Ecological site R028BY082NV
LOAMY FAN 12+ P.Z.

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General information

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.

MLRA notes

Major Land Resource Area (MLRA): 028B–Central Nevada Basin and Range

MLRA 28B occurs entirely in Nevada and comprises about 23,555 square miles (61,035 square kilometers). More than nine-tenths of this MLRA is federally owned. This area is in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. It is an area of nearly level, aggraded desert basins and valleys between a series of mountain ranges trending north to south. The basins are bordered by long, gently sloping to strongly sloping alluvial fans. The mountains are uplifted fault blocks with steep sideslopes. Many of the valleys are closed basins containing sinks or playas. Elevation ranges from 4,900 to 6,550 feet (1,495 to 1,995 meters) in the valleys and basins and from 6,550 to 11,900 feet (1,995 to 3,630 meters) in the mountains.
The mountains in the southern half are dominated by andesite and basalt rocks that were formed in the Miocene and Oligocene. Paleozoic and older carbonate rocks are prominent in the mountains to the north. Scattered outcrops of older Tertiary intrusives and very young tuffaceous sediments are throughout this area. The valleys consist mostly of alluvial fill, but lake deposits are at the lowest elevations in the closed basins. The alluvial valley fill consists of cobbles, gravel, and coarse sand near the mountains in the apex of the alluvial fans. Sands, silts, and clays are on the distal ends of the fans.
The average annual precipitation ranges from 4 to 12 inches (100 to 305 millimeters) in most areas on the valley floors. Average annual precipitation in the mountains ranges from 8 to 36 inches (205 to 915 millimeters) depending on elevation. The driest period is from midsummer to midautumn. The average annual temperature is 34 to 52 degrees F (1 to 11 degrees C). The freeze-free period averages 125 days and ranges from 80 to 170 days, decreasing in length with elevation.
The dominant soil orders in this MLRA are Aridisols, Entisols, and Mollisols. The soils in the area dominantly have a mesic soil temperature regime, an aridic or xeric soil moisture regime, and mixed or carbonatic mineralogy. They generally are well drained, loamy or loamyskeletal, and shallow to very deep.
Nevada’s climate is predominantly arid, with large daily ranges of temperature, infrequent severe storms and heavy snowfall in the higher mountains. Three basic geographical factors largely influence Nevada’s climate: continentality, latitude, and elevation. The strong continental effect is expressed in the form of both dryness and large temperature variations. Nevada lies on the eastern, lee side of the Sierra Nevada Range, a massive mountain barrier that markedly influences the climate of the State. The prevailing winds are from the west, and as the warm moist air from the Pacific Ocean ascend the western slopes of the Sierra Range, the air cools, condensation occurs and most of the moisture falls as precipitation. As the air descends the eastern slope, it is warmed by compression, and very little precipitation occurs. The effects of this mountain barrier are felt not only in the West but throughout the state, as a result the lowlands of Nevada are largely desert or steppes.
The temperature regime is also affected by the blocking of the inland-moving maritime air. Nevada sheltered from maritime winds, has a continental climate with well-developed seasons and the terrain responds quickly to changes in solar heating. Nevada lies within the midlatitude belt of prevailing westerly winds which occur most of the year. These winds bring frequent changes in weather during the late fall, winter and spring months, when most of the precipitation occurs.
To the south of the mid-latitude westerlies, lies a zone of high pressure in subtropical latitudes, with a center over the Pacific Ocean. In the summer, this high-pressure belt shifts northward over the latitudes of Nevada, blocking storms from the ocean. The resulting weather is mostly clear and dry during the summer and early fall, with

occasional thundershowers. The eastern portion of the state receives noteworthy summer thunderstorms generated from monsoonal moisture pushed up from the Gulf of California, known as the North American monsoon. The monsoon system peaks in August and by October the monsoon high over the Western U.S. begins to weaken and the precipitation retreats southward towards the tropics (NOAA 2004).

Ecological site concept

This site occurs on inset fans and fan remnants. Slopes range from 2 to 15 percent, but slope gradients of 2 to 4 percent are most typical. Elevations are 6200 to 7000 feet.
The climate associated with this site is semiarid, characterized by cold, moist winters and warm, dry summers. Average annual precipitation is 12 or more inches. Mean annual air temperature is 43 to 45 degrees F. The average growing season is about 70 to 100 days.
The soils associated with this site have formed in silty alluvium from mixed rock sources. These soils are very deep and are well drained. Surface textures are generally silt loams to sandy loams. They have a moderate to high available water capacity. Runoff is low to high and permeability is moderately slow to moderate.
The reference state is dominated by big sagebrush, basin wildrye, streambank wheatgrass and bluegrass species. Production ranges from 900 to 1400 pounds per acre.

Associated sites

R028BY007NV	**LOAMY 10-12 P.Z.** This site occurs on fan remnants. Slopes gradients of 4 to 15 percent are most typical. Elevations are 6400 to 7000 feet. Soils associated with this site are moderately deep to a duripan, well drained and formed in alluvium derived from andesite/quartzite. Surface soils are medium to coarse textured. Soils have a mollic epipedon, an argillic horizon and are modified with a high volume of rock fragments throughout the profile. The reference state is characterized by a stand of perennial bunchgrasses and deep-rooted shrubs. The plant community is dominated by Wyoming big sagebrush, Thurber's needlegrass and bluebunch wheatgrass. Production ranges from 600 to 1000 pounds per acre.
R028BY030NV	**LOAMY 12-16 P.Z.** This site occurs on concave mountain sideslopes. Slopes gradients of 15 to 50 percent are typical and elevations range from 6500 to 8200 feet. Soils associated with this site are very deep, well drained, and formed in residuum/colluvium derived from volcanic sources. The profile is characterized by a mollic epipedon, an argillic horizon and greater than 35 percent rock fragments. The reference state is dominated by perennial grasses and shrubs with a few scattered trees. Dominant plant species include mountain big sagebrush, snowberry, Utah serviceberry, antelope bitterbrush, bluebunch wheatgrass, Thurber's needlegrass, and western needlegrass. Production ranges from 900 to 1500 pounds per acre.

Similar sites

R028BY003NV	**LOAMY BOTTOM 10-14 P.Z.** More productive site
R028BY041NV	**DRY FLOODPLAIN** LETR5 dominant grass; more productive site; lower elevations; typically occurs on axial-stream floodplains
R028BY007NV	**LOAMY 10-12 P.Z.** ACTH7-PSSP codominant; less productive site
R028BY024NV	**LOAMY BOTTOM 14+ P.Z.** More productive site
R028BY045NV	**LOAMY FAN 8-12 P.Z.** ACHY codominant grass; ARTRW dominant shrub; less productive site

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata subsp. tridentata* (2) *Artemisia tridentata subsp. vaseyana*

Herbaceous	(1) *Leymus cinereus* (2) *Hesperostipa comata*

Physiographic features

This site occurs on inset fans and fan remnants. Slopes range from 2 to 15 percent, but slope gradients of 2 to 4 percent are most typical. Elevations are 6200 to 7000 feet.

Table 2. Representative physiographic features

Landforms	(1) Inset fan (2) Fan remnant
Runoff class	Low to high
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	Rare
Ponding frequency	None
Elevation	1,890–2,134 m
Slope	2–15%
Water table depth	183 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate associated with this site is semiarid, characterized by cold, moist winters and warm, dry summers.

Average annual precipitation is about 12 or more inches. Mean annual air temperature is about 43 to 45 degrees F. The average growing season is about 70 to 100 days.

Mean annual precipitation at the RUTH,NEVADA climate station (267175) is 12.14 inches. Monthly mean precipitation is:
January 0.91; February 1.06; March 0.96; April 1.40;
May 1.22; June 1.10; July 0.89; August 0.95;
September .83; October 1.04;
November 0.82; December 0.95.

Table 3. Representative climatic features

Frost-free period (average)	91 days
Freeze-free period (average)	119 days
Precipitation total (average)	356 mm

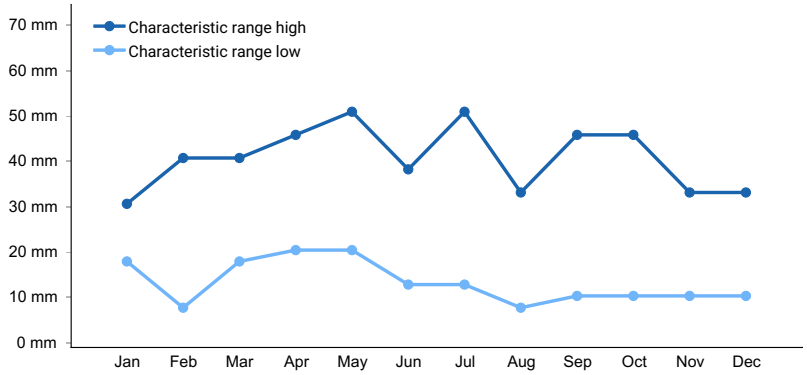


Figure 1. Monthly precipitation range

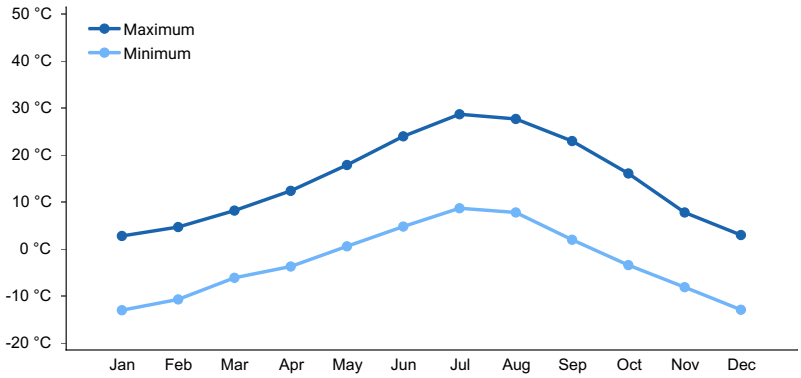


Figure 2. Monthly average minimum and maximum temperature

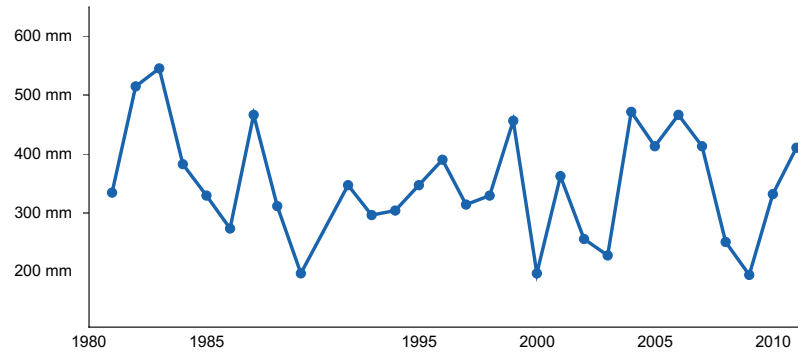


Figure 3. Annual precipitation pattern

Climate stations used

- (1) RUTH [USC00267175], Ely, NV

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils associated with this site have formed in silty alluvium from mixed rock sources. These soils are very deep and are well drained. Surface textures are generally silt loams or very fine sandy loams. They have a moderate to high available water capacity. Runoff is low to high and permeability is moderately slow to moderate. The soils series associated with this site include: Orr and Pern.

The representative soil series is Orr, a Fine-loamy, mixed, superactive, mesic Aridic Argixerolls. Diagnostic horizons include an Mollic epipedon from the soil surface to 25 cm, and a Argillic horizon from 25 to 127 cm. Clay content in the particle control section averages 18 to 25 percent. Rock fragments range from 10 to 25 percent. Reaction is neutral. Effervescence is none. Lithology consists of igneous rocks such as andesite and granodiorite.

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Alluvium–limestone
Surface texture	(1) Sandy loam (2) Silt loam (3) Loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate to rapid

Soil depth	140–152 cm
Surface fragment cover <=3"	5–15%
Surface fragment cover >3"	0–2%
Available water capacity (0-101.6cm)	14.99–20.07 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.8
Subsurface fragment volume <=3" (Depth not specified)	10–25%
Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

An ecological site is the product of all the environmental factors responsible for its development and it has a set of key characteristics that influence a site's resilience to disturbance and resistance to invasives. Key characteristics include 1) climate (precipitation, temperature), 2) topography (aspect, slope, elevation, and landform), 3) hydrology (infiltration, runoff), 4) soils (depth, texture, structure, organic matter), 5) plant communities (functional groups, productivity), and 6) natural disturbance regime (fire, herbivory, etc.) (Caudle et al 2013). Biotic factors that influence resilience include site productivity, species composition and structure, and population regulation and regeneration (Chambers et al. 2013).

The Great Basin sagebrush communities have high spatial and temporal variability in precipitation both among years and within growing seasons. Nutrient availability is typically low but increases with elevation and closely follows moisture availability. The moisture resource supporting the greatest amount of plant growth is usually the water stored in the soil profile during the winter. The invasibility of plant communities is often linked to resource availability. Disturbance can decrease resource uptake due to damage or mortality of the native species and depressed competition or can increase resource pools by the decomposition of dead plant material following disturbance. The invasion of sagebrush communities by cheatgrass has been linked to disturbances (fire, abusive grazing) that have resulted in fluctuations in resources (Chambers et al 2007).

The ecological site is dominated by the deep-rooted cool season, perennial bunchgrasses such as basin wildrye and long-lived shrubs (50+ years) such as basin big sagebrush and Wyoming big sagebrush. These shrubs have high root to shoot ratios. Root length of mature big sagebrush plants was measured to a depth of 2 meters in alluvial soils in Utah (Richards and Caldwell 1987). These shrubs have a flexible generalized root system with development of both deep taproots and laterals near the surface (Comstock and Ehleringer 1992). Differences in root depth distribution between grasses and shrubs result in resource partitioning in this system.

The perennial bunchgrasses generally have somewhat shallower root systems than the shrubs, but root densities are often as high as or higher than those of shrubs in the upper 0.5 m but taper off more rapidly than shrubs. However, basin wildrye is weakly rhizomatous and has been found to root to depths of up to 2 meters and to exhibit greater lateral root spread than many other grass species (Abbott et al. 1991, Reynolds and Fraley 1989).

Basin wildrye is a large, cool-season perennial bunchgrass with an extensive deep coarse fibrous root system (Reynolds and Fraley 1989). Clumps may reach up to six feet in height (Ogle et al 2012a). Basin wildrye does not tolerate long periods of inundation; it prefers cycles of wet winters and dry summers and is most commonly found in deep soils with high water holding capacities or seasonally high water tables (Ogle et al 2012a, Perryman and Skinner 2007).

Beardless wildrye, also known as creeping wildrye, is a subdominant grass on this site. It is a cool-season perennial sod-forming grass that is strongly rhizomatous (Young-Mathews and Winslow 2010). In a study of native California grasses, beardless wildrye performed the best in terms of above-ground biomass and high resistance to invasion by non-native annuals (Lulow 2006).

Needle and thread (*Hesperostipa comata*), a subdominant grass on some sites in this group, is most commonly

found on warm/dry soils (Miller et al. 2013). Needle and thread grass is most commonly found on warm/dry soils (Miller et al. 2013). It is not grazing tolerant and will be one of the first grasses to decrease under heavy grazing pressure (Smoliak et al. 1972, Tueller and Blackburn 1974). Heavy grazing is likely to reduce basal area of these plants (Smoliak et al. 1972). With the reduction in competition from deep rooted perennial bunchgrasses, shallower rooted grasses forbs may increase (Smoliak et al. 1972).

Millions of acres in the arid and semi-arid West have been brush-beaten and planted with crested wheatgrass in order to benefit both livestock and wildlife and to increase range production (Zlatnik 1999). Crested wheatgrass is a cool-season, medium height, exotic perennial bunchgrass. As a native of Russia, it is adapted to very cold and very dry climates which made it the common choice for range rehabilitation. This site may exhibit an understory of crested wheatgrass in areas where historical seedings have been allowed to return to sagebrush.

Seasonally high water tables have been found to be necessary for maintenance of site productivity and reestablishment of basin wildrye stands following disturbances such as fire, drought or excessive herbivory (Eckert et al. 1973). The sensitivity of basin wildrye seedling establishment to reduced soil water availability is increased as soil pH increases (Stuart et al. 1971). Lowering of the water table through extended drought, channel incision or water pumping will decrease basin wildrye production and establishment, while sagebrush, black greasewood, rabbitbrush, and invasive weeds increase. Farming and abandonment may facilitate the creation of surface vesicular crust, increased surface ponding, and decreased infiltration; which leads to dominance by sprouting shrubs and an annual understory.

The ecological site has moderate resilience to disturbance and resistance to invasion. A primary disturbance on these ecological sites is drought, fire, flooding, Aroga infestation (Aroga websteri), and channel incision or other disturbance leading to a lowered seasonal water table. This facilitates an increase in shrubs and a decrease in basin wildrye. The introduction of annual weedy species, like cheatgrass (*Bromus tectorum*), may cause an increase in fire frequency and eventually lead to an annual state or a state dominated by rabbitbrush. Other troublesome non-native weeds such as broadleaved pepperweed or tall whitetop (*Lepidium latifolium*), hoary cress or whitetop (*Cardaria draba*), scotch cottonthistle (*Onopordum acanthium*) or bull thistle (*Cirsium vulgare*) are potential invaders on this site. Four possible alternative stable states have been identified for this site.

Fire Ecology:

Natural fire return intervals are estimated to vary between less than 35 years up to 100 years in sagebrush ecosystems with basin wildrye (Paysen et al. 2000). Higher production sites would have experienced fire more frequently than lower production sites. Few if any fire history studies have been conducted on basin big sagebrush; however, Sapsis and Kauffman (1991) suggest that fire return intervals in basin big sagebrush are intermediate between mountain big sagebrush (15 to 25 years) and Wyoming big sagebrush (50 to 100 years). In many Great Basin plant communities, changes in fire frequency occurred along with fire suppression, livestock grazing, and OHV use. Fire severity is described as "variable" depending on weather, fuels, and topography and is typically stand replacing (Sapsis and Kauffman 1991). The introduction and expansion of cheatgrass has dramatically altered the fire regime (Balch et al. 2013), therefore altering restoration potential of big sagebrush/basin wildrye plant communities (Evans and Young 1978).

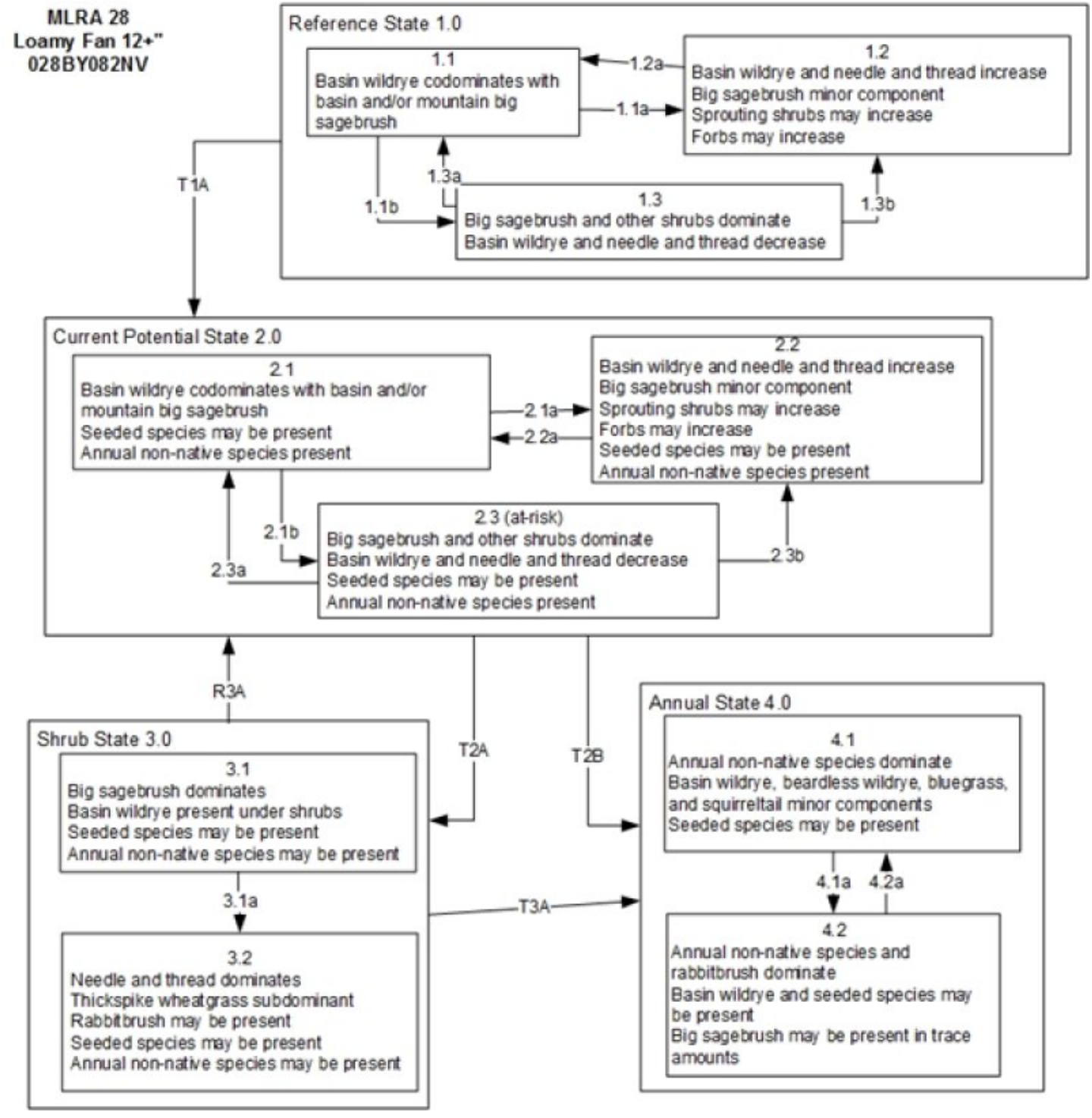
The effect of fire on bunchgrasses relates to culm density, culm-leaf morphology, and the size of the plant. The initial condition of bunchgrasses within the site along with seasonality and intensity of the fire all factor into the individual species response. For most forbs and grasses the growing points are located at or below the soil surface providing relative protection from disturbances which 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). Season and severity of the fire will influence plant response as will. post-fire soil moisture availability.

Basin wildrye is relatively resistant to fire, particularly dormant season fire, as plants sprout from surviving root crowns and rhizomes (Zschaechner 1985). Fire maintained the grass dominance of these ecosystems, therefore increases in the fire return interval favors increases in the shrub component of the plant community. The reduction of grasses potentially facilitates increases in bare ground, inland salt grass, and invasive weeds. Lack of fire combined with excessive herbivory converts these sites to sagebrush, black greasewood, and rabbitbrush dominance.

Basin big sagebrush and Wyoming big sagebrush is easily killed by fire and do not sprout after fire. Repeated fires may eliminate the onsite seed source; reinvasion into these areas may be extremely slow (Bunting et al. 1987). Basin big sagebrush and Wyoming big sagebrush reinvade a site primarily by off-site seed or seed from plants that survive in unburned patches. Approximately 90% of big sagebrush seed is dispersed within 30 feet (9 m) of the parent shrub (Goodrich et al. 1985) with maximum seed dispersal at approximately 108 feet (33 m) from the parent shrub (Shumar and Anderson 1986). Therefore regeneration of big sagebrush after stand replacing fires is difficult and dependent upon proximity of residual mature plants and favorable moisture conditions (Johnson and Payne 1968, Humphrey 1984). Reestablishment after fire may require 50 to 120 or more years (Baker 2006).

The majority of research concerning rabbitbrush has been conducted on green rabbitbrush. Green rabbitbrush has a large taproot 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 and Chilcote 1957, Miller et al. 2013). Depending on fire severity, rabbitbrush may increase after fire. Rubber rabbitbrush is top-killed by fire, but can resprout after fire and can also establish from seed (Young 1983). Shortened fire intervals within this ecological site favor a beardless wildrye understory with varying amounts of rabbitbrush dominated overstory. Needle and thread is a fine leaf grass and is considered sensitive to fire (Akinsoji 1988, Bradley et al. 1992, Miller et al. 2013). In a study by Wright and Klemmedson (1965), season of burn rather than fire intensity seemed to be the crucial factor in mortality for needle and thread grass. Early spring season burning was seen to kill the plants while August burning had no effect. Thus, under wildfire scenarios needle-and-thread is often present in the post-burn community.

State and transition model



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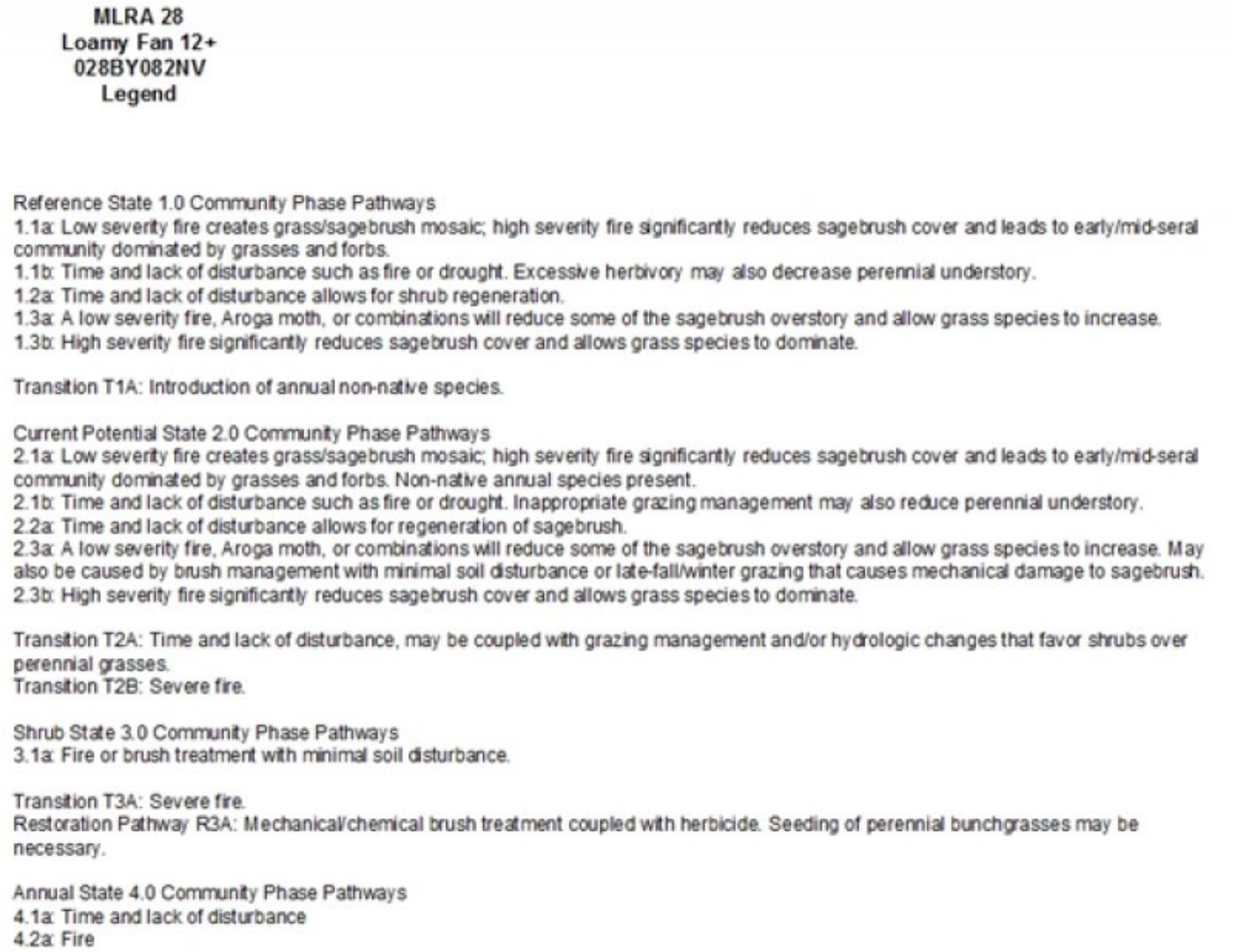

Figure 6. Legend

Animal community

Livestock Interpretations:
This site is suited to livestock grazing. Grazing management should be keyed to perennial grass production. The early growth and abundant production of basin wildrye make it a valuable source of forage for livestock. It is important forage for cattle and is readily grazed by cattle and horses in early spring and fall. Though coarse-textured during the winter, basin wildrye may be utilized more frequently by livestock and wildlife when snow has covered low shrubs and other grasses. Needleandthread provides highly palatable forage, especially in the spring before fruits have developed. Needlegrasses are grazed in the fall only if the fruits are softened by rain. Streambank wheatgrass is palatable to all classes of livestock and wildlife. It is a preferred feed for cattle, sheep, horses, and elk in spring and is considered a desirable feed for deer and antelope in spring. It is considered a desirable feed for cattle, sheep, and horses in summer, fall, and winter. Streambank wheatgrass's extensive rhizome system allows established stands to withstand heavy grazing and trampling. Canby's and Nevada bluegrass is a widespread forage grass. Bluegrasses green up in the spring and are sought by domestic livestock and several wildlife species. Canby's and Nevada bluegrass are palatable species, but their production is closely tied to weather conditions. Basin big sagebrush may serve as emergency food during severe winter weather, but it is not usually sought out by livestock. Mountain big sagebrush is eaten by domestic livestock but has long been considered to be of low palatability, and a competitor to more desirable species. In general, livestock forage only lightly on rubber rabbitbrush during the summer, but winter use can be heavy in some locations. Fall use is variable, but flowers are often used by livestock. A few leaves and the more tender stems may also be used.

Stocking rates vary over time depending upon season of use, climate variations, site, and previous and current management goals. A safe starting stocking rate is an estimated stocking rate that is fine tuned by the client by adaptive management through the year and from year to year.

Wildlife Interpretations:
Basin big sagebrush is the least palatable of all the subspecies of big sagebrush. Basin big sagebrush is browsed by mule deer from fall to early spring, but is not preferred. Mountain big sagebrush is highly preferred and nutritious winter forage for mule deer and elk. Sagebrush-grassland communities provide critical sage-grouse breeding and nesting habitats. Meadows surrounded by sagebrush may be used as feeding and strutting grounds. Sagebrush is a crucial component of their diet year-round, and sage-grouse select sagebrush almost exclusively for cover. Sage-grouse prefer mountain big sagebrush and Wyoming big sagebrush communities to basin big sagebrush communities. Wildlife forage only lightly on rubber rabbitbrush during the summer, but winter use can be heavy in some locations. Fall use is variable, but flowers are often used by wildlife. A few leaves and the more tender stems may also be used. The forage value of rubber rabbitbrush varies greatly among subspecies and ecotypes. Basin wildrye provides winter forage for mule deer, though use is often low compared to other native grasses. Basin wildrye provides summer forage for black-tailed jackrabbits. Because basin wildrye remains green throughout early summer, it remains available for small mammal forage for longer time than other grasses. Needleandthread is moderately important spring forage for mule deer, but use declines considerably as more preferred forages become available. In the spring, streambank wheatgrass is a preferred feed for elk and is considered desirable feed for deer and antelope. It is desirable feed for elk during summer, fall, and winter. Streambank wheatgrass is also a component of black-tailed jackrabbit diets. Thickspike wheatgrass provides some cover for small mammals and birds.

Livestock/Wildlife Grazing Interpretations:
Basin wildrye is valuable forage for livestock (Ganskopp et al. 2007) and wildlife, but is intolerant of heavy, repeated, or spring grazing (Krall et al. 1971). Basin wildrye is used often as a winter feed for livestock and wildlife; not only providing roughage above the snow but also cover in the early spring months (Majerus 1992). Inadequate rest and recovery from defoliation causes a decrease in basin wildrye and an increase in basin big sagebrush and rubber rabbitbrush along with western wheatgrass (Pascopyrum smithii) and beardless wildrye. Further deterioration of the sites promotes shrub dominance, increased bare ground and the invasion of annual weeds, primarily cheatgrass and Russian thistle.
During settlement, many of the cattle in the Great Basin were wintered on extensive basin wildrye stands, however due to sensitivity to spring use many stands were decimated by early in the 20th century (Young et al. 1976). Less palatable species such as black greasewood, rabbitbrush and inland salt grass (Distichlis spicata) increased in dominance along with invasive non-native species such as Russian thistle (Salsola tragus), mustards, and cheatgrass (Roundy 1985). Spring defoliation of basin wildrye and/or consistent, heavy grazing during the growing season has been found to significantly reduce basin wildrye production and density (Krall et al. 1971). Thus, inadequate rest and recovery from defoliation can cause a decrease in basin wildrye and an increase in rabbitbrush, black greasewood, beardless wildrye, inland saltgrass, and non-native weeds (Young et al. 1976, Roundy 1985). Additionally, native basin wildrye seed viability has been found to be low and seedlings lack vigor (Young and Evans 1981). Roundy (1985) found that although basin wildrye is adapted to seasonally dry saline soils, high and frequent spring precipitation is necessary to establish it from seed. This suggests that establishment of native basin wildrye seedlings occurs only during years of unusually high precipitation. Therefore, reestablishment of a stand that has been decimated by grazing may be episodic.
Beardless wildrye tolerates tramping and recovers well following grazing (Young-Mathews 2010). Because if it’s grazing tolerance, with continued heavy grazing beardless wildrye may become the dominant grass on this site.
Basin big sagebrush/basin wildrye communities provide cover and food for large ungulates, upland game birds, and smaller wildlife. Because of its tall, heavy growth, basin wildrye provides forage for elk (Cervus canadensis) and other big game in the winter when snow cover is more than two feet (Plummer et al 1968).
Wild ungulates use basin big sagebrush for cover and feed. Mule deer, pronghorn (Antilocarpra americana) and elk will browse basin big sagebrush from autumn through early spring (Wambolt et al. 1994). Early and midseral basin big sagebrush provide forage and protection from predators for mule deer (Wildlife Action Plan Team 2012). Mule deer preference for the shrub varies seasonally. Basin big sagebrush was used more by mule deer populations in Oregon and Utah in winter than by the same populations in fall. (Sheehy and Winward 1981, Welch et al. 1981) This could be because basin big sagebrush is consumed as a last resort plant and browsed when plants considered more palatable were no longer available (Welch et al. 1981). Elk and pronghorn antelope will browse basin big sagebrush in areas where mountain and Wyoming sagebrush are unavailable (Beale and Smith 1970, Wambolt 1996). A study by Brown (1977) determined that desert bighorn sheep preferred big sagebrush over other shrub types; however, the variety was not noted.
These plants communities provide cover and food for smaller desert wildlife such as lagomorphs and rodents. Pygmy rabbits (Brachylagus idahoensis) rely on tall basin big sagebrush for shelter and food throughout the year

(Green and Flinders 1980, White et al. 1982, Wildlife Action Plan Team 2012). A study by Larrison and Johnson (1973) captured deer mice (Peromyscus maniculatus) in big sagebrush communities more than any other plant community, suggesting the mice prefer these plant communities for cover over other plant communities.
Basin big sagebrush serves as valuable habitat for native birds. Studies have suggested that sage grouse use basin big sagebrush for cover and food where mountain and Wyoming big sagebrush are absent (Welch et al. 1991). Birds such as Brewer's sparrows (Spizella breweri) are considered dependent on sagebrush communities for cover and will nest in basin big sagebrush. Thus when basin big sagebrush communities are converted to agriculture fields, Brewer's sparrow populations can decline due to loss of habitat (Knick et al. 2003). In fact, mature basin big sagebrush act as nesting structures, protection from predators and thermal cover for Greater sage grouse (Centrocercus urophasianus), the loggerhead shrike (Lanius ludovicianus), the sage sparrow (Artemisiospiza nevadensis), Brewer's sparrow and sage thrasher (Oreoscoptes montanus) (Wildlife Action Plan Team 2012). The plant also acts as important cover for game-birds such as the gray partridge (Perdix perdix), mountain quail (Oreotyx pictus), and mourning doves (Zenaida macroura), as well as passerines such as, towhees (Pipilo spp.) and finches (Haemorhous spp.), that occur on arid range lands in the West (Dobbs et al. 2012, Booth 1985).

Changes in plant community composition caused by, human activity, invasive weeds, fire frequency associated with this ecological site could affect the distribution and presence of wildlife species.

Hydrological functions

Runoff is low to high. Permeability is moderately slow to moderate. Rills are rare. Water flow patterns are rare. Pedestals are rare. Occurrence is usually limited to areas of water flow patterns. Frost heaving of shallow rooted plants should not be considered a normal condition. Gullies are rare in areas of this site that occur on stable landforms. Perennial herbaceous plants (especially deep-rooted bunchgrasses [i.e., basin wildrye & needleandthread] slow runoff and increase infiltration. Shrub canopy and associated litter break raindrop impact and provide opportunity for snow catch and accumulation on site.

Recreational uses

Aesthetic value is derived from the diverse floral and faunal composition and the colorful flowering of wild flowers and shrubs during the spring and early summer. This site offers rewarding opportunities to photographers and for nature study. This site is used for hiking and has potential for upland and big game hunting.

Other products

Some Native American peoples used the bark of big sagebrush to make rope and baskets. Native Americans used big sagebrush leaves and branches for medicinal teas, and the leaves as a fumigant. Bark was woven into mats, bags and clothing. Basin wildrye was used as bedding for various Native American ceremonies, providing a cool place for dancers to stand.

Other information

Basin big sagebrush shows high potential for range restoration and soil stabilization. Basin big sagebrush grows rapidly and spreads readily from seed. Basin wildrye is useful in mine reclamation, fire rehabilitation and stabilizing disturbed areas. Its usefulness in range seeding, however, may be limited by initially weak stand establishment. Needleandthread is useful for stabilizing eroded or degraded sites. Streambank wheatgrass is a good revegetation species because it forms tight sod under dry rangeland conditions, has good seedling strength, and performs well in low fertility or eroded sites. It does not compete well with aggressive introduced grasses during the establishment period, but are very compatible with slower developing natives, bluebunch wheatgrass (Pseudoroegneria spicata), western wheatgrass (Pascopyrum smithii), and needlegrass (Achnatherum spp.) species. It's drought tolerance combined with rhizomes, fibrous root systems, and good seedling vigor make these species ideal for reclamation in areas receiving 8 to 20 inches annual precipitation. Streambank wheatgrass can be used for hay production and will make nutritious feed, but is more suited to pasture use.

Inventory data references

NASIS soil component data.

Type locality

Location 1: White Pine County, NV	
Township/Range/Section	T16N R62E S20
Latitude	39° 14′ 12″
Longitude	115° 1′ 11″
General legal description	SE ¼ SW ¼, About 7 miles west of Ely, White Pine County, Nevada.
Location 2: Elko County, NV	
Township/Range/Section	T36N R63E S1
Latitude	41° 1′ 58″
Longitude	114° 48′ 7″
General legal description	SE ¼, Wood Hills area, west side of Independence Valley, about 10 miles southeast of Wells, Elko County, Nevada.

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Approval

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	Patti Novak-Echenique
Contact for lead author	State Rangeland Management Specialist
Date	09/24/2009
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are rare.

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2. **Presence of water flow patterns:** Water flow patterns are rare.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals are rare. Occurrence is usually limited to areas of water flow patterns. Frost heaving of shallow rooted plants should not be considered a normal condition.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground ± 10-20%.

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5. **Number of gullies and erosion associated with gullies:** Gullies are rare in areas of this site that occur on stable landforms.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None

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7. **Amount of litter movement (describe size and distance expected to travel):** Fine litter (foliage from grasses and annual & perennial forbs) expected to move distance of slope length during intense summer convection storms or rapid snowmelt events. Persistent litter (large woody material) will remain in place except during catastrophic events.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil stability values should be 3 to 6 on most soil textures found on this site. Areas of this site occurring on soils that have a physical crust will probably have stability values less than 3. (To be field tested.)

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Surface structure is weak thin platy or medium subangular blocky. Soil surface colors are light and soils are typified by a mollic epipedon. Organic carbon of the surface 2 to 3 inches is typically 1.5 to 2 percent dropping off quickly below. Organic matter content can be more or less depending on micro-topography.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Perennial herbaceous plants (especially deep-rooted bunchgrasses [i.e., basin wildrye & needleandthread] slow runoff and increase infiltration. Shrub canopy and associated litter break raindrop impact and provide opportunity for snow catch and accumulation on site.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** Compacted layers are not typical. Subangular blocky, platy, or massive sub-surface horizons are not to be interpreted as compacted layers.

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Reference State: Deep-rooted, cool season, perennial bunchgrasses

    Sub-dominant: tall shrubs (basin big sagebrush and mountain big sagebrush) >> associated shrubs = shallow-rooted, cool season, perennial bunchgrasses > deep-rooted, cool season, perennial forbs = fibrous, shallow-rooted, cool season, perennial forbs = annual forbs

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Dead branches within individual shrubs common and standing dead shrub canopy material may be as much as 25% of total woody canopy; some of the mature bunchgrasses (<20%) have dead centers.

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14. **Average percent litter cover (%) and depth (in):** Within plant interspaces (± 15%) and depth of litter is ±¼ inch.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** For normal or average growing season (end of May) ± 1100 lbs/ac.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Increasers include rubber rabbitbrush, singleleaf pinyon, and Utah juniper. Invaders include cheatgrass, halogeton, Russian thistle, bassia, and annual mustards.

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17. **Perennial plant reproductive capability:** All functional groups should reproduce in average (or normal) and above average growing season years.
