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California Montane Riparian Systems

BpS Model/Description Version: Aug. 2020 ,

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Reviewer: Janet Fryer

Vegetation Type

Mixed Upland and Wetland

Map Zones

4, 5

Geographic Range

This ecological system is found mostly in the central and inner northern Coast Ranges

of California and Sierra Nevada foothills.

Biophysical Site Description

It includes springs, seeps, and perennial and intermittent streams in serpentine substrates and non-serpentine substrates.

Vegetation Description

This system often occurs as a mosaic of multiple alliances that may be tree or shrub dominated. The variety of plant associations connected to this system reflects elevation, stream gradient, valley confinement, floodplain development, and flood frequency, magnitude, and timing. Dominant trees may include *Alnus rhombifolia*, *Acer negundo*, *Alnus rubra* (in Coast Ranges), *Populus fremontii, Populus balsamifera* ssp. *trichocarpa, Salix laevigata, Salix lucida* ssp. *lasiandra, Salix gooddingii, Pseudotsuga menziesii, Platanus racemosa, Quercus agrifolia*, and *Acer macrophyllum* (in central and south coast). Dominant shrubs include *Salix exigua* and *Salix lasiolepis*. These riparian areas may contain madrone, tanoak, California laurel, dogwood, maple, and ash. Willow species are common, with species changing as elevation increases.

**BpS Dominant and Indicator Species**

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| SABR2 | *Salix breweri* | Brewer's willow |
| HESA17 | *Hesperocyparis sargentii* | Sargent's cypress |
| FRCA12 | *Frangula californica* | California buckthorn |
| UMCA | *Umbellularia californica* | California laurel |
| CIFO2 | *Cirsium fontinale* | Fountain thistle |
| STAL | *Stachys albens* | Whitestem hedgenettle |

Species names are from the NRCS PLANTS database. Check species codes at http://plants.usda.gov.

Disturbance Description

Riparian portions of this system are disturbance-driven and require flood-induced scour and deposition for seed germination and stand maintenance of seral vegetation. Stands initiate on depositional features (point-bar and floodplains), colonizing the active channels of larger streams and rivers. Flooding events are highly variable and may include local erosion and deposition in most years during winter or spring. Smaller floods (i.e., those smaller than a 10yr flood event) are responsible for maintaining the summer low water channel free of annually regenerating riparian hardwood seedlings. Major flooding events (i.e., those greater than a 10yr flood event) may scour away, setting back succession in riparian vegetation growing along the active channel and low floodplain surfaces, while flooding and depositing fine, silty sediments in established riparian stands farther from active channels.

There are few fire history studies of this Biophysical Setting (BpS). Montane riparian zones of California experience surface fires, mixed fires, and crown fires (Bendix and Cowell 2010; Kobziar and McBride 2006; Murphy et al. 2007). Skinner (1997) reported that fire frequency is less (about double the mean return interval) in perennial riparian zones than in the adjacent uplands, but that the range of intervals is comparable. Shrub communities that are wet throughout the year, such as willow scrub, usually burn less frequently than adjacent upland communities (Luce et al. 2012). However, Skinner suggested there is more variability in fire frequency and severity in forested riparian areas than in uplands (Skinner 2002, 2003). Because riparian areas are moister than upland areas, some fires may leave no scars on riparian trees. Consequently, fire histories using fire scars may underestimate fire frequency in riparian zones (Skinner 2002). Taylor and Skinner (1998) reported that fires in steep upper reaches of intermittent streams have frequent, severe fires.

Perennial riparian zones appear to stop the spread of some fires (Luce et al. 2012; Pettit and Maiman 2007) and thus contribute to spatial and temporal diversity of landscapes beyond what their relative area would suggest. Most commonly, riparian areas act as fuel breaks where large perennial streams or river valleys create large breaks in fuel composition and continuity. However, not all riparian areas act as fuel breaks. Riparian areas burn less severely and/or less frequently than adjacent uplands where the riparian area is wetter than adjacent vegetation. Fire severity is similar in riparian and adjacent upland areas when riparian vegetation and terrain are similar to those in the upland area.

Finally, riparian areas may burn more severely and/or more frequently than adjacent uplands. Fire managers have observed this in steep terrain and narrow stream valleys (Luce et al. 2012). High fuel loads in riparian areas can increase fire spread and severity by acting as "wicks." Fuel loads higher than those of surrounding vegetation may be due to natural succession, fire exclusion, tree harvesting, or fuel treatments in uplands (Luce et al. 2012). During the 2007 Angora Fire on the Tahoe National Forest, for example, heavy, dead woody debris in the Angora Creek stream-riparian corridor helped fuel a mixed surface and active crown fire that raced down the corridor and up Angora Ridge (Murphy et al. 2007).

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 100 | 43 |  |  |
| Moderate (Mixed) | 76 | 57 |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 43 | 100 |  |  |

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is the central tendency modeled. Percent of all fires is the percent of all fires modeled in that severity class. Minimum and Maximum FIs show the relative range of fire intervals as estimated by model contributors, if known.

Scale Description

This system can exist as small to large linear features in the landscape (e.g., Klamath, Eel, Mattole Rivers) and is characteristically patchy and non-contiguous. At lower elevation and higher stream order riverine systems, this vegetation may exist as mid to large contiguous patches. Fire disturbance patch size varies from 1-100ac, but uncertainty exists about fire size and behavior in these riparian systems.

Adjacency or Identification Concerns

Fire exclusion may have had some impact on the levels of fuels and amount of shading in riparian areas (Skinner 1997). Fire exclusion has altered stand structure and plant species composition, and increased fuel loads in many montane riparian corridors (Luce et al. 2012; Safford et al. 2009). Heavy fuel accumulation is particularly common in early post-fire and late-seral riparian forests (Spies and Cline 1988).

Fire exclusion also affects debris accumulation in aquatic ecosystems. Parenti (Parenti 2002) suggested that with fire exclusion in the Sierra Nevada, the frequency of large woody debris deposition into streams, pool frequency, and pool volume are all reduced compared to historical levels. When fire does occur in suppression areas, post-fire deposition of large woody debris and sediment is often greater than historical levels. Parenti hypothesized that first-order streams have sufficient stream power to transport increased fuel and sediment loads; however, mid-elevation (around 5,000ft [1,500m]) alluvial stream channels cannot transport these loads efficiently because their stream power is too low. As a result, pool volumes are decreased from historical levels as sediment from first-order streams is transported and deposited into alluvial streams (Parenti 2002).

Many of California's riparian plant communities have undergone dramatic changes in species composition due to non-native plant invasions (Bossard and Randall 2007; Dudley 1998), and highly flammable nonnative species may increase fuel biomass, continuity, and fire severity (Verkaik et al. 2013). Exotic trees such as *Ailanthus altissima* and *Eucalyptus* spp. and exotic herbs such as *Arundo donax* occur. In Yosemite National Park, invasives were significantly more abundant in burned riparian areas compared to burned upland areas (Kaczynski 2007).

Issues or Problems

Many of the montane riparian systems are affected by the lack of large floods that set back succession, which has fragmented a large percentage of this vegetation. The lack of reset also has affected the age and canopy structure within these stands, making them prone to exotic species invasion and fire.

Shaffer and others (Shaffer et al. 2006) suggested that although the fire return interval may not have changed due to altered stream flows, fires probably move through valley bottoms and low-gradient riparian zones differently than they did historically. Human alterations in hydrology and to the terrain vegetation have likely increased the probability of severe fires and reduced the capacity of riparian areas to serve as fuel breaks (Dwier and Kauffman 2003). Some speculate that lack of flooding on regulated watercourses has contributed to higher fuel accumulations and more severe fires than occurred prior to regulation (Ellis 2001; Klinger et al. 2008).

Native Uncharacteristic Conditions

Many rivers in this system are out of sync due to dams changing what was winter and spring delivery of sediment and flooding to a more even delivery of summer water without high flooding events. Nonnative invasion of trees such as *Ailanthus althissima, Robinia pseudoacacia,* and *Arundo donax* have also changed species dynamics, particularly *Ailanthus* invading the drier sites that were once riparian and *Robinia* invading older riparian stands.

Comments

During the 2016 BpS review, Janet Fryer reviewed this BpS and made descriptive edits. As a result of review, beaver clear-cutting was removed as a disturbance in the Early class because the reviewer noted that the trees were too small for beaver at that stage and that the modeled replacement fire frequency was increased in all classes.

Succession Classes

**Mapping Rules**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Upper Layer Lifeform** | **Height (m)** | **Canopy Cover (%)** | | | | | | | | | |
| **0-10** | **11-20** | **21-30** | **31-40** | **41 - 50** | **51-60** | **61-70** | **71-80** | **81-90** | **91-100** |
| Herb | 0-0.5 | A | A | A | A | A | A | A | A | A | A |
| Herb | 0.5-1.0 | A | A | A | A | A | A | A | A | A | A |
| Herb | >1.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 0-0.5 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 0.5-1.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 1.0-3.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | >3.0 | A | A | A | A | A | A | A | A | A | A |
| Tree | 0-5 | B | B | B | B | B | B | B | B | B | B |
| Tree | 5-10 | B | B | B | B | B | B | B | B | B | B |
| Tree | 10-25 | C | C | C | C | C | C | C | C | C | C |
| Tree | 25-50 | C | C | C | C | C | C | C | C | C | C |
| Tree | >50 | C | C | C | C | C | C | C | C | C | C |

Succession class letters A-E are described in the Succession Class Description section. Some classes use a leafform distinction where a qualifier is added to the class letter: Brdl (broadleaf), Con (conifer), or Mix (mixed conifer and broadleaf). UN refers to uncharacteristic native or a combination of height and cover that would not be expected under the reference condition. NP refers to not possible or a combination of height and cover which is not physiologically possible for the species in the BpS.

**Description**

Class A 23 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| SAEX | Salix exigua | Narrowleaf willow | Upper |
| SALA3 | Salix laevigata | Red willow | Upper |
| SALAL2 | Salix lasiolepis var. lasiolepis | Arroyo willow | None |
| ALNUS | Alnus | Alder | None |

Description

Highly dependent on flow patterns in the first 5yrs after nursery site formed. Composition highly variable. Typically tree-dominated, but shrubs may co-dominate. *Salix* and *Alnus* are shrubs at this seral stage.

*Maximum Tree Size Class*  
None

Class B 54 Mid Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| SAEX | Salix exigua | Narrowleaf willow | Middle |
| SALA3 | Salix laevigate | Red willow | Upper |
| SALUC | Salix lucida ssp. caudata | Greenleaf willow | Upper |
| SALAL2 | Salix lasiolepis var. lasiolepis | Arroyo willow | None |

Description

Vegetation composition is highly dependent on the hydrologic regime and includes tall trees and shrubs. *Alnus* and *Populus balsamifera* ssp. *trichocarpa* are additional indicator species for this class.

*Maximum Tree Size Class*  
Pole 5-9" DBH

Class C 23 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| POPUL | Populus | Cottonwood | Upper |
| SALA3 | Salix laevigate | Red willow | Mid-Upper |
| SALUC | Salix lucida ssp. caudata | Greenleaf willow | None |
| ALNUS | Alnus | Alder | None |

Description

Mature, large cottonwood, alder, etc., woodlands. Tree height can exceed 75ft.

*Maximum Tree Size Class*  
Large 21-33" DBH

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:ALL | 4 |
| Mid1:ALL | 5 | Late1:CLS | 24 |
| Late1:CLS | 25 | Late1:CLS | 999 |

Probabilistic Transitions

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Disturbance Type** | **Disturbance occurs In** | **Moves vegetation to** | **Disturbance Probability** | **Return Interval (yrs)** | **Reset Age to New Class Start Age After Disturbance?** | **Years Since Last Disturbance** |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Wind or Weather or Stress | Early1:ALL | Early1:ALL | 0.1 | 10 | Yes | 0 |
| Optional 1 | Mid1:ALL | Mid1:ALL | 0.001 | 1000 | No | 0 |
| Replacement Fire | Mid1:ALL | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Mixed Fire | Mid1:ALL | Early1:ALL | 0.02 | 50 | Yes | 0 |
| Wind or Weather or Stress | Mid1:ALL | Early1:ALL | 0.04 | 25 | Yes | 0 |
| Wind or Weather or Stress | Mid1:ALL | Mid1:ALL | 0.2 | 5 | No | 0 |
| Optional 1 | Late1:CLS | Mid1:ALL | 0.001 | 1000 | Yes | 0 |
| Mixed Fire | Late1:CLS | Mid1:ALL | 0.01 | 100 | Yes | 0 |
| Wind or Weather or Stress | Late1:CLS | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Wind or Weather or Stress | Late1:CLS | Mid1:ALL | 0.02 | 50 | Yes | 0 |

Optional Disturbances

Optional 1: American beaver

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