Ecological site group R021XG904CA
Dry Loamy

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Key Characteristics

- Upland sites
- < 12" ppt
- > 20" depth
- Loamy texture

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 ESG can be found on lower elevation uplands, lava plains, hills, mountains, and plateaus. Slopes range from 0 to 80 percent.

Climate

The average annual precipitation in this MLRA is typically 9 to 25 inches (241 to 635 millimeters). It is highest, up to 57 inches (1,450 millimeters), in small areas at high elevations on the western and southwestern edges of this MLRA. Other high precipitation zones are in the scattered mountain ranges throughout the rest of this area. Most of the rainfall occurs as low- or moderate-intensity Pacific frontal storms during the winter. At the higher elevations, rain generally turns to snow. Snow may fall at the lower elevations in winter but does not last. Summers are dry. The average annual temperature is 37 to 53 degrees F (3 to 12 degrees C). The frost-free period is 70 to 185 days and averages 130 days.

Soil features

This ESG consists of soils that are moderately deep and well drained. They formed in residuum and colluvium derived from mixed rocks. Representative soils include the Searles (loamy-skeletal, mixed, superactive, mesic Aridic Argixerolls), Truax (fine-loamy, mixed, superactive, mesic Aridic Argixerolls), Sumine (loamy-skeletal, mixed, superactive, frigid Aridic Argixerolls), and Calimus (fine-loamy, mixed, superactive, mesic Pachic Haploxerolls) series.

Soils with substantial mapped acres (totaling over 200,000 acres) that are included in this ESG but do not fit the central concept of the ESG include the Capjac, Tulana, Inlow, Henley, Laki, and Malin series.

Vegetation dynamics

This ESG represents loamy soils that receive under 12 inches (305 millimeters) of precipitation. It includes poorly drained silt loam or saline soils with drastically contrasting hydrology (i.e., wetter) on flatter valleys and basins with substantial alteration and cultivation that should be reviewed in the future to determine whether they belong in other sites (namely sites dominated by cattails, bulrushes, and saline tolerant greasewoods and saltgrasses).

The vegetation dynamics that are described for this ESG focus on the soils that are dominated by Wyoming big sagebrush communities within MLRA 21 that are at low elevations on the warmest, driest sites. Wyoming big sagebrush communities tend to have the lowest annual production of the three varieties of big sagebrush. Basin big sagebrush communities are also in this ESG, but these communities are often small and found on more productive bottomland soils. Many have been substantially altered for agriculture. While there is considerable overlap in average annual precipitation and elevation between Wyoming big sagebrush and basin big sagebrush sites, Wyoming big sagebrush generally occurs on dry uplands with moderately deep, moderately fertile soils.

Historically, fire was one of many natural disturbances that affected Wyoming big sagebrush and basin big sagebrush communities. Other important large-scale disturbances in these communities included herbivory (e.g., insects, small mammals, and wild ungulates) and water table changes (e.g., flooding or drought). In general, big sagebrush can persist as a habitat dominant in late-successional stages in the absence of fire or other large-scale disturbances, particularly when far from conifers. Evers et al. (2013) modeled succession in Wyoming big sagebrush and basin big sagebrush communities in southeastern Oregon. Their models included the effects of fire, drought, insects, and/or pronghorn herbivory, but did not include succession to conifers. They concluded that fire had less influence than all other disturbance types, except drought, because other disturbances were more frequent and took fewer years to affect the study area. However, fire is an important disturbance because it kills establishing conifers in big sagebrush communities adjacent to woodlands.

Pre-settlement fire regimes in Wyoming big sagebrush and basin big sagebrush communities are difficult to characterize over large areas because they were spatially and temporally complex due to variation in site characteristics (e.g., topography, soils, vegetation, and fuel structure, composition, moisture content, and continuity), grazing and other disturbance history, climate, weather, lightning, and American Indian ignition rates. In addition, records of fire history in Wyoming big sagebrush and basin big sagebrush communities are lacking and commonly used fire history methods, such as fire-scar analyses, are not possible because big sagebrush plants are killed by fire and hence do not form fire scars. Instead, inferences from fire adaptations and post-fire recovery rates of big sagebrush and associated conifers, and proxy information—including charcoal fragments in soils, wetlands, and lakes; fire evidence from adjacent or intermixed conifers; and historical land-survey records—are supplemented with information on contemporary fires to estimate historical fire regime characteristics. The fire history of mountain big sagebrush ecosystems is the most well studied of the three major big sagebrush subspecies. Much less is known about fire history in Wyoming big sagebrush and basin big sagebrush ecosystems.

Wyoming big sagebrush and basin big sagebrush hybridize with other sagebrush taxa. Sites occupied by parent taxa and their hybrids may be distinct from one another, but no studies examined fire history of hybrid communities.

Pre-Settlement Fire Ignition

Pre-settlement fires in the sagebrush biome were human- and lightning-caused, and sagebrush communities were generally not ignition- limited. However, little information on historical fire ignitions specific to Wyoming big sagebrush and basin big sagebrush communities was available as of 2019.

American Indian Ignitions

In the sagebrush biome, American Indians started fires and benefitted from lightning-ignited wildfires. The frequency and purpose of intentional burning varied across the region. Fires were used to improve forage for game, drive game animals, increase production of edible plants and seeds, maintain desirable plant communities, improve visibility, clear campsites, control pests, communicate over distances, and defend against or attack intruders. For example, the Kucadikadi, a band of Northern Paiute people who live near Mono Lake in California, held rabbit drives every fall, setting fire to the sagebrush to flush out the animals. Some intentionally set fires in sagebrush steppes were relatively large, and multiple fires were often set at once. In the Northwestern Great Plains, American Indians may have intentionally set fires during wet years when fuels were abundant.

It is difficult to generalize the effects of burning by American Indians on sagebrush ecosystems because the importance of human-caused fires likely varied "from place to place and culture to culture" [3], and historical records regarding American Indian burning practices are lacking for many tribes in the arid and semiarid regions of the West. In general, American Indian populations in big sagebrush steppe and shrublands were thought to be low prior to European-American settlement. Early accounts suggest that American Indian-set fires were rare in the "drier, sagebrush valleys" but perhaps more common at higher elevations, where grass fuels were more abundant. Many authors noted potential bias by European-Americans in recording American Indian-set fires, depending on the observer, vegetation type, and season, which makes reliability questionable and interpretation of these early accounts difficult. Oral histories from American Indians would be more reliable, but they are too few to draw conclusions regarding fire use in sagebrush communities, and none specifically address Wyoming big sagebrush or basin big sagebrush communities. Anecdotal and ethnographic accounts describing the use of fire by American Indians within the sagebrush biome are reviewed by many authors, including several chapters in “Fire, Native Peoples, and the Natural Landscape” (Vale 2002).

Burning by American Indians may have increased fire frequency in some areas, and the seasonality and size of human-caused fires may have been different from those of lightning-caused fires. Based on contemporary rates and causes of ignitions, Griffin proposed four hypotheses about American Indian impacts on historical fire regimes in the Great Basin: human-caused ignitions were less important than lightning ignitions across most of the region; human-caused fires were most frequent in the northern Great Basin, particularly along transportation corridors and areas near water; American Indian burning practices made year-to-year ignition frequencies more constant than they would have otherwise been; burning by American Indians resulted in more fires in fall, winter, and spring than would have otherwise occurred.

Whether American Indian ignitions were less important than lightning ignitions in the West is debated. Some authors suggest that most pre- settlement fires were lightning-caused, while others suggest that most pre-settlement fires were human-caused. For example, a review of fire history in national parks of the Great Plains concluded that while human ignitions were likely locally important, fire frequency was mostly a function of regional climate, with fire more frequent in the south than north and more frequent in the west than east. However, in some places such as Yellowstone National Park, lightning appears insufficient to explain the frequency of fires recorded by fire scars, and ignitions by American Indians have been suggested to explain the difference.

Authors described the effects of American Indian ignitions as ranging from limited and highly localized, to substantial and widespread. Based on accounts in journals and other historical documents of 145 fires between 1776 and 1900 in Oregon, Idaho, Montana, Wyoming, Utah, and Nevada, Gruell concluded that 41 percent of fires observed were ignited by American Indians and located primarily at lower and middle elevations, 7 percent were attributed to other "non-Indian" causes, and no mention of ignition source was made for the remaining 52 percent. An analysis of American Indian fire use in sagebrush-perennial grass communities concluded that the pre-settlement Great Basin landscape was a "patchwork of areas altered by aboriginal people and areas shaped primarily by biophysical properties". American Indian impacts in the sagebrush region were likely concentrated near grasslands, low-elevation forests, and in or near settlement areas (e.g., riparian areas and major river valleys). According to West, the most important parts of big sagebrush ecosystems to American Indians, as well as early European-Americans, were likely areas of sandy soil or alluvial sites along streams with relatively high cover of grasses and forbs. However, even remote areas were likely impacted by American Indian-set fires, at least on occasion, as fires spread from other areas.

By the end of the 1700s, American Indian populations throughout the Intermountain West had been reduced by about 80 percent due to diseases introduced from Europe and other factors [121,273]. While the number of American Indian-set fires was declining, they were still reported by early explorers and European-American settlers in some parts of the West throughout the 1800s [147]. By the late 1800s, American Indians had been relocated to reservations, and their scope of influence on the landscape severely diminished.

Lightning-caused Ignitions

In the West, lightning frequency does not generally limit fire frequency or inter-annual area burned [2] at regional scales; rather, fire probabilities are associated with fuel loadings (production and continuity), fuel moisture levels, and lightning arc duration. In steppes throughout the Intermountain West, the frequency of lightning ignitions varies spatially and is influenced by geography (i.e., climate and weather patterns), topography, and fuel characteristics. Lightning strike density is apparently not correlated with ignition frequency at regional scales, but it likely influences ignition frequency at local scales. From 1980 to 1994, ignition frequency in grass-dominated communities of the Intermountain West (native and non-native grasslands, sagebrush steppes, and conifer savannas) was highest in the western third of the region and in areas with the largest elevational differences (indicative of sites with varied topography) and the most summer precipitation (associated with greater fuel production). In contrast, lightning strike density was greatest in the southeastern part of the region, decreasing steadily toward the northwest, and was not well correlated with ignition frequency. Ignition frequency was greatest in mountainous areas, including the eastern foothills of the Oregon Cascade Range and the Sierra Nevada, and the foothills of the Carson Range in Nevada and California. High ignition frequency also occurred near the Stansbury Mountains in Utah, on the Snake River Plain of Idaho, and in the Ruby Mountains of Nevada. Low ignition frequency was particularly pronounced in the Lahontan Basin in Oregon and Nevada and the Bonneville Basin in Utah. At smaller spatial scales, ignition frequency may be more strongly influenced by lightning strike density, which varies with topographic position. For example, a study in California and Oregon found that among seven mountain big sagebrush/Idaho fescue sites, the site with the most frequent fire (as determined from fire scars on adjacent and intermixed ponderosa pine trees) occurred on a long ridge above a high-elevation tableland—a location that made it highly susceptible to lightning strikes [270].

Information on lightning frequency specific to Wyoming big sagebrush and basin big sagebrush communities was not available as of 2019. Ignition frequency may be higher in forests than sagebrush communities.

Pre-settlement Fire Season

Limited information from fire scars on adjacent and intermixed ponderosa pine trees suggests that fires in Wyoming big sagebrush and mountain big sagebrush communities adjacent to ponderosa pine communities were most common in summer and fall. A study in Thunder Basin National Grasslands in northeastern Wyoming found that most fires (80 percent)—as recorded in fire scars from ponderosa pine and Rocky Mountain juniper trees in conifer cover types intermixed with Wyoming big sagebrush communities—occurred during the latter stages of the growing season or during the dormant period [298]. Across seven sites in California and Oregon, fire-scars dated from 1600 to 1830 on ponderosa pine trees within and adjacent to mountain big sagebrush-Idaho fescue communities indicated that most pre-settlement fires occurred from mid-summer to late fall, particularly in late summer, when dry lightning storms are most common. Only one spring fire occurred in the fire-scar record across the seven sites. However, spring fires probably burned at relatively low intensities, which may have caused less scarring of trees and may mean that evaluating fire scars on trees provides an underestimate spring fire frequency.

Where fire was used by American Indians, American Indian-set fires may have extended the fire season in big sagebrush communities. A review concluded that in North America in general, most intentional American Indian-set fires were ignited in spring or late fall, when burning conditions were less severe. While little is known about historical fire seasons, contemporary records of wildfires indicate that peak fire season occurs from April to October, depending on the region, but most wildfires occur in July and August throughout the West. Fire occurrence peaks earliest in the Southwest and progressively later to the north and west. A study of 410,000 reports of fires that occurred from 1980 to 2001 on lands managed by four of five federal land management agencies in the West found that 94 percent of lightning- and human-caused fires occurred and 98 percent of the area burned from May to October, with peak fire activity in July and August. Fire ignitions began sooner in Arizona and New Mexico than elsewhere, as early as May and June.

Both small and large fires in the Intermountain region of California, Idaho, Oregon, and Utah occur mostly in July and August, although small fires are more widely distributed throughout the fire season. An analysis of fire data from 1980 to 1995 from grasslands, sagebrush steppe, and savanna communities indicated that greater than 82 percent of large fires (at least 4,962 acres (2,008 ha)) occurred in July and August. Less than 1 percent occurred before June and less than 6 percent occurred after August. Although 71 percent of small fires (

Major Land Resource Area

MLRA 021X
Klamath and Shasta Valleys and Basins

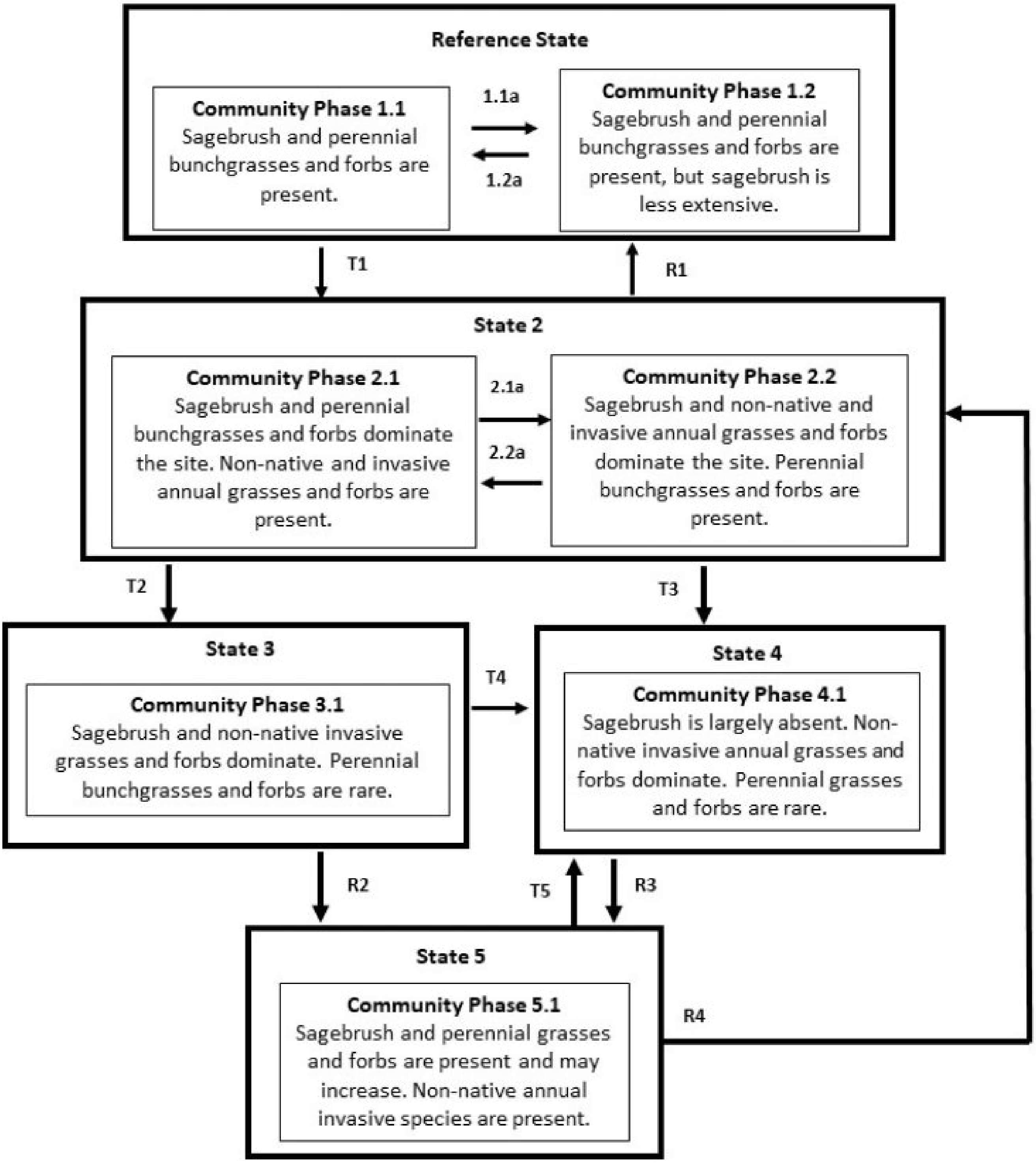
Stage

Provisional

State and transition model

Dry Loamy

**Adapted from USDA Forest Service Gen. Tech. Rep. RMRS-GTR-326 (2014)



Community Pathway 1.1a: Perennial grasses and forbs increase due to disturbances that decrease sagebrush such as wildfires, insects, diseases, and pathogens.

Community Pathway 1.2a: Sagebrush increases with time.

T1: The presence of an invasive seed source, coupled with disturbances such as fires, improper grazing, insects, diseases, or pathogens, trigger a threshold-crossing event.

R1: A combination of management strategies that reduce pressures toward native perennial grasses and forbs and sagebrush are unlikely on all but the coolest and highest soil moisture sites. Management would include use of fires, herbicides, mechanical treatments, and grazing management strategies that fit site-specific conditions. This restoration pathway is time, labor, and money intensive once the invasive annuals rule the ecological functions and processes on the site.

Community Pathway 2.1a: Perennial grasses and forbs decrease, and sagebrush and invasive species increase due to improper grazing by wildlife or domestic livestock. The site enters an at-risk phase. Decreases in sagebrush due to insects, diseases, or pathogens can further increase the presence of invasive species.

Community Pathway 2.2a: This community pathway occurs when the site experiences one or both of the following: decreased grazing pressure from wild and domestic ungulates; winter, spring, and summer moisture exceeds average levels for two to four years. This pathway is especially, or perhaps only possible on the coolest, wettest sites. Reduced grazing pressure and abundant moisture promote the competitive growth and vigor of perennial grasses and forbs and may provide an opportunity for native components to return to dominance. The warmer, drier sites may transition straight from Community Phase 2.1 to State 3 depending on the degree of disturbance and climatic conditions.

T2: All or most of the perennial grasses and forbs are removed from the site by continued grazing pressure from wild and/or domestic livestock, prolonged droughts, or both.

T3, T4, and T5: Sagebrush is removed by fire or other disturbances, resulting in a state dominated by annual invasive species. Perennial grasses and forbs are rare and recovery potential is low due to low precipitation, mesic soil temperatures, and competition from annual invasive species. Repeated fires can cause sites on drier soils and landscape positions to cross an ecological threshold and develop solid stands of annual grasses and annual invasive forbs. Opportunistic shrubs may also be present post-disturbance.

R2 and R3: A seeded state results from seeding following fires, removal of invasive species, or both. Sagebrush may recolonize depending on patch size, but annual invasive species are still present.

R4: Cooler sites with greater soil moisture, such as those at higher elevations and/or in higher precipitation zones, may begin to resemble State 2 over time, if a seed source is present.

Citations

. 2002. Fire, native peoples, and the natural landscape. Island Press, Washington, D.C..

Chambers, J.C., D.A. Pyke, J.D. Maestas, M. Pellant, C.S. Boyd, S.B. Campbell, S. Esipinosa, D.W. Havlina, K.E. Mayer, and A. Wuenschel. 2014. Using resistance and resilience concepts to reduce impacts of invasive annual grasses and altered fire regimes on the sagebrush ecosystem and greater sage-grouse: A strategic multi-scale approach.. Gen. Tech. Rep. RMRS-GTR-326.. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station., Fort Collins, CO. 73.

Evers, L.B., R.F. Miller, P.S. Doescher, M. Hemstrom, and R.P. Neilson. 2013. Simulating current successional trajectories in sagebrush ecosystems with multiple disturbances using a state-and-transition modeling framework. Rangeland Ecology & Management 66:313–329.

Griffin, D. 2002. Prehistoric human impacts on fire regimes and vegetation in the northern Intermountain West. in Fire, native peoples, and the natural landscape. Island Press, Washington, D.C..

Gruell, G.E. 1985. Fire on the early western landscape: an annotated record of wildland fires 1776-1900. Northwest Science 59:97–107.