10620
Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland

BpS Model/Description Version: Aug. 2020

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Vegetation Type
Forest and Woodland

Map Zone
13

Geographic Range
The curl-leaf mountain mahogany (*Cercocarpus ledifolius* var. *intermontanus*) community type occurs in the Sierra Nevada and Cascade Range to Rocky Mountains from Montana to northern Arizona and in Baja California and Mexico (Marshall, 1995). Found on the mountain ranges of the Mojave Desert.

Biophysical Site Description
Curl-leaf mountain mahogany (*Cercocarpus ledifolius* var. *intermontanus*) communities are usually found on upper slopes and ridges between 1,940-2,950m (average 2,355m) elevation (Nachlinger and Reese 1996; NRCS 2003). Curl-leaf mountain mahogany stands occur on many aspects, but southwestern slopes are more common. Slope ranges from 3-35 degrees. Most stands occur on rocky shallow soils and outcrops, with mature stand cover between 10-55%. In the absence of fire, old stands may occur on somewhat deeper soils, with >55% cover.

Vegetation Description
Curl-leaf mountain mahogany (*Cercocarpus ledifolius* var. *intermontanus*) is dominant. Singleleaf pinyon (*Pinus monphylla*), Utah juniper (*Juniperus osteosperma*), big sagebrush (*Artemisia tridentata*), snowberry (*Symphoricarpos* spp.), and Cooper's rubberweed (*Hymenoxys cooperi*) 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* spp.) may co-dominate. Litter and shading by woody plants inhibits establishment of curl-leaf mountain mahogany. Reproduction often appears dependent upon geographic variables (slope, aspect, and elevation) more than biotic factors. Black sagebrush is infrequently associated. White fir, ponderosa pine, and limber pine may be present, with <10% total cover.

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 tridentate*	Antelope bitterbrush
SYMPH	*Symphoricarpos*	Snowberry
PIMO	*Pinus monophyla*	Singleleaf pinyon
HYCOC 2	*Hymenoxys cooperi var. cooperi*	Cooper's rubberweed
ELEL5	*Elymus elymoides*	Squirreltail
JUOS	*Juniperus osteosperma*	Utah juniper

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

Disturbance Description

Fire: Curl-leaf mountain mahogany does not resprout, and is easily killed by fire (Marshall 1995). Curl-leaf mountain mahogany is a primary early succession 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 150-500yrs) become more common in mid-seral stands, where herbs and smaller shrubs provide ladder fuel. By late 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 and shrubby understory. Trees can become very old and will rarely show fire scars. Without past mixed-severity or surface fires, herbs and small forbs will be nearly absent from late, closed stands. Replacement fires will be uncommon (FRI of 500yrs), requiring extreme winds and drought, because thick duff provides fuel for more intense fires. Mixed-severity fires (MFRI of 50-200yrs) are present in all classes, except the late closed one, and more frequent in the mid-development classes.

Ungulate herbivory: Heavy browsing by native medium-sized and large mammals reduces mountain mahogany productivity and reproduction (NRCS 2003). This is an important disturbance in early and mid-seral stages, when mountain mahogany seedlings are becoming established. In map zones [MZs] north of the Mojave Desert, browsing by small mammals has been documented (Marshall 1995) but is relatively unimportant and was incorporated as a minor component of native herbivory mortality.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	287	24	100	500
Moderate (Mixed)	149	46	50	150
Low (Surface)	233	30		
All Fires	69	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

In the Mojave Desert, Biophysical Setting (BpS) 131062 is adjacent or intermingled with BpS 131019, Great Basin Piynon-Juniper Woodlands. Nachlinger and Reese (1996) always describe curl-leaf mountain mahogany as part of the *Pinus monophyla*/*Cercocarpus ledifolius* var. *intermontanus*/*Artemisia tridentata* association for the Spring Mountains. On this mountain range, curl-leaf mountain mahogany is also associated with white fir (BpS 131052) and ponderosa pine (BpS 131054) (Nachlinger and Reese 1996).

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 big sagebrush types, now uncharacteristic because of fire exclusion.

Issues or Problems

Data on intense native grazing of mahogany seedlings are lacking but consistently observed by experts in the Great Basin; in the model, only Class A had a reversal of woody succession for native grazing, whereas effect was specified for classes B and C, which do not have many seedlings. It is not clear how well seedling herbivory carries to the Mojave Desert.

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 (FRG) 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 FRG 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.

Native Uncharacteristic Conditions

Cover >70% is uncharacteristic.

Comments

Data from a thesis in Nevada and expert observations suggest 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.

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	UN	UN	UN
Herb	0.5-1.0	A	A	A	A	A	A	A	UN	UN	UN
Herb	>1.0	A	A	A	A	A	A	A	UN	UN	UN

Shrub	0-0.5	A	A	A	A	A	A	A	UN	UN	UN
Shrub	0.5-1.0	A	A	A	A	A	A	A	UN	UN	UN
Shrub	1.0-3.0	A	A	A	A	A	A	A	UN	UN	UN
Shrub	>3.0	C	C	C	B	B	B	B	UN	UN	UN
Tree	0-5	C	C	C	B	B	B	B	UN	UN	UN
Tree	5-10	D	D	D	E	E	E	E	UN	UN	UN
Tree	10-25	D	D	D	E	E	E	E	UN	UN	UN
Tree	25-50	D	D	D	E	E	E	E	UN	UN	UN
Tree	>50	D	D	D	E	E	E	E	UN	UN	UN

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 **7** **Early Development 1 - All Structures**

Upper Layer Lifeform: Shrub

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 inhibits 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.

Class B 14 Mid Development 1 - Closed

Upper Layer Lifeform: Shrub

Upper-layer lifeform is not the dominant lifeform. Various shrub species typically dominate. However, under mixed-severity fire disturbance, various grass species may dominate.

Indicator Species

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

Description

Young curl-leaf mountain mahogany are common, although shrub diversity is very high. One out of every 1,000 mountain mahogany are taken by herbivores, but this has no effect on model dynamics.

Class C 12 Mid Development 1 - Open

Upper Layer Lifeform: Shrub

Indicator Species

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

Description

Curl-leaf mountain mahogany may co-dominate with mature sagebrush, bitterbrush, snowberry, and rabbitbrush co-dominant. Few mountain mahogany seedlings are present.

Class D 22 Late Development 1 - Open

Upper Layer Lifeform: Tree

Upper-layer lifeform is not the dominant lifeform. Various shrub species typically dominate. However, under mixed-severity fire disturbance, various grass species may dominate.

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
ELEL5	Elymus elymoides	Squirreltail	Lower

Description

Moderate cover of mountain mahogany. This class represents a combined Mid2-Open and Late1-Open cover and structure. Further, this class describes one of two late-successional endpoints for curl-leaf mountain mahogany. Evidence of infrequent 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 become closed and not support an herbaceous understory.

Class E 45 Late Development 1 - Closed

Upper Layer Lifeform: Tree

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
CELE3	Cercocarpus ledifolius	Curl-leaf mountain mahogany	Upper
PIMO	Pinus monophylla	Singleleaf pinyon	Upper
JUOS	Juniperus osteosperma	Utah juniper	Upper
SYMPH	Symphoricarpos	Snowberry	Middle

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 class describes one of two late-successional endpoints for curl-leaf mountain mahogany.

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	Late1:CLS	149
Late1:OPN	60	Late1:OPN	999
Late1:CLS	150	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	0.002	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	Late1:OPN	0.005	200	Yes	0
Replacement Fire	Mid1:CLS	Early1:ALL	0.007	143	Yes	0
Mixed Fire	Mid1:CLS	Mid1:CLS	0.013	77	No	0
Alternative Succession	Late1:OPN	Late1:CLS	1	1	Yes	150
Replacement Fire	Late1:OPN	Early1:ALL	0.003	333	Yes	0
Mixed Fire	Late1:OPN	Late1:OPN	0.005	200	No	0
Surface Fire	Late1:OPN	Late1:OPN	0.02	50	No	0
Replacement Fire	Late1:CLS	Early1:ALL	0.002	500	Yes	0

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