

Ecological site group R023XY917NV

Mountain Slope 16-20 PZ Mahogany

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Key Characteristics

- Site does not pond or flood
- Landform other than dunes
- Surface soils are not clayey
- Sites are tree dominated
- Elevations < 7000'
- Soils loamy or ashy
- Frost free days < 100
- Soils > 12" deep.

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

Physiography

This group is on mountain slopes at elevations between 5,500 and 9,400 feet. Slopes are 15 to 50 percent.

Climate

The climate is classified as Cold Semi-Arid in the Koppen Classification System.

The area receives 16 to 24 inches annual precipitation as snow in the winter and rain in the spring and fall. Summers are generally dry.

The frost-free period is 40 to 70 days.

Soil features

The soils in this group are loamy-skeletal or ashy-skeletal. Soil depth may be very shallow to deep. Very shallow soils in this group have a paralithic contact. Soil temperature regimes are principally cryic.

Typically, the surface has considerable amounts of rock fragments. Taxonomically, these soils are Mollisols.

The common soil series in this group are Badgercamp, Cowbell, and Zorromount.

Vegetation dynamics

Ecological Dynamics and Disturbance Response:

An ecological site is the product of all the environmental factors responsible for its development. Each site has a set of key characteristics that influence its resilience to disturbance and resistance to invasives. According to Caudle et al. (2013), key characteristics include:

1. Climate factors such as precipitation and temperature.
2. Topographic characteristics such as aspect, slope, elevation, and landform.
3. Hydrologic processes such as infiltration and runoff.

4. Soil characteristics such as depth, texture, structure, and organic matter.
5. Plant communities and their associated functional groups and productivity.
6. Natural disturbance (fire, herbivory, etc.) regime.

Biotic factors that influence resilience include site productivity, species composition and structure, and population regulation and regeneration (Chambers et al., 2013).

The Great Basin vegetative communities have high spatial and temporal variability in precipitation both among years and within growing seasons (MacMahon, 1980). Nutrient availability is typically low but increases with elevation and closely follows moisture availability. Water stored in the soil profile during winter is the moisture resource that supports most plant growth. Disturbance changes resource uptake and increases nutrient availability, often to the benefit of non-native species; native species are often damaged and their ability to use resources is depressed for a time, but resource pools may increase from lack of use and/or the decomposition of dead plant material following disturbance (Whisenant, 1999; Miller et al., 2013). The invasion of cheatgrass (*Bromus tectorum*) has been linked to disturbances (fire, abusive grazing) that result in fluctuations in resources (Chambers et al., 2007). Dobrowski et al. (1990) cite multiple authors on the extent of the soil profile exploited by the competitive, exotic annual cheatgrass. Specifically, the root depth of cheatgrass depends on the size of the plant. In competitive environments, cheatgrass roots were found to penetrate only 15 centimeters; roots of isolated plants and pure stands were measured to at least 1 meter, with some plants rooting as deep as 1.5 to 1.7 meters.

Long-lived curl-leaf mountain mahogany (*Cercocarpus ledifolius*), deep-rooted, cool-season perennial bunchgrasses, and long-lived shrubs (at least 50 years old) with high root to shoot ratios dominate the ecological sites in this group. The dominant shrubs usually root to the full depth of the winter-spring soil moisture recharge, which ranges from 1.0 to over 3.0 meters (Comstock & Ehleringer, 1992). Root length of mature sagebrush plants was measured to a depth of 2 meters in alluvial soils in Utah (Richards & Caldwell, 1987). These shrubs have a flexible generalized root system with development of both deep taproots and laterals near the surface (Comstock & Ehleringer, 1992). The perennial bunchgrasses generally have somewhat shallower root systems than the shrubs on these sites; root densities of perennial bunchgrasses are often as high as or higher than those of shrubs in the upper 0.5 meters. The general differences in root depth distributions between grasses and shrubs result in resource partitioning in this system.

Curl-leaf mountain mahogany is a multi-branched, evergreen shrub or tree extending from 3 to over 20 feet in height. The roots of curl-leaf mountain mahogany are spreading and limited by the depth to bedrock. Youngberg and Hu (1972) reported in an Oregon study that curl-leaf mountain mahogany produces nitrogen-fixing root nodules. They also reported that nodulated plants had the highest amounts of nitrogen in the leaves. It is the most widely distributed species of *Cercocarpus* and is the only species of the genus that extends as far north and west as Washington. Curl-leaf mountain mahogany stands most often grow on warm, dry, rocky ridges or outcrops where fire is infrequent (USDA, 1988). Dealy (1974) and Scheldt (1969) found that curl-leaf mountain mahogany trees were larger and older on fire-resistant rocky sites. Trees in these positions become seed sources if fire destroys the non-rocky portion of a site.

Curl-leaf mountain mahogany plants are long-lived and can surpass 1,300 years of age (Schultz, 1987; Schultz et al., 1990). As curl-leaf mountain mahogany stands increase in average age, the average canopy volume and height of the individuals present also increase. As average canopy height and volume increase, stand density declines (Schultz et al., 1991). Stands with a closed, or nearly closed canopy often have few or zero young curl-leaf mountain mahogany individuals (i.e., recruitment) in the understory (Schultz et al., 1990, 1991), despite high seed density beneath trees (Russell & Schupp, 1998; Ibáñez & Schupp, 2002). Intraspecific competition reduces the growth rates of all age classes below the potential growth rates for the species. Competition may also increase mortality in the younger plants.

Once germination occurs, the seedlings exhibit rapid growth in relation to top growth, providing some resistance to drought and competition with invasive species (Dealy, 1974). Dealy (1974) reported that curl-leaf mountain mahogany seedlings have a mean taproot length of 0.97 meters after 120 days. The mean height was slightly less than 2.5 centimeters. Multiple sources (Ibáñez et al., 1999; Schultz et al., 1996) found that curl-leaf mountain mahogany seedlings germinate abundantly under the canopy of adult plants but rarely successfully establish there due to shading and higher litter amounts. In addition, Schultz et al. (1996) found that seedlings had significantly higher long-term success in areas dominated by sagebrush canopy than in areas under curl-leaf mountain mahogany canopy or in interspaces. Some hypothesize that the light shading and hydraulic lift provided by

sagebrush may create a microsite that facilitates curl-leaf mountain mahogany recruitment (Gruell et al., 1985; Ibáñez et al., 1999).

Curl-leaf mountain mahogany stands are susceptible to drought, frost, and invasion by non-native species, especially cheatgrass. Cheatgrass affects curl-leaf mountain mahogany seedling growth by competing for water resources and nutrients (Ross, 1999).

Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is generally long-lived; therefore, it is not necessary for new individuals to recruit every year for perpetuation of the stand. Infrequent, large recruitment events and simultaneous low, continuous recruitment are the foundation of population maintenance (Noy-Meir, 1973). Survival of the seedlings depends on adequate moisture conditions.

The perennial bunchgrasses that are co-dominant with the shrubs on these sites include bluebunch wheatgrass (*Pseudoroegneria spicata*) and Idaho fescue (*Festuca idahoensis*). These species generally have somewhat shallower root systems than the shrubs on these sites; root densities of bluebunch wheatgrass and Idaho fescue are often as high as or higher than those of shrubs in the upper 0.5 meters but densities taper off more rapidly than shrubs. The differences in root depth distributions between grasses and shrubs result in resource partitioning in these shrub/grass systems.

Letterman's needlegrass (*Achnatherum lettermanii*), the dominant grass on the non-modal ecological site, is an erect, densely tufted perennial bunchgrass that forms large clumps. It grows on dry soils in a variety of vegetation communities, including high elevation meadows, subalpine grasslands, open areas underneath aspen, and sagebrush communities. It grows best on loamy soils that are greater than 20 centimeters deep (Dittberner & Olson, 1983).

Cusick's bluegrass (*Poa cusickii*) and/or muttongrass (*Poa fendleriana*) are on the sites of this group. There is evidence that these two common names have been used interchangeably (Monsen et al., 2004) or are sometimes misidentified, but they occupy similar ecological niches (Cronquist et al., 1994). Cusick's bluegrass is a strongly tufted perennial grass but may be somewhat rhizomatous in loose soils (Cronquist et al., 1994). It begins growth very early in the season and may produce two crops of inflorescences in a growing season (Cronquist et al., 1994).

The ecological sites in this group have moderate to high resilience to disturbance and resistance to invasion. Resilience increases with elevation, northerly aspect, precipitation, and nutrient availability. Long-term disturbance response may be influenced by small differences in landscape topography. North slopes are more resilient than south slopes because lower soil surface temperatures operate to keep moisture content higher on northern exposures. Two possible alternative stable states have been identified for this group.

Fire Ecology:

The fire return interval in curl-leaf mountain mahogany-dominated sites is not well documented. However, a study by Arno and Wilson (1986) suggests sites of curl-leaf mountain mahogany with ponderosa pine (*Pinus ponderosa*) had fire return intervals of 13 to 22 years before 1900. Fire frequency most likely depends on surrounding vegetation. Most often, curl-leaf mountain mahogany stands are on warm, dry, rocky ridges or outcrops where fire is infrequent (USDA, 1988). Dealy (1974) and Scheldt (1969) found that curl-leaf mountain mahogany trees are larger and older on fire-resistant rocky sites and are seed sources if fire destroys the non-rocky portion of a site. Curl-leaf mountain Mahogany will persist longest in rocky areas where it is protected from fire. Because of their thicker bark, mature trees can often survive low-severity fires (Gruell et al., 1985). Curl-leaf mountain mahogany sprouts weakly after fire. It is usually moderately to severely damaged by severe fires and the recovery time of these sites is variable; some measurements show that stands lack recruitment for up to 30 years post-fire (Gruell et al., 1985).

Mountain big sagebrush is killed by fire (Neuenschwander, 1980; Blaisdell et al., 1982), and does not resprout (Blaisdell, 1953). Post-fire regeneration starts from seed and varies depending on site characteristics, seed source, and fire characteristics. Mountain big sagebrush seedlings can grow rapidly and may reach reproductive maturity within 3 to 5 years (Bunting et al., 1987). Mountain big sagebrush may return to pre-burn density and cover within 15 to 20 years following fire, but establishment after severe fires may proceed more slowly (Bunting et al., 1987).

Depending on fire severity, snowberry (*Symphoricarpos* sp.) and other sprouting shrubs may increase after fire. Snowberry is top-killed by fire, but resprouts after fire from rhizomes (Leege & Hickey, 1971; Noste & Bushey,

1987). Snowberry has been noted to regenerate well and exceed pre-burn biomass in the third season after a fire (Merrill et al., 1982). Yellow rabbitbrush (*Chrysothamnus viscidiflorus*) is also on these sites. It has a large taproot system and is known to be shorter lived and less competitive than sagebrush. Seedling density, flower production, and shoot growth decline as competition from other species increases (McKell & Chilcote, 1957; Miller et al. 2013). Yellow rabbitbrush is top-killed by fire, but sprouts vigorously after fire (Kuntz, 1982; Akinsoji 1988). If balsamroot (*Balsamorhiza* sp.) or mule-ears (*Wyethia* sp.) are common before fire, these plants will increase after fire or with heavy grazing (Wright, 1985).

Idaho fescue response to fire varies with condition and size of the plant, season and severity of fire, and ecological conditions. Idaho fescue can generally survive low-severity fires but can be severely damaged by fire in all seasons (Wright et al., 1979; Wright, 1985). Rapid burns leave little damage to root crowns, and production of new tillers corresponds with the onset of fall moisture (Johnson et al., 1994). However, another study found the dense, fine leaves of Idaho fescue provided enough fuel to burn for hours after a fire had passed, thereby killing or seriously injuring the plant regardless of the intensity of the fire (Wright et al., 1979). Rapid tillering can occur after fire when root crowns are not killed and soil moisture is favorable (Johnson et al., 1994; Robberecht & Defossé, 1995).

Fire will remove aboveground biomass from bluebunch wheatgrass but plant mortality is generally low (Robberecht & Defossé, 1995) because the buds are underground (Conrad & Poulton, 1966) or protected by foliage. However, season and severity of the fire will influence plant response. Plant response will vary depending on post-fire soil moisture availability. Letterman's needlegrass recovers well after fire (Monsen et al., 2004). Burning reduces the basal area and flower stalk production of Cusick's bluegrass (Uresk et al., 1976). In the same study, burning enhanced the growth of bluebunch wheatgrass.

Livestock/Wildlife Grazing Interpretations:

Curl-leaf mountain mahogany is an important cover and browse species for big game such as elk (*Cervus canadensis*), mule deer (*Odocoileus hemionus*), pronghorn antelope (*Antilocapra americana*), and bighorn sheep (*Ovis canadensis*) (Lanner, 1984; Furniss et al., 1988; Sabo et al., 2005). Sampson and Jespersen (1963) state that curl-leaf mountain mahogany is excellent browse for mule deer, and domestic livestock will browse this plant to varying degrees in all seasons except summer. It is not uncommon for these trees to develop a "hedged" appearance after years of regular browsing by wildlife. According to Olsen (1992), curl-leaf mountain mahogany is consumed widely by mule deer throughout the year. In fact, mule deer fecal pellets contained curl-leaf mountain mahogany year-round, with the highest frequency of leaves found in winter (Gucker, 2006). Mule deer will use curl-leaf mountain mahogany for cover as well (Steele et al., 1981).

Despite low palatability, mountain big sagebrush is eaten in small amounts by sheep, cattle, goats, and horses. Chemical analysis indicates that the leaves of big sagebrush equal alfalfa meal in protein, have a higher carbohydrate content, and yield twelvefold more fat (USDA, 1988).

Antelope bitterbrush (*Purshia tridentata*) is a small component of these sites, but is a critical browse species for mule deer, antelope, and elk and is often utilized heavily by domestic livestock (Wood et al., 1995). Grazing tolerance depends on site conditions (Garrison, 1953) and the shrub can be severely hedged during the dormant season for grasses and forbs.

Idaho fescue is valuable forage for livestock and wildlife. It is an excellent forage grass and can withstand heavy trampling (USDA, 1988). However, Idaho fescue decreases under heavy grazing by livestock (Eckert & Spencer, 1987) and wildlife (Gaffney, 1941).

Bluebunch wheatgrass is moderately grazing-tolerant and is very sensitive to defoliation during the active growth period (Blaisdell & Pechanec, 1949; Laycock, 1967; Anderson & Scherzinger, 1975). In studies, herbage and flower stalk production were reduced with clipping at all times during the growing season; clipping was most harmful, however, during the boot stage (Blaisdell & Pechanec, 1949; Britton et al., 1990). Tiller production and growth of bluebunch wheatgrass were greatly reduced when clipping was coupled with drought (Busso & Richards, 1995). Mueggler (1975) estimated that low-vigor bluebunch wheatgrass may need up to 8 years rest to recover. Although an important forage species, it is not always the preferred species by livestock and wildlife.

Letterman's needlegrass provides valuable forage for both livestock and wildlife (Taylor, 2000). It begins growth early in the year and is available to be utilized when other grasses are not yet palatable. It is especially important fall

forage for big game (Monsen et al., 2004). Letterman's needlegrass has been shown to increase under sheep grazing and decreases under light cattle and horse grazing (Bowns & Bagley, 1986). It also declines when grazing is excluded for a long time (Turner, 1969).

Cusick's bluegrass was the most palatable and preferred grass compared to Thurber's needlegrass (*Achnatherum thurberianum*) and bluebunch wheatgrass in a grazing study, but was also the most negatively affected by grazing (Rickard et al., 1975). Uresk and Rickard (1976) found Cusick's bluegrass to be a highly preferred grass, especially in the spring, even when it is a minor component of the plant community.

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Major Land Resource Area

MLRA 023X
Malheur High Plateau

Subclasses

- F023XY092NV–ABCO/CEVE
- R023XY026NV–MAHOGANY SAVANNA
- R023XY073NV–GRANITIC MAHOGANY THICKET
- R023XY510OR–ROCKY RIDGES 16-35 PZ

Correlated Map Unit Components

21500675, 21501468, 21501492, 21501534, 21501532, 21501526, 21501457, 21500994, 21500898, 21500902, 21589650, 21590030, 21589694, 21589887, 21590073, 21589483, 21589886, 21590069, 21590806, 21590309, 21590707, 21590393, 21604613, 21604594, 21604596, 22171079, 22170895

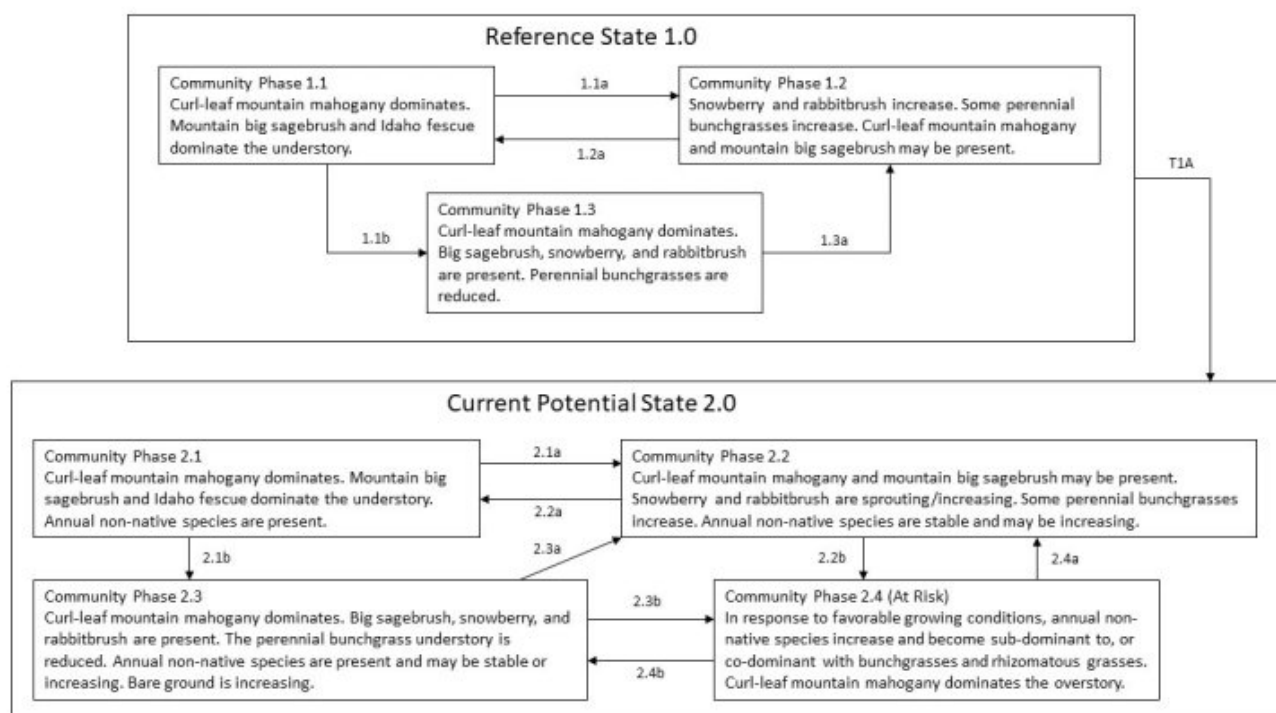
Stage

Provisional

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State and transition model



Reference State 1.0 Community Phase Pathways

1.1a: Low-severity fire, snow loading, or insect damage reduces curl-leaf mountain mahogany.

1.1b: Time and lack of disturbance allow curl-leaf mountain mahogany to reach peak canopy cover. Shade from the canopy increases Cusick's bluegrass.

1.2a: Time and lack of disturbance facilitate this pathway.

1.3a: Low-severity fire, snow loading, or insect damage reduces curl-leaf mahogany.

Transition T1A: This transition occurs following the introduction of non-native annual species.

Current Potential State 2.0 Community Phase Pathways

2.1a: Low-severity fire, snow loading, or insect damage reduces curl-leaf mountain mahogany.

2.1b: Time and lack of disturbance allow curl-leaf mountain mahogany to reach peak canopy cover. Shade from the canopy increases Cusick's bluegrass.

2.2a: Time and lack of disturbance facilitate this pathway.

2.2b: This pathway occurs when late spring moisture favors the germination and production of non-native, annual grasses. This pathway typically occurs 3 to 5 years post-fire. Community Phase 2.4 may be a transitory plant community.

2.3a: Low-severity fire, snow loading, or insect damage reduces curl-leaf mountain mahogany.

2.3b: This pathway occurs when late spring moisture favors the germination and production of non-native, annual grasses. Community Phase 2.4 may be a transitory plant community. The development of this pathway may be exacerbated by long-term, excessive herbivory.

2.4a: This pathway occurs when rainfall patterns favor perennial bunchgrass production and reduce cheatgrass production.

2.4b: This pathway occurs when rainfall patterns favor perennial bunchgrass production and reduce cheatgrass production.

Citations

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