

10620

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

BpS Model/Description Version: Aug. 2020

Modelers		Reviewers	
Chris Ross	c1ross@nv.blm.gov		
Don Major	dmajor@tnc.org		
Louis Provencher	lprovencher@tnc.org		

Reviewer: Curtis Talbot

Vegetation Type

Forest and Woodland

Map Zones

6, 12, 17, 18

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, Mexico (Marshall 1995).

Biophysical Site Description

Curl-leaf mountain mahogany (*Cercocarpus ledifolius* var. *intermontanus*) communities are usually found on upper slopes and ridges between 6,300ft and -10,500ft elevation (USDA-NRCS 2003, 2016), although northern stands may occur as low as 2,000ft (Marshall 1995). In western Nevada, curl-leaf mountain mahogany may occur down to 5,000ft or lower and is restricted to northwestern and especially northeastern aspects at drier, lower edge of range. Most stands occur on rocky shallow soils and outcrops, with mature stand cover between 10% and 55%. In the absence of fire, old stands may occur on somewhat deeper soils, with more than 55% cover on somewhat productive sites with moderately deep soils or, at least, fractured below ground bedrock. In southern ID, curleaf mountain mahogany is most often associated with a limestone bedrock.

Vegetation Description

Mountain big sagebrush is the most common co-dominant species 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, invading bare mineral soils rapidly after disturbance, and the dominant long-lived species. Where curl-leaf mountain mahogany has re-established quickly after fire, rabbitbrush (*Chrysothamnus nauseosus*) may co-dominate. Litter and shading by woody plants inhibit establishment of curl-leaf mountain mahogany. Invasion by Utah and Rocky Mountain juniper and Douglas-fir can occur and will eventually shade-out the curleaf mountain mahogany. Reproduction often appears dependent upon geographic variables (slope, aspect, and elevation) more than biotic factors. Low sagebrush, black sagebrush, mountain big sagebrush and antelope bitterbrush may

be associated with this type. Snowberry, Utah serviceberry, and currant are present in cooler sites with more moisture. Single-leaf pinyon, western juniper, Utah juniper, Douglas-fir, red fir, white fir, Rocky Mountain juniper, Jeffrey pine, and limber pine may be present in small (<10% total cover) to large (>30% cover) amounts. 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

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, invading bare mineral soils rapidly after disturbance. Fires are not common in early seral stages, when there is little fuel, except in chaparral. Replacement fire becomes 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 and past mixed-severity fire in younger classes, the stand adopts a savanna-like woodland structure with a grassy understory, with spiny phlox and currant. Trees can become very old and rarely show fire scars. In late, closed stands, the absence of herbs and small forbs makes replacement fire uncommon, requiring extreme winds and drought. In such cases, thick duff provides fuel for more intense fires.

Several fire regimes affect this community type. It is clear that being very sensitive to fire and very long-lived would suggest an infrequent, high severity fire regime and development in fire-safe sites (Gruell et al. 1985). 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 moderate frequency, high severity fire regime. Finally, on more productive sites in MZ 18 or sites associated with ponderosa pine (FRI of 13-22 year; Arno and Wilson 1986), a high frequency, low severity fire regime may be appropriate (very open, grassy stands). 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.

Ungulate herbivory: Heavy browsing by native medium-size 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. Browsing by small mammals has been documented (Marshall 1995), but is relatively unimportant and was incorporated as a minor component of native herbivory mortality.

Avian-caused mortality: In western Nevada for ranges in close proximity to the Sierra Nevada, sapsucker drilling of young curl-leaf mountain mahogany has been observed to cause stand-replacement mortality (Christopher Ross, Nevada BLM, pers. comm.).

Windthrow and snow creep on steep slopes are also sources of mortality.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	281	24	100	500
Moderate (Mixed)	146	47	50	150
Low (Surface)	232	29		
All Fires	68	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 separated spatially 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, especially in southern ID.

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 Biophysical Settings (e.g. BpS 1125, Inter-Mountain Basins Big sagebrush Steppe and BpS 1126, Inter-Mountain Basins Montane Sagebrush Steppe), 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 included more appropriately in the pinyon pine model.

Issues or Problems

Data for the setback in succession caused by native grazing are lacking but consistently observed by experts. In the model, only Class A had a setback of -20 for native grazing, whereas no setback was specified for Class B and Class C, which do not have many seedlings.

Several fire regimes affect this community type. It is clear that being very sensitive to fire and being very long-lived suggest a low-frequency, high-severity fire regime. This is true of late-development classes, but younger classes can resemble more the surrounding chaparral or sagebrush communities in their fire behavior and may exhibit a more frequent fire regime. Experts had divergent opinions on this issue; some emphasized infrequent and only stand-replacing fires whereas others suggested more frequent replacement fire, 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

Comments

Curtis Talbot reviewed this model during the 2017 BpS model review. Additional modelers for zones 6, 12 and 17 during LANDFIRE National were Sandy Gregory (s50grego@nv.blm.gov), Julia Richardson (jhrichardson@fs.fed.us), and Cheri Howell (chowell@fs.fed.us). Sarah Heide was a modeler and Jon Bates was a reviewer for zone 18.

For LANDFIRE National Sarah Heide accepted as-is BpS 1062 for MZ18 from zones 12 and 17 with minor modifications to the description. Jon Bates (reviewer) suggested a few editorial changes and comments: 1) Western juniper was added to the list of conifers present in these stands. 2) Under Biophysical Site Description, the occurrence of curlleaf mountain mahogany on more productive soils with deeper soils and fractured bedrock was described. 3) Under Issues/Problems, FRG I was introduced as a possibility for more productive sites in MZ18, which are sometimes associated with ponderosa pines or sagebrush. The model was not changed to reflect this case.

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	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	B	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	A	A	A	A	A	A	A	A
Tree	5-10	C	C	C	B	B	B	B	B	B	B
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
CHRY5	Chrysactinia	Chrysactinia	Upper
SYMPH	Symphoricarpos	Snowberry	Upper

Description

Curl-leaf mountain mahogany invades bare mineral soils rapidly after fire. Litter and shading by woody plants inhibit establishment. Bunchgrasses, disturbance-tolerant forbs, and resprouting shrubs, such as snowberry, may be present. Rabbitbrush and sagebrush seedlings are present. Vegetation composition affects fire behavior, especially if chaparral species are present. Native herbivory may affect two out of every 100 seedlings.

Maximum Tree Size Class

Seedling <4.5ft

Class B 14 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	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. Various shrub species typically dominate. However, under mixed-severity fire disturbance, various grass species may dominate. One out of every 1,000 mountain mahogany are taken by herbivores.

Maximum Tree Size Class

Sapling >4.5ft; <5" DBH

Class C 12 Mid Development 1 - 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
CHRY5	Chrysactinia	Chrysactinia	Low-Mid

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. Old-growth trees may reach >1,000yrs.

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	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

References

Arno, S.F. and A E. Wilson. 1986. Dating past fires in curlleaf 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 curlleaf mountain mahogany in the Intermountain West. Pages 58-72 in: J.K. Brown and J. Logan, eds, *Fire's effects on wildlife habitat*. Symposium Proceedings. USDA Forest Service Gen. Tech. Rep. INT-186.

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.

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

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

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 successional 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. Available online: <http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx>.

USDA-NRCS. 2016. Major land resource area 28A. Great Salt Lake Area. Ecological site descriptions. Draft.

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. USDS USFS INT 276, Ogden, Utah.