

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 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 (Marshall 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	<i>Cercocarpus ledifolius</i>	Curl-leaf mountain mahogany
ARTRV	<i>Artemisia tridentata</i> ssp. <i>vaseyana</i>	Mountain big sagebrush

PUTR2	<i>Purshia tridentata</i>	Antelope bitterbrush
SYMPH	<i>Symphoricarpos</i>	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
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
CELE3	Cercocarpus ledifolius	Curl-leaf mountain mahogany	Upper
ARTR2	Artemisia tridentata	Big sagebrush	Upper
CHRY5	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
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
CELE3	Cercocarpus ledifolius	Curl-leaf mountain mahogany	Upper
ARTR2	Artemisia tridentate	Big sagebrush	Mid-Upper
CHRY5	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
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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
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Indicator Species

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

Description

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.

Medium 9-21" DBH

Class E	41	Late Development 2 - Closed
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
CELE3	<i>Cercocarpus ledifolius</i>	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

References

Arno, S.F. and A.E. Wilson. 1986. Dating past fires in curleaf mountain-mahogany communities. *Journal of Range Management* 39: 241-243.

Billings, W.D. 1994. Ecological impacts of cheatgrass and resultant fire on ecosystems in the western Great Basin. In: *Proc. Ecology and management of annual rangelands*. USDA USFS GTR-INT-313.

Brown, J.K. and J. Kapler-Smith, eds. 2000. *Wildland fire in ecosystems: effects of fire on flora*. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. 257 pp.

Gruell, G., S. Bunting and L. Neuenschwander. 1984. Influence of fire on curleaf mountain mahogany in the Intermountain West. *Proc. Symposium on fire's effects on wildlife habitat*. Missoula, Montana.

Marshall, K.A. 1995. *Cercocarpus ledifolius*. In: *Fire Effects Information System*, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: <http://www.fs.fed.us/database/feis/> [2004, November 16].

Monsen, S.B. and E.D. Mc Arthur. 1984. Factors influencing establishment of seeded broadleaf herbs and shrubs following fire. Pages 112-124 in: K. Sanders and J. Durham, eds. *Proc. Symp.: Rangelands fire effects*. USDI Bureau of Land Management, Idaho Field Office, Boise, Idaho.

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

Ross, C. 1999. Population dynamics and changes in curlleaf mountain mahogany in two adjacent sierran and Great Basin mountain ranges. 111 pp.

Peters, E.F. and S.C. Bunting. 1994. Fire conditions pre- and post-occurrence of annual grasses on the Snake River plain. In: Proc. Ecology and management of annual rangelands. USDA USFS GTR-INT-313.

Schultz, B.W., R.J. Tausch and P.T. Tueller. 1996. Spatial relationships among young *Cercocarpus ledifolius* (curlleaf mountain mahogany). Great Basin Naturalist 56: 261-266.

Tausch, R.J., P.E. Wigand and J.W. Burkhardt. 1993. Viewpoint: Plant community thresholds, multiple steady states, and multiple succession pathways: legacy of the Quaternary? Journal of Range Management 46: 439-447.

USDA-NRCS. 2003. Major land resource area 29. Southern Nevada Basin and Range. Ecological site descriptions. US Department of Agriculture. Available online: <http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx>.

Whisenant, S.G. 1990. Changing fire frequencies on Idaho's Snake River plains: Ecological and management implications. In: Proc. Symp., Cheatgrass Invasion, shrub die-off, and other aspects of shrub biology and management. USDA Forest Service. GTR-INT-276, Ogden, Utah.