USDA Natural Resources Conservation Service

Ecological site F026XY068NV
Poorly Drained Stream Terrace POTR5 WSG:2W1710

Last updated: 4/10/2024
Accessed: 05/13/2025

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): 026X–Carson Basin and Mountains

The area lies within western Nevada and eastern California, with about 69 percent being within Nevada, and 31 percent being within California. Almost all this area is in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. Isolated north-south trending mountain ranges are separated by aggraded desert plains. The mountains are uplifted fault blocks with steep side slopes. Most of the valleys are drained by three major rivers flowing east across this MLRA. A narrow strip along the western border of the area is in the Sierra Nevada Section of the Cascade-Sierra Mountains Province of the Pacific Mountain System. The Sierra Nevada Mountains are primarily a large fault block that has been uplifted with a dominant tilt to the west. This structure leaves an impressive wall of mountains directly west of this area. This helps create a rain shadow affect to MLRA 26. Parts of this eastern face, but mostly just the foothills, mark the western boundary of this area. Elevations range from about 3,806 feet (1,160 meters) on the west shore of Pyramid Lake to 11,653 feet (3,552 meters) on the summit of Mount Patterson in the Sweetwater Mountains.

Valley areas are dominantly composed of Quaternary alluvial deposits with Quaternary playa or alluvial flat deposits often occupying the lowest valley bottoms in the internally drained valleys, and river deposited alluvium being dominant in externally drained valleys. Hills and mountains are dominantly Tertiary andesitic flows, breccias, ash flow tuffs, rhyolite tuffs or granodioritic rocks. Quaternary basalt flows are present in lesser amounts, and Jurassic and Triassic limestone and shale, and Precambrian limestone and dolomite are also present in very limited amounts. Also of limited extent are glacial till deposits along the east flank of the Sierra Nevada Mountains, the result of alpine glaciation.

The average annual precipitation in this area is 5 to 36 inches (125 to 915 millimeters), increasing with elevation. Most of the rainfall occurs as high-intensity, convective storms in spring and autumn. Precipitation is mostly snow in winter. Summers are dry. The average annual temperature is 37 to 54 degrees F (3 to 12 degrees C). The freeze-free period averages 115 days and ranges from 40 to 195 days, decreasing in length with elevation.

The dominant soil orders in this MLRA are Aridisols and Mollisols. The soils in the area dominantly have a mesic soil temperature regime, an aridic or xeric soil moisture regime, and mixed or smectitic mineralogy. They generally are well drained, are clayey or loamy and commonly skeletal, and are very shallow to moderately deep.

This area supports shrub-grass vegetation characterized by big sagebrush. Low sagebrush and Lahontan sagebrush occur on some soils. Antelope bitterbrush, squirreltail, desert needlegrass, Thurber needlegrass, and Indian ricegrass are important associated plants. Green ephedra, Sandberg bluegrass, Anderson peachbrush, and several forb species also are common. Juniper-pinyon woodland is typical on mountain slopes. Jeffrey pine, lodgepole pine, white fir, and manzanita grow on the highest mountain slopes. Shadscale is the typical plant in the drier parts of the area. Sedges, rushes, and moisture-loving grasses grow on the wettest parts of the wet flood plains and terraces. Basin wildrye, alkali sacaton, saltgrass, buffaloberry, black greasewood, and rubber rabbitbrush grow on the drier sites that have a high concentration of salts.

Some of the major wildlife species in this area are mule deer, coyote, beaver, muskrat, jackrabbit, cottontail, raptors, pheasant, chukar, blue grouse, mountain quail, and mourning dove. The species of fish in the area include trout and catfish. The Lahontan cutthroat trout in the Truckee River is a threatened and endangered species.

LRU notes

The Sierra Influenced Ranges LRU is characterized by wooded great basin mountains with climatic and biotic affinities to the Sierra Nevada mountain range. The Sierra Influences Ranges LRU receives greater precipitation that the mountain ranges of central NV. Amount of precipitation varies in relation to the local strength of the Sierra NV rain shadow, characterized by pinyon and juniper trees. The White, Sweetwater, Pine Nut, Wassuk, and Virginia ranges of Nevada support varying amounts of Sierra Nevada flora, such as ponderosa pine. Elevations range from 1610 to 2420 meters and slopes range from 5 to 49 percent, with a median value of 22 percent. Frost free days (FFD) ranges from 92 to 163.

Ecological site concept

This woodland site occurs on nearly level to gently sloping mountain basins and along mountain streams and terraces. Slopes range from 0 to 15 percent, but are typically 2 to 8 percent. Elevations are 6900 to 8500 feet. Soils typically are more than 60 inches deep and are usually poorly drained. The soils normally have a seasonally high water table within 12 to 20 inches of the surface. The dominant plants are aspen (Populus tremuloides), Sandberg bluegrass (Poa secunda), and slender wheatgrass (Elymus trachycaulus ssp. trachycaulus).

Table 1. Dominant plant species

Tree	(1) *Populus tremuloides*
Shrub	Not specified
Herbaceous	(1) *Poa secunda* (2) *Elymus trachycaulus ssp. trachycaulus*

Physiographic features

This woodland site occurs on nearly level to gently sloping mountain basins and along mountain streams and terraces. Slopes range from 0 to 15 percent, but are typically 2 to 8 percent. Elevations are 6900 to 8500 feet.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	Rare
Ponding frequency	None
Elevation	2,103–2,591 m
Slope	2–8%
Water table depth	30–51 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate associated with this site is subhumid with cool, dry summers and cold, wet winters. Average annual precipitation is 16 to over 20 inches. Mean annual air temperature is 40 to 43 degrees F. The average growing season is 50 to 70 days. Climate data used to support this section were derived from PRISM and is not specifically tied to any dominant climate station.

Nevada’s climate is predominantly arid, with large daily ranges of temperature, infrequent severe storms, heavy snowfall in the higher mountains, and great location variations with elevation. Three basic geographical factors largely influence Nevada’s climate: continentality, latitude, and elevation. Continentality is the most important factor.

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, with the result that 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 mid-latitude 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 scattered thundershowers. The eastern portion of the state receives significant 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).

Table 3. Representative climatic features

Frost-free period (average)	60 days
Freeze-free period (average)	
Precipitation total (average)	457 mm

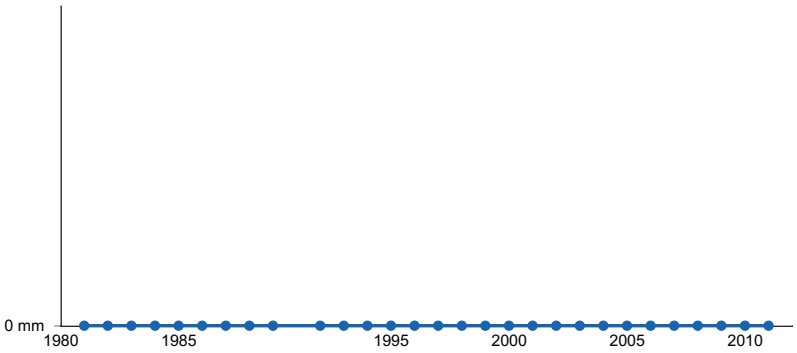


Figure 1. Annual precipitation pattern

Influencing water features

There are no influencing water features associated with this site.

Soil features

Soils typically are more than 60 inches deep and are usually poorly drained. The soils normally have a seasonally high water table within 12 to 20 inches of the surface. These soils have a thick, dark, medium textured surface layer. The underlying material is medium to moderately fine textured and is slightly acid to mildly alkaline in reaction. Available water capacity is moderate and surface runoff is medium depending on slope. The soils are susceptible to gullying which intercepts normal overflow patterns causing site degradation. The soil associated with this site include Fluvaquentic Endoaquolls.

Table 4. Representative soil features

Parent material	(1) Alluvium

Surface texture	(1) Very stony sandy loam
Family particle size	(1) Loamy
Drainage class	Poorly drained
Permeability class	Moderately slow
Soil depth	183–213 cm
Surface fragment cover <=3"	25%
Surface fragment cover >3"	5%
Available water capacity (0-101.6cm)	16.76–21.34 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	5–6.1
Subsurface fragment volume <=3" (Depth not specified)	23%
Subsurface fragment volume >3" (Depth not specified)	3%

Ecological dynamics

Fire Ecology:
Wildfire is recognized as a natural disturbance that influenced the structure and composition of the climax vegetation of this woodland site. Infrequent, yet periodic wildfire in the riparian zone, prevents over-mature aspen stands and maintains a naturally stratified mosaic of even-aged aspen communities in various stages of successional development. In the absence of fire, harvest, or similar events, aspen stands become uneven-aged. Uneven-aged stands form under stable conditions where the overstory gradually disintegrates with disease or age, and is replaced by aspen suckers. The most important agent of disturbance in aspen forests before 1900 was fire, although other natural disturbances were locally important including windthrow, snow damage, hail, lightning, fungal diseases and insect damage. Most aspen forests in the West are seral and have been dependent upon fire for their perpetuation. If fire occurs at infrequent intervals (e.g. 50-150 years) and is intense enough to kill most of the aspen and competing conifers, them most aspen sites in the West will retain viable stands of aspen. Periodic wildfires prevent over-mature aspen stands and maintain a naturally stratified mosaic of even-aged aspen communities in various stages of successional development. Uneven-aged stands form under stable conditions where the overstory gradually disintegrates with disease or age, and is replaced by aspen suckers. Although aspen forests do not burn readily, aspen trees are extremely sensitive to fire. A severe fire will top-kill the aspen overstory and will stimulate abundant suckering. A severe fire also removes the duff and may kill roots. Repeated fires have a detrimental effect on site quality and can eliminate aspen from a site.

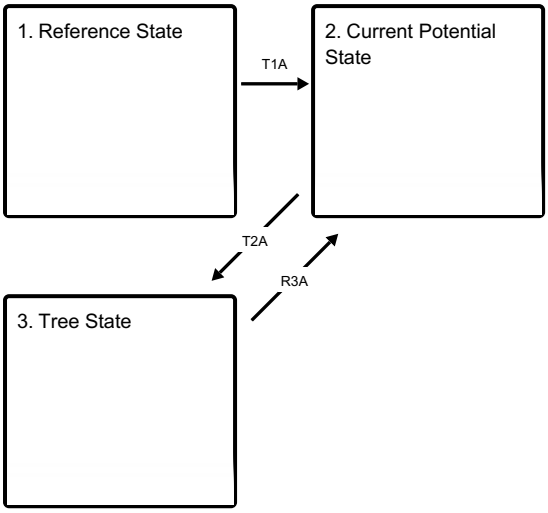
Aspen is highly competitive on burned sites and has several adaptations to fire including the following: a) the thin bark has little heat resistance, and aspen is easily top-killed by fire, b) root systems of top-killed stems send up a profusion of sprouts for several years after fire, c)sprouts grow rapidly by extracting water, nutrients, and photosynthate from an extant root system, and may outcompete other woody vegetation, d)following fire, a new, even-aged quaking aspen stand can develop within a decade, and e) aspen is self-thinning and a mature forest of healthy trees can develop from dense sprouts.

Nevada bluegrass communities is generally unharmed by fire. It produces little litter, and its small bunch size and sparse litter reduces the amount of heat transferred to perennating buds in the soil. The effects of fire on slender wheatgrass are dependent on its growth form. Tall, decadent plants with many leaves sustain the most fire damage, while those with short, sparse growth form, is the least likely to sustain damage to the root system during a fire.

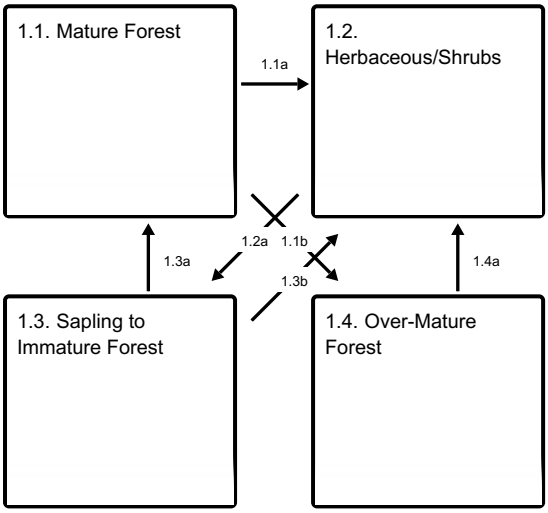
Sedge is top-killed by fire, with rhizomes protected by insulating soil. The rhizomes of Carex species may be killed by high-severity fires that remove most of the soil organic layer. Reestablishment after fire occurs by seed establishment and/or rhizomatous spread.

State and transition model

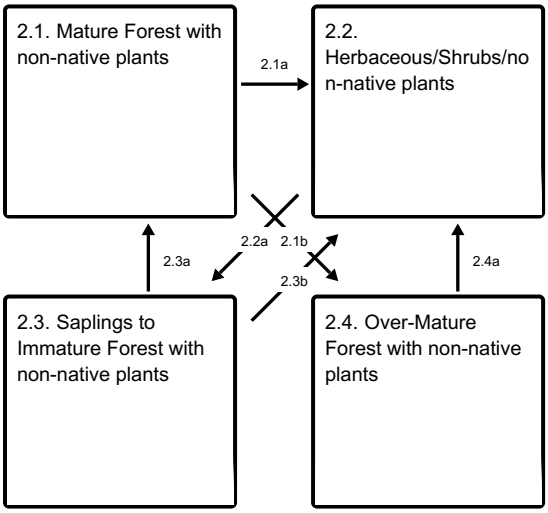
Ecosystem states



State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities

3.1. Evergreen Trees

State 1
Reference State

The Reference State is a representative of the natural range of variability under pristine conditions. This site has four general community phases; a mature woodland phase, a sucker/sapling phase, an immature woodland phase and an over mature woodland/conifer 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, 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.

Community 1.1
Mature Forest

The reference plant community is dominated by one to several quaking aspen clones, each with a common genetic makeup and individual phenological and physiological characteristics. An overstory canopy cover of about 35 percent is assumed to be representative of tree dominance on this site in a natural environment. Overstory tree canopy composition is 100 percent quaking aspen. Wood's rose and willow are the principal understory shrubs. Nevada bluegrass, sedges, slender wheatgrass, mountain brome, groundsel, yarrow, and meadowrue are common understory species associated with this site. MATURE FOREST: Diameter growth shows strong recovery with reduced competition during this stage. The visual aspect and vegetal structure are dominated by single-storied aspen that have reached or are near maximal heights for the site. Tree heights range from 50 to 80 feet, depending upon site and clone genotype. Tree canopy cover ranges from 25 to about 40 percent. Trees have developed tall, straight, clear stems with short, narrow, dome-like crowns, that develop greater spread at the edge of the stand. Despite considerable forage production in most aspen communities, the overstory trees do compete with the undergrowth plants for moisture, light, nutrients, and space. Vegetative shoots and/or saplings of aspen occur in the understory, but they are inconspicuous and have a high mortality rate.

Forest overstory. Diameter growth shows strong recovery with reduced competition during this stage. The visual aspect and vegetal structure are dominated by single-storied aspen that have reached or are near maximal heights for the site. Tree heights range from 50 to 80 feet, depending upon site and clone genotype. Tree canopy cover ranges from 25 to about 40 percent. Trees have developed tall, straight, clear stems with short, narrow, dome-like crowns, that develop greater spread at the edge of the stand. Despite considerable forage production in most aspen communities, the overstory trees do compete with the undergrowth plants for moisture, light, nutrients, and space. Vegetative shoots and/or saplings of aspen occur in the understory, but they are inconspicuous and have a high mortality rate.

Forest understory. Sufficient light is able to penetrate the tree canopy to support abundant understory vegetation. Understory vegetative composition is about 45 percent grasses, 30 percent forbs and 15 percent shrubs and young trees when the average overstory canopy is medium (about 35 percent). Average understory production ranges from 1000 to 1600 pounds per acre with a medium canopy cover. Understory production includes the total annual production of all species within 4½ feet of the ground surface.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	673	874	1076
Forb	224	291	359
Shrub/Vine	168	219	269
Tree	56	73	90
Total	**1121**	**1457**	**1794**

Community 1.2
Herbaceous/Shrubs

HERBACEOUS: Vegetation is dominated by grasses and forbs under full sunlight. This stage is experienced after a major disturbance such as fire, root-rot, insect damage, or tree harvest. Following a major disturbance, the root system gives rise to many root suckers, assuming the root system is intact and healthy. Residual trees left following harvest have little or no affect on the composition and production of the herbaceous vegetation. SHRUB-HERBACEOUS: Herbaceous vegetation dominates the site. Quaking aspen suckers are evident. If the aspen stand is healthy, these first two stages will only last from one to two years. However, if competing brush and herbaceous plants grow for a full season before aspen suckers emerge, a reduction in growth and survival of aspen suckers may occur.

Community 1.3
Sapling to Immature Forest

SAPLING: Early growth of quaking aspen suckers ranges from less than 1 foot to more than 3 feet per year for shoots having good competitive position. In the absence of disturbance, suckers develop into saplings (to 4½ feet in height) with a range in canopy cover of about 5 to 15 percent. Vegetation consists of grasses, forbs and a few shrubs in association with tree saplings. POLE STAGE: As the canopy closes, trees stratify into crown classes quickly despite genetic uniformity within clones. Aspen stands are self-thinning, especially at young ages. This stage is characterized by rapid growth of the aspen trees, both in height and canopy. The visual aspect and vegetal structure are dominated by aspen ranging from about 10 to 20 feet in height, and having a diameter at breast height (DBH) of about 2 to 4 inches. Understory vegetation is moderately influenced by a tree canopy of about 15 to over 25 percent. IMMATURE FOREST: Growth of the aspen slows somewhat during this stage. There is a fairly continual adjustment of trees to growing space, and a loss in competitive position of many trees making up the codominant, intermediate, and overtopped classes. When competition becomes intense enough to appreciably affect the diameter growth of dominants, mortality quickly reduces the number of trees in the lower crown classes. When competition becomes intense enough to appreciably affect the diameter growth of dominants, mortality quickly reduces the number of trees in the lower crown classes. There are periodic surges in mortality, with a large number of trees dying within a short time. The visual aspect and vegetal structure are dominated by aspen mostly greater than 25 feet in height. Understory vegetation is moderately influenced by a tree overstory canopy of about 25 to over 50 percent.

Community 1.4
Over-Mature Forest

OVER-MATURE FOREST: In the absence of wildfire or other naturally occurring disturbances, the tree canopy on this site can become somewhat dense. This stage is normally dominated by aspen that have reached maximal heights for the site. Trees have straight, clear stems with short, high-rounded crowns. In the absence of disturbance, over-mature, even-aged aspen stands slowly die. The canopy opens up, and otherwise inconspicuous aspen suckers survive and grow in the openings left by the aspen. These suckers typically arise over a period of several years and the resulting stand is broadly even-aged. If broadly even-aged stands reach old age without disturbance, their deterioration is likely to extend over a longer period than before because of the range of tree ages. That, in turn, will result in a longer regeneration period and a new stand with an even greater range of ages. If this continues over several generations, all-aged stands will result. Tree canopy cover is usually greater than 50 percent. Understory production is strongly influenced by the overstory, as is species composition. Shade tolerant forbs, grasses, and grass-like plants, will dominate the understory.

Pathway 1.1a
Community 1.1 to 1.2

Fire would reduce the mature aspen and allow for the suckers, saplings and the herbaceous understory to increase.

Pathway 1.1b
Community 1.1 to 1.4

Time and lack of disturbance will allow for the conifer trees in the understory to mature and dominate the site.

Pathway 1.2a
Community 1.2 to 1.3

Time and lack of disturbance, release from herbivory will allow for the aspen suckers to mature

Pathway 1.3a
Community 1.3 to 1.1

Time and lack of disturbance, release from herbivory will allow for the aspen trees to mature.

Pathway 1.3b
Community 1.3 to 1.2

Fire, insects, disease or wind damage can reduce the aspen canopy and the subsequent competition with the understory allowing the understory herbaceous community to increase. Excessive herbivory while trees are still within reach to browse may also reduce aspen growth.

Pathway 1.4a
Community 1.4 to 1.2

Fire would decrease the conifer canopy and allow for the aspen suckers to increase.

State 2
Current Potential State

This state is similar to the Reference State with four similar community phases. Ecological function has not changed, however the resiliency of the state has been reduced by the presence of invasive weeds. Non-natives may increase in abundance but will not become dominant within this State. 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 feedbacks 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.

Community 2.1
Mature Forest with non-native plants

MATURE FOREST: Diameter growth shows strong recovery with reduced competition during this stage. The visual aspect and vegetal structure are dominated by single-storied aspen that have reached or are near maximal heights for the site. Tree heights range from 50 to 80 feet, depending upon site and clone genotype. Tree canopy cover ranges from 25 to about 40 percent. Trees have developed tall, straight, clear stems with short, narrow, dome-like crowns, that develop greater spread at the edge of the stand. Despite considerable forage production in most aspen communities, the overstory trees do compete with the undergrowth plants for moisture, light, nutrients, and space. Vegetative shoots and/or saplings of aspen occur in the understory, but they are inconspicuous and have a high mortality rate.

Community 2.2
Herbaceous/Shrubs/non-native plants

HERBACEOUS: Vegetation is dominated by grasses and forbs under full sunlight. This stage is experienced after a major disturbance such as fire, root-rot, insect damage, or tree harvest. Following a major disturbance, the root system gives rise to many root suckers, assuming the root system is intact and healthy. Residual trees left following harvest have little or no affect on the composition and production of the herbaceous vegetation. SHRUB-HERBACEOUS: Herbaceous vegetation dominates the site. Quaking aspen suckers are evident. If the aspen stand is healthy, these first two stages will only last from one to two years. However, if competing brush and herbaceous plants grow for a full season before aspen suckers emerge, a reduction in growth and survival of aspen suckers may occur.

Community 2.3
Saplings to Immature Forest with non-native plants

SAPLING: Early growth of quaking aspen suckers ranges from less than 1 foot to more than 3 feet per year for shoots having good competitive position. In the absence of disturbance, suckers develop into saplings (to 4½ feet in height) with a range in canopy cover of about 5 to 15 percent. Vegetation consists of grasses, forbs and a few shrubs in association with tree saplings. POLE STAGE: As the canopy closes, trees stratify into crown classes quickly despite genetic uniformity within clones. Aspen stands are self-thinning, especially at young ages. This stage is characterized by rapid growth of the aspen trees, both in height and canopy. The visual aspect and vegetal structure are dominated by aspen ranging from about 10 to 20 feet in height, and having a diameter at breast height (DBH) of about 2 to 4 inches. Understory vegetation is moderately influenced by a tree canopy of about 15 to over 25 percent. IMMATURE FOREST: Growth of the aspen slows somewhat during this stage. There is a fairly continual adjustment of trees to growing space, and a loss in competitive position of many trees making up the codominant, intermediate, and overtopped classes. When competition becomes intense enough to appreciably affect the diameter growth of dominants, mortality quickly reduces the number of trees in the lower crown classes.

Community 2.4
Over-Mature Forest with non-native plants

OVER-MATURE FOREST: In the absence of wildfire or other naturally occurring disturbances, the tree canopy on this site can become somewhat dense. This stage is normally dominated by aspen that have reached maximal heights for the site. Trees have straight, clear stems with short, high-rounded crowns. In the absence of disturbance, over-mature, even-aged aspen stands slowly die. The canopy opens up, and otherwise inconspicuous aspen suckers survive and grow in the openings left by the aspen. These suckers typically arise over a period of several years and the resulting stand is broadly even-aged. If broadly even-aged stands reach old age without disturbance, their deterioration is likely to extend over a longer period than before because of the range of tree ages. That, in turn, will result in a longer regeneration period and a new stand with an even greater range of ages. If this continues over several generations, all-aged stands will result. Tree canopy cover is usually greater than 50 percent. Understory production is strongly influenced by the overstory, as is species composition. Shade tolerant forbs, grasses, and grass-like plants, will dominate the understory.

Pathway 2.1a
Community 2.1 to 2.2

Fire would reduce the mature aspen and allow for the suckers, saplings and the herbaceous understory to increase. Annual non-natives are likely to increase after fire.

Pathway 2.1b
Community 2.1 to 2.4

Time and lack of disturbance will allow for the conifers in the understory to mature and dominate the site.

Pathway 2.2a
Community 2.2 to 2.3

Time and lack of disturbance, changing of grazing season or grazing reduction/exclusion will allow for the aspen suckers to mature.

Pathway 2.3a
Community 2.3 to 2.1

Time and lack of disturbance and/or release from browsing, will allow for the aspen trees to mature.

Pathway 2.3b
Community 2.3 to 2.2

Fire, insects, disease or wind damage can reduce the aspen canopy and the subsequent competition with the understory allowing the understory herbaceous community to increase. Inappropriate grazing especially by sheep, and/or herbivory by large ungulates while trees are still within reach to browse may also reduce aspen growth.

Pathway 2.4a
Community 2.4 to 2.2

Fire, or equivalent such as clearcutting/harvesting of the conifers would allow for the aspen suckers to increase and the understory plant community to increase of shrubs and grasses to increase.

State 3
Tree State

This state is characterized by one community phase dominated by Rocky Mountain fir and Engelmann's spruce. Aspen may be present in trace amounts however trees are decadent and little to no regeneration is present. Understory vegetation is sparse. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These feedbacks include the dense canopy cover of conifer creating a shade rich environment that facilitates the germination and establishment of conifers and retards the growth and suckering of aspen. Positive feedbacks decrease ecosystem resilience and stability of the state. These include high fuel loads from canopy closure and dead and down wood leading to the potential for stand replacing fire.

Community 3.1
Evergreen Trees

This community phase is dominated by Rocky Mountain fir and Engelmann’s spruce. Aspen trees may be present but show decadence and are significantly reduced. Understory vegetation is reduced due to competition of the overstory canopy. Annual non-native species may be present.

Transition T1A
State 1 to 2

Trigger: This transition is caused by the introduction of non-native annual plants, such as Kentucky bluegrass, thistles and common dandelion. Slow variables: Over time the annual non-native species 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 T2A
State 2 to 3

Trigger: Time and a lack of disturbance allow conifer trees to establish, grow and mature grown in understory. Slow variables: Over time the abundance and size of trees will increase. Threshold: Conifer canopy cover is greater than 60% of the stand and conifer height exceeds aspen height. Aspen are decadent and dying with little to no regeneration. Little understory vegetation remains due to competition with trees for site resources.

Restoration pathway R3A
State 3 to 2

Prescribed fire or mechanical removal of trees potentially coupled with root ripping to stimulate suckering.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Primary Perennial Grasses**			219–393	
	sedge	CAREX	*Carex*	73–131	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	73–131	–
	bluegrass	POA	*Poa*	73–131	–
2	**Secondary Perennial Grasses**			29–160	
	mountain brome	BRMA4	*Bromus marginatus*	15–73	–
	rush	JUNCU	*Juncus*	15–73	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–15	–
Forb					
3	**Perennial Forbs**			44–248	
	columbine	AQUIL	*Aquilegia*	15–73	–
	ragwort	SENEC	*Senecio*	15–73	–
	Fendler's meadow-rue	THFE	*Thalictrum fendleri*	15–73	–
	yarrow	ACHIL	*Achillea*	0–15	–
	angelica	ANGEL	*Angelica*	0–15	–
Shrub/Vine					
4	**Primary Perennial Grasses**			73–131	
	willow	SALIX	*Salix*	73–131	–
5	**Secondary Shrubs**			15–73	
	Woods' rose	ROWO	*Rosa woodsii*	0–15	–
Tree					
6	**Trees**			73–131	
	quaking aspen	POTR5	*Populus tremuloides*	73–131	–

Animal community

Livestock Interpretations:
This site is suited to cattle and sheep grazing during the summer and early fall. Livestock use aspen types for forage and shade. Cattle select for Nevada bluegrass, mountain brome, slender wheatgrass, and other forage grasses while sheep select for bluegrasses, meadowrue and forbs. Nevada bluegrass is a palatable species, but its production is closely tied to weather conditions. It produces little forage in drought years, making it a less dependable food source than other perennial bunchgrasses. Sedge and slender wheatgrass are also important forage species for several livestock species. Browsing has a direct impact on aspen. Through the early sapling stage, browsing reduces aspen growth, vigor and numbers. Heavy browsing by sheep or deer can eliminate aspen sucker regeneration. Suckers can be drastically reduced or eliminated by big game browsing on winter ranges. Sheep browse the aspen with increasing pressure through late summer and early fall. Browsing is incidental to grazing by cattle. If grazing is light to moderate, the effect on aspen will be also. This, however, is less true for sheep and wild ungulates. Grazing management should allow aspen saplings to attain a minimum height of 55 to 60 inches before use to prevent destructive browsing by livestock. Bluegrass is a widespread forage grass. It is one of

the earliest grasses in the spring and is sought by domestic livestock and several wildlife species. Harvesting trees under a sound management program can open up the tree canopy to allow increased production of understory species desirable for grazing and browsing.

Stocking rates vary with such factors as kind and class of grazing animal, season of use and fluctuations in climate. Actual use records for individual sites, a determination of the degree to which the sites have been grazed, and an evaluation of trend in site condition offer the most reliable basis for developing initial stocking rates.

The forage value rating is not an ecological evaluation of the understory as is the range condition rating for rangeland. The forage value rating is a utilitarian rating of the existing understory plants for use by specific kinds of grazing animals.
The amount and nature of the understory vegetation in a forestland is highly responsive to the amount and duration of shade provided by the overstory canopy. Significant changes in kinds and abundance of plants occur as the canopy changes, often regardless of grazing use.

Wildlife Interpretations:
The aspen community is important habitat for many species of birds and mammals, especially where it is associated with free flowing streams. Mule deer and elk use aspen woodlands mostly in summer and fall for browse, thermal and hiding cover. Commonly associated birds using aspen during breeding season include the Western tanager, common nighthawk, mourning dove, Swainson's hawk and various species of bluebird, thrush and flycatcher. Birds using aspen during the wintering season include the Ruby-crowned kinglet, Townsend's solitaire, rough-legged hawk, Cooper's hawk, sharp-shinned hawk, and various species of finch and waxwing. Birds that use aspen either yearlong or as migrants, include the American robin, American kestrel, mountain chickadee, scrub jay, yellow-bellied sapsucker, long-eared owl, screech owl, great-horned owl, California quail, red-tailed hawk, golden eagle, and various species of sparrow, nuthatch and woodpecker. Commonly associated mammals using the aspen community type include various species of shrew, myotis, bat, mouse and vole. Some very common species include deer mouse, Nuttall's cottontail, least chipmunk, Western gray squirrel, bushy-tailed woodrat, raccoon, long-tailed weasel and the North American porcupine. Slender wheatgrass is grazed by sage grouse, deer, elk, moose, 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.
Sedge and Nevada bluegrass are also important forage species for several wildlife species.

Recreational uses

Aesthetic value is derived from the rich hues and textures of the aspen trees, particularly in the fall. The diverse flora and fauna, and the colorful wildflowers in the summer enhance the beauty of this site. The site offers rewarding opportunities to photographers and for nature study. It has high value for hunting, camping, picnicking, cross country skiing and family wood gathering. Management of the aspen woodland should include small, irregularly shaped clearcuts that blend into the natural landscape. Harvesting plans should include a mix of even-aged aspen patches in all size classes. Aspen fits well into management for dispersed recreation activities, but does not tolerate concentrated use such as found in established campgrounds. Encouraging concentrated recreation or developing campgrounds within aspen stands can lead to serious damage, including carving on trees, vandalism, destruction or removal of young suckers and trampling and disturbance of the soil.

Wood products

Historically, quaking aspen has been used for mine props, posts, bridge planking, flooring, furniture and fuelwood. This tree has a considerable potential for increased utilization. It makes excellent pulp, excelsior, door corestock, paper, particleboard, matchsticks, structural flakeboard, lumber products and boxwood.
Aspen propagates almost entirely by vegetative means throughout the Great Basin. Regeneration by seed is very rare, although aspen in this area produce large quantities of viable seed. Aspen seeds require a continually moist seedbed and the dry spring and summers of the Great Basin are not conducive to seedling survival.
An undesirable characteristic of the quaking aspen is their heavy drain on available water in the soil.
This site has moderate to moderately low site quality for tree production. Site indexes for quaking aspen range from 45 to 55 (Baker, 1925).
Productivity class: Quaking aspen - 2

CMAI*: 20 to 28 ft3/ac/yr
1.4 to 2.0 m3/ha/yr
*CMAI: is the culmination of mean annual increment or highest average growth rate of the stand in the units specified.
Saw timber: About 400 board ft/ac for stands averaging 6 inches at breast height (USDA Technical Bulletin 1291, Table 17).
Basal Area: About 115 square feet/acre for stands averaging 6 inches in diameter at breast height (USDA Technical Bulletin 1291, Table 17).
Fuelwood Production: About 17 cords per acre of quaking aspen in stands averaging 6 inches in diameter at breast height and 100 years in age (USDA Technical Bulletin 1291, Table 17). There are about 203,000 gross British Thermal Units (BTUs) heat content per cubic foot of quaking aspen wood. Firewood is commonly measured by the cord, or a stacked unit equivalent to 128 cubic feet. Solid wood volume in a cord varies, but assuming an average of 75 cubic feet of solid wood per cord, there are about 15 million BTUs of heat value in a cord of quaking aspen wood.
LIMITATIONS AND CONSIDERATIONS
a. Soil compaction and erosion hazards are greatest if logging is done with heavy equipment when soils are saturated in late spring or early summer. Logging at this time is most damaging to aspen roots, which can reduce suckering. Because root carbohydrate reserves are lowest in spring, harvesting at this time can further reduce sprouting.
b. Proper spacing is the key to a well managed, multiple use and multi-product aspen woodland.
c. To begin short-rotation management, older stands with larger trees need to be harvested.
d. Cut residual, unmerchantable, trees to stimulate maximum sucker regeneration and rapid development of a replacement stand – thin resulting sucker stands.
2. ESSENTIAL REQUIREMENTS
a. Adequately protect from high intensity wildfire.
b. Protect soils from accelerated erosion.
c. Apply proper grazing management.
3. SILVICULTURAL PRACTICES
a. Harvest Cutting: Selectively harvest surplus trees to achieve desired spacing. Harvest stands in small blocks of 1/5 to 1/2 acre with slash left in place to shelter emerging aspen suckers from browsing.
1) Clear-Cutting - Clear-cutting is appropriate when the primary management objective is sustained production of forest products, either saw timber or fiber. Cutting sub-merchantable stems along with the merchantable ones will maximize sucker production, minimize the presence of diseased or defective growing stock in the new stand, and avoid suppression of the new crop by residual overstory stems.
2) Partial Cutting - Partial cutting may be feasible in some uneven-aged stands where management objectives require vertical canopy diversity or retention of some overstory; partial cutting may result in enough sprouting to adequately regenerate stands. Individual tree or group selection cutting methods can be applied. Extreme care is necessary to avoid injury to residual stems during logging. Partial cutting is not worthwhile in deteriorated aspen clones where root system die back has reduced suckering.
3.) Selective Tree Removal:
Remove selected trees on suitable sites to enhance forage production and manage site reproduction.
b. Thinning - Ordinarily, only stands on saw timber sites should be thinned. Pre-commercial thinning may be uneconomical as the low productivity of this site would not justify thinning costs.
c. Protection from Disease - There are no proven forest stand treatments that successfully prevent or control disease in aspen. Maintenance of well-stocked stands, minimizing wounding of stems and control of damaging agents, and harvesting at the proper rotation age are the best management recommendations that can be made today.
d. Protection from Insects - Direct control of insects in aspen forests has not been practical. The environmental side-effects from chemical pesticide spraying usually has not been acceptable in the aspen ecosystem. Maintenance of a well-stocked stand and protection from wounding is the most practical method of coping with insects in the aspen forest.
e. Protection from Mammals - Domestic livestock, wild ungulates, porcupines, rodents and hares utilize aspen as food and can have measurable impacts on some stands (see FORAGE PRODUCTS). Most animal damage can be prevented by careful husbandry of domestic livestock and by population control of wild game. Because most aspen stands are grazed by cattle and/or sheep and have a significant population of wild ungulates, grazing management and game management are important to aspen communities.
f. Fire Management - Fire is a natural feature of the aspen ecosystem. Fire is considered responsible for the abundance of aspen in the west as well as the even-aged structure of many stands. Without human intervention,

fire appears to be necessary for the continued well-being of aspen on sites where natural degeneration of the clone occurs, or where insects or pests are especially harmful to the stand. Fires in aspen generally are infrequent, spread slowly and are of low intensity. Although aspen forests do not burn readily, aspen trees are extremely sensitive to fire. Even very light fires will kill aspen because the bark is thin and green, and lacks protective corky layers. Moderate intensity fire that kills most or all the overstory will stimulate adequate suckering and will have the least effect on subsequent sucker growth.

Other information

Quaking aspens are used to stabilize soil and watersheds. The trees produce abundant litter that contains more nitrogen, phosphorus, potash and calcium than leaf litter of most other hardwoods. The litter decays rapidly, forming nutrient-rich humus that may amount to 25 tons per acre (oven-dry basis). The humus reduces runoff and aids in percolation and recharge of ground water. Slender wheatgrass is widely used for revegetating disturbed lands. It has been used for rehabilitating mine spoils, livestock ranges, and wildlife habitat and watershed areas. Slender wheatgrass is used for rehabilitating alpine meadows and other high elevation habitats.

Type locality

Location 1: Mineral County, NV	
Township/Range/Section	T8N R28E S2
General legal description	Along Cottonwood Creek drainage, Wassuck Range, Hawthorne Army Depot, Mineral County, Nevada. This site also occurs in Elko, and White Pine Counties, Nevada. Another Location, Section 35, T9N, R28E

Other references

Fire Effects Information System (Online; http://www.fs.fed.us/database/feis/plants/).

USDA-NRCS Plants Database (Online; http://www.plants.usda.gov).

Howell, J. 1940. Pinyon and juniper: a preliminary study of volume, growth, and yield. Regional Bulletin 71. Albuquerque, NM: USDA, NRCS; 90p.

Jordan, M. 1974. An Inventory of Two Selected Woodland Sites in the Pine Nut Hills of Western Nevada. Master's Thesis, UNReno.

USDA-NRCS. 1998. National Forestry Manual - Part 537. Washington, D.C.

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Approval

Kendra Moseley, 4/10/2024

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)	
Contact for lead author	
Date	05/13/2025
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

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

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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:

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-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:**

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17. **Perennial plant reproductive capability:**
