Ecological site group R004BK201CA
Coastal Mountain perennial grasslands

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Key Characteristics

- Not like the previous LRUs – LRU K
- Soils support perennial rangelands

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

Physiography

This ecological site is generally found on ridges, knobs, and the upper elevation slopes generally between 15-75% within the forested areas of LRU K. This site is generally found above 800 ft. but can be lower near the southern end of the LRU.

Climate

The average annual precipitation in this MLRA is 23 to 98 inches (585 to 2,490 millimeters), increasing with elevation inland. Most of the rainfall occurs as low-intensity, Pacific frontal storms. Precipitation is evenly distributed throughout fall, winter, and spring, but summers are dry. Snowfall is rare along the coast, but snow accumulates at the higher elevations directly inland. Fog is a significant variable that defines this MLRA from other similar MLRAs. Summer fog frequency values of greater than 35% are strongly correlated to the extent of coast redwood distribution, which is a primary indicator species in this MLRA. Nightime fog is approximately twice as common as daytime fog and seasonally, it reaches its peak frequency in early August, with the greatest occurrence of fog from June through September (Johnstone and Dawson 2010). The average annual temperature is 49 to 59 degrees F (10 to 15 degrees C). The freeze-free period averages 300 days and ranges from 230 to 365 days, decreasing inland as elevation increases.

Unlike the conifer-dominated forests of LRU I to the north, these central redwood forests in LRU K are typically more a mixture of conifers and hardwoods. Vegetation includes a multi-story canopy of redwood, Douglas-fir, tanoak, bigleaf maple, evergreen shrubs, and various grasses. The near-coastal part of the region that is influenced more by fog has more redwoods and similarities to LRU I to the north, however the drier summers and

more limited duration of coastal fog limits the competitive advantage of the coastal redwoods in this LRU. This creates limited areas that remain dominated by coast redwood and a larger portion of the LRU dominated by Douglas-fir and other hardwoods, with some redwoods near the lower parts of the mountain slopes where fog still has some influence or the drainages are narrower and remain cooler in the summers, limiting evapotranspiration losses.

Soil features

Although the soils of this provisional site concept are highly varied, they all share the common variable of steeper slopes with a bedrock restriction, higher runoff rates, and loamy soil textures that provide good growing conditions for shallower rooted herbaceous species.

Vegetation dynamics

This provisional ecological site concept attempts to describe the various complicated areas of coastal prairie in LRU K. They exist in a patchy dynamic intermixed with coyotebrush shrublands, and Douglas-fir and/or redwood forests. These prairie complexes relied heavily on hundreds of years of Native American burning to maintain their dominance in an area that provided no limitations to on the growing conditions for trees that would have overtaken many of these prairies without the fires to burn them back. This concept lumps many of the unique prairie expressions into one large concept, due to limited soil mapping that successfully parses out the differences between these types and focuses primarily on the primary abiotic factors and ecological dynamics that maintain and/or alter these vegetative communities. The extent of this ecological site concept stretches primarily along the inner coastal mountain portions of LRU K.

The ustic-isomesic soil climate regime of this LRU is mainly at elevations between 500 and 2,000 feet. It is within the zone of moderate marine influence. The fog influence is less pronounced than in the udic moisture regime, but some moisture is added to the soil where the tree canopy causes water to precipitate from the fog. The fog is less dense and does not blanket this zone as frequently as in the wetter zone at the lower elevations. The soils are dry for part of the summer, and there is little variation between summer and winter soil temperatures at a depth of 20 inches. The first continuous north-south range of mountains inland from the coast that reaches 2,000 feet forms an effective barrier to the encroachment of marine air. In some drainageways, such as the Noyo River watershed, this zone extends inland 20 miles or more. In other areas, such as along Elkhorn Ridge 7 miles north of Branscomb, the marine influence stops within 8 miles of the coast.

Abiotic Factors

The primary factors that maintain these sites in either coastal prairies, coyotebrush shrublands, and Douglas-fir and/or redwoods are related to time without fire, the skeletal soils, and seed source availability.

Primary Disturbances

The primary disturbance to this ecological site concept is fire and active soil movement on the steeper slopes through surface runoff that keeps the woody species that are actively encroaching the site from establishing, allowing these grasslands to maintain the competitive advantage. When summer fog is less prevalent, tree and shrub encroachment will slow and years when summer fog is very consistent tree and shrub encroachment may be quite rapid.

Historically, prairies within this region were thought to have been dominated by native perennial bunchgrasses and numerous associated forbs. Native Americans utilized the prairies for food and cultural materials. Regular burning stimulated the growth of grasses and eliminated invading shrubs and trees, thereby attracting wildlife. The use of fire for over 5,000 years by Native Americans created a system in equilibrium that controlled the vegetative structure and composition.

With the advent of European settlements, changing land use practices significantly altered the vegetation. In the 1800s cattle and sheep grazing became widespread. Increased grazing pressure from domestic livestock and range seeding reduced the native perennials and increased the population of introduced perennials and forbs. More studies are needed to understand grazing and native plant interactions. Shifts in the annual plant community caused by grazing are difficult to document. Certain species will increase with favorable weather and grazing conditions.

Non-native grasses often outcompete natives for water, nutrients and growing space. *Arrhenatherum elatius* (tall oatgrass), an introduced perennial within these prairies, is considered an invasive exotic. One study indicates that early season burning may be more effective in eliminating flowers and developing seeds of tall oatgrass prior to their dispersal. However, spring burning has a negative effect on some of the native perennials, like *Danthonia californica* (California oatgrass). Fall burning has slowed the advance of tall oatgrass within parts of this LRU.

Prescribed burning may favor one species over another. Recent studies indicate that periodic fire may favor perennial species by reducing litter cover and eliminating other plant competition, however it may also increase the production of non-natives and exotic forbs. Long term studies are lacking to evaluate the interaction of prescribed fire, climate, and grazing on both natives and non-native species.

Historically, there was very little overlap between the prairie and conifer systems within much of this LRU. Fire exclusion in the last century has allowed for the encroachment of shrubs, and in some cases trees, into the prairies. Roads established for harvesting purposes left exposed cut and fill slopes that were rapidly invaded by Douglas-fir. Invasion of prairie by conifers has led to conversion to forest in a very short period of time.

Major Land Resource Area

MLRA 004B
Coastal Redwood Belt

Stage

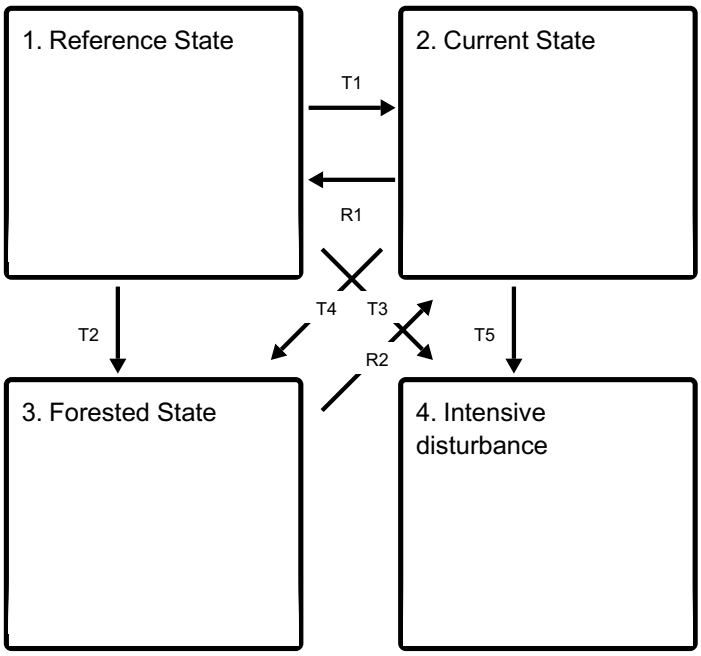
Provisional

Contributors

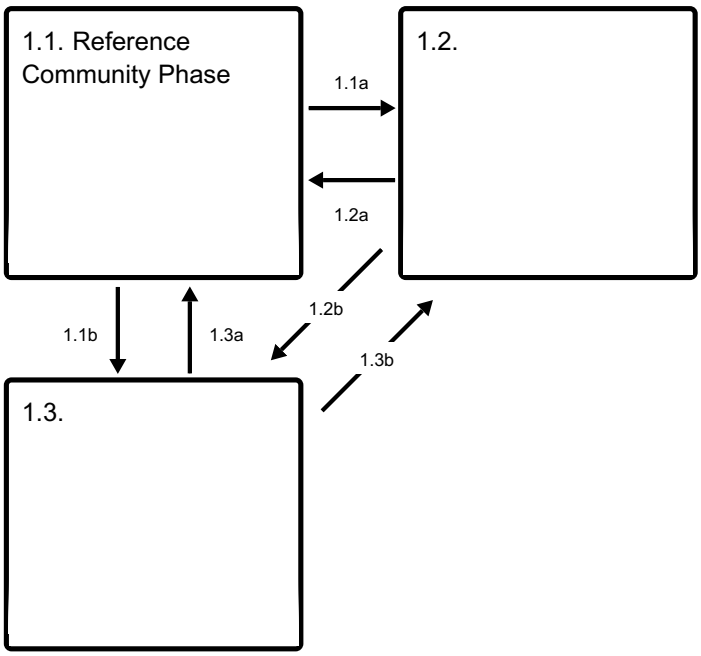
Kendra Moseley

State and transition model

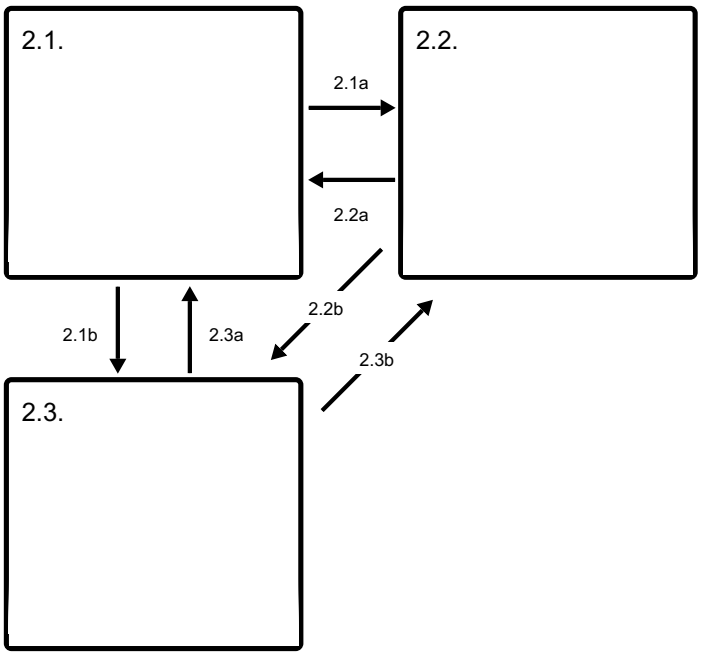
Ecosystem states



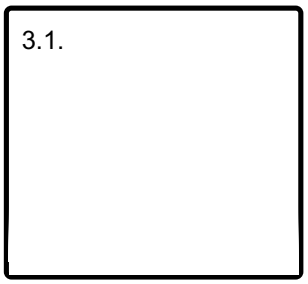
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities

4.1. Intensive disturbance

State 1
Reference State

The dynamics described below are general to the level that the site concept has been developed for provisional ecological site concept identification and further investigation purposes only. It is meant to give a general overview of the ecological dynamics of the system and should not be viewed as a model for a specific ecological site level management. It is supported by the current available literature that was reviewed for a general understanding of the system and basic understanding of the abiotic and biotic drivers. Further investigations and soil-site data collection and analysis should be conducted before specific land management can be applied at the ecological site-specific scale. This STM only explains the general ecology and dynamics. Composition and dynamics specific to this ecological site concept are not well documented and will require more data collection and soil investigation to properly define and describe them for land management decisions on an ecological site basis. Reference State (State 1) – It is thought that native perennial grasses and forbs once dominated many of the grasslands throughout this LRU. Native American burning often were primarily responsible for sustaining these plant communities over several thousand years. Without fires every few years, this community phase is actively encroached by shrubs and trees depending on where it is found within the LRU. Many of these rangelands are inland from the coast and more protected from the winds and daily harsh conditions of the coast, leaving them more susceptible to encroachment and infill of shrubs and trees.

Community 1.1
Reference Community Phase

Native perennial grasses may have included *Danthonia californica* (California oatgrass), *Elymus glaucus* (blue wildrye), and Agrostis spp. (bentgrass). *Pteridium aquilinum* (Western brackenfern) is also a common native forb.

Community 1.2

This community phase will be most prevalent in areas where *Baccharis pilularis* (coyotebrush) seed is available and time without fire has allowed the coyotebrush and western brackenfern to slowly encroach the grasslands.

Community 1.3

This community phase is dominated by Douglas-fir and/or redwood with an understory of shrubs and brackenferns.

Pathway 1.1a
Community 1.1 to 1.2

Regular burning of prairies by Native Americans stimulated the growth of grasses and eliminated invading shrubs and trees. Native perennial grasslands are favored by periodic burning. Loss of fire results in an increase of native shrubs provided there is sufficient seed source.

Pathway 1.1b
Community 1.1 to 1.3

In areas where *Baccharis pilularis* (coyotebrush) seed is unavailable, CP 1.1 may go straight to tree dominated, as Douglas-fir and/or redwood slowly infill without frequent fire.

Pathway 1.2a
Community 1.2 to 1.1

Prescribed fire or a natural fire would thin native shrubs and return the vegetation structure and composition to community phase 1.1.

Pathway 1.2b
Community 1.2 to 1.3

Extended time without fire, allows time for Pseudotsuga menzeisii (Douglas-fir) and/or *Sequoia sempervirens* (redwood) to overtop the shrubs and dominate the site, shading out and killing off the coyotebrush, grass and most herbaceous plants.

Pathway 1.3a
Community 1.3 to 1.1

Either through a stand-replacing fire or through logging clearcuts, Pseudotsuga menzeisii (Douglas-fir) and/or *Sequoia sempervirens* (redwood) will be removed from the site and the grassland species will re-emerge from a persistent seed bank. It may take several fire disturbance cycles to reduce woody fuel loads and snags and recover a composition reflective of the reference grassland plant community. When fire is not employed, the seed bank can be slower to respond, and planting may be required to prevent invasion and dominance by non-native annuals and perennials.

Pathway 1.3b

Community 1.3 to 1.2

This pathway would only occur if the timing of the fire came before the Douglas-fir and/or redwoods became too substantial to burn in a light intensity fire and coyotebrush was still a dominant component of the canopy structure.

State 2
Current State

With European settlement in the mid-1800s, the use of fire largely ceased. Seeding of introduced perennials was practiced in many areas suitable for grazing and other types pasture practices. Uncontrolled grazing of domestic livestock may have also contributed to an increase in annual grasses and forbs. Introduced perennials and annuals have out-competed native grasses and dominated the plant community in some areas. Fire may stimulate growth of native perennials by reducing competition but may also increase the amount of introduced perennials and forbs. When fire is re-introduced to the system, varying effects on vegetation may result. Burning may cause an increase in native and exotic forbs such as western brackenfern and in introduced perennials such as tall oatgrass. Timing of burning appears to be an important factor affecting the presence of the native perennial California oatgrass; cover and frequency may decline with early summer burns versus late summer burning. Spring burning may be more successful in reducing tall oatgrass than fall burning; other studies indicate that spring burning may be detrimental to established native populations such as California oatgrass. Studies indicate that the effects of fire on native grasses are variable and further study is needed.

Community 2.1

This community phase is dominated by non-native perennial and annual grasses. They likely include *Arrhenatherum elatius* (tall oatgrass), *Dactylis glomerata* (orchardgrass), *Anthoxanthum aristatum* (annual vernalgrass), and *Cynosurus echinatus* (bristly dogstail grass).

Community 2.2

This community phase will be most prevalent in areas where *Baccharis pilularis* (coyotebrush) seed is available and time without fire has allowed the coyotebrush and western brackenfern to slowly encroach the grasslands.

Community 2.3

This community phase is dominated by Douglas-fir and/or redwood with an understory of shrubs and brackenferns.

Pathway 2.1a

Community 2.1 to 2.2

Regular burning of prairies by Native Americans stimulated the growth of grasses and eliminated invading shrubs and trees. Native perennial grasslands are favored by periodic burning and may temporarily be more dominant in the mix of grasses.

Pathway 2.1b
Community 2.1 to 2.3

In areas where *Baccharis pilularis* (coyotebrush) seed is unavailable, CP 1.1 may go straight to tree dominated, as Douglas-fir and/or redwood infill without fire.

Pathway 2.2a
Community 2.2 to 2.1

Fire will return the vegetation to community phase 1.1.

Pathway 2.2b
Community 2.2 to 2.3

Extended time without fire, allows time for Pseudotsuga menzeisii (Douglas-fir) and/or *Sequoia sempervirens* (redwood) to begin to overtop the shrubs and begin to dominate the site, shading out and killing off the coyotebrush.

Pathway 2.3a
Community 2.3 to 2.1

Either through a stand-replacing fire or through logging clearcuts, Pseudotsuga menzeisii (Douglas-fir) and/or *Sequoia sempervirens* (redwood) will be removed from the site and the grassland species will re-emerge from a persistent seed bank. It may take several fire disturbance cycles to reduce woody fuel loads and snags. When fire is not employed, the herbaceous seed bank can be slower to respond.

Pathway 2.3b
Community 2.3 to 2.2

This pathway would only occur if the timing of the fire came before the Douglas-fir and/or redwoods became too substantial to burn in a light intensity fire and coyotebrush was still a dominant component of the canopy structure.

State 3
Forested State

This state represents the point when fire has been suppressed for too long and the site has crossed a threshold and become a forest site, dominated by Douglas-fir and/or redwood

and resembles many of the other surrounding associated forest sites. This state is not fleshed out beyond recognizing that the prairie may cross a threshold and begin to resemble the surrounding forest sites, depending on where in the LRU that prairie resides.

Community 3.1

This community phase represents the point when fire has been suppressed for too long and the site has crossed a threshold and become a forest site, dominated by Douglas-fir and/or redwood and resembles many of the other surrounding associated forest sites. This phase is not fleshed out beyond recognizing that the prairie may cross a threshold and begin to resemble the surrounding forest sites, depending on where in the LRU that prairie is.

State 4
Intensive disturbance

This state represents the intensive land uses that have significantly altered this ecological site due to urban developments, recreational activities, and agriculture. More information about this state is needed to flesh out the various impacts these types of land uses/alterations have had on the ecological site in order to better understand how to better manage of these areas or potentially attempt restoration of these areas where possible.

Community 4.1
Intensive disturbance

This community phase represents all the varied land uses that significantly alter this ecological site. This is an extremely varied community phase that includes all types of alterations that so significantly alter the phase that it is permanently changed and no longer has typical or even representative ecological dynamics.

Transition T1
State 1 to 2

This transition is caused by the introduction of non-native seed that allowed the conversion from a native perennial prairie to a non-native perennial and annual dominated prairie. Once these species become a part of the system, it is highly unlikely to go back without significant time and labor, and yearly maintenance.

Transition T2
State 1 to 3

This transition is caused by the long-term suppression of fire or fire emulating practices that allowed the Douglas-fir and/or redwoods to persist and shift the site characteristics and feedback mechanisms to those of a forested site, not a grassland. Time without fire is

long enough that even if fire were used there is no longer a seed source or the soil properties necessary to allow grasslands to outcompete the trees and shrubs that now dominate the site. There is no restoration pathway for this site, as it is not known if this type of restoration is possible once it has crossed this threshold.

Transition T3
State 1 to 4

This transition is caused by significant human alterations that force this ecological site over a threshold and change the function and structure of this site in extensive ways.

Restoration pathway R1
State 2 to 1

This restoration pathway occurs only when significant time and money inputs that would require constant maintenance and weed management and should be focused on areas that have not been permanently altered by urban developments. This restoration pathway may be less likely than R2, since most of these very altered landscapes will be more hospitable to invasive species than to the native species that are more particular and require specific growing conditions that may not be replicable due to the alterations to the site that had occurred.

Transition T4
State 2 to 3

This transition is caused by the long-term suppression of fire or fire emulating practices that allowed the Douglas-fir and/or redwoods to persist and shift the site characteristics and feedback mechanisms to those of a forested site, not a grassland. Time without fire is long enough that even if fire were used there is no longer a seed source or the soil properties necessary to allow grasslands to outcompete the trees and shrubs that now dominate the site. There is no restoration pathway for this site, as it is not known if this type of restoration is possible once it has crossed this threshold.

Transition T5
State 2 to 4

This transition is caused by significant human alterations that force this ecological site over a threshold and change the function and structure of this site in extensive ways.

Restoration pathway R2
State 3 to 2

This restoration pathway occurs only when significant time and money inputs that would require constant maintenance and weed management and should be focused on areas

that have not been permanently altered by urban developments. This restoration pathway may be more likely than R1, since most of these very altered landscapes will be more hospitable to invasive species than to the native species that are more particular and require specific growing conditions and simply don’t have the ability to compete with the non-native species in most cases.

Citations