USDA Natural Resources Conservation Service

Ecological site R028BY029NV
LOAMY 16+ 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.

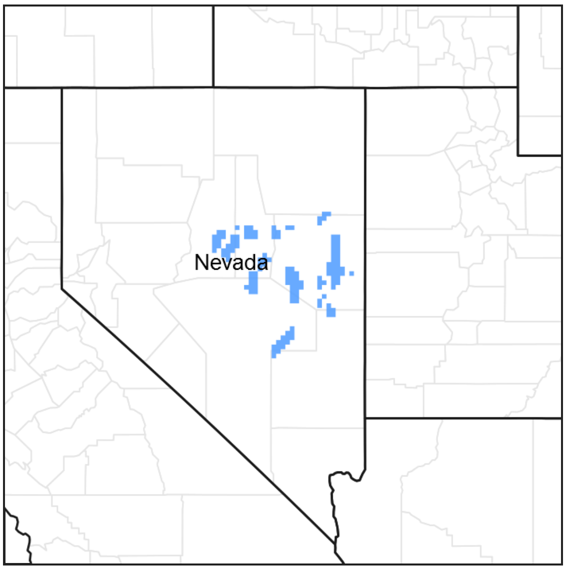

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

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 is found on north-facing, concave mountain sideslopes. Slope gradients of 15 to 30 percent are most typical. Elevations are 8000 to 10,000 feet.

The soils associated with this site are deep, well drained and formed in residuum/colluvium from volcanic and mixed parent material. They have a thick mollic epipedon and an argillic horizon within 50cm of the soil surface. The soil moisture regime is xeric and the soil temperature regime is cryic.

The reference state is dominated by mountain brome, Letterman needlegrass, and mountain big sagebrush in association with a variety of mountain browse shrub species. Production ranges from 900 to 1700 pounds per acre. This site is characterized by snow accumulation late into the spring. Delayed snowmelt provides increased available moisture during active growth period. Future investigations will determine if the sagebrush dominating this site is actually snowfield sagebrush (Artemisia spiciformis).

Associated sites

F028BY063NV	**ABCOC-PIFL2-PILO/ARTRV/LEKI2**
R028BY015NV	**LOAMY SLOPE 12-16 P.Z.**
R028BY033NV	**GRAVELLY CLAY 14+ P.Z.**
R028BY038NV	**MOUNTAIN RIDGE 14+ P.Z.**

Similar sites

R028BY070NV	**MOUNTAIN LOAM 16+ P.Z.** PSSP dominant grass; less productive site
R028BY088NV	**CALCAREOUS LOAM 14-16 P.Z.** PSSPS dominant grass; less productive site
R028BY030NV	**LOAMY 12-16 P.Z.** PSSPS dominant grass

R028BY085NV	**CALCAREOUS LOAM 16+ P.Z.** PSSPS-ACLE9 or ACNED codominant grasses; less productive site
R028BY033NV	**GRAVELLY CLAY 14+ P.Z.** PSSPS dominant grass; less productive site
R028BY015NV	**LOAMY SLOPE 12-16 P.Z.** PSSPS dominant grass and frigid soil temperature

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata subsp. vaseyana*
Herbaceous	(1) *Bromus marginatus* (2) *Achnatherum lettermanii*

Physiographic features

This site occurs on northfacing concave mountain sideslopes. Slopes range from 8 to 50 percent, but slope gradients of 15 to 30 percent are most typical. Elevations typically range between 8000 to 10,000 feet, but may occur as low as 7500 feet in some locations.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Mountain
Flooding frequency	None
Ponding frequency	None
Elevation	8,000–10,000 ft
Slope	15–30%
Aspect	N, NE, NW

Climatic features

The climate associated with this site is semiarid, characterized by cold, moist winters and warm, dry summers. The estimated average annual precipitation is greater than 16 inches. Mean annual air temperature is about 40 to 43 degrees F. The average growing season is about 50 to 70 days. Weather stations with a long term data record are not currently available for this ecological site. Associated climate data will be updated when information becomes available.

Table 3. Representative climatic features

Frost-free period (average)	50 days
Freeze-free period (average)	70 days
Precipitation total (average)	16 in

Influencing water features

Influencing water features are not associated with this site.

Soil features

The soils associated with this site are deep, well drained, and formed in residuum and colluvium derived from volcanic and mixed parent material. Soils profile is characterized by a thick mollic epipedon and an argillic horizon within 50cm of the soil surface.

The soil moisture regime is xeric and the soil temperature regime is cryic. The soil series associated with this site include Luset, Hapgood, Hatur, Newlands, Tusel, and Winu.
The representative soil series for this ecological site is Luset, a Loamy-skeletal, mixed, superactive Vitrandic Argicryolls. Diagnostic horizons include a mollic epipedon from the soil surface to 50cm, an argillic horizon from 30 to 107cm, and lithic contact at 125cm. Clay content averages 25 to 35 percent and rock fragments range from 35 to 60 percent in the particle size control section. Soils are not effervescent.
Important abiotic factors contributing to the presence of this site include aspect and elevation which create an environment where soil temperatures and evaporation potentials are limited during the growing season due to reduced insolation. Snow accumulation persists on this site late into spring when the soil is not frozen. Snow-melt, at this time, is added to the soil moisture supply and is available during most of the active growth period.

Table 4. Representative soil features

Parent material	(1) Residuum–welded tuff
Surface texture	(1) Cobbly fine sandy loam (2) Ashy
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Soil depth	40–60 in
Surface fragment cover <=3"	5–20%
Surface fragment cover >3"	5–10%
Available water capacity (0-40in)	6–9 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.4–7.2
Subsurface fragment volume <=3" (Depth not specified)	35–60%
Subsurface fragment volume >3" (Depth not specified)	0–10%

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 ecological site is dominated by deep-rooted cool season, perennial bunchgrasses and long-lived shrubs (50+ years) 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 m. (Comstock and Ehleringer 1992). Root length of mature 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). 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. General differences in root depth distributions between grasses and shrubs results in resource partitioning in these shrub/grass systems.

Mountain big sagebrush and mountain snowberry are generally long-lived; therefore it is not necessary for new individuals to recruit every year for perpetuation of the stand. Infrequent large recruitment events and simultaneous low, continuous recruitment is the foundation of population maintenance (Noy-Meir 1973). Survival of the seedlings is dependent on adequate moisture conditions.
The dominant perennial bunchgrasses include mountain brome, Letterman's needlegrass, Idaho fescue, Columbia needlegrass and slender wheatgrass. These species 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. Differences in root depth distributions between grasses and shrubs result in resource partitioning in these shrub/grass systems.
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 uptake 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). Dobrowolski et al. (1990) cite multiple authors on the extent of the soil profile exploited by the competitive exotic annual cheatgrass. Specifically, the depth of rooting is dependent on the size the plant achieves and in competitive environments cheatgrass roots were found to penetrate only 15 cm whereas isolated plants and pure stands were found to root at least 1 m in depth with some plants rooting as deep as 1.5 to 1.7 m.
The ecological site has moderate to high resilience to disturbance and resistance to invasion. Resilience increases with elevation, aspect, precipitation, and nutrient availability. Long-term disturbance response may be influenced by small differences in landscape topography. North-facing slopes are also more resilient than south slopes because lower soil surface temperatures operate to keep moisture content higher on northern exposures. Two possible alternative stable states have been identified for this site.

Fire Ecology:
Fire is believed to be the dominant disturbance force in natural big sagebrush communities. Several authors suggest pre-settlement fire return intervals in mountain big sagebrush communities varied from 15 to 25 years (Burkhardt and Tisdale 1969, Houston 1973, and Miller et al. 2000). Kitchen and McArthur (2007) suggest a mean fire return interval of 40 to 80 years for mountain big sagebrush communities. The range from 15 to 80 years is probably more accurate and reflects the differences in elevation and precipitation where mountain big sagebrush communities occur. On a landscape scale, multiple seral stages were represented in a mosaic reflecting periodic reoccurrence of fire and other disturbances (Crawford et al 2004). Post-fire hydrologic recovery and resilience is primarily influenced by pre-fire site conditions, fire severity, and post-fire weather and land use that relate to vegetation recovery. Fire adaptation by herbaceous species is generally superior to the dominant shrubs, which are typically killed by fire. Sites with low abundances of native perennial grasses and forbs typically have reduced resiliency following disturbance and are less resistant to invasion or increases in cheatgrass (Miller et al 2013).

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

Depending on fire severity, rabbitbrush and mountain snowberry may increase after fire. Douglas' rabbitbrush 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 and Hickey 1971, Noste and Bushey 1987). Snowberry has been noted to regenerate well and exceed pre-burn biomass in the third season after a fire (Merrill et al. 1982). If balsamroot or mules ear 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 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).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. Mature Idaho fescue plants are commonly reported to be severely damaged by fire in all seasons (Wright et al. 1979). Initial mortality may be high (in excess of 75%) on severe burns, but usually varies from 20 to 50% (Barrington et al 1988). Rapid burns have been found to leave little damage to root crowns, and new tillers are produced with onset of fall moisture (Johnson et al. 1994). However, Wright and others (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 (Wright et al. 1979).

State and transition model

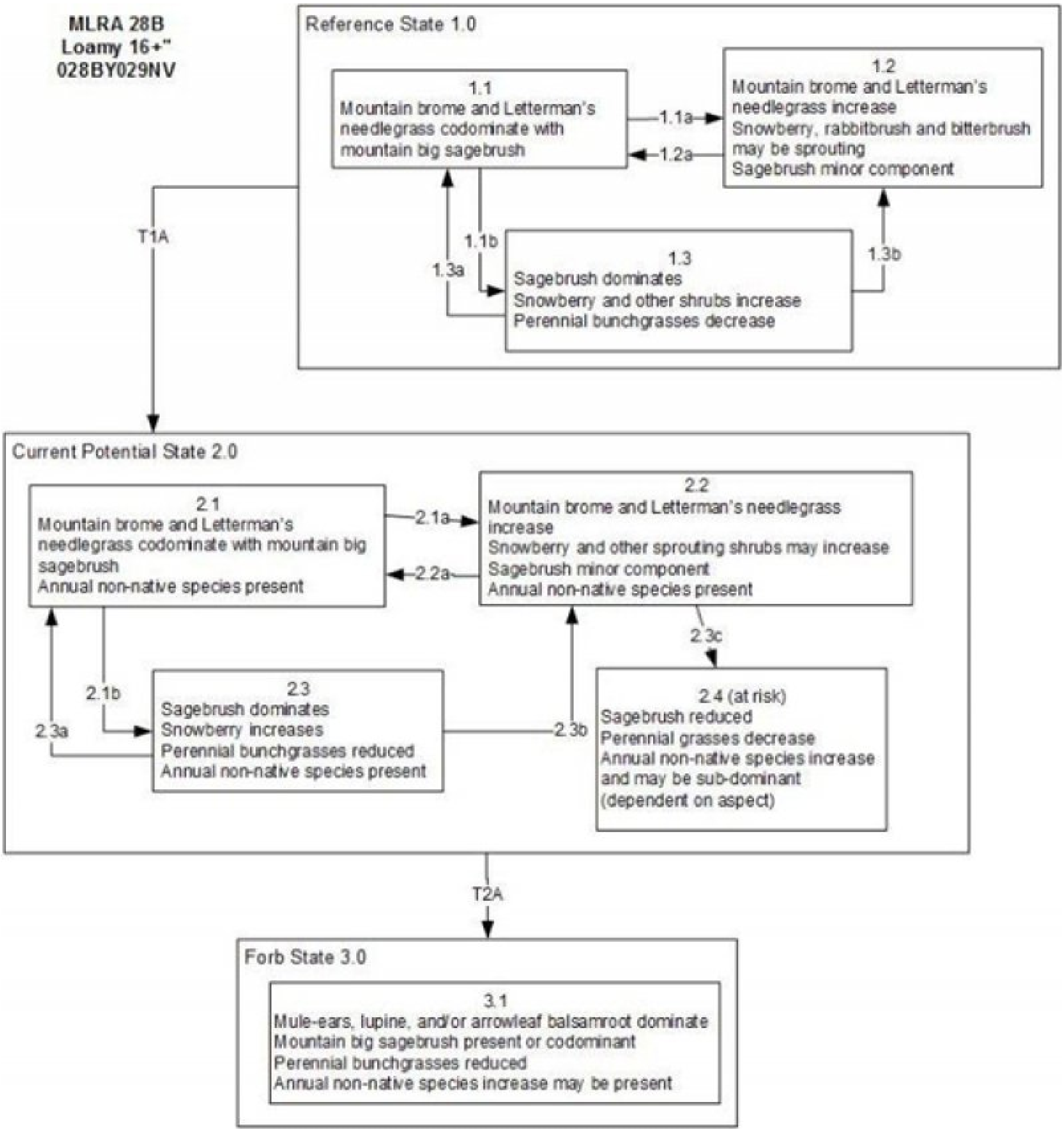

Figure 4. State and Transition Model

MLRA 28B
Loamy 16+"
028BY029NV

Reference State 1.0 Community Phase Pathways
1.1a: Low severity fire creates sagebrush/grass mosaic; high severity fire significantly reduces sagebrush cover and leads to early/mid-seral community dominated by grasses and forbs.
1.1b: Time and lack of disturbance such as fire or long-term drought. Excessive herbivory may also decrease perennial understory.
1.2a: Time and lack of disturbance allows for regeneration of sagebrush.
1.3a: Low severity fire resulting in a mosaic pattern.
1.3b: High severity fire significantly reduces sagebrush cover leading to early/mid-seral community.

Transition T1A: Introduction of non native species.

Current Potential State 2.0 Community Phase Pathways
2.1a: Low severity fire creates sagebrush/grass mosaic; high severity fire significantly reduces sagebrush cover and leads to early/mid-seral community dominated by grasses and forbs.
2.1b: Time and lack of disturbance such as fire or long-term drought; inappropriate grazing management may also decrease perennial understory.
2.2a: Time and lack of disturbance allows for regeneration of sagebrush.
2.2b: Fire in the presence of annual grass species coupled with heavy spring precipitation.
2.3a: Low severity fire creates sagebrush/grass mosaic. Brush management with minimal soil disturbance; late-fall/winter grazing causing mechanical damage to sagebrush.
2.3b: High severity fire significantly reduces sagebrush cover leading to early/mid-seral community.

Transition T2A: Excessive herbivory over time reduces perennial grass component. Non-palatable forbs dominate.

Forb State 3.0 Community Phase Pathways
None.

Figure 5. Legend

State 1
Reference State

The Reference State is a representative of the natural range of variability under pristine conditions. The reference state has three general community phases: a shrub-grass dominant phase, a perennial grass dominant phase and a shrub dominant phase. State dynamics are maintained by interactions between climatic patterns and disturbance regimes. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. Plant community phase changes are primarily driven by fire, periodic drought and/or insect or disease attack. Management should focus on maintaining high species diversity of desired species to promote site resiliency.

Community 1.1
Community Phase

The plant community phase is dominated by mountain brome and Letterman needlegrass. The visual aspect is dominated by mountain big sagebrush in association with a variety of mountain browse shrubs. Potential vegetative composition is about 55% grasses and grass-likes, 10% forbs and 35% shrubs. Approximate ground cover (basal and crown) is 35 to 50 percent.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	495	660	935
Shrub/Vine	315	420	595
Forb	90	120	170
Total	**900**	**1200**	**1700**

Community 1.2
Community Phase

Mountain big sagebrush is reduced and the perennial bunchgrasses in the understory increase. Mountain snowberry, rabbitbrush, Utah serviceberry, chokecherry and elderberry may be sprouting.

Community 1.3
Community Phase

Mountain big sagebrush increases in the absence of disturbance or with grazing management that favors shrubs. Decadent sagebrush dominates the overstory and the deep-rooted perennial bunchgrasses in the understory are reduced either from competition with shrubs or from grazing management.

Pathway a
Community 1.1 to 1.2

Low severity fire creates sagebrush/grass mosaic; higher intensity fires significantly reduce sagebrush cover and lead to early/mid seral community dominated by grasses and forbs.

Pathway b
Community 1.1 to 1.3

Absence of fire over time allows for sagebrush to increase; inappropriate grazing may also reduce fine fuels and lead to reduced fire frequency and increased shrub cover.

Pathway a
Community 1.2 to 1.1

Absence of fire over time allows mountain big sagebrush to increase. Grazing management that favors shrubs may accelerate this transition.

Pathway a
Community 1.3 to 1.1

Aroga moth infestation would reduce the mountain big sagebrush overstory and allow the perennial bunchgrasses to recover.

Pathway b
Community 1.3 to 1.2

Fire would reduce the mountain big sagebrush and allow the perennial bunchgrasses to dominate the site.

State 2
Current Potential State

This state is similar to the Reference State 1.0. Ecological function has not changed, however the resiliency of the state has been reduced by the presence of invasive weeds. This state has the same three general community phases. These non-natives can be highly flammable, and can promote fire where historically fire had been infrequent. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These include the presence of all structural and functional groups, low fine fuel loads and retention of organic matter and nutrients. Positive feedbacks decrease ecosystem resilience and stability of the state. These include the non-natives' high seed output, persistent seed bank, rapid growth rate, ability to cross pollinate and adaptations for seed dispersal. Management would be to maintain high diversity of desired species to promote organic matter inputs and prevent the dispersal and seed production of the non-native invasive species. Targeted grazing could be used to reduce seed production and density of cheatgrass.

Community 2.1
Community Phase

The plant community consists of mountain big sagebrush as the major overstory shrub, with snowberry also common on this site. Bluebunch wheatgrass is the dominant understory species. Annual non-native species are now present in this community. Cheatgrass is the species most likely to invade.

Community 2.2
Community Phase

Mountain big sagebrush is reduced. Mountain snowberry, rabbitbrush, Utah serviceberry, chokecherry and elderberry may be sprouting. Perennial bunchgrasses in the understory increase and dominate. Annual non-native species are stable to increasing.

Community 2.3
Community Phase

Mountain big sagebrush increases and the perennial understory is reduced. Decadent sagebrush dominates the overstory and the deep-rooted perennial bunchgrasses in the understory are reduced either from competition with shrubs or from grazing management. Perennial forbs such as mules-ear may increase with inappropriate herbivory. Annual non-natives are present.

Community 2.4
Community Phase (at risk)

This phase is characterized by an increase of annual non-native species such as cheatgrass in the understory cheatgrass. Mountain big sagebrush and perennial bunchgrasses such as bluebunch wheatgrass still co-dominate. This site is unlikely to go to an annual phase due to the amount of precipitation and high elevation, but this phase is very at risk of another fire. Years with heavy spring precipitation will cause an increase in the amount of cheatgrass in the understory. See potential resilience differences for notes on this phase.

Pathway a
Community 2.1 to 2.2

Low severity fire creates sagebrush/grass mosaic; high intensity fires significantly reduce sagebrush cover and lead to early/mid seral community dominated by grasses and forbs.

Pathway b
Community 2.1 to 2.3

Absence of fire over time allows for sagebrush to increase. Inappropriate grazing may also reduce fine fuels and lead to reduced fire frequency and increased shrub cover.

Pathway a
Community 2.2 to 2.1

Time without disturbance allows for mountain big sagebrush to recover as well as other perennial bunchgrasses.

Pathway b
Community 2.2 to 2.4

A disturbance such as fire or brush treatment, when applied in the presence of non-native annual grasses like cheatgrass allows these non-natives to increase in abundance. This pathway occurs in years with heavy spring precipitation.

Pathway a
Community 2.3 to 2.1

An aroga moth infestation that reduces shrub cover or a change in management that encourages growth of bunch grasses allows for perennial bunchgrasses to increase. Release from drought conditions may also cause an increase in the amount of grasses.

Pathway b
Community 2.3 to 2.2

Fire reduces mountain big sagebrush overstory and allows for perennial bunchgrasses to increase.

State 3
Perennial Forb State

The Forb State has one community phase. Native, deep-rooted perennial, cool-season forbs dominate. This State is a result of heavy use by sheep bedding and grazing. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These include the presence of all structural and functional groups, low fine fuel loads and retention of organic matter and nutrients. Positive feedbacks include the presence a competitive functional group that possesses deep rooted taproots and strong lateral roots, sprouting ability of roots or root crown, high seed production, and the ability to monopolize soil moisture. Management would include reduction of the perennial forbs by herbicide and reseeding with desired native perennial bunchgrasses, forbs and shrubs.

Community 3.1
Community Phase 1.1

This community phase is dominated by an aggressive, deep-rooted native perennial forb (*Wyethia amplexicaulis*). Mountain big sagebrush and perennial bunchgrasses are present but are not dominant. Herbicides can be used to reduce the abundance of this forb. This practice could transition this phase to State 1 or State 2.

Transition A
State 1 to 2

Trigger: Introduction of annual non-native species Slow variable: Over time the annual non-native plants will increase within the community. Threshold: Any amount of introduced non-native species causes an immediate decrease in the resilience of the site. Annual non-native species cannot be easily removed from the system and have the potential to significantly alter disturbance regimes from their historic range of variation.

Transition A
State 2 to 3

Excessive herbivory or sheep bedding decreases native perennial grasses and increases non-palatable native deep-rooted perennial forbs.

Restoration pathway A
State 3 to 2

Herbicides are an effective means of eradicating Wyethia.

Conservation practices

Herbaceous Weed Control

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Primary Grasses**			492–888	
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	180–240	–
	mountain brome	BRMA4	*Bromus marginatus*	180–240	–
	Idaho fescue	FEID	*Festuca idahoensis*	60–120	–
	sedge	CAREX	*Carex*	24–96	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	24–96	–
	Dore's needlegrass	ACNED	*Achnatherum nelsonii ssp. dorei*	24–96	–
2	**Secondary Grasses**			60–180	
	prairie Junegrass	KOMA	*Koeleria macrantha*	6–60	–
	basin wildrye	LECI4	*Leymus cinereus*	6–60	–
	bluebunch wheatgrass	PSSPS	*Pseudoroegneria spicata ssp. spicata*	6–60	–
Forb					
3	**Perennial**			60–180	
	aster	ASTER	*Aster*	6–24	–
	Indian paintbrush	CASTI2	*Castilleja*	6–24	–
	western stoneseed	LIRU4	*Lithospermum ruderale*	6–24	–
	lupine	LUPIN	*Lupinus*	6–24	–
	mule-ears	WYAM	*Wyethia amplexicaulis*	6–24	–
Shrub/Vine					
4	**Primary Shrubs**			204–396	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	180–300	–
	snowberry	SYMPH	*Symphoricarpos*	24–96	–
5	**Secondary Shrubs**			60–180	
	serviceberry	AMELA	*Amelanchier*	6–24	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	6–24	–
	chokecherry	PRVI	*Prunus virginiana*	6–24	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	6–24	–
	elderberry	SAMBU	*Sambucus*	6–24	–

Animal community

Livestock Interpretations:
This site is suitable for livestock grazing. Considerations for grazing management including timing, intensity and duration of grazing. Targeted grazing could be used to decrease the density of non-natives.
Bunchgrasses, in general, best tolerate light grazing after seed formation. Britton and others (1979) observed the effects of harvest date on basal area of 5 bunchgrasses in eastern Oregon, including Idaho fescue, and found grazing from August to October (after seed set) has the least impact on these bunchgrasses. Therefore, abusive grazing during the growing season will reduce perennial bunchgrasses, with the exception of Sandberg bluegrass (Tisdale and Hironaka 1981).
Mountain brome is ranked as excellent forage for both cattle and horses and good for domestic sheep. Domestic sheep will graze mountain brome only when it is fairly succulent. Letterman’s needlegrass begins growth early in the year and remains green throughout the relatively long growing season, thus, making it valuable forage for livestock. Slender wheatgrass is grazed by all classes of livestock.Idaho fescue tolerates light to moderate grazing

(Ganskopp and Bedell 1980) and is moderately resistant to trampling (Cole 1987). Heavy grazing may lead to replacement of Idaho fescue with non-native species such as cheatgrass (Mueggler 1984).
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. Mountain snowberry is readily eaten by all classes of livestock, particularly domestic sheep. Inappropriate grazing management leads to a decline in understory plants and an increase in mountain big sagebrush. Invasion of annual weedy forbs and cheatgrass could occur with further grazing degradation, leading to an increase in bare ground. A combination of overgrazing and prolonged drought may lead to soil redistribution, increased bare ground and a loss in plant production.
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:
Many wildlife species are dependent on the sagebrush ecosystem including the greater sage grouse, sage sparrow, pygmy rabbit and the sagebrush vole. Dobkin and Sauder (2004) identified 61 species, including 24 mammals and 37 birds, associated with the shrub-steppe habitats of the Intermountain West. Mountain big sagebrush is important to wildlife for both food and cover. Mountain big sagebrush is highly preferred and nutritious winter forage for mule deer, elk and pronghorn. Elk (Alces alces) and pronghorn antelope (Antilocapra americana) prefer mountain big sagebrush over basin and Wyoming sagebrush (Beale and Smith 1970, Wambolt 1996). A study by Brown (1977) determined that desert bighorn sheep (Ovis canadensis nelisoni) preferred big sagebrush over other shrub types; however, the variety was not noted. Welch and Wagstaff (1992) noted in a study near Provo, Utah, mountain big sagebrush was highly preferred winter forage of mule deer (Odocoileus hemionus) over other available forage. Other studies have determined, in the same study area, that mountain big sagebrush is preferred by both wintering domestic sheep as well as mule deer (Welch et al. 1986).
Furthermore, wildlife use a variety of associated understory plants and soils that occur in basin big sagebrush habitat. For example: sage grouse (Centrocercus urophasianus), sagebrush vole (Lemmiscus curtatus), Merriam’s shrew (Sorex merriami) and Preble’s shrew (Sorex preblei) use the grasses that occur with mountain big sagebrush for nesting, cover and forage. Mountain big sagebrush sandy soil sites provide burrowing opportunities and protection from predators for burrowing owls (Athene cunicularia), dark and pale kangaroo mice (Microdipodops megacephalus and Microdipodops pallidus, respectively). Mountain big sagebrush that occur on woodland and rock ecotnes provides nesting and foraging habitat for the ferruginous hawk (Buteo regalis) (Nevada Wildlife Action Plan 2012). Deer and elk make heavy use of muttongrass, especially in early spring when other green forage is scarce. Depending upon availability of other nutritious forage, deer may use mutton grass in all seasons. Muttongrass cures well and is an important fall and winter deer food in some areas.
Several reptiles and amphibians are distributed throughout the sagebrush steppe in the west in Nevada. (Bernard and Brown 1977). Reptile species including: eastern racers (Coluber constrictor), ringneck snakes (Diadophis punctatus), night snakes (Hypsiglena torquata), Sonoran mountain kingsnakes (Lampropeltis pyromelana), striped whipsnakes (Masticophis taeniatus), gopher snakes (Pituophis catenifer), long-nosed snakes (Rhinoceheilus lecontei), wandering garter snakes (Thamnophis elegans vagrans), Great Basin rattlesnakes (Crotalus oreganus lutosus), Great Basin collared lizard (Crotaphytus bicinctores), long-nosed leopard lizard (Gambelia wislizenii), short-horned lizard (Phrynosoma douglassi), desert-horned lizard (Phrynosoma platyrhinos), sagebrush lizards (Sceloporus graciosus), western fence lizards (Sceloporus occidentalis), northern side-blotched lizards (Uta uta stansburiana), western skinks (Plestiodon skiltonianus), and Great Basin whiptails (Aspidoscelis tigris) occur in areas where sagebrush is dominant. Similarly, amphibians such as: western toads (Anaxyrus boreas), Woodhouse’s toads (Anaxyrus woodhousii), northern leopard frogs (Lithobates pipiens), Columbia spotted frogs (Rana luteiventris), bullfrogs (Lithobates catesbeianus), and Great Basin spadefoots (Spea intermontana) also occur throughout the Great Basin in areas sagebrush species are dominant (Hamilton 2004). Studies have not determined if reptiles and amphibians prefer certain species of sagebrush; however, researchers agree that maintaining habitat where big sagebrush and reptiles and amphibians occur is important. In fact, wildlife biologists have noticed declines in reptiles where sagebrush steppe habitat has been seeded with introduced grasses (West 1999 and ref. therein).
Sagebrush communities are important for maintaining lagomorph and rodent populations. Pygmy rabbits, sagebrush obligates, use sites with big sagebrush at a higher intensity than low sagebrush sites (Heady and Laundre 2005). A study by Larrison and Johnson (1973) captured more deer mice in big sagebrush communities than in any other plant community. Although specific varieties of big sagebrush are not mentioned in these studies, thus, suggests that deer mice prefer big sagebrush plant communities where mountain big sagebrush are present, for cover over other plant communities.
It should be noted that sagebrush-grassland communities provide critical sage-grouse (Centrocercus urophaianus)

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.
Mountain snowberry is considered important browse for many types of wildlife. Bighorn sheep use mountain snowberry regularly during the summer. Forage value to elk is fair. Mountain snowberry is important as both cover and food for bird and small mammal populations. These include sharp-tailed, ruffed, and blue grouse, wild turkey and, several non-game species of bird including the kingbird, western flycatcher, and western bluebird. Among small mammals that rely on mountain snowberry are fox squirrels, desert cottontails, and pocket gopher. Slender wheatgrass is grazed by sage grouse, deer, elk, moose, and bighorn sheep, mountain goat, pronghorn, various rodents, and all classes of livestock. The seeds are eaten by various seed predators. Slender wheatgrass provides hiding and thermal cover for songbirds, upland game birds, waterfowl, and small mammals. Sedges have a high to moderate resource value for elk and a medium value for mule deer. Elk consume beaked sedge later in the growing season.

Hydrological functions

Runoff is high to very high. Permeability is very slow to moderate. The available water holding capacity is low to moderate.

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 camping and hiking and has potential for upland and big game hunting.

Other information

Mountain snowberry is useful for establishing cover on bare sites and has done well when planted onto roadbanks. Slender wheatgrass is widely used for revegetating disturbed lands. Slender wheatgrass is a short-lived perennial with good seedling vigor. It germinates and establishes quickly when seeded making it a good choice for quick cover on disturbed sites. It persists long enough for other, slower developing species to establish. It is especially valuable for use in saline soils. It has been used for rehabilitating mine spoils, livestock ranges, and wildlife habitat and watershed areas.

Type locality

Location 1: White Pine County, NV	
Township/Range/Section	T17N R64E S35
UTM zone	N
UTM northing	4351929
UTM easting	694508
Latitude	39° 17′ 41″
Longitude	114° 44′ 40″
General legal description	SW¼ Section 35, T17N. R64E. MDBM. Duck Creek Range, White Pine County, Nevada. Cleve Creek Baldy USGS 7.5 minute quadrangle

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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)	P Novak-Echenique
Contact for lead author	State Rangeland Management Specialist
Date	03/01/2011
Approved by	PN-E
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are none to rare. A few may occur after summer convection storms or rapid snowmelt. These will be short and stable and will begin to heal during the first growing season.

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2. **Presence of water flow patterns:** Waterflow patterns are none to rare. A few may occur after summer convection storms or rapid snowmelt. These are short and stable (<2m and disconnected.)

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3. **Number and height of erosional pedestals or terracettes:** Pedestals are none to rare. Occurrence is usually limited tc 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 is ± 10-25% depending on amount of surface rock fragments.

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5. **Number of gullies and erosion associated with gullies:** None

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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 large rainfall 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 4 to 6 on most soil textures found on this site.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Surface structure is thick platy, subangular blocky, or fine granular. Soil surface colors are dark grayish browns and soils are typified by a mollic epipedon. Surface textures are loams. Organic matter of the surface 2 to 3 inches is typically 1 to 3 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 (i.e., Idaho fescue, needlegrasses) 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 none. Massive structure or argillic 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 > tall shrubs (i.e., mountain big sagebrush)

    Sub-dominant: associated shrubs > shallow-rooted, cool season, perennial bunchgrasses > deep-rooted, cool season, perennial forbs = fibrous, shallow-rooted, cool season, perennial and annual forbs.

    Other:

    Additional: With an extended fire return interval, the shrub component will increase at the expense of the herbaceous component.

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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):** Between plant interspaces (± 35-50%) and depth of litter is <½ 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 July) ± 1200 lbs/ac; Favorable years ± 1700 lbs/ac and unfavorable years ± 900 lbs/ac. Spring moisture significantly affects total production.

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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:** Potential invaders include cheatgrass, mustards and Kentucky bluegrass.

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