11520

California Montane Riparian Systems

BpS Model/Description Version: Aug. 202012/20/05 18/14

|  |  |  |  |
| --- | --- | --- | --- |
| **Modelers** |  | **Reviewers** |  |
| John Foster | jfoster@tnc.org | Dave Schmidt | dschmidt@tnc.org |
| None | None | None | None |
| None | None | None | None |

Reviewer: Janet Fryer

Vegetation Type

Mixed Upland and Wetland

Map Zone

6

Geographic Range

This Biophysical Setting (BpS) 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 BpS often occurs as a mosaic of multiple communities that are tree-dominated with a diverse shrub component. The variety of plant associations connected to this system reflects elevation, stream gradient, floodplain width, and flooding events. Dominant trees may include *Alnus rhombifolia*, *Acer negundo*, *Alnus rubra* (in Coast Ranges), *Populus fremontii*, *Salix laevigata*, *Salix gooddingii*, *Pseudotsuga menziesii*, *Platanus racemosa*, *Quercus agrifolia*, and *Acer macrophyllum* (in central and south coast). Dominant shrubs include *Salix exigua* and *Salix lasiolepis*.

At lowest elevations, the riparian areas may contain madrone, tanoak, California laurel, dogwood, maple, and ash. Willow species are common throughout, with species changing as elevation increases. At the highest riparian areas in the Klamath region, the vegetation has a more Sierran appearance.

BpS Dominant and Indicator Species

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

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

Disturbance Description

Riparian portions of this BpS are disturbance-driven and require limited flooding, scour, and deposition for seed germination and maintenance of seral vegetation.

There are few fire history studies for this 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).

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). Taylor and Skinner (1998) reported that fires in steep upper reaches of intermittent streams have frequent, severe fires.

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 | 89 | 52 |  |  |
| Moderate (Mixed) | 96 | 48 |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 46 | 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, Matole rivers). In larger, low-elevation riverine systems, this system may exist as mid to large 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 [1,500 m]) 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

Modeler is not specifically familiar with this type. Uncertainty exists about the effects of American beaver activity and historic fire in these systems.

Native Uncharacteristic Conditions

Comments

During the 2016 model review period, this model was reviewed and descriptive changes made by Janet Fryer (jfryer@fs.fed.us). 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.

The fire return interval was derived from composite of the available upland types in the Sierra (mixed-conifer, red fir), then doubling the return interval in accordance with Skinner (1997). Expert input on hydrologic cycle is needed.

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 19 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| SALIX | Salix | Willow | Upper |
| ALNUS | Alnus | Alder | Upper |

Description

Immediate post-disturbance responses are dependent on pre-burn vegetation composition. 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 60 Mid Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| SALIX | Salix | Willow | Middle |
| POPUL | Populus | Cottonwood | Upper |
| ALNUS | Alnus | Alder | Upper |

Description

Vegetation composition is highly dependent on the hydrologic regime and includes tall trees and shrubs.

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

Class C 21 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| POPUL | Populus | Cottonwood | Upper |
| ALNUS | Alnus | Alder | Mid-Upper |

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 | 0.0125 | 80 | Yes | 0 |
| Wind or Weather or Stress | Early1:ALL | Early1:ALL | 0.1 | 10 | Yes | 0 |
| Wind or Weather or Stress | Mid1:ALL | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Replacement Fire | Mid1:ALL | Early1:ALL | 0.0125 | 80 | Yes | 0 |
| Mixed Fire | Mid1:ALL | Mid1:ALL | 0.015 | 67 | No | 0 |
| Optional 1 | Mid1:ALL | Mid1:ALL | 0.025 | 40 | No | 0 |
| Optional 1 | Mid1:ALL | Early1:ALL | 0.025 | 40 | 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 | 0.007 | 143 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.007 | 143 | Yes | 0 |
| Wind or Weather or Stress | Late1:CLS | Early1:ALL | 0.02 | 50 | Yes | 0 |
| Wind or Weather or Stress | Late1:CLS | Mid1:ALL | 0.05 | 20 | Yes | 0 |

Optional Disturbances

Optional 1: American beaver

References

Bendix, Jacob; Cowell, C. Mark. 2010. Impacts of wildfire on the composition and structure of riparian forests in southern California. Ecosystems. 13(1): 99-107.

Bossard, Carla C.; Randall, John M. 2007. Nonnative plants of California. In: Barbour, Michael G.; Keeler-Wolf, Todd; Schoenherr, Allan A., eds. Terrestrial vegetation of California. Berkeley, CA: University of California Press: 107-123.

Dudley, Tom. 1998. Exotic plant invasions in California riparian areas and wetlands. Fremontia. 26(4): 24-29.

Dwire, Kathleen A.; Kauffman, J. Boone. 2003. Fire and riparian ecosystems in landscapes of the western USA. In: Young, Michael K.; Gresswell, Robert E.; Luce, Charles H., eds. Selected papers from an international symposium on effects of wildland fire on aquatic ecosystems in the western USA; 2002 April 22-24; Boise, ID. In: Forest Ecology and Management. Special Issue: The effects of wildland fire on aquatic ecosystems in the western USA. 178(1-2): 61-74.

Dwire, Kathleen A.; Meyer, Kristen E.; Ryan, Sandra E.; Riegel, Gregg; Burton, Timothy. 2011. A guide to fuels management in riparian areas of the Interior West. Final Report. JFSP Project Number 09-2-01-20. Boise, ID: Joint Fire Science Program. 30p.

Ellis, Lisa M. 2001. Short-term response of woody plants to fire in a Rio Grande riparian forest, central New Mexico, USA. Biological Conservation. 97(2): 159-170.

Fryer, Janet L. 2015. Fire regimes of montane riparian communities in California and southwestern Oregon. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/fire\_regimes/CA\_montane\_riparian/all.html

Gage, Edward; Cooper, David J. 2013. Historical range of variation assessment for wetland and riparian ecosystems, U.S. Forest Service Rocky Mountain Region. Gen. Tech. Rep. RMRS-GTR-286WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 239 p.

Kaczynski, Kristen Mannix. 2007. Invasive species in wilderness as a function of burn severity: a case study in Yosemite National Park, California. Boulder, CO: University of Colorado. 84 p. Thesis.

Klinger, Rob; Wills, Robin; Brooks, Matthew L. 2008. Fire and nonnative invasive plants in the Southwest Coastal bioregion. In: Zouhar, Kristin; Smith, Jane Kapler; Sutherland, Steve; Brooks, Matthew L., eds. Wildland fire in ecosystems: fire and nonnative invasive plants. Gen. Tech. Rep. RMRS-GTR-42-vol. 6. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 175-196.

Kobziar, Leda N.; McBride, Joe R. 2006. Wildfire burn patterns and riparian vegetation response along two northern Sierra Nevada streams. Forest Ecology and Management. 222(1-3): 254-265.

Luce, Charles; Morgan, Penny; Dwire, Kathleen; Isaak, Daniel; Holden, Zachary; Rieman, Bruce. 2012. Part II: Biological systems. In: Luce, Charles; Morgan, Penny; Dwire, Kathleen; Isaak, Daniel; Holden, Zachary; Rieman, Bruce, eds. Climate change, forests, fire, water, and fish: building resilient landscapes, streams, and managers. General Technical Report RMRS-GTR-290. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 39-86.

Murphy, Kathy; Rich, Tim; Sexton, Tim. 2007. An assessment of fuel treatment effects on fire behavior, suppression effectiveness, and structure ignition on the Angora Fire. Tech. Pap. R5-TP-025. Vallejo, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Region, Lake Tahoe Basin Management Unit. 32 p.

NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. Data current as of 10 February 2007.

Obedzinski, Robert A.; Shaw, Charles G., III; Neary, Daniel G. 2001. Declining woody vegetation in riparian ecosystems of the western United States. Western Journal of Applied Forestry. 16(4): 169-181.

Ohmart, Robert D.; Deason, Wayne O.; Burke, Constance. 1977. A riparian case history: the Colorado River. In: Johnson, Roy; Jones, Dale A., technical coordinators. Importance, preservation and management of riparian habitat: A symposium; 1977 July 9; Tucson, AZ. Gen. Tech. Rep. RM-43. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 35-47. Available from: NTIS, Springfield, VA 22151; PB-274 582.

Parenti, Michael J. 2002. Altered fire regimes and changes in stream channel morphology in the Sierra Nevada. In: Sugihara, Neil G.; Morales, Maria; Morales, Tony, eds. Fire in California ecosystems: integrating ecology, prevention and management: Proceedings of the symposium; 1997 November 17-20; San Diego, CA. Misc. Pub. No. 1. [Berkeley, CA]: Association for Fire Ecology: 273-278.

Pettit, Neil E.; Naiman, Robert J. 2007. Fire in the riparian zone: characteristics and ecological consequences. Ecosystems. 10(5): 673-687.

Safford, Hugh D.; Schmidt, David A.; Carlson, Chris H. 2009. Effects of fuel treatments on fire severity in an area of wildland-urban interface, Angora fire, Lake Tahoe Basin, California. Forest Ecology and Management. 258(5): 773-787.

Shaffer, Kevin E.; Laudenslayer, William F., Jr. 2006. Fire and animal interactions. In: Sugihara, Neil G.; van Wagtendonk, Jan W.; Shaffer, Kevin E.; Fites-Kaufman, Joann; Thode, Andrea E., eds. Fire in California's ecosystems. Berkeley, CA: University of California Press: 118-144.

Schoenherr, Allan A. 1992. A Natural History of California. Berkeley, UC Press.

Skinner, Carl N. 1997. Fire history in riparian reserves of the Klamath Mountains. In: Cooper, Sandra and Neil Sugihara, eds. Proceedings - Fire in California Ecosystems: Integrating Ecology, Prevention, and Management. 17-20 November 1997; San Diego, CA. California Association for Fire Ecology (CAFE).

Skinner, Carl N. 2002. Fire history in riparian reserves of the Klamath Mountains. In: Sugihara, Neil G.; Morales, Maria; Morales, Tony, eds. Fire in California ecosystems: integrating ecology, prevention and management: Proceedings of the symposium; 1997 November 17-20; San Diego, CA. Misc. Pub. No. 1. [Berkeley, CA]: Association for Fire Ecology: 164-169.

Skinner, Carl N. 2003. A tree-ring based fire history of riparian reserves in the Klamath Mountains. In: Faber, Phyllis M., ed. California riparian systems: processes and floodplains management, ecology and restoration. Riparian habitat and floodplains conference proceedings; 2001 March 12-15; Sacramento, CA. Sacramento, CA: Riparian Habitat Joint Venture: 116-119.

Spies, Thomas A.; Cline, Steven P. 1988. Coarse woody debris in forests and plantations of coastal Oregon. In: Maser, Chris; Tarrant, Robert F.; Trappe, James M.; Franklin, Jerry F., tech. eds. From the forest to the sea: a story of fallen trees. Gen. Tech. Rep. PNW-GTR-229. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 5-24.

Stine, Scott; Gaines, David; Vorster, Peter. 1984. Destruction of riparian systems due to water development in the Mono Lake Watershed. In: Warner, Richard E.; Hendrix, Kathleen M., eds. California riparian systems: Ecology, conservation, and productive management: Proceedings of the conference; 1981 September 17-19; Davis, CA. Berkeley, CA: University of California Press: 528-533.

Svejcar, Tony. 1997. Riparian zones: 2) History and human impacts. Rangelands. 19(4): 8-12.

Van de Water, Kip. 2011. Fire history of coniferous riparian forests in the Sierra Nevada. Davis, CA: University of California, Davis. 47 p. Thesis.

Van de Water, Kip; North, Malcolm. 2010. Fire history of coniferous riparian forests in the Sierra Nevada. Forest Ecology and Management. 260(3): 383-395.

Verkaik, Iraima; Rieradevall, Maria; Cooper, Scott D.; Melack, John M; Dudley, Tom L.; Prat, Narcis. 2013. Fire as a disturbance in mediterranean climate streams. Hydrobiologia. 719(1): 353-382.

Young, Jim. 2000. Bromus tectorum L. In: Bossard, Carla C.; Randall, John M.; Hoshovsky, Marc C., eds. Invasive plants of California's wildlands. Berkeley, CA: University of California Press: 76-80.