Ecological site group R023XY906NV
Ashy or Loamy Skeletal Moderately Deep 10-20 PZ High-Resilience Mountain Big Sagebrush and Idaho Fescue

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Key Characteristics

- Site does not pond or flood
- Landform other than dunes
- Surface soils are not clayey
- Sites are shrub or grass dominated
- [Criteria]MAP >10"
- Soil is moderately deep or deeper
- Site on other aspects or landforms
- Soil textures (PCS) ashy
- Sites are on plateau summits and shoulders

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 found on plateaus and mountains at elevations between 5,500 and 8,500 feet. Slopes are 1 to 65 percent, but 20 to 40 percent slopes are the most typical and representative.

Climate

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

The area receives between 10 and 20 inches of annual precipitation as snow in the winter and rain in spring and fall. Summers are generally dry.

The frost-free period is 40 to 90 days. The mean annual air temperature is between 35 and 45 °F.

Soil features

The soils of this group are moderately deep or deeper. Bedrock or another root restrictive layers is at least 24 inches from the surface. The texturs are clayey, often with gravelly or cobbly surface textures. The parent material of these soils is volcanic colluvium, residuum, or ash.

Soil temperature regimes are generally frigid with a few mesic map units. The soils classify as Mollisols. Common soil series in this group include Nutzan, Bearbutte, and Bullump.

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 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 ecological sites in this group are dominated by deep-rooted, cool-season, perennial bunchgrasses and long-lived shrubs (at least 50 years old) with high root to shoot ratios. 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 (Dobrowolski et al., 1990). 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).

Periodic drought regularly influences sagebrush ecosystems, and drought duration and severity have increased throughout the 20th century in much of the Intermountain West. Major shifts away from historical precipitation patterns have the greatest potential to alter ecosystem function and productivity. Species composition and productivity can be altered by the timing of precipitation and water availability within the soil profile (Bates et al., 2006).

The Great Basin sagebrush 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. The invasibility of plant communities is often linked to resource availability. 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). Although there is no documentation of these sites with significant cover of non-native species, it is important to recognize the potential impact of invasion. The invasion of sagebrush communities by cheatgrass (*Bromus tectorum*) has been linked to disturbances (fire, abusive grazing) that result in fluctuations in resources (Beckstead & Augspurger, 2004; Chambers et al., 2007; Johnson et al., 2011).

Native insect outbreaks are also important drivers of ecosystem dynamics in sagebrush communities. Climate is generally believed to influence the timing of insect outbreaks, especially outbreaks of a sagebrush defoliator called Aroga moth (Aroga websteri). Aroga moth infestations occurred in the Great Basin in the 1960s, the early 1970s, and have been ongoing in Nevada since 2004 (Bentz et al., 2008). Thousands of acres of big sagebrush (*Artemisia tridentata*) have been impacted, with partial to complete die-off observed. The Aroga moth can partially or entirely kill individual plants or entire stands of big sagebrush (Furniss & Barr, 1975).

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

South slopes will generally express a higher abundance of bluebunch wheatgrass, while north slopes will have more Idaho fescue. Production will be higher on sites with deeper soils. Overgrazing by livestock and horses will cause a decrease in deep-rooted perennial bunchgrasses, mainly Idaho fescue and bluebunch wheatgrass. Continued inappropriate grazing may result in an increase in bluegrasses, balsamroot, lupine, sagebrush, and yellow rabbitbrush (Chrysothamnus visidiflorus).

The ecological sites in this group have high resilience to disturbance and resistance to invasion. Resilience increases with elevation, northerly aspect, precipitation, and nutrient availability. Two possible stable states have been identified for this group. Minor differences in resilience to disturbance for the remaining ecological sites contained within this group are described at the end of this document.

Fire Ecology:

Pre-settlement fire return intervals in mountain big sagebrush (*Artemisia tridentata* ssp. vaseyana) communities varied from 15 to 25 years (Burkhardt & Tisdale, 1969; Houston, 1973; Miller & Tausch, 2001). Mountain big sagebrush is killed by fire (Neuenschwander, 1980; Blaisdell et al., 1982), and does not resprout (Blaisdell, 1953). Post-fire regeneration originates from seed and will vary depending on site characteristics, seed sources, and fire characteristics. Mountain big sagebrush seedlings can grow rapidly and may reach reproductive maturity within three to five 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 and can take up to 50 years (Bunting et al., 1987; Ziegenhagen, 2003; Miller & Heyerdahl, 2008; Ziegenhagen & Miller, 2009). The introduction of annual weedy species, like cheatgrass, may cause an increase in fire frequency and put the site at risk for further invasion. Fire is a natural disturbance in this ecosystem. Without fire, juniper may increase. However, juniper has not been documented in large quantities during site visits.

Antelope bitterbrush is moderately fire tolerant (McConnell & Smith, 1977). It regenerates from seed and resprouting (Blaisdell & Mueggler, 1956; McArthur et al., 1982). However, sprouting ability is highly variable and is attributed to genetics, plant age, phenology, soil moisture, soil texture, and fire severity (Blaisdell & Mueggler, 1956; Blaisdell et al., 1982; Clark et al., 1982; Cook et al., 1994). Bitterbrush sprouts from a region on the stem approximately 1.5 inches above and below the soil surface. The plant rarely sprouts if the root crown is killed by fire (Blaisdell & Mueggler, 1956). Low-intensity fires may allow bitterbrush to sprout; however, community response also depends on soil moisture levels at time of fire (Murray, 1983). Lower soil moisture allows more charring of the stem below ground level (Blaisdell & Mueggler, 1956), so sprouting will usually be more successful after a spring fire than after a fire in summer or fall (Murray, 1983; Busse et al., 2000; Kerns et al., 2006). If cheatgrass is present, bitterbrush seedling success is much lower. The factor that most limits establishment of bitterbrush seedlings is competition for water resources with the invasive species cheatgrass (Clements & Young, 2002).

Depending on fire severity, rabbitbrush and snowberry (Symphoricarpos spp.) may increase after fire. Rubber rabbitbrush (*Ericameria nauseosa*) is top-killed by fire, but can resprout after fire and can also establish from seed (Young, 1983). Yellow rabbitbrush (*Chrysothamnus viscidiflorus*) is top-killed by fire, but sprouts vigorously after fire (Kuntz, 1982; Akinsoji, 1988). Snowberry is also top-killed by fire, but resprouts after fire from rhizomes (Leege & Hickey, 1971; Noste & Bushey, 1987). Snowberry may regenerate well and exceed pre-burn biomass in the third season after a fire (Merrill et al., 1982). If balsamroot or mule-ears is common before fire, they will increase after fire or with heavy grazing (Wright, 1985).

The effect of fire on bunchgrasses relates to culm density, culm-leaf morphology, and the size of the plant. The initial condition of bunchgrasses on the site and seasonality and intensity of the fire all factor into the individual species response. For most forbs and grasses, the growing points are located at or below the soil surface. This provides relative protection from disturbances that decrease above ground biomass, such as grazing or fire. Thus, fire mortality is more correlated to duration and intensity of heat, which is related to culm density, culm-leaf morphology, size of plant, and abundance of old growth (Wright, 1971; Young, 1983).

Idaho fescue, the dominant grass within this community, response to fire varies with condition and size of the plant, season and severity of fire, and ecological conditions. It can survive low-severity fires but can be severely damaged by fire in all seasons (Wright et al., 1979; Wright, 1985). Idaho fescue is a dense, fine-leaved bunchgrass that allows fires to burn and smolder in the accumulated leaves at the base of the plant. Rapid tillering can occur after fire when root crowns are not killed and soil moisture is favorable (Johnson et al., 1994; Robberecht & Defossé, 1995).

Bluebunch wheatgrass has coarse stems with little leafy material; therefore, the plant's aboveground biomass burns rapidly, and little heat is transferred downward into the crowns (Young 1983). Bluebunch wheatgrass is typically fairly tolerant of burning, except in May in eastern Oregon (Britton et al., 1990). Uresk et al. (1976) reported burning increased vegetative and reproductive vigor of bluebunch wheatgrass. Thus, bluebunch wheatgrass is more susceptible in drought years (Young, 1983). Most authors classify the plant as undamaged by fire (Kuntz, 1982).

The grasses likely to invade the sites in this group are cheatgrass and medusahead. These invasive grasses can displace desirable perennial grasses, reduce livestock forage, and accumulate large fuel loads that foster frequent fires (Davies & Svejcar, 2008). Invasion by annual grasses can alter the fire cycle by increasing fire size, fire season length, rate of spread, numbers of individual fires, and likelihood of fires spreading into native or managed ecosystems (D'Antonio & Vitousek, 1992; Brooks et al., 2004). While historical fire return intervals are estimated at 15 to 100 years, areas dominated by cheatgrass are estimated to have a fire return interval of 3 to 5 years (Whisenant, 1990). The mechanisms by which invasive annual grasses alter fire regimes likely interact with climate. For example, cheatgrass cover and biomass vary with climate (Chambers et al., 2007) and are promoted by wet and warm conditions during the fall and spring. Invasive annual species can take advantage of high nitrogen availability following fire because of their higher growth rates and increased seedling establishment relative to native perennial grasses (Monaco et al., 2003).

Livestock/Wildlife Grazing Interpretations:

Sheehy and Winward (1981) studied preferences of mule deer and sheep in a controlled experiment. Several different varieties of sagebrush including basin big sagebrush (*Artemisia tridentata* ssp. tridentata), black sagebrush (*Artemisia nova*), silver sagebrush (formerly Bolanda silver sagebrush; *Artemisia cana* ssp. bolanderi), big sagebrush (formerly foothill big sagebrush; *Artemisia tridentata* ssp. xericensis), low sagebrush (*Artemisia arbuscula*), mountain big sagebrush, and Wyoming big sagebrush (*Artemisia tridentata* ssp. wyomingensis) were brought into a pen and the animals' preferences were measured. Deer showed the most preference for low sagebrush, mountain big sagebrush, foothill sagebrush, and Bolander silver sagebrush. They showed the least preference for black sagebrush (*Artemisia nova*). Sheep showed the highest preference for low sagebrush, moderate preference for black sagebrush, and the least preference for Wyoming and basin big sagebrush. In a study by Personius et al. (1987), mountain big sagebrush was the most preferred taxon by mule deer. Fecal samples from ungulates in Montana showed that big horn sheep, mule deer, and elk all consumed mountain big sagebrush in small amounts in winter, while cattle showed no sign of sagebrush use (Kasworm et al., 1984).

Antelope bitterbrush is an important shrub species to a variety of animals, such as domestic livestock, antelope, deer, and elk. Bitterbrush is critical browse for mule deer, domestic livestock, antelope, and elk (Wood et al., 1995). Antelope bitterbrush is most common on soils that minimally restrict deep root penetration such as coarse textured soil, or finer-textured soil with high stone content (Driscoll, 1964; Clements & Young, 2002). Grazing tolerance of antelope bitterbrush depends on site conditions (Garrison, 1953).

Idaho fescue is valuable forage for livestock and wildlife. However, Idaho fescue decreases under heavy grazing by livestock (Eckert & Spencer, 1986, 1987) and wildlife (Gaffney, 1941).

Bluebunch wheatgrass is moderately tolerant of grazing and is very sensitive to defoliation during the active growth period (Blaisdell & Pechanec, 1949; Laycock, 1967, Anderson & Scherzinger, 1975; Britton et al., 1990). In a study, 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). Tiller production and growth of bluebunch wheatgrass can be greatly reduced when clipping is 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.

Reduced bunchgrass vigor or density provides an opportunity for bluegrass and/or cheatgrass and other invasive species to expand onto or occupy interspaces, leading to increased fire frequency and potentially an annual plant community. Bluegrasses increase under grazing pressure (Tisdale & Hironaka, 1981) and are capable of co-existing with cheatgrass. Excessive sheep grazing favors bluegrass; however, where cattle are the dominant grazers, cheatgrass often dominates (Daubenmire, 1970). Thus, depending on the season of use, the type of grazing animal, and site conditions, either bluegrass or cheatgrass may become the dominant understory species with inappropriate grazing management.

Long-term disturbance response may be influenced by small differences in landscape topography. Concave areas hold a little more moisture and may retain deep-rooted perennial grasses whereas convex areas are slightly less resilient and may have more bluegrass species present.

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Major Land Resource Area

MLRA 023X
Malheur High Plateau

Subclasses

- R023XY050NV–STONY GRANITIC SLOPE 14+ P.Z.
- R023XY053NV–GRAVELLY NORTH SLOPE
- R023XY054NV–STEEP NORTH SLOPE
- R023XY058NV–GRANITIC LOAM 14-16 P.Z.
- R023XY061NV–MOUNTAIN SHOULDERS 14-18 P.Z.
- R023XY064NV–SOUTH SLOPE 16+ P.Z.
- R023XY066NV–ASHY LOAM 14-16 P.Z.
- R023XY071NV–ASHY LOAM 10-12 P.Z.
- R023XY096NV–ASHY SANDY LOAM 10-12 P.Z.
- R023XY308OR–NORTH SLOPES 10-12 PZ
- R023XY515OR–DROUGHTY PUMICE 9-12 PZ
- R023XY604OR–ARID PLAINS 8-11 PZ

Correlated Map Unit Components

21500835, 21500589, 21500579, 21500950, 21501112, 21500995, 21501193, 21501107, 21501451, 21500864, 21501497, 21500873, 21501426, 21500875, 21501237, 21501243, 21501113, 21501232, 21501106, 21501452, 21500876, 21501145, 21501124, 21501501, 21501105, 21501248, 21501242, 21501069, 21501191, 21589963, 21589656, 21590008, 21590040, 21590023, 21589453, 21589686, 21589709, 21589919, 21589923, 21590704, 21590852, 21590540, 21590549, 21590921, 21590329, 21590754, 21590415, 21590422, 21590543, 21590673, 21590538, 21590356, 21590873, 21590845, 21590683, 21590326, 21604285, 21604611, 21605190, 21604436, 21729595, 21729856, 21729593, 21729598, 21729313, 21729309, 21729515, 21730118, 21729005, 21729134, 21729417, 21729609, 22168378, 22168226, 22168357, 22168353, 22168127, 22168356, 22168241, 22168282, 22168133, 22168129, 22168126, 22175644, 22175529, 22176786, 22176789, 22175645, 22176798, 22175052, 22175555, 22175777, 22175028, 22175865, 22175869, 22175723, 22175530, 22176037, 22176033, 22175767, 22175526, 22175498, 22168265, 22168248, 22168258, 22171301, 22170557, 22170565, 22170816, 22170477, 22170473, 22171149, 22171260, 22171252, 22171253, 22171254, 22171255, 22171256, 22170476, 22171235, 22171203, 22170468, 22171153, 22171152, 22171150, 22171146, 22171144, 22171142, 22171139, 22171137, 22171133, 22170898, 22170782, 22171140, 22171128, 22171127, 22171125, 22170991, 22170835, 22171123, 22171122, 22170784, 22170976, 22170467, 22170469, 22170554, 22170463, 22170464, 22170459, 22170456, 22170455, 22170944, 22170942, 22170943, 22170934, 22170932, 22170933, 22170551, 22170864, 22170564, 22170548, 22170811, 22170804, 22170802, 22170800, 22170466, 22170785, 22170783, 22170781, 22171302, 22170780, 22170481, 22170710, 22170707, 22170662, 22170474, 22170660, 22170627, 22170658, 22175057, 22175465, 22175577, 22176803, 22176793, 22175548, 22176855, 22168189

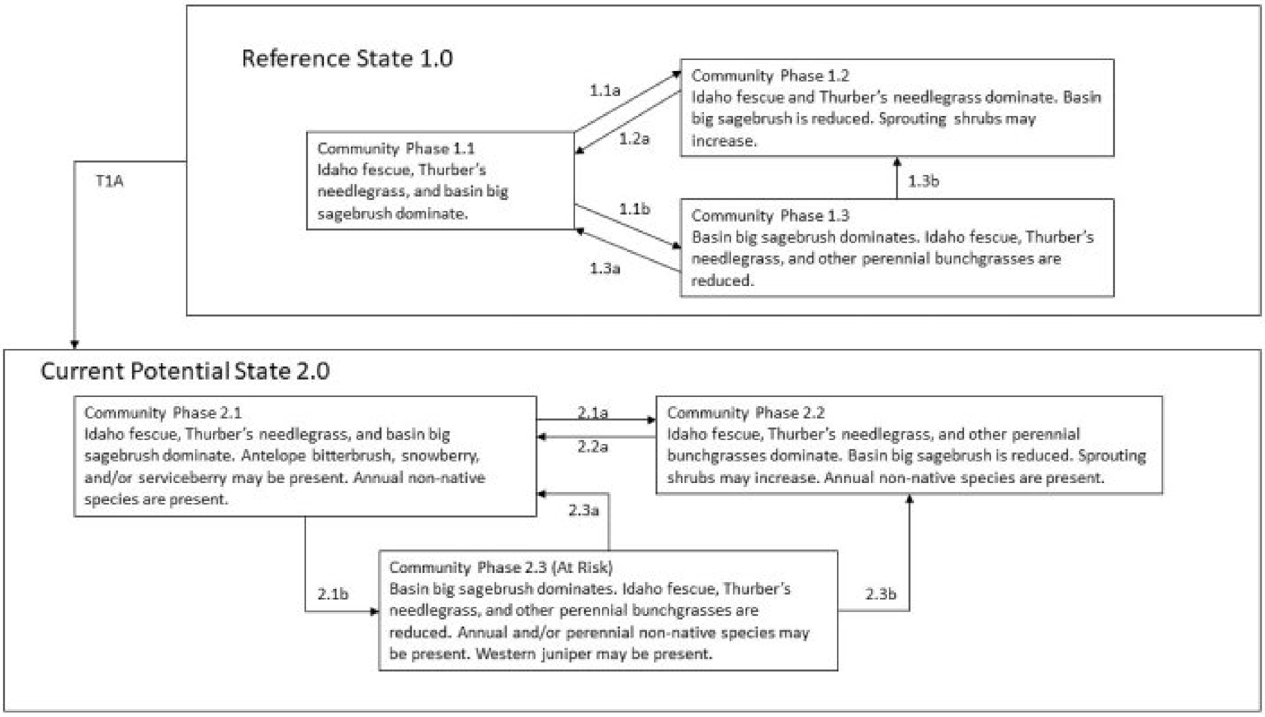
Stage

Provisional

Contributors

T Stringham (UNR under contract with BLM)
DMP

State and transition model



Reference State 1.0 Community Pathways
1.1a: Low-severity fire creates a sagebrush/grass mosaic. High-severity fire significantly reduces sagebrush cover and leads to an early or mid-seral community dominated by grasses and forbs. A high-severity Aroga moth infestation could also reduce sagebrush cover.
1.1b: Time and lack of disturbance allow sagebrush to increase and become decadent. Herbivory and/or chronic drought may also reduce fine fuels and lead to reduced fire frequency and increased shrub cover.
1.2a: Time and lack of disturbance allow shrubs to regenerate.
1.3a: Low-severity fire, Aroga moth infestation, and/or herbivory create a sagebrush/grass mosaic.
1.3b: High-severity fire significantly reduces sagebrush cover, resulting in an early or mid-seral community. A high-severity Aroga moth infestation may also reduce sagebrush cover.

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

Current Potential State 2.0 Community Pathways
2.1a: Low-severity fire creates a sagebrush/grass mosaic. High-severity fire significantly reduces sagebrush cover and leads to an early or mid-seral community dominated by grasses and forbs. A high-severity Aroga moth infestation could also reduce sagebrush cover. Non-native annual species are present.
2.1b: Time and lack of disturbance allow shrubs to increase and become decadent. Inappropriate grazing management and/or chronic drought may also reduce fine fuels and lead to reduced fire frequency and increased shrub cover.
2.2a: Time and lack of disturbance allow for the regeneration of sagebrush.
2.3a: Low-severity fire, Aroga moth infestation, and/or grazing management create a sagebrush/grass mosaic.
2.3b: High-severity fire significantly reduces sagebrush cover, resulting in an early or mid-seral community.

Citations

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