**10620**

Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland

BpS Model/Description Version: Aug. 2020

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| --- | --- | --- | --- |
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Vegetation Type

Forest and Woodland

Map Zones

16, 23

Geographic Range

The Curl-leaf mountain mahogany (*Cercocarpus ledifolius* var. *intermontanus*) community type occurs in the Sierra Nevada and Cascade Range to the Rocky Mountains from Montana to northern Arizona and in Baja California and Mexico (Marshal 1995).

Biophysical Site Description

Curl-leaf mountain mahogany (*Cercocarpus ledifolius* var. *intermontanus*) communities are usually found on upper slopes and ridges between 2,100-3,180m elevations (USDA-NRCS 2003), although northern stands may occur as low as 600m (Marshall 1995). Most stands occur on rocky shallow soils and outcrops, with mature stand cover between 10-55%. In fire absence, old stands may occur on somewhat deeper soils, with >55% cover.

Vegetation Description

Mountain big sagebrush is the most common co-dominant with curl-leaf mountain mahogany, although chaparral species such as manzanita (*Arctostaphylos patula*), tobaccobrush (*Ceanothus velutinus*), and green ephedra (*Ephedra viridis*) often co-dominate on some sites. Curl-leaf mountain mahogany is both a primary early successional colonizer, rapidly invading bare mineral soils after disturbance, and the dominant long-lived species. Where curl-leaf mountain mahogany has reestablished quickly after fire, rabbitbrush (*Chrysothamnus nauseosus*) may co-dominate. Litter and shading by woody plants inhibit establishment of curl-leaf mountain mahogany. Reproduction often appears dependent upon geographic variables (slope, aspect, and elevation) more than biotic factors. Low sagebrush and black sagebrush are infrequently associated. Snowberry, Utah serviceberry, and currant are present on cooler sites with more moisture. Singleleaf pinyon, western juniper, Douglas-fir, red fire, white fir, Rocky Mountain juniper, jeffrey pine, and limber pine may be present, with <10% total cover. In old, closed-canopy stands, understory may consist largely of prickly phlox (*Leptodactylon pungens*).

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| CELE3 | *Cercocarpus ledifolius* | Curl-leaf mountain mahogany |
| ARTRV | *Artemisia tridentata ssp. vaseyana* | Mountain big sagebrush |
| PUTR2 | *Purshia tridentata* | Antelope bitterbrush |
| SYMPH | *Symphoricarpos* | Snowberry |

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

Disturbance Description

Curl-leaf mountain mahogany does not resprout and is easily killed by fire (Marshall 1995). Curl-leaf mountain mahogany is a primary early successional colonizer rapidly invading bare mineral soils after disturbance. Fires are not common in early-seral stages, when there is little fuel, except in chaparral. Replacement fires (mean fire return interval [MFRI] of 100-500yrs) become more common in mid-seral stands, where herbs and smaller shrubs provide ladder fuel. In the later stages of succession, two classes and fire regimes are possible, depending on the history of mixed-severity and surface fires. In the presence of surface fire (fire return interval [FRI] of 50yrs) and past mixed-severity fires in younger classes, the stand will adopt a savanna-like woodland structure with a grassy understory. Trees can become very old and will rarely show fire scars. In late, closed stands, the absence of herbs and small forbs makes replacement fires uncommon, requiring extreme winds and drought. In such cases, thick duff provides fuel for more intense fires. Mixed-severity fires (MFRI of 50-200yrs) are present in all classes, except the late-closed class, and more frequent in the mid-development classes. This Biophysical Setting (BpS) is typically characterized by a moderate frequency fire regime with variable fire severity.

Heavy browsing by native medium-sized and large mammals reduces mountain mahogany productivity and reproduction (USDA-NRCS 2003). This is an important disturbance especially in early- but also in mid-seral stages, when mountain mahogany seedlings are becoming established. Browsing by small mammals has been documented (Marshall 1995) but is relatively unimportant and was incorporated as a minor component of native herbivory mortality.

In western Nevada for ranges in close proximity to the Sierra Nevada, sapsuckers’ drilling of young curl-leaf mountain mahogany has been observed to cause stand-replacement mortality (Christopher Ross, NV BLM, personal communication). This disturbance was not modeled.

Windthrow and snow creep on steep slopes are also sources of mortality. These disturbances were not modeled.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 245 | 26 | 100 | 500 |
| Moderate (Mixed) | 137 | 46 | 50 | 150 |
| Low (Surface) | 227 | 28 |  |  |
| All Fires | 63 | 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

Because these communities are restricted to rock outcrops and thin soils, stands usually occur on a small scale and are spatially separated from each other by other communities that occur on different aspects or soil types. A few curl-leaf mountain mahogany stands may be much larger than 100ac.

Adjacency or Identification Concerns

Littleleaf mountain mahogany, *Cercocarpus intricatus*, is restricted to limestone substrates and very shallow soils in California, Nevada, and Utah. It has similar stand structure and disturbance regime, so the curl-leaf mountain mahogany model should be applicable to it. Some existing curl-leaf mountain mahogany stands may be in the big sagebrush BpS, now uncharacteristic because of fire exclusion.

An extensive zone of mixed mountain mahogany and pinyon pine exists in western Nevada and eastern California and perhaps elsewhere. This type was not incorporated into the model and is probably more appropriately included in the pinyon pine model.

Issues or Problems

Classes B and C are reversed (i.e., Class B is mid-development open and Class C is mid-development closed).

Data for how much native grazing may cause a setback in succession are lacking but consistently observed by experts. In the model, only Class A was set back by native grazing, whereas the ages of Classes B and C, which do not have many seedlings, were not affected by native grazing.

Several fire regimes affect this community type. It is clear that being very sensitive to fire and very long-lived would suggest Fire Regime Group V. This is true of late-development classes, but younger classes can resemble more the surrounding chaparral or sagebrush communities in their fire behavior and exhibit a Fire Regime Group IV. Experts had divergent opinions on this issue; some emphasized infrequent and only stand-replacing fires whereas others suggested more frequent replacement fires, mixed-severity fires, and surface fires. The current model is a compromise reflecting more frequent fire in early-development classes, surface fire in the late, open class, and infrequent fire in the late, closed class.

Data from a thesis in Nevada and expert observations suggest that some large mountain mahogany may survive less intense fires. Therefore, surface fires were added as a disturbance to late-seral stages, but this is a more recent concept in curl-leaf mountain mahogany ecology. Surface fires were assumed to occur on a very small scale, perhaps caused by lightning strikes.

Tree cover >60% is uncharacteristic for this BpS (added 15 July 2005 by Louis Provencher and Kelly Pohl).

Native Uncharacteristic Conditions

Comments

Map zones (MZs) 16 and 23 were combined during 2015 BpS Review.

In the final quality control, cover ranges were changed to assist mapping and differentiating between classes (Pohl, 28 March 2005). C was changed from 10-45% cover to 35-55%; D was changed from 5-30% cover to 10-30%; E was changed from 10-55% cover to 30-55%.

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 | A | A | B | B | C | C | C | C | C | C |
| Tree | 5-10 | D | D | D | E | E | E | E | E | E | E |
| Tree | 10-25 | D | D | D | E | E | E | E | E | E | E |
| Tree | 25-50 | D | D | D | E | E | E | E | E | E | E |
| Tree | >50 | D | D | D | E | E | E | E | E | E | E |

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 8 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| CELE3 | Cercocarpus ledifolius | Curl-leaf mountain mahogany | Upper |
| ARTR2 | Artemisia tridentata | Big sagebrush | Upper |
| CHRYS | Chrysactinia | Chrysactinia | Upper |
| SYMPH | Symphoricarpos | Snowberry | Upper |

Description

Curl-leaf mountain mahogany rapidly invades bare mineral soils after fire. Litter and shading by woody plants inhibit establishment. Bunchgrasses and disturbance-tolerant forbs and resprouting shrubs, such as snowberry, may be present. Rabbitbrush and sagebrush seedlings are present. Vegetation composition will affect fire behavior, especially if chaparral species are present. Replacement fire and native herbivory of seedlings (2 out of every 100 seedlings) will reset the age of stands to 0. Mixed-severity fire does not affect succession age.

*Maximum Tree Size Class*  
Seedling <4.5ft

Class B 14 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| CELE3 | Cercocarpus ledifolius | Curl-leaf mountain mahogany | Upper |
| ARTR2 | Artemisia tridentate | Big sagebrush | Mid-Upper |
| CHRYS | Chrysactinia | Chrysactinia | Mid-Upper |
| SYMPH | Symphoricarpos | Snowberry | Mid-Upper |

Description

Curl-leaf mountain mahogany may co-dominate with mature sagebrush, bitterbrush, snowberry, and rabbitbrush co-dominant. Few mountain mahogany seedlings are present. Native herbivory of seedlings and young saplings occurs at a rate of 1/100 seedlings.

*Maximum Tree Size Class*  
Sapling >4.5ft; <5" DBH

Class C 15 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| CELE3 | Cercocarpus ledifolius | Curl-leaf mountain mahogany | Upper |
| ARTR2 | Artemisia tridentata | Big sagebrush | Low-Mid |
| PUTR2 | Purshia tridentata | Antelope bitterbrush | Low-Mid |
| SYMPH | Symphoricarpos | Snowberry | Low-Mid |

Description

Young curl-leaf mountain mahogany are common, although shrub diversity is very high. Various shrub species typically dominate, but under mixed fire disturbance, various grass species may dominate. One out of every 1,000 mountain mahogany are taken by herbivores, but this has no effect on vegetation dynamics.

*Maximum Tree Size Class*  
Sapling >4.5ft; <5" DBH

Class D 22 Mid Development 2 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| CELE3 | Cercocarpus ledifolius | Curl-leaf mountain mahogany | Upper |
| ARTR2 | Artemisia tridentata | Big sagebrush | Low-Mid |
| PUTR2 | Purshia tridentata | Antelope bitterbrush | Low-Mid |

Description

Moderate cover of mountain mahogany. Various shrub species typically dominate but, under mixed fire disturbance, various grass species may dominate. This class represents a range of mid- and late-development cover/structures resulting from a mixed fire. This class describes a late-succession endpoint for curl-leaf mountain mahogany that is maintained by surface fire. Evidence of fire scars on older trees and presence of open savanna-like woodlands with herbaceous-dominated understory are evidence for this condition. Other shrub species may be abundant but decadent. In the absence of fire, the stand will eventually become closed and not support a herbaceous understory.

*Maximum Tree Size Class*  
Medium 9-21" DBH

Class E 41 Late Development 2 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| CELE3 | Cercocarpus ledifolius | Curl-leaf mountain mahogany | Upper |

Description

High cover of large shrub- or tree-like mountain mahogany. Very few other shrubs are present, and herb cover is low. Duff may be very deep. Scattered trees may occur in this class. This is a late-succession endpoint for curl-leaf mountain mahogany. Class will become old growth.

*Maximum Tree Size Class*  
Medium 9-21" DBH

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:OPN | 19 |
| Mid1:OPN | 20 | Mid1:CLS | 59 |
| Mid1:CLS | 60 | Late2:CLS | 149 |
| Mid2:OPN | 60 | Mid2:OPN | 999 |
| Late2:CLS | 150 | Late2: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 | 0.002 | 500 | Yes | 0 |
| Mixed Fire | Early1:ALL | Early1:ALL | 0.01 | 100 | No | 0 |
| Native Grazing | Early1:ALL | Early1:ALL | 0.02 | 50 | Yes | 0 |
| Replacement Fire | Mid1:OPN | Early1:ALL | 0.007 | 143 | Yes | 0 |
| Native Grazing | Mid1:OPN | Mid1:OPN | 0.01 | 100 | No | 0 |
| Mixed Fire | Mid1:OPN | Mid1:OPN | 0.02 | 50 | No | 0 |
| Native Grazing | Mid1:CLS | Mid1:CLS | 0.001 | 1000 | No | 0 |
| Mixed Fire | Mid1:CLS | Mid2:OPN | 0.005 | 200 | Yes | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Mixed Fire | Mid1:CLS | Mid1:CLS | 0.013 | 77 | No | 0 |
| Alternative Succession | Mid2:OPN | Late2:CLS | 1 | 1 | Yes | 150 |
| Replacement Fire | Mid2:OPN | Early1:ALL | 0.003 | 333 | Yes | 0 |
| Mixed Fire | Mid2:OPN | Mid2:OPN | 0.005 | 200 | No | 0 |
| Surface Fire | Mid2:OPN | Mid2:OPN | 0.02 | 50 | No | 0 |
| Replacement Fire | Late2:CLS | Early1:ALL | 0.002 | 500 | Yes | 0 |

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