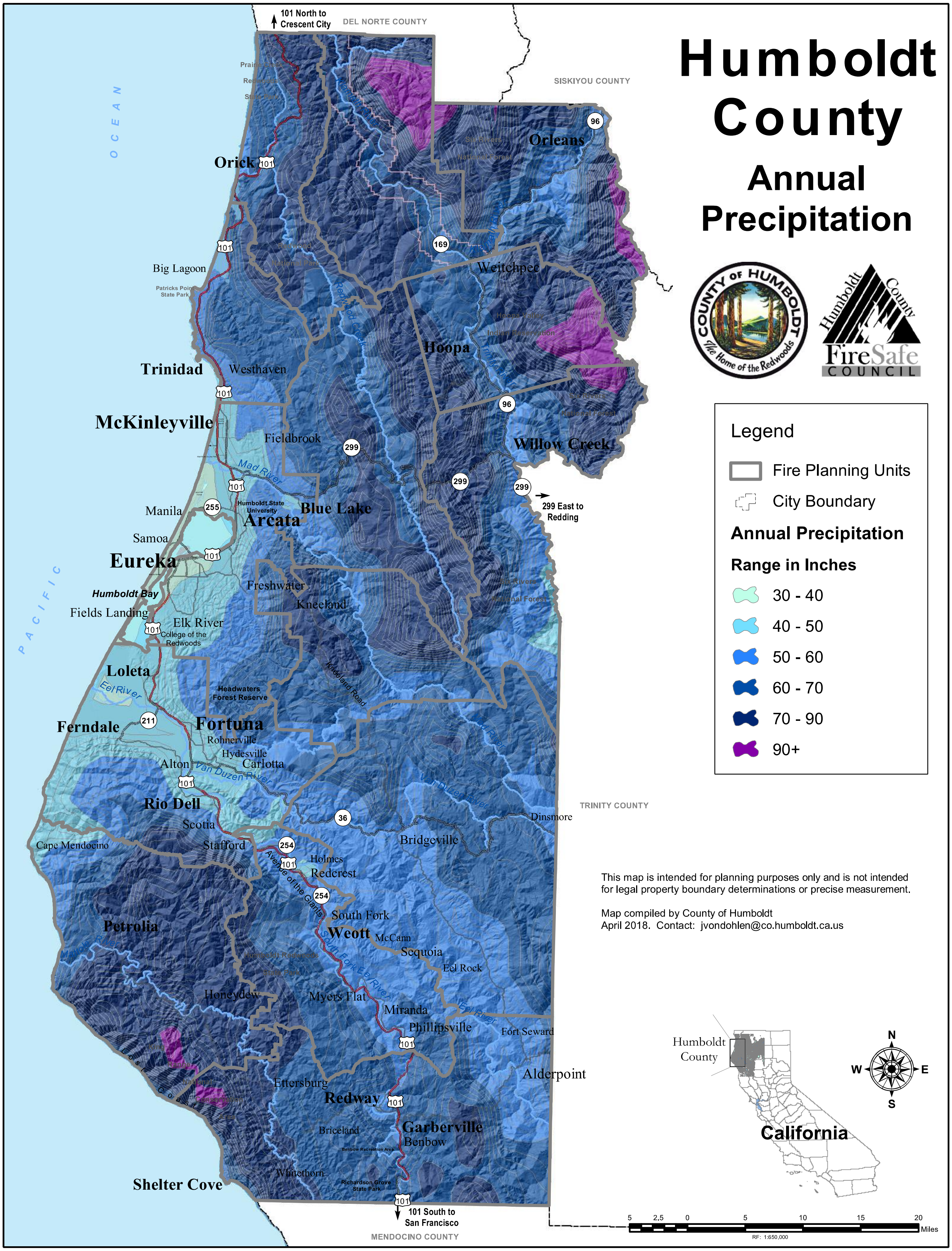
[3] Husari, S., Nichols, T., Sugihara, N.G. & Stephens, S.L. (2006). Fuel management. In Sugihara, N.G., van Wagtendonk, J., Shaffer, K.E., Fites-Kaufman, J., & Thode, A.E. (Eds.). Fire in California’s Ecosystems. (pp. 444–465.) Berkeley: University of California Press.

[4] Climate Change in Coast Redwood Forests. (n.d.). Coast Redwood Ecology and Management. Retrieved September 17, 2018 from www.redwood.forestthreats.org/climatechange.htm

## Map E.3 Precipitation



# Humboldt County

## Annual Precipitation

Legend

- Fire Planning Units
- City Boundary

**Annual Precipitation**

**Range in Inches**

- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 90
- 90+

This map is intended for planning purposes only and is not intended for legal property boundary determinations or precise measurement.

Map compiled by County of Humboldt
April 2018. Contact: jvondohlen@co.humboldt.ca.us

## E.3 FUEL MODELS

Vegetation is highly variable in many respects, including size, height, density, and relative volatility/flammability. The volume, character, distribution, and arrangement, relative presence of volatile oils, and moisture content of fuels are all factors that greatly influence fire behavior.

A fuel model is a standardized description of fuels available to a fire, based on the amount, distribution, and continuity of vegetation and wood.[5] Among other things, fuel model information helps fire suppression agencies determine what kind of fire might be expected in different areas. Fuel models distinguish between vegetation such as tall and short grass, timber with and without an understory, and oak woodland with and without understory vegetation. Fire managers use fuel models within the Fire Behavior Prediction System (FBPS)—called FBPS #1, 4, 10, etc.—to forecast how fast a fire will spread, how damaging the fire might become (in terms of fire intensity), or whether it is likely to torch in the area. Information regarding fuel volumes and fire behavior descriptions is available from the USDA Forest Service publication How to Predict the Spread and Intensity of Forest and Range Fires.[6]

Fuel models describe vegetation structure, in addition to typical species composition; structure largely determines the fuel that will actually support the fire. The understory is more important than the overstory. The most significant factor is the amount and distribution of smaller-diameter fuels because these materials generally contribute to the spread of wildfires. A grassy field with oak trees that cover less than one-third of the slope would be classified as a grass fuel model, because the contribution of oak leaves and branches to fire behavior may be negligible (due to the minor amount of leaf drop or the relative height at which the first branches grow above the ground). Similarly, where brush covers less than one-third of a conifer stand, it would be classified as a conifer stand. The amount and size of dead material distinguishes among the three types of conifer fuel models. Another important factor in fuel models is the amount of dead biomass and the ratio of live-to-dead material where there are significant brush and tree stands. Dead biomass contributes fine fuel litter and carries flames more readily.

The table below shows the fuel models present in Humboldt County, their respective acreages and percentages, and their generally expected flame lengths. Surface fuels (based on these same fuel models) are illustrated in *Map 5.2.1* in *Chapter 5.2 Wildfire Environment.*

**FIGURE E.1 FUEL MODELS FOUND IN HUMBOLDT COUNTY**

| *Fuel Model Description* | *Typical Fuel Model*[7, 8] | *Acres and Percentage found in Humboldt County* | | *Average Flame Length (ft.)* |
|---|---|---|---|---|
| Grass | 1 | 233,415 | 10% | 4 |
| Pine/Grass | 2 | 141,129 | 6% | >9 |
| Light Brush | 5 | 89,295 | 4% | >13 |
| Intermediate Brush | 6 | 7,497 | less than 1% | 12 |
| Hardwood/Conifer Light | 8 | 624,514 | 27% | 2 |
| Medium Conifer | 9 | 748,023 | 33% | 7 |
| Heavy Conifer | 10 | 295,454 | 13% | >100 |
| Light Slash/Treated Conifer | 11 | 9,353 | less than 1% | 3.5 |

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[5] National Park Service. (2015). Glossary of Fire Terms. Retrieved from http://www.nps.gov/seki/naturescience/fic_firegloss.htm

[6] Rothermel, R.C. (1983). How to predict the spread and intensity of forest and range fires. General Technical Report INT-143. Ogden, UT: USDA, Forest Service, Intermountain Forest and Range Experiment Station.

[7] There is a wide variety of fuel volume, structure, and size class distribution within vegetation types; fuel models should be determined by site-specific conditions. Fuel models can be classified by comparing photographs of fuel models with on-site conditions (Anderson 1982), by using expert opinion to translate vegetation types to fuel models, or by using a "key" provided in Rothermel (1983).

[8] Anderson, H.E. (1983). Predicting Wind-driven Wild Land Fire Size and Shape. Research Paper INT-305 (p. 26). Ogden, UT: USDA, Forest Service, Intermountain Forest and Range Experiment Station.

**FIGURE E.1 FUEL MODELS FOUND IN HUMBOLDT COUNTY**

| *Fuel Model Description* | *Typical Fuel Model*[7, 8] | *Acres and Percentage found in Humboldt County* | | *Average Flame Length (ft.)* |
|---|---|---|---|---|
| Medium Slash | 12 | 44,144 | 2% | 8 |
| Non-Burnables (such as Urban, Agriculture, Water, and Rock/Barren) | 28, 97, 98, and 99 | 99,398 | 4% | n/a |

The following is a brief description of each of the Fuel Models found in Humboldt County.

## Model 1 – 2 Grass Models

**Fuel Model 1 –** This model contains annual and perennial short grasses, about one foot tall, which are fairly uniform and homogenous. Less than 1/3 of the area contains other types of vegetation such as trees and shrubs. This fuel model is most commonly found distributed throughout the large ranchlands in the southwestern and southeastern portions of the county. Grazing is the predominant use of these areas. There is approximately 3/4 tons[9] per acre of fuel at a depth of about one foot. Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured vegetation and contain flame lengths approximately 4-feet high.

**Fuel Model 2 –** This model is dominated by grasses approximately one- to two-feet tall. The grasses within this model generally occur under an open, wooded timber canopy. This fuel type constitutes a very small percentage of the land area within the county with concentrations located on Six Rivers National Forest lands at high elevations to the east of the Hoopa Valley Indian Reservation and within the King Range National Conservations Area and Humboldt Redwoods State Park. There is approximately four live/dead tons of <3-inch fuel per acre at a depth of about one foot. Also occurring within the 1-ft. fuel bed are approximately two tons of 1/4-inch dead material as well as a 1/2-ton of live (foliage) material. Fire spread occurs in the live/dead fine surface materials. Areas with high fuel loads associated with the hardwood and conifer component can be intense and cause firebrands. Fires within this model can produce flames over 9 feet.

## Model 5 – 6 Shrub Models

**Fuel Model 5 –** This model consists of stands of mature shrubs with little or no dead material component. Most of the fuels within this model are alive, consisting of green vegetation that is not very volatile. This fuel model occurs on poor sites, on recent burns, and may occur under tree canopies. There are smatterings of this fuel model throughout the county collectively adding up to only about 4% of the land area. A coastal strip with concentrations near Orick, Big Lagoon, Cape Mendocino, and the southern portion of the King Range National Conservation Area include varying combinations of coyote brush, manzanita, and/or lupine; sometimes referred to as coastal scrub. Inland areas, particularly along the eastern edge of the county, are sprinkled with patches of this fuel model.

This fuel model consists of approximately 3.5 live/dead tons of <3-inch fuel per acre to a depth of about two feet. Also occurring within the 2-ft. fuel bed are approximately one ton of 1/4-inch dead material as well as 2 live tons per acre. Fires in this fuel model generally do not burn intensely or rapidly, due to high concentration of live material. Flames can reach heights of over 13 feet.

**Fuel Model 6 –** This model consists of vegetation that is taller and more flammable than that of Fuel Model 5. In many instances a Fuel Model 5 will evolve into a Fuel Model 6 by the latter part of the summer. Only one percent of the county is classified with this fuel model, showing up in a few patches on Six Rivers National Forest lands in the northeastern corner of the county and southwest of Willow Creek; this is likely

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[9] This includes both live and dead vegetation. Dead vegetation, e.g. dead branches, responds quickly to weather conditions while live fuels, e.g. flowering branches, are slower to change with weather and are less flammable.

brush related to logging operations in the mixed conifer forests of those areas. There is approximately 6 live/dead tons of <3-inch fuel per acre to a depth of about 2.5 feet. Also occurring within the 2.5-ft. fuel bed are approximately 1.5 tons of 1/4-inch dead material per acre. Fires in this model will burn in the foliage of standing vegetation, but only when wind speeds are greater than eight mph. Fires within this model can produce flames about 12-feet tall.

## Model 8 – 10 Timber Litter Models

**Fuel Model 8 –** This model consists mainly of needles, leaves, and occasionally twigs below a conifer or hardwood canopy. Approximately 27% of the county can be associated with this fuel model making it second only to Model 9 in amount of area covered. Coastal areas are dominated in the north by coast redwood and in the south and east by conifer/hardwood forests with less of an understory than Fuel Model 9. There are approximately 5 live/dead tons of <3-inch fuel per acre to a depth of about 0.2 feet. Also occurring within the 0.2-ft. fuel bed are approximately 1.5 tons of 1/4-inch dead material per acre. Fires within this model are generally slow burning and of low intensity within the compacted vegetation, although the fire may encounter an occasional "jackpot" or heavy fuel concentration that can flare up. Fires in this model do not pose a control threat unless high temperatures, low relative humidity, and high winds allow the fire to spread into the canopy. Fires within this model can produce flames about 2 feet tall.

**Fuel Model 9 –** This model is similar to Fuel Model 8, except it has more fine fuels, which increase fire severity. This model represents 33% of the county and the associated vegetation type varies depending on geographic location. Coast redwood, Douglas-fir, and spruce are found in coastal areas. Inland areas classified under this model are dominated by Douglas-fir intermingled with hardwoods. There is approximately 3.5 live/dead tons of <3-in. fuel per acre to a depth of about 0.2 feet. Also occurring within the 0.2-ft. fuel bed are approximately 2.9 tons of 1/4-inch dead material per acre. Autumn fires in the hardwoods in this model are predictable, but high winds will actually cause higher rates of spread than predicted because of spotting (spot fires) caused by rolling and blowing leaves. Concentrations of dead and downed woody debris will contribute to possible torching, crowning, and spotting. Fires within this model can produce 7-foot flames.

**Fuel Model 10 –** This model consists of a shrub, sapling, or immature tree understory with a diseased and/or mature overstory. Much of the county's old growth forests fall into this category with a mature closed canopy and a thick, lush understory with large amounts of biomass. The largest concentration of this type is located along the South Fork Eel River and the lower Van Duzen River including parts of Humboldt Redwoods State Park, the Avenue of the Giants, and Humboldt Redwood Company and Green Diamond Resource Company lands. The predominant forest type falling into this fuel model is older coast redwood, with patches of Douglas-fir located in the northeastern portion of the county. There is approximately 12 live/dead tons of <3-inch fuel per acre to a depth of about 1 foot. Also occurring within the 1-ft. fuel bed are approximately 3 tons of 1/4-inch dead material as well as 2 live tons per acre. Fires in this model burn with a moderate rate of spread and can be very intense. Crown scorch (and/or torching) of individual trees and spot fires are common within Fuel Model 10. This fuel model poses the most control problem of all the fuel models within the three timber litter models. Fires within this model can produce flames over 100 feet high in extreme conditions.

## Model 11 – 12 Logging Slash Models

**Fuel Model 11 –** This model consists mainly of logging slash produced by thinning operations or light, partial cuts within mixed conifer or hardwood stands, as well as herbaceous material intermixed with slash. Only 1% of the county is characterized by this model and it is lightly sprinkled over the landscape. It is found in many locations associated with past timber harvests. There is approximately 11.5 live/dead tons of <3-inch fuel per acre to a depth of about 1 foot. Also occurring within the 1-foot fuel bed are approximately 1.5 tons of ¼-inch dead material, and there is typically no live material within the fuel bed. Fires in this model generally have a low rate of spread and burn at low intensities. Fire potential can be limited by wide spacing between light loads of mostly fine fuels, as well as shade from the remaining overstory. Fires within this model can produce flames 3.5 feet in length.

**Fuel Model 12 –** This model consists of heavy amounts of slash produced either by clearcuts, medium- or heavy-partial cuts, or heavily thinned mixed conifer or mixed conifer/hardwood stands. Similar to Fuel Model 11, there is a very small percentage of the county (2%) that is characterized by this model and it can generally be associated with areas where timber harvesting has occurred. There is approximately 34.6 live/dead tons of <3-inch fuel per acre to a depth of about 2.3 feet. Also occurring within the 2.3-ft. fuel bed are approximately 4 tons of ¼-inch dead material, and there is typically no live material within the fuel bed. Fires in this model can spread quite rapidly with moderate or high intensities and are capable of generating firebrands. Consistent, even distribution of the fuels within this model continue to sustain fires once they start, until a change or break in the fuel continuity is encountered. Fires within this model can produce 8-foot flames.

## E.4 WILDFIRE HAZARD ASSESSMENT AND FIRE HAZARD SEVERITY MAPPING

Fire hazard is a way to measure physical fire behavior to predict the damage a fire is likely to cause and how resistant it will be to control. Fire hazard measurement includes the speed at which a wildfire moves, the amount of heat produced by the fire, and most importantly, the burning firebrands that the fire sends ahead of the flaming front. Fire hazard elements include the following, which have been described in more detail in the General Wildfire Environment Descriptions section above:

- **Vegetation –** Whether live or dead, vegetation is "fuel" to a wildfire and it changes over time. The fire hazard severity rating considers the potential vegetation over a 50-year time horizon.
- **Topography –** Fire burns more intensely and spreads more rapidly on steep slopes.
- **Weather –** Fire burns faster and with more intensity when air temperature is high, relative humidity is low, and winds are strong.
- **Crown Fire Potential –** Under extreme conditions, fire burns upwards into tall brush and tree canopies.
- **Ember Production and Movement –** Firebrands are blown ahead of the main fire, which can ignite buildings and spread the fire (spotting).
- **Likelihood of Fire –** The likelihood of an area burning over a 30 – 50 year period.

> ‘ Fire Hazard Severity Zones represent areas of variable size ranging from 20 acres in urbanized areas to at least 200 acres in wildland areas, with relatively homogeneous characteristics regarding expected burn probability and potential fire behavior attributes based on climax fuel conditions over a 30-50 year time horizon.[10] ’

CAL FIRE completed a major effort to reclassify FHSZs in 2007 as a component of implementing the new Wildland-Urban Interface building code *(See Appendix H, **Living with Wildfire** of this CWPP for more information on building codes).* These reclassifications included State Responsibility Areas (SRA) and Local Responsibility Areas (LRA).[11]

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[10] Sapsis, D. (n.d.) Fire Hazard Severity Zoning (FHSZ) Draft Map Review and Validation [PowerPoint slideshow]. CAL FIRE. Retrieved September 17, 2018 from *http://frap.fire.ca.gov/projects/hazard/Fire_Hazard_Zoning_workshop_1_8.ppt*

[11] For more information on Fire Hazard Severity Zone mapping, please see: CAL FIRE. (2007). Fire Hazard Severity Zone Re-Mapping Project. Retrieved from *http://frap.fire.ca.gov/projects/hazard/fhz.html* and for information on hazard mapping and associated building codes, please see: CAL FIRE. (2007). Wildland Hazard/Building Codes. Retrieved from *http://www.fire.ca.gov/fire_prevention/fire_prevention_wildland.php*

## E.5 FIRE REGIME

Fire regime is a description of fire's historic natural occurrence, variability, and influence on vegetation dynamics in the landscape. Fire regimes can provide information for fire planning, as they describe the frequency of fire and the effects a fire is expected to have on a particular area's vegetation. Generally based on fire history reconstructions, fire regime descriptions include the season, frequency, severity, size, and spatial distribution of fires. There is quite a wide variability of "natural" intervals, severities, and seasons, but some generalities have been made. Over the years, foresters and plant ecologists have come to use a small number of standardized fire regime classes to make general comparisons about the fire ecology of different ecosystems and geographic regions. The regimes listed below show fire regime classes commonly used by the USFS and other land management agencies.[12]

The five historical fire regimes are classified based on the average number of years between fires (fire frequency) combined with the fire severity (amount of consumption of the dominant overstory vegetation). The five regimes are:

- **I:** 0 to 35-year frequency and low (surface fires most common) to mixed severity (less than 75% of the dominant overstory vegetation replaced);
- **II:** 0 to 35-year frequency and high (stand replacement) severity (greater than 75% of the dominant overstory vegetation replaced);
- **III:** 35- to 100+-year frequency and mixed severity;
- **IV:** 35- to 100+-year frequency and high severity;
- **V:** 200+-year frequency and high severity.

The above classification system was used to make one of the first nationwide, coarse-scale maps of fire regimes. CAL FIRE used it to produce the somewhat more detailed (but still very coarse scale) statewide fire regime maps.[13] The LANDFIRE (also known as Landscape Fire Resource and Management Planning) program has since revised the fire regime class definitions and conducted a national analysis for the National Interagency Fire Coordinating Group. They have produced an elaborate methodology for conducting regional scale analyses that could be undertaken to produce more local-scale map products for Humboldt County.[14]

The CAL FIRE fire regime data for Humboldt County is shown in *Map E.4 Fire Regime* below. Although the fire regimes in Humboldt have been altered due to fire suppression and other land management activities, there are two pre-settlement fire regimes still found here today. According to information collected and analyzed by CAL FIRE, Humboldt County primarily has a natural fire return interval between 0 – 35 years of low severity fire (Fire Regime I), as well as scattered areas of Fire Regime III (generally on ridgetops, and more often in the eastern parts of the county), with a 35 – 100+ year frequency of mixed severity fire.

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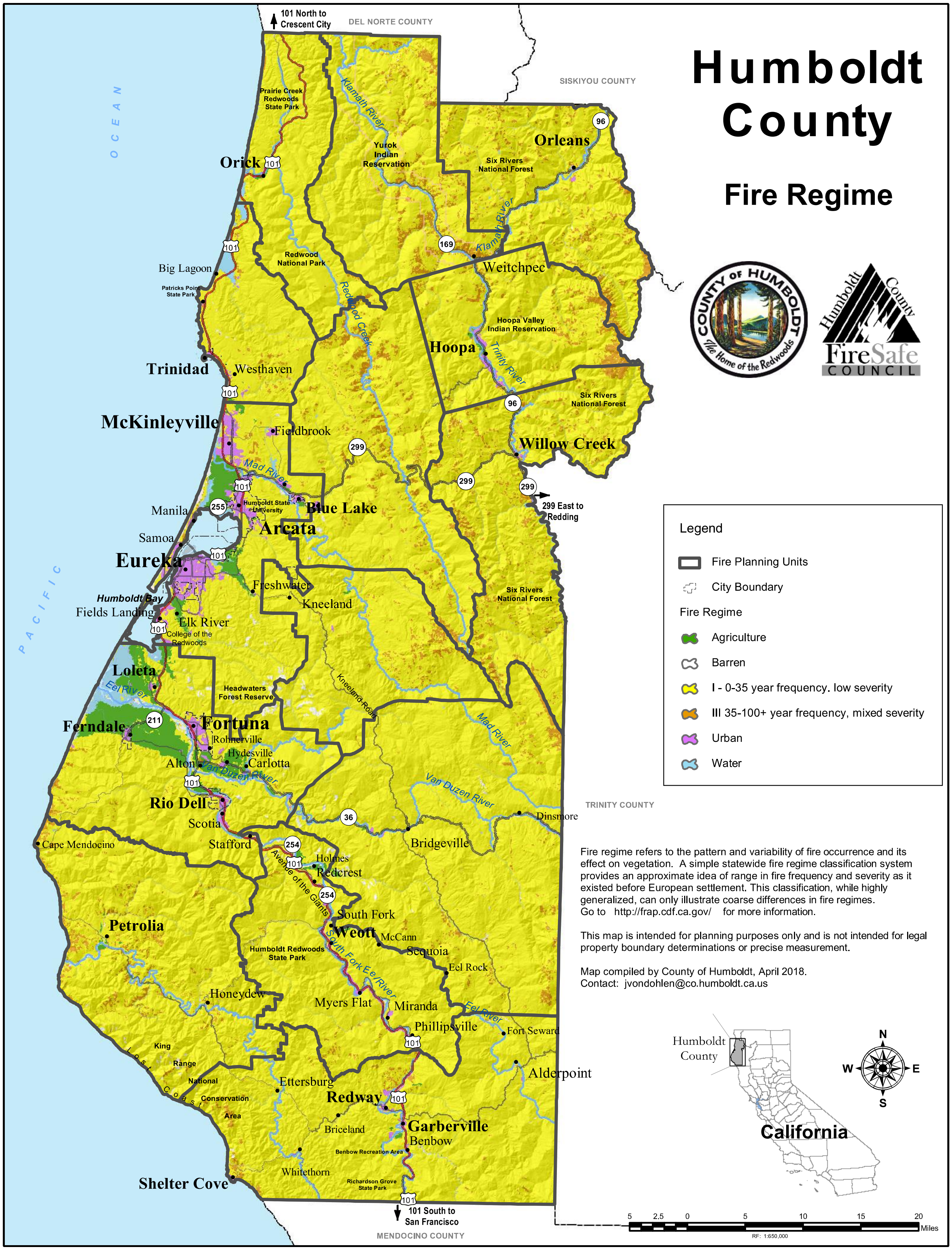
[12] Schmidt, K.M., Menakis, J.P., Hardy, C.C., Hann, W.J., & Bunnell, D.L. (2002). Development of coarse-scale spatial data for wildland fire and fuel management. General Technical Report RMRS-GTR-87. Fort Collins, CO.

[13] CAL FIRE. (2003). Fire Regime and Condition Class. Geographic Information System data file [ArcInfo grid file]. Cafrcc_03v2. Metadata. Retrieved from *http://frap.cdf.ca.gov/data/frapgisdata/download.asp?rec=cafrcc*

[14] Barrett, S., Havlina, D., Jones, J., Hann, W., Frame, C., Hamilton, D., Schon, K., Demeo, T., Hutter, L., & Menakis, J. (2010). Interagency Fire Regime Condition Class Guidebook, Version 3.0. National Interagency Fuels, Fire, & Vegetation Technology Transfer. [PDF]. Retrieved from *https://www.frames.gov/files/7313/8388/1679/FRCC_Guidebook_2010_final.pdf*

## Map E.4 Fire Regime



Fire regime refers to the pattern and variability of fire occurrence and its effect on vegetation. A simple statewide fire regime classification system provides an approximate idea of range in fire frequency and severity as it existed before European settlement. This classification, while highly generalized, can only illustrate coarse differences in fire regimes. Go to http://frap.cdf.ca.gov/ for more information.

This map is intended for planning purposes only and is not intended for legal property boundary determinations or precise measurement.

Map compiled by County of Humboldt, April 2018.
Contact: jvondohlen@co.humboldt.ca.us

## E.6 CONDITION CLASS

The difference in fire regime between pre- and post-European settlement is described by the condition class, or the degree of departure from the historical natural fire regime. Mapping of the fire regime condition class has been done nationwide and is widely used. Usually where the condition class indicates that fire has been absent for an unnaturally long time, the hazard and potential damages are high to both the environment and human developments in the area.

Fire Regime Condition Class (FRCC)[15] is based on a relative measure describing the degree of departure from the historical natural fire regime. The departure from natural fire regimes results in changes to one or more of the following ecological components: vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances (e.g. insect and disease mortality, grazing, and drought). There are no wildland vegetation and fuel conditions or wildfire situations that do not fit within one of the three classes.

The three classes are based on low (FRCC 1), moderate (FRCC 2), and high (FRCC 3) departure from the central tendency of the natural (historical) regime. "Low departure is considered to be within the natural (historical) range of variability, while moderate and high departures are outside."[16] Areas considered at a high or moderate departure from the natural regime are experiencing dramatic increases in fire behavior, intensity, severity, and fire size.[17]

The greater the departure from the natural fire regime, the greater the variations to ecological components and the higher the risk of losing key ecosystem components. For example, FRCC 3 classification means that fire regimes have been greatly altered from their natural range (e.g., from 3 – 10 years between fires, prior to European settlement, to 50 – 70 years since) and, likewise, vegetation characteristics have been dramatically altered from their natural range. For example, an area may have experienced a fire regime of small, frequent, low-intensity fires prior to European settlement. However, because fire suppression has been successful, only one fire has burned in the area in the past 100 years. The fuels have become voluminous and hence fire behavior is predicted to be intense, with the potential to kill trees that have survived other fires over the centuries. The fuels have also become more uniform, creating conditions that facilitate fire spread and result in larger fires. Therefore, the risk of losing key ecosystem components is high.

Fuel management projects can restore the vegetation type and structure through prescribed fire and/or other types of management techniques in a spatial distribution that can mimic the effect of natural fire regimes. Thus, fuel management can move a condition class to one more closely resembling pre-European settlement, regardless of recent fire history.

Condition class does not relate directly to fire hazard but is designed to better predict the effects of a fire, specifically the fire-related risks to ecosystems. All three condition classes (1, 2, and 3) exist in Humboldt County, as shown on the following map. Condition class is generally within or near fires' historical range for the western and lower elevation/riparian areas of the county. As elevation increases, condition class changes from moderately altered to severely altered from historical range, as shown on the following map.

The influence of fire significantly shaped the ecosystems found throughout Humboldt County today. Understanding the local wildfire environment and people's place in it—through fire history, fire behavior, and fire science—will help Humboldt communities to live safely within this fire-evolved landscape.

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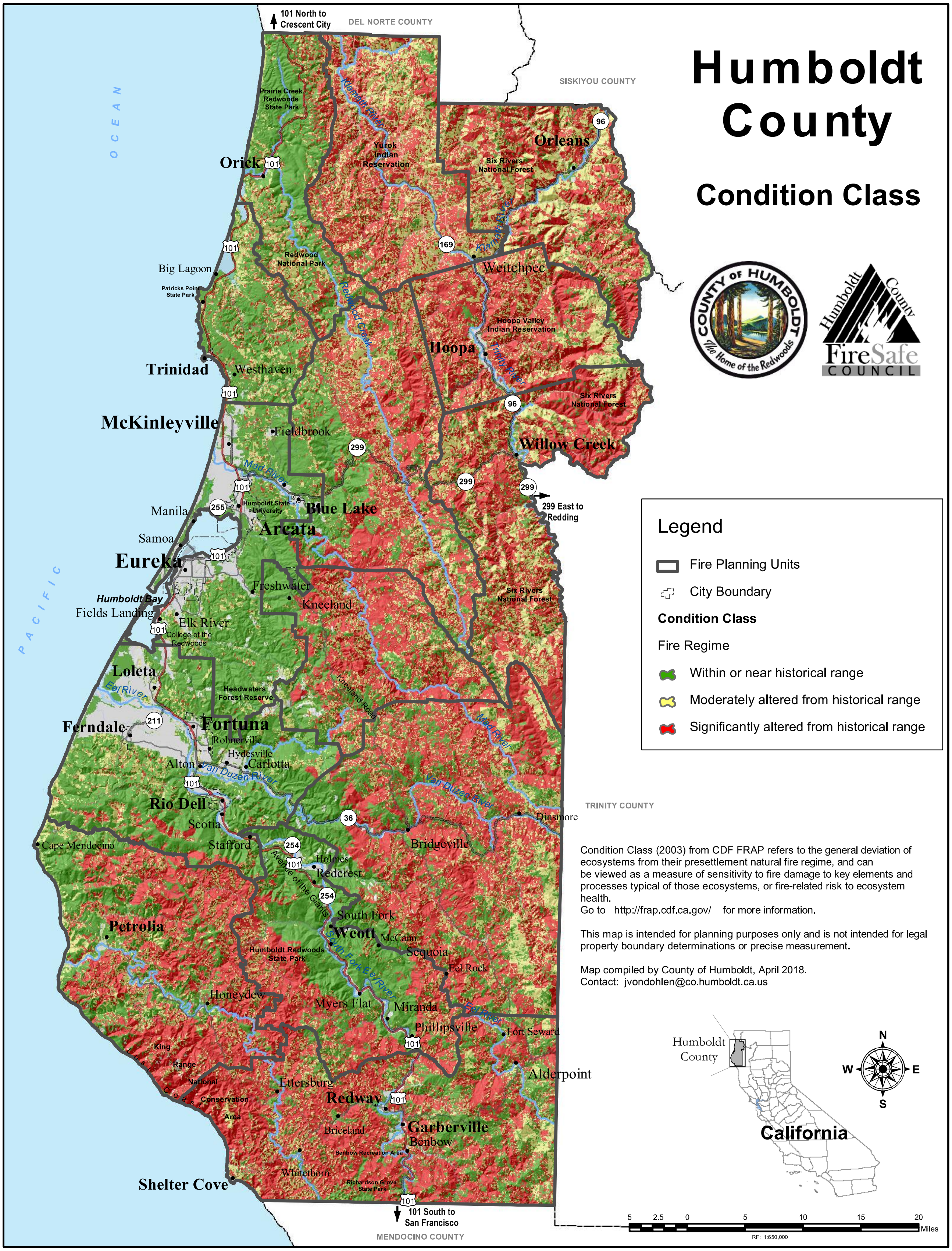
[15] Barrett, S. et al. (2010). Interagency Fire Regime Condition Class (FRCC) Guidebook.

[16] National Wildfire Coordinating Group. (2018). Fire Regime Current Condition Class Definition. Retrieved from *https://www.nwcg.gov/glossary/a-z*

[17] Barrett, S. et al. (2010). Interagency Fire Regime Condition Class (FRCC) Guidebook.

## Map E.5 Condition Class



# Humboldt County

## Condition Class

### Legend

▭ Fire Planning Units

⬚ City Boundary

**Condition Class**

Fire Regime

🟩 Within or near historical range

🟨 Moderately altered from historical range

🟥 Significantly altered from historical range

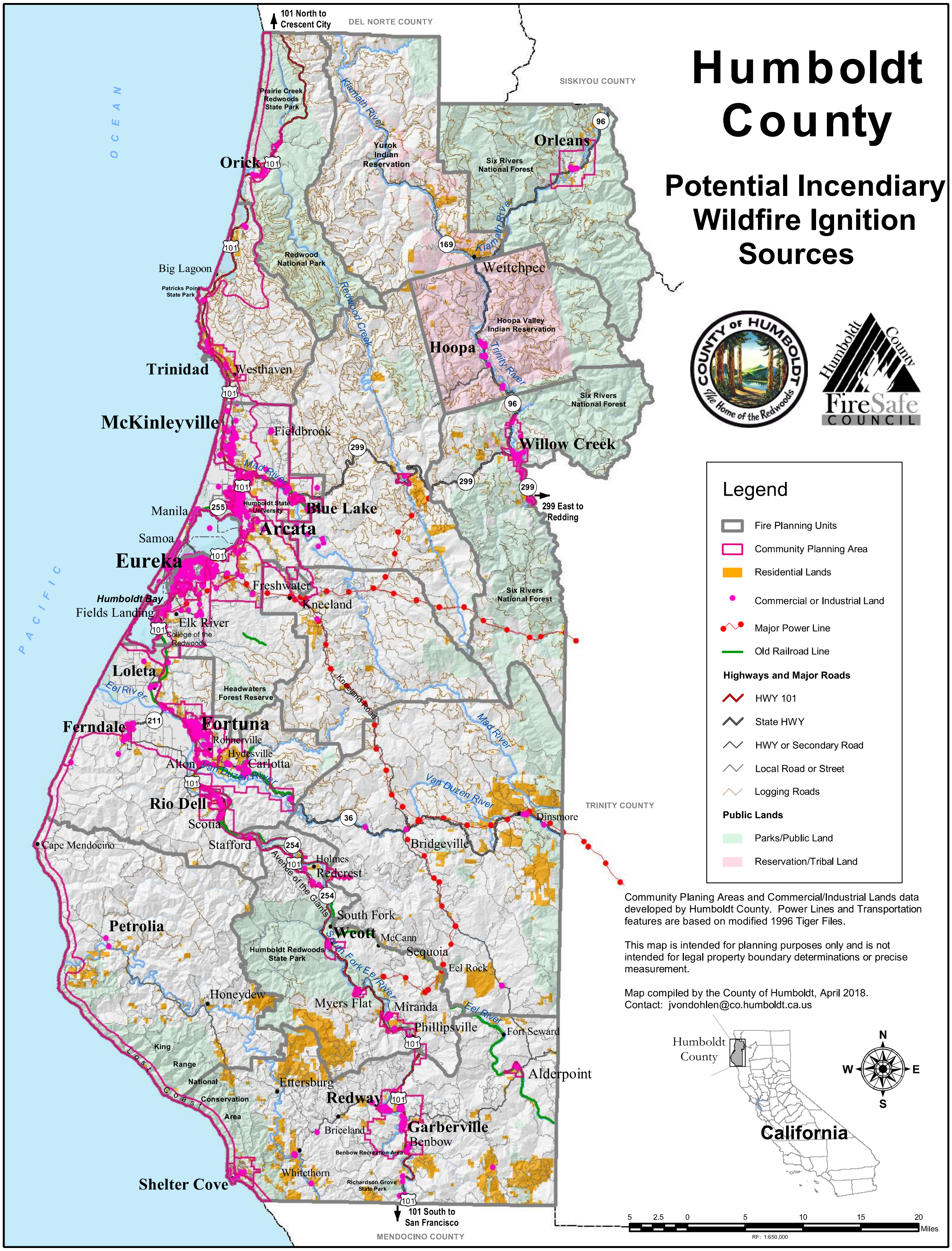
Condition Class (2003) from CDF FRAP refers to the general deviation of ecosystems from their presettlement natural fire regime, and can be viewed as a measure of sensitivity to fire damage to key elements and processes typical of those ecosystems, or fire-related risk to ecosystem health.
Go to http://frap.cdf.ca.gov/ for more information.

This map is intended for planning purposes only and is not intended for legal property boundary determinations or precise measurement.

Map compiled by County of Humboldt, April 2018.
Contact: jvondohlen@co.humboldt.ca.us

## E.7 WILDFIRE RISK

**Map E.6 Potential Incendiary Wildfire Ignition Sources**



Humboldt County

Potential Incendiary Wildfire Ignition Sources

Community Planing Areas and Commercial/Industrial Lands data developed by Humboldt County. Power Lines and Transportation features are based on modified 1996 Tiger Files.

This map is intended for planning purposes only and is not intended for legal property boundary determinations or precise measurement.

Map compiled by the County of Humboldt, April 2018.
Contact: jvondohlen@co.humboldt.ca.us