

Ecological site group R023XY902OR

Shallow and Moderately Deep >12 PZ Low and Lahontan sagebrush and Idaho fescue

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Key Characteristics

- Site does not pond or flood
- Landform other than dunes
- Soil surface is clayey
- MAP > 10"
- Soil Temperature Regime Frigid. Frost Free Days per Year < 80

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 plateaus and mountains above 5,500 feet. Slopes are typically 2 to 20 percent. Slopes up to 75 percent are uncommon.

Climate

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

The area receives between 12 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 50 to 90 days. The mean annual air temperature is between 40 and 45 °F.

Soil features

The soils in this group have bedrock or another root restrictive layer within 36 inches of the surface. The textures are clayey and loamy-skeletal.

The soil temperature regime is frigid. The soils are principally Mollisols. There are some Aridisols on R023XY090NV. Common soil series in this ecological site group include Ninemile and Hutchley.

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). However, community types with low sagebrush (*Artemisia arbuscula*) as the dominant shrub may only have available rooting depths of 71 to 81 centimeters (Jensen, 1990). 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).

Low sagebrush is fairly drought tolerant but also tolerates periodic wetness during some portion of the growing season (Fosberg & Hironaka, 1964; Blackburn et al., 1968a, 1968b, 1969). It grows on soils that have a strongly structured B2t (argillic) horizon close to the soil surface (Winward, 1980; Fosberg & Hironaka, 1964; Zamora & Tueller, 1973). Low sagebrush is also susceptible to the sagebrush defoliator known as the Aroga moth (*Aroga websteri*). While the Aroga moth can partially or entirely kill individual plants or entire stands of big sagebrush (*Artemisia tridentata*) (Furniss & Barr, 1975), research is inconclusive of the damage sustained by low sagebrush populations.

Lahontan sagebrush was only recently identified as a unique species of sagebrush (Winward & McArthur, 1995). Lahontan sagebrush is a cross between low sagebrush and Wyoming sagebrush (*Artemisia tridentata* ssp. *wyomingensis*). It typically grows near the old shorelines of Lake Lahontan from the Pleistocene Epoch. This subspecies grows on soils similar to low sagebrush with shallow depths and low water holding capabilities (Winward & McArthur, 1995).

In the Clay Plain ecological site, early sagebrush (*Artemisia arbuscula* ssp. *longiloba*) is the dominant shrub. Early sagebrush (also known as alkali sagebrush) is a unique subspecies of *Artemisia arbuscula* that is differentiated because it blooms in mid-June to July. It was originally named alkali sagebrush because it was found on alkaline limestone soils (Beetle, 1960). However, a body of research challenges this claim across the species' range (Passey & Hugie, 1962; Robertson et al., 1966; Zamora & Tueller, 1973). It grows on soils similar to low sagebrush, with a restrictive horizon close to the soil surface (Robertson et al., 1966; Zamora & Tueller, 1973).

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). The invasion of sagebrush communities by cheatgrass (*Bromus tectorum*) has been linked to disturbances that result in fluctuations in resources such as fire and abusive grazing (Beckstead & Augspurger, 2004; Chambers et al., 2007; Johnson et al., 2011).

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. Four possible stable states have been identified for this group.

Fire Ecology:

Low sagebrush is killed by fire and does not resprout (Tisdale & Hironaka, 1981). Fire risk is greatest following a wet, productive year when there is greater production of fine fuels (Beardall & Sylvester, 1976). Fire return intervals are not well understood because these ecosystems rarely coincide with fire-scarred conifers, but a wide range of 20

to well over 100 years has been estimated (Miller & Rose, 1995, 1999; Baker, 2006; Knick et al., 2005).

Historically, fires were probably patchy due to the low productivity of these sites (Beardall & Sylvester, 1976; Ralphs & Busby, 1979; Wright et al., 1979; Smith & Busby, 1981). Fine fuel loads generally average 100 to 400 pounds per acre (110 to 450 kilograms per hectare) but are occasionally as high as 600 pounds per acre (680 kilograms per hectare) in low sagebrush habitat types (Bradley et al., 1992). Reestablishment occurs from off-site wind-dispersed seed (Young, 1983). Recovery time of low sagebrush following fire is variable (Young, 1983). After fire, if regeneration conditions are favorable, low sagebrush recovers in 2 to 5 years; on harsh sites where cover is low to begin with and/or erosion occurs after fire, recovery may require more than 10 years (Young, 1983). Slow regeneration may subsequently worsen erosion (Blaisdell et al., 1982). We were unable to find any substantial research on success of seeding low sagebrush after fire. To date, we have not been able to find specific research on the fire response of Lahontan sagebrush.

The effect of fire on bunchgrasses relates to culm density, culm-leaf morphology, and the size of the plant. Idaho fescue (*Festuca idahoensis*) is the dominant grass on these communities. Idaho fescue's response to fire varies with condition and size of the plant, season and severity of fire, and ecological conditions. Mature Idaho fescue plants are commonly severely damaged by fire in all seasons (Wright et al., 1979). 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, Wright et al. (1979) 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. Idaho fescue is generally more sensitive to fire than the other prominent grasses on these sites such as bluebunch wheatgrass (*Pseudoroegneria spicata*) (Conrad & Poulton, 1966). However, Robberecht and Defossé (1995) suggest the latter is more sensitive. They observed culm and biomass reduction of bluebunch wheatgrass following fires of moderate severity, whereas Idaho fescue required high fire severity for a similar reduction in culm and biomass. Also, given the same fire severity treatment, post-fire culm production initiated earlier and more rapidly in Idaho fescue.

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. Bluebunch wheatgrass experiences slight damage from fire but is more susceptible to fire damage in drought years (Young, 1983). Most authors classify the plant as undamaged by fire (Kuntz, 1982).

Thurber's needlegrass (*Achnatherum thurberianum*), a minor component on these sites, is very susceptible to fire-caused mortality. Burning can decrease the vegetative and reproductive vigor of Thurber's needlegrass (Uresk et al., 1976). Fire can cause high mortality in addition to reducing basal area and yield of Thurber's needlegrass (Britton et al., 1990). The fine leaves and densely tufted growth form make this grass susceptible to subsurface charring of the crowns (Wright & Klemmedson, 1965). Although timing of fire highly influences the response and mortality of Thurber's needlegrass, smaller bunch sizes are less likely to be damaged by fire (Wright & Klemmedson, 1965). However, Thurber's needlegrass often survives fire and will continue growth when conditions are favorable (Koniak, 1985). Thus, the initial condition of the bunchgrasses on the site and seasonality and intensity of the fire all factor into the individual species response.

Sandberg bluegrass (*Poa secunda*), a minor component on these ecological sites, can increase following fire likely due to its low stature and productivity (Daubenmire, 1975) and may slow reestablishment of more deeply rooted bunchgrasses.

Livestock/Wildlife Grazing Interpretations:

Domestic sheep and, to a much lesser degree, cattle consume low sagebrush, particularly during the spring, fall, and winter (Sheehy & Winward, 1981). Heavy dormant season grazing by sheep will reduce sagebrush cover and increase grass production (Laycock, 1967). Trampling damage, particularly from cattle or horses, in low sagebrush habitat types is greatest on areas with highly clayey soils during spring snowmelt when surface soils are saturated. In drier areas with more gravelly soils, trampling is less of a problem (Hironaka et al., 1983). Bunchgrasses, in general, best tolerate light grazing after seed formation. Britton et al. (1990) observed the effects of clipping date on basal area of five bunchgrasses in eastern Oregon and found grazing from August to October (after seed set) has the least impact.

Heavy grazing during the growing season will reduce perennial bunchgrasses and increase sagebrush (Laycock, 1967). Abusive grazing by cattle or horses allows unpalatable plants like low sagebrush, rabbitbrush, and some forbs such as arrowleaf balsamroot (*Balsamorhiza sagittata*) to become dominant on the site. Sandberg bluegrass is grazing tolerant due to its short stature. Annual, non-native, weedy species such as cheatgrass, mustards, and medusahead may invade.

Throughout 2 years of site visits, Lahontan sagebrush was observed in a heavily-browsed state on several ecological sites in this group. This recently differentiated subspecies of low sagebrush (Winward & McArthur, 1995) is moderately to highly palatable to browse species (McArthur, 2005; Rosentreter, 2005). Dwarf sagebrush species such as Lahontan sagebrush, low sagebrush, and black sagebrush are preferred by mule deer for browse among the sagebrush species.

Idaho fescue tolerates light to moderate grazing (Ganskopp & Bedell, 1981). It is moderately resistant to trampling (Cole, 1987). Heavy grazing may lead to replacement of Idaho fescue with non-native species such as cheatgrass (Mueggler, 1975).

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; Britton et al., 1990). 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 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.

Thurber's needlegrass is an important forage source for livestock and wildlife in the arid regions of the West (Ganskopp, 1988). The seeds (despite their hard callus) are apparently not injurious, but grazing animals avoid them when the seeds begin to mature. Sheep, however, have been observed grazing the leaves closely, leaving stems untouched (Eckert & Spencer, 1987). Heavy grazing during the growing season can reduce the basal area of Thurber's needlegrass (Eckert & Spencer, 1987). A single defoliation, particularly during the boot stage, can reduce herbage production and root mass thus potentially lowering the competitive ability of this needlegrass (Ganskopp, 1988).

Reduced bunchgrass vigor or density provides an opportunity for Sandberg bluegrass and/or cheatgrass and other invasive species to expand onto or occupy interspaces. Sandberg bluegrass increases under grazing pressure (Tisdale & Hironaka, 1981). It is capable of co-existing with cheatgrass or other weedy species. Excessive sheep grazing favors Sandberg 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 Sandberg bluegrass or cheatgrass may become the dominant understory species with inappropriate grazing management.

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Major Land Resource Area

MLRA 023X

Malheur High Plateau

Subclasses

- R023XY008NV–MOUNTAIN RIDGE
- R023XY014NV–SHALLOW LOAM 14+ P.Z.
- R023XY017NV–CLAYPAN 14-16 P.Z.
- R023XY090NV–CLAY PLAIN
- R023XY211OR–PUMICE CLAYPAN 10-12 PZ
- R023XY216OR–CLAYPAN 12-16 PZ
- R023XY217OR–JUNIPER TABLELAND 12-16 PZ
- R023XY312OR–SHALLOW NORTH 12-16 PZ
- R023XY410OR–GRAVELLY RIDGE 12-16 PZ
- R023XY412OR–GRAVELLY RIDGE 16+ PZ
- R023XY507OR–CLAYPAN 16-25 PZ
- R023XY511OR–JUNIPER LAVA BENCHES 9-12 PZ

Correlated Map Unit Components

22177325, 22177348, 22177349, 22177110, 22177113, 22177228, 22177475, 22177230, 22177476, 22177233, 22177123, 22177127, 22177583, 22177584, 22177586, 22177587, 22177538, 21500867, 21500861, 21501522, 21501014, 21501141, 21501195, 21500993, 21501257, 21501263, 21501236, 21501235, 21501181, 21501516, 21501519, 21500731, 21501551, 21500713, 21501305, 21501308, 21501540, 21500854, 21501246, 21500941, 21500958, 21500903, 21501311, 21582072, 21582565, 21582570, 21589867, 21590076, 21589827, 21590047, 21589899, 21589883, 21590063, 21589468, 21589394, 21589962, 21589804, 21589678, 21589504, 21589653, 21589836, 21589438, 21589765, 21589762, 21589593, 21589641, 21590004, 21590005, 21589629, 21589630, 21589638, 21589637, 21590000, 21589833, 21589596, 21589598, 21589853, 21589950, 21590289, 21590855, 21590756, 21590545, 21590717, 21590368, 21590869, 21590375, 21590710, 21590561, 21590926, 21590913, 21590667, 21590311, 21590567, 21590575, 21590675, 21590830, 21604715, 21604135, 21604286, 21604612, 21605186, 21604599, 21605197, 21604406, 21729121, 21729123, 21729153, 21729169, 21729141, 21728950, 21728759, 21729307, 21730061, 21729524, 21729527, 21729513, 21729519, 21728975, 21730107, 21729571, 21729009, 21729014, 21729020, 22168434, 22168432, 22168433, 22168242, 22168240, 22168247, 22168268, 22168271, 22168272, 22168234, 22168260, 22168251, 22168267, 22168263, 22168264, 22168252, 22168253, 22168228, 22168227, 22168225, 22168255, 22168261, 22168262, 22170526, 22170523, 22170520, 22170491, 22171257, 22171254, 22171258, 22171261, 22171243, 22171250, 22171237, 22171218, 22171185, 22171182, 22171176, 22171164, 22171155, 22171135, 22171129, 22170999, 22170982, 22170979, 22170465, 22170581, 22170900, 22170901, 22170929, 22170927, 22170925, 22170921, 22170917, 22170914, 22170912, 22170908, 22170905, 22170902, 22170903, 22170896, 22170851, 22170846, 22170847, 22170611, 22176890, 22176680, 22176880, 22175176, 22176487, 22176790, 22175764, 22175448, 22176799, 22176820, 22175038, 22175053, 22175033, 22176856, 22175088, 22175690, 22175694, 22175695, 22175776, 22175112, 22175753, 22176753, 22176754, 22176380, 22176331, 22175073, 22176950, 22175615, 22175551, 22175024, 22175482, 22175773, 22176571, 22175627, 22175547, 22175102, 22175808, 22175809, 22175583, 22175584, 22175485, 22175486, 22175167, 22175191, 22176291, 22176502, 22176918, 22175163, 22175154, 22176398, 22176301, 22176281, 22176283, 22176642, 22176298, 22176287, 22175827, 22175653, 22176833, 22175490, 22175716, 22175823, 22175061, 22175554, 22175712, 22175630, 22175631, 22175559, 22175560, 22175568, 22175122, 22175141, 22177264, 22177284, 22177285, 22177286, 22177159, 22177175, 22177181, 22177068, 22177069, 22177079, 22177080, 22177077, 22177078, 22177193, 22177194, 22177445, 22177444, 22177323, 22177324

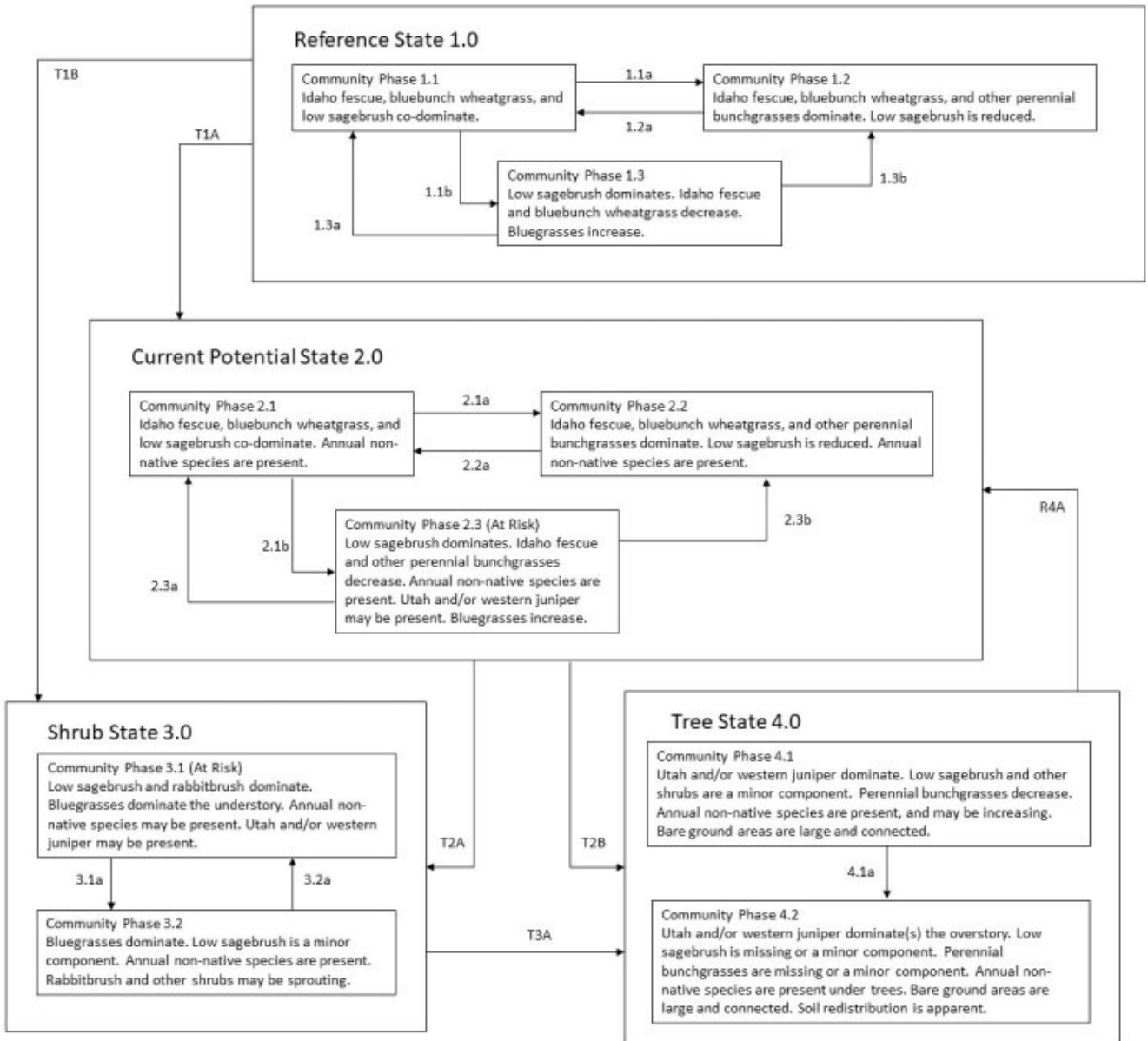
Stage

Provisional

Contributors

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State and transition model



Reference State 1.0 Community Phase Pathways

1.1a: Low-severity fire creates a grass/sagebrush mosaic. High-severity fire significantly reduces sagebrush cover and leads to an early or mid-seral community dominated by grasses and forbs.

1.1b: Time and lack of disturbance, such as fire or drought, or excessive herbivory reduce the perennial understory and facilitate this pathway.

1.2a: Time and lack of disturbance allow shrubs to regenerate.

1.3a: This pathway occurs following low-severity fire and/or herbivory.

1.3b: High-severity fire significantly reduces sagebrush.

Transition T1A: This transition occurs following the introduction of non-native species such as bulbous bluegrass, cheatgrass, and thistles.

Transition T1B: Inappropriate grazing management facilitates a transition to Community Phase 3.1. Fire or brush treatment, sometimes coupled with inappropriate grazing management, triggers a transition to Community Phase 3.2.

Current Potential State 2.0 Community Phase Pathways

2.1a: Low-severity fire creates a grass/sagebrush mosaic. High-severity fire significantly reduces sagebrush cover and leads to an early or mid-seral community dominated by grasses and forbs. Non-native species are present.

2.1b: Time and lack of disturbance, such fire or drought, or inappropriate grazing management reduce the perennial understory and facilitate this pathway.

2.2a: Time and lack of disturbance allow shrubs to regenerate.

2.3a: This pathway occurs after low-severity fire and/or late fall/winter grazing management that causes mechanical damage to sagebrush.

2.3b: High-severity fire significantly reduces sagebrush. Brush management that minimally disturbs the soil and late fall/winter grazing that causes mechanical damage to sagebrush may also reduce sagebrush.

Transition T2A: Inappropriate grazing management triggers a transition to Community Phase 3.1. Fire or brush treatment, sometimes coupled with inappropriate grazing management, triggers a transition to Community Phase 3.2.

Transition T2B: Time and lack of fire allow Utah juniper and pinyon pine to establish, overtop the sagebrush, and dominate site resources. Inappropriate grazing management may also contribute to this transition.

Shrub State 3.0 Community Phase Pathways

3.1a: This pathway occurs following fire or brush management (i.e., mowing) that minimally disturbs the soil.

3.2a: Time and lack of disturbance facilitate this pathway. This pathway is unlikely to occur.

Transition T3A: Time and lack of fire allows Utah/western juniper to establish and dominate site resources. This may be coupled with inappropriate grazing management that reduces perennial grass density and increases tree establishment.

Tree State 4.0 Community Phase Pathways

4.1a: Time without disturbance allows maturation of the tree community to occur.

Restoration R4A: Tree removal from sites in Community Phase 4.1 would decrease tree cover and allow for the understory to recover.

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