Ecological site F028BY109NV
GRAVELLY STREAMBANK A

Last updated: 2/19/2025
Accessed: 05/12/2025

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): 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).

Classification relationships

US National Vegetation Classification (USNVC): 1. Forest to Open Woodland, 1.B. Temperate and Boreal Forest, 1.B.3. Temperate Flooded and Swamp Forest, D012 Western North American Flooded & Swamp Forest, M034 Rocky Mountain & Great Basin Flooded and Swamp Forest, G506 Rocky Mountain & Great Basin Montane Riparian Forest Group, CEGL000648 *Populus angustifolia*/*Betula occidentalis* Woodland.

Ecological site concept

The Gravelly Streambank A is found along perennial stream and drainage ways of steep, narrow mountain valleys between 6000 to 7700 ft elevation. Slopes are typically less than 8 percent and the site may experience brief flooding in the spring. Soils are deep to very deep, moderately well drained, and modified by 30 to 70 percent rock fragments throughout the profile.
The plant community is dominated by narrowleaf cottonwood, common understory shrubs include Wood's rose, willow, and currant.

Associated sites

F028BY025NV	**Mountain Stream Terrace** Mountain Stream Terrace on stream terraces
F028BY063NV	**ABCOC-PIFL2-PILO/ARTRV/LEKI2** This forest site occurs on smooth to slightly concave mountain sideslopes. Slopes are typically 30 to 50 percent. Elevations range from 8500 to over 10,700 feet.
R028BY001NV	**WET MEADOW 10-14 P.Z.** Wet meadow 10-14" P.Z.
R028BY024NV	**LOAMY BOTTOM 14+ P.Z.** This site occurs on inset fans, flood plains and lake plains. Slopes range from 0 to 8 percent. Slope gradients of 2 to 8 percent are most typical. Elevations are 7000 to 8500 feet.
R028BY030NV	**LOAMY 12-16 P.Z.** This site occurs on concave mountain sideslopes. Slopes gradients of 15 to 50 percent are typical and elevations range from 6500 to 8200 feet. Soils associated with this site are very deep, well drained, and formed in residuum/colluvium derived from volcanic sources. The profile is characterized by a mollic epipedon, an argillic horizon and greater than 35 percent rock fragments.
R028BY041NV	**DRY FLOODPLAIN** This site occurs on drainageways, inset fans and alluvial fans. Slope gradients of 0 to 15 percent, but 0 to 2 percent are most typical. Elevations are 3900 to 6500 feet. The soils associated with this site are typically very deep and moderately well drained. The soils are subject to overflow in the spring on an average of one year in seven. Although run-in from higher landscapes can supply additional moisture for plant growth, there typically is insufficient moisture to leach salts and alkali from the upper soil profile.
R028BY103NV	**STREAMBANK 12+** This riparian ecological complex occurs along floodplains and stream terraces adjacent to perennial streams in mountain valleys. Slope range from 2 to 15 percent, but slopes of 2 to 4 are typical. Elevations are 6800 to about 8200 feet.

Similar sites

F028BY110NV	**GRAVELLY STREAMBANK B** Salix important understory species [POAN3/SALIX]
F028AY079NV	**POAN3 WSG:6W1410** Found in MLRA 28A [POAN3/SALIX-BEOC2/CAREX]

Table 1. Dominant plant species

Tree	(1) *Populus angustifolia* (2) *Betula occidentalis*
Shrub	(1) *Rosa woodsii*
Herbaceous	(1) *Leymus cinereus* (2) *Poa*

Physiographic features

The Gravelly Streambank A site typically occurs along perennial streams and in drainageways of steep, narrow mountain valleys. Slope gradients range from 8 to 15 percent. Elevations are 6700 to about 7700 feet. This ecological site typically occurs along A2, A3 and B2 stream types (Rosgen 1994 and Manning and Padgett 1995).

Table 2. Representative physiographic features

Landforms	(1) Drainageway
Runoff class	Medium
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to occasional
Elevation	6,700–7,700 ft
Slope	8–15%
Water table depth	31–39 in
Aspect	Aspect is not a significant factor

Climatic features

The climate is dry-subhumid with cool moist winters and warm dry summers.

Average annual precipitation ranges from 12 to over 18 inches. The mean annual air temperature is about 42 to 45 degrees F. The average growing season is 70 to 100 days.

Average monthly precipitation (inches): Jan 1.05, Feb 1.18, March 1.37, April 1.21, May 1.24, June 0.87, July 0.97, Aug 1.18, Sept 1.08, Oct 1.24, Nov 0.97, Dec 0.96. The is no weather station information available at this site, the nearest representative weather station Great Basin National Park (263340) was used.

Table 3. Representative climatic features

Frost-free period (characteristic range)	94 days
Freeze-free period (characteristic range)	138 days
Precipitation total (characteristic range)	14 in
Frost-free period (actual range)	94 days
Freeze-free period (actual range)	138 days
Precipitation total (actual range)	14 in
Frost-free period (average)	94 days
Freeze-free period (average)	138 days
Precipitation total (average)	14 in

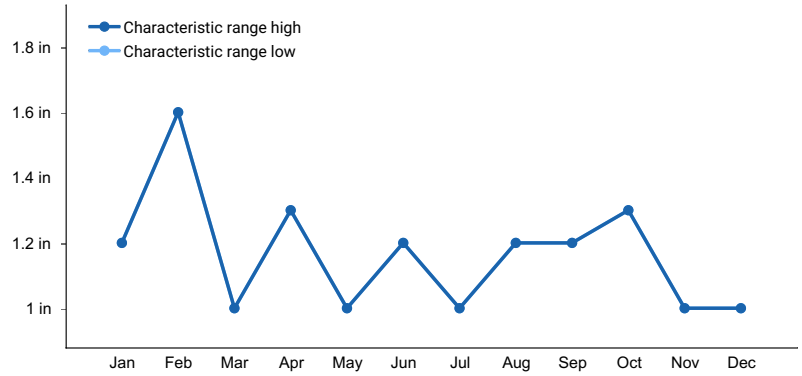


Figure 1. Monthly precipitation range

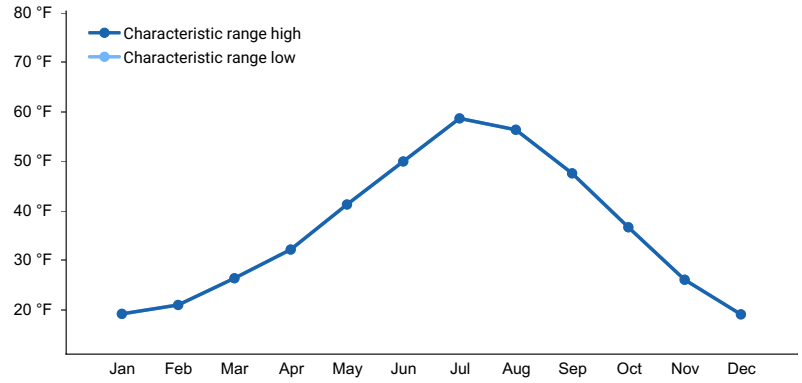


Figure 2. Monthly minimum temperature range

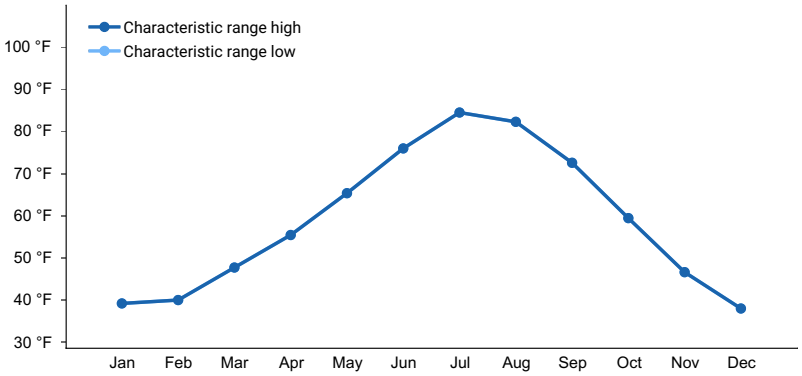


Figure 3. Monthly maximum temperature range

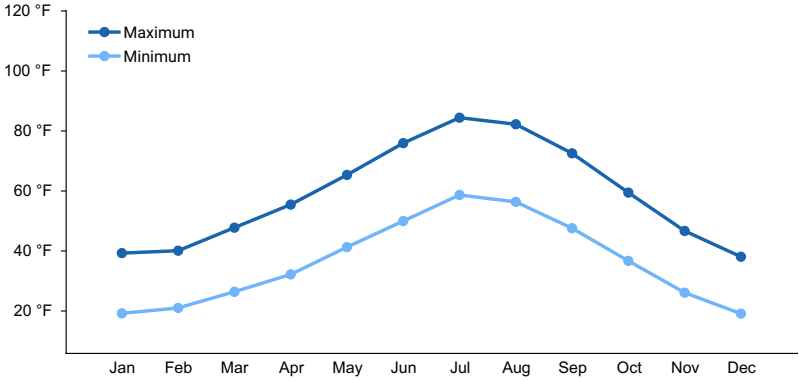


Figure 4. Monthly average minimum and maximum temperature

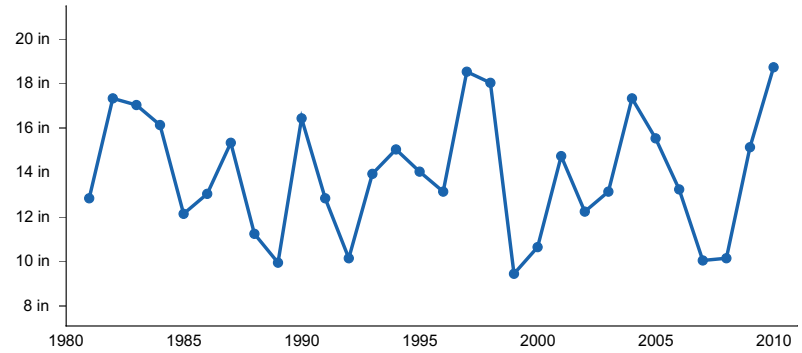


Figure 5. Annual precipitation pattern

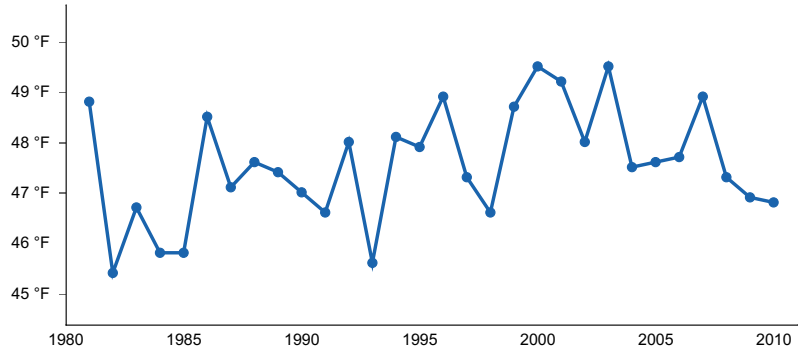


Figure 6. Annual average temperature pattern

Climate stations used

- (1) GREAT BASIN NP [USC00263340], Baker, NV

Influencing water features

The ecological site receives additional run-on moisture making it wetter than the precipitation zone alone would indicate. Persistence of this ecological site is dependent on ground water provided by the adjacent perennial stream. The ground water table typically varies between 31 and 68 inches between the months of April and June. This site may experience brief to occasional flooding from March to September.

Soil features

The soils are deep to very deep, moderately well drained soils that formed in alluvium derived from limestone, dolomite, quartzite and granitic rocks. The soil profile is modified with between 30 and 70 percent rock fragments by volume, mostly gravels and cobbles. These soils are occasionally flooded for brief periods between March and September and have a transitory seasonal water table within 100 cm of the surface in most years. These soils receive run-on moisture making it wetter than the precipitation zone would indicate. Diagnostic features include a mollic epipedon and a cambic horizon in the zone from 84 to 127 cm. Surface runoff is low to medium with adequate vegetative cover. Soil series associated with this site include Ripcon a loamy-skeletal, mixed, superactive, frigid Cumulic Haploxerolls.

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone (2) Alluvium–granite (3) Alluvium–quartzite
Surface texture	(1) Gravelly loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained

Permeability class	Slow
Soil depth	60 in
Surface fragment cover <=3"	2–6%
Surface fragment cover >3"	0–5%
Available water capacity (0-40in)	2.65–4.33 in
Calcium carbonate equivalent (0-40in)	0–5%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	7.7–8.9
Subsurface fragment volume <=3" (Depth not specified)	30–60%
Subsurface fragment volume >3" (Depth not specified)	10–20%

Ecological dynamics

The community phases of this ecological site are dynamic in response to changes in disturbance regimes and weather patterns. Natural disturbances affecting this ecological site include flooding, drought, disease, insect attack and infrequent wildfire. Narrowleaf cottonwood (*Populus angustifolia*) is common on alluvial benches and streambanks in dry mountains, desert shrublands and coniferous forests. Cottonwood communities are multi-layered and periodic disturbance is important for stand maintenance. Narrowleaf cottonwood is a facultative wetland species and is tolerant of frequent and prolonged flooding. It is not drought tolerant and periods of drought will result in increased mortality.

Floods are the most frequent and intense natural physical disturbance impacting the communities of riparian ecological sites (Swanson et al. 1998). The physical processes of erosion and deposition during a flood creates disturbance patches and refuges in which aquatic and riparian organisms either recolonize or survive. The spatial pattern of plant community phases, age classes and species diversity strongly reflects past flooding and other disturbances (Swanson et al. 1998). Droughts also create habitat patchiness along a stream. Streams undergoing droughts always show a reduction, usually dramatic, in habitat space. Droughts commonly result in varying degrees of fragmentation in the normal stream continuum (Lake 2000). For example, larger deeper pools may persist while shallower pools may dry up. Typically, the intensity of biotic interactions is thought to be reduced during and immediately following floods, whereas during droughts the intensity of biotic interactions increase as habitat space is reduced (Lake 2000).

The Populus genus is divided into five sections, four of which are represented in North America. Narrowleaf cottonwood belongs to the Tacamahaca or balsam poplar type. Taxonomy of the genus, Populus, is complex because natural variation and hybridization are common. Narrowleaf cottonwood commonly reaches ages of 100-200 years. It is capable of reproducing both asexually and sexually. Phenological development is directly related to annual hydrologic events. Flowering and pollination typically coincide with springtime peaks in river flow. Flowering occurs in May before or during leaf emergence, fruits typically form May through July, and seed dispersal can begin as early as June. Seed dispersal generally coincides with annual declines in river flow (Simonin 2001). Narrowleaf cottonwood seeds readily germinate when deposited on newly exposed substrate. Successful germination and establishment is dependent upon a suite of biotic and abiotic conditions, with insolation and moisture availability the most limiting factors (Simonin 2001). Germination occurs rapidly on moist sites, but the shade intolerant seedlings are not competitive with established vegetation (Gom and Rood 1999). Sprouting commonly follow disturbance events that scarify stems and/or roots and redistribute sediment. This type of vegetative propagation is a dominant mode of reproduction within relatively clear streams with coarse substrates (Simonin 2001). Steep gradients, coarse streambeds and constrained channels also promote clonal reproduction. The sexual reproduction strategy of

riparian cottonwoods is well adapted to colonized disturbed sites. However, little or no cottonwood seedling recruitment occurs on most sites in most years. The compliment to this strategy is clonal reproduction. Clonal reproduction provides the basis of population maintenance and allows expansion when conditions prevent seedling establishment (Gom and Rood 1999).

Healthy riparian zones provide critical ecosystem functions including; nutrient cycling, water purification, attenuation of floods, maintenance of stream flows and stream temperatures, recharging of groundwater, and maintenance of fish and wildlife habitat (Kauffman et al. 1997). Narrowleaf cottonwood is excellent bank stabilizing species. It occurs on a wide range of soil textures, inhabiting loamy sand to sandy loam with high percentages of coarse fragments and gravel bars. A healthy narrowleaf cottonwood community provides excellent watershed protection. Narrowleaf cottonwood is an excellent bank stabilizing species. Medium height shrubs and tall herbs frequently form a rather open and intermittent layer beneath the tree canopy. Sufficient light is able to penetrate the canopies to support abundant understory vegetation. A mixture of herbaceous and woody root systems penetrates and anchors the soil. Erosion producing overland flow is almost non-existent. Naturally stable, un-altered riparian ecosystems are highly resilient following disturbances such as flooding and drought. Most riparian species are evolutionarily adapted to flooding disturbances. The physical process of flooding creates disturbance patches in which species will recolonize, and refuges in which species survive (Swanson et al. 1998).

However, anthropogenic activities and management decisions can negatively impact critical ecosystem functions by disrupting the natural stability of the riparian system. Impacts such as road development can increase they delivery of water and soil into streams, due to increased runoff. This results in increased streamflow, as well as, increased availability of sediment and coarse, woody debris in the stream (Swanson et al. 1998). Stream channels can become incised. An incised river or stream has abandoned previous floodplains due to a lowering of local base level and is characterized by high streambanks bounded by alluvial terraces (Rosgen 1997). The consequences of stream channelization, straightening, encroachment and confinement is associated with accelerated streambank erosion, land loss, aquatic habitat loss, lowering of the water tables, land productivity reduction and downstream sedimentation (Rosgen 1997). Degraded riparian communities no longer connected to their floodplain commonly support upland species and may resemble begin to resemble another ecological site altogether. Non-native species commonly found on this ecological site include common mullein (*Verbascum thapsus*), dandelion (Taraxacum spp.), Kentucky bluegrass (*Poa pratensis*) and cheatgrass (*Bromus tectorum*). Native species that temporarily increase after fire, or become dominant in a degraded state or community phase include Louisiana sagewort (*Artemisia ludoviciana*), stinging nettle (Urtica dicoica), western tansy mustard (*Descurainia pinnata*), tuber starwort (*Pseudostellaria jamesiana*), rubber rabbitbrush (*Ericameria nauseosa*) and Douglas' rabbitbrush (Chrysothamnus viscidiflorous).

Distribution of streamside vegetation is partially determined by water table depth, rooting characteristics and texture and hydraulic conductivities of the soil (Amlin and Rood 2002). Cottonwood species are extensively clonal, so are closely related willow species. Willows are often found in finer substrates, at lower elevations and closer to the stream than cottonwoods. A primary source of moisture for both species is provided by water that laterally infiltrates into streamside substrates. Understanding the roll of ground water in the establishment and persistence of cottonwood forests is important for use and management. Riparian poplars are generally phreatophytic, dependent on ground water to meet their water requirements. Phreatophytes may be supplied with surface water but often have their roots in constant contact with moisture in the soil. Root growth or activation must be adequate to maintain contact throughout seasonal variations in the water table. Drought stress and mortality will occur if water table declines too rapidly for the roots to maintain functional contact (Mahoney and Rood 1991). Anthropogenic impacts causing abrupt lowering of the water table may lead to drought-induced mortality of all age classes in a cottonwood forest.

Streams and rivers are organized into groups based on morphological characteristics such as, entrenchment, slope, dominant channel material and sinuosity (Rosgen 1994). This classification system aims to predict a rivers behavior from its appearance and provide a mechanism to extrapolate site-specific data on a particular stream reach to those similar in character. The first level of delineation combines influences of climate, depositional history, and life zones on channel morphology. Stream types that typically support this ecological site are A2, A3 and B2. Type A streams are generally steep, entrenched and confined with cascading reaches and are characterized by step-pool bed morphology. Typically found in erosional, depositional and bedrock landforms (Rosgen 1994). Type B streams are generally moderately entrenched, moderately sloping and riffle dominated with infrequently spaced pools. Typically found in narrow, gently sloping valleys and soils formed in colluvium and/or residuum (Rosgen 1994). The stream types are given numbers related to the particle size diameter of the channel material. In this case, channel materials

are dominated by boulders (A2 and B2) or cobbles (A3).

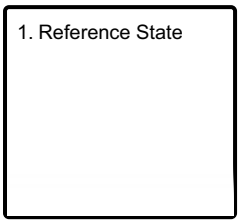
Fire ecology:
Wildfire is recognized as a natural disturbance that influenced the structure, composition and perpetuation of the climax vegetation of this forest site. Periodic wildfires prevent over-mature cottonwood stands, inhibit conifer encroachment and maintain a naturally stratified mosaic of even-aged stands in various stages of successional development. Natural fire return interval is highly variable in narrowleaf cottonwood stands. In areas with fire return interval of 50 to 100 years, single clones may persist for centuries or even longer (Wyckoff and Zasasa 2008). Riparian forests do not readily burn. Fires are generally infrequent, spread slowly, are of low intensity, and easy to control. Fire in this system is closely related to adequate ignition sources, the frequency and duration of favorable fire weather and annual hydrology. Susceptibility to burning increases with extended dry periods and especially with the accumulation of dead biomass (Simonin 2001). Cottonwood communities only support crown fires under the severest burning conditions (Burns and Honkala 1990). Thickness of bark increases with age, increasing resistance to fire. However, the bark tends to be deeply fissured and the protection to the cambium is less than continuous. Mortality is largely dependent on fire severity. Mature trees can generally withstand mild to moderate fires. Post-fire sprouting occurs from the roots, root crown and/or healthy and fire damaged branches. Following fire the sediment load in streams generally increase. Narrowleaf cottonwood branch fragments increase deposition by obstructing stream flow and trapping sediment. Fresh, moist, barren alluvium in full sun is the preferred environment for narrowleaf cottonwood seedling germination (Simonim 2001).

Water birch (*Betula occidentalis*) readily sprouts following aboveground damage and has been reported in early succession after fire and logging (Gucker 2012). Survival and sprouting is greatest after low-severity fires, mortality can occur following severe fires. In the Schell Creek Range of eastern Nevada, sites dominated by white fir and a low layer of water birch were dominated by water birch after fire. Along drainages in the Nevada water birch has been observed 4 to5 years post-fire (Manning and Padgett 1995). Willows (Salix spp.) are fire-tolerant shrubs. They are generally top killed by fire, but readily sprout from the roots and root crown. It also produces many small seeds that are important for recolonizing recently burned areas. Slow moving, intense fires can kill willows by completely removing organic layers and charring the roots (Esser 1992). Wood's rose (*Rosa woodsii*) is moderately tolerant of fire. It is generally top-killed by low to moderate severity fire, but survives by sprouting from the undamaged root crowns and rhizomes. It also is capable of recolonizing from on- and off-site seed sources. Basin big sagebrush (*Artemisia tridentata* subsp. tridentata) is readily killed by all fire intensities. Reestablishment following fire is dependent on seed production of nearby plants. Skunkbrush sumac (Rhus aromatic) shows a variety of fire adaptations. It sprouts vigorously from the root crown post-fire and high temperatures (>180°F) have been shown to break seed dormancy in greenhouse experiments. However, the overall density and vigor of skunkbrush sumac will be reduced by frequent and severe fires (Anderson 2004). Currant (Ribes spp.) species are severely damaged or killed by wildfire and is described as a weak sprouter. Seedlings commonly establish after fire. Short-duration, low-severity fire favors regeneration because soil-stored seed requires scarification to germinate. Creeping barberry (*Mahonia repens*) is fire adapted due to its well-developed rhizomes. However, plants with rhizomes above the mineral soil layer can be killed by severe fires. Redoiser dogwood (*Cornus sericea*) typically sprouts from the root crown, stem or stolon following low to moderate severity fires. Chokecherry (*Prunus virginiana*) is well adapted to fire. It readily sprouts from the surviving root crown and rhizomes following top kill by fire. Seed germination improves with heat treatment. Post-fire regeneration may also be improved by bird and mammal dispersed seed. Black cottonwood (*Populus balsamifera* L. spp. trichocarpa) trees are often damaged or top killed by fire regardless of age. The relatively thin bark of black cottonwood does not provide adequate protection to the cambium. Black cottonwood sprouts from stumps, charred boles, root crowns and lateral roots post-fire. Fire induced sprouting is common in the Tacamahaca section; in which narrowleaf cottonwood and black cottonwood both belong. Quaking aspen (*Populus tremuloides*) is well adapted to fire and is highly competitive on burned sites. Even where it was a barely detectable component of the pre-fire vegeation, it is initial colonizer and dominates a site post-fire. Like other Populus species it is thin barked and easily top killed by fire and root systems of top killed stems send up an abundance of sprouts for several years following a burn. Young western juniper (*Juniperus occidentalis*) are readily killed by all fire intensities, older trees are moderately resistant to fire due to increasing bark thickness with age. It does not sprout and reestablishment occurs solely through seed.
Perennial bunchgrasses are generally well adapted to endure fire. Basin wildrye (*Leymus cinereus*) is generally tolerant of fire but may be damaged by early-season fire combined with dry soil conditions. Typically, the coarseness of its foliage resists prolonged burning and plants sprout from surviving root crowns and rhizomes post-fire. Basin wildrye also regenerates by seed from nearby sources. Mountain brome (*Bromus marginatus*) is likely top killed by fire and has the greatest chances of surviving late-season fires when it is dormant. Mountain brome regenerates by self-seeding and vegetative spread. It is an abundant seed producer, seeds germinate quickly and

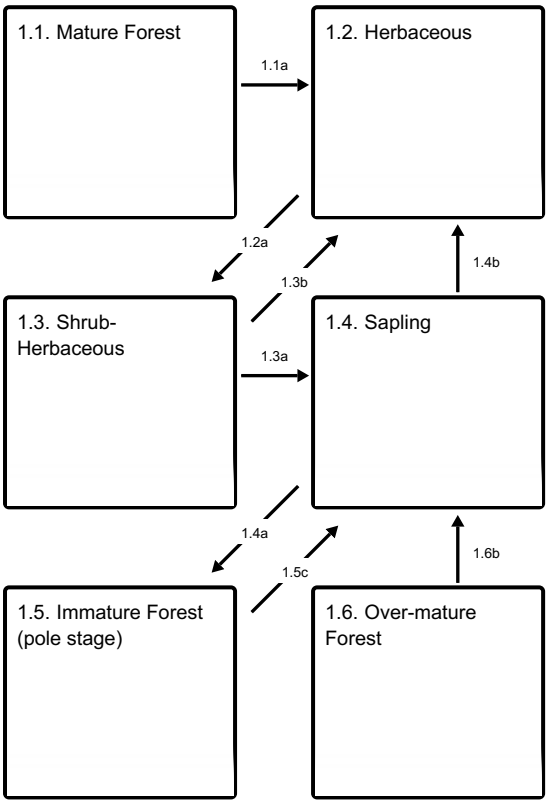
seedlings establish easily (Tollefson 2006). Streambank wheatgrass (*Elymus lanceolatus*) is tolerant of fire. Plants are initially top killed by fire, but roots easily survive moderate and low severity fires. Surviving roots will send up new growth and typically increase in cover post-fire (Scher 2002). Slender wheatgrass (*Elymus trachycaulus*) is also tolerant of moderate severity fires and may experience increased cover and vigor following fire. It is most sensitive to spring fires when it's actively growing (Howard 1992). Nebraska sedge (*Carex nebrascensis*) is a strongly rhizomatous perennial and likely tolerant of low to moderate severity fires.

State and transition model

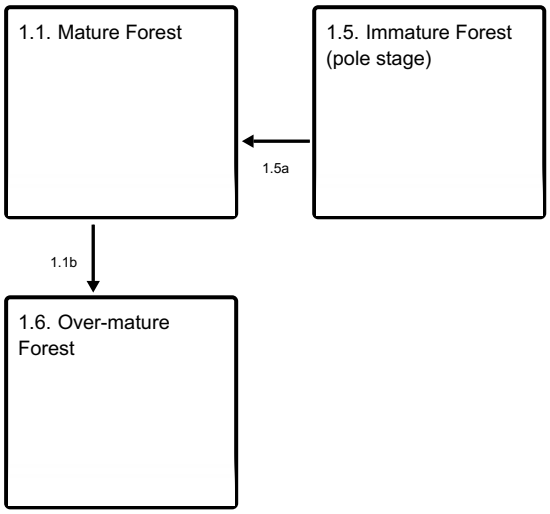
Ecosystem states



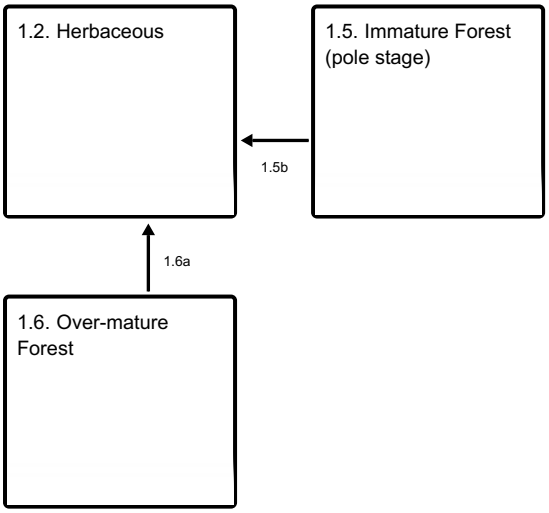
State 1 submodel, plant communities



Communities 1, 5 and 6 (additional pathways)



Communities 2, 5 and 6 (additional pathways)



State 1
Reference State

The reference state is representative of the natural range of variability under naturally stable, pre- European settlement conditions. The reference state has six community phases: herbaceous, shrub-herbaceous, sapling, immature forest (pole stage), mature forest and over mature forest. Community phases or seral stages are ecological responses to disturbance or absence from disturbance and are within the amplitude of natural variability of the reference state. The community phases of this state are dynamic in response to changes in weather patterns and disturbance regimes. Natural disturbances affecting this ecological site include flooding, drought, disease, insect attack and infrequent wildfire. Wildfire and flooding disturbances are important for stand maintenance. These disturbances prevent over-mature cottonwood stand and encourage seedling establishment and clonal reproduction. Sustaining an adequate level of ground water is important for maintaining the reference state. This ecological site is dependent on the availability of ground water, not annual precipitation for perpetuation of the stand.

Community 1.1
Mature Forest

The visual aspect of this community phase is dominated by cottonwoods that have reached or are near to maximal heights for the site. Tree heights range from 35 to 50 feet, depending on site and clonal genotype. Tree canopy ranges from 20 to 35 percent. Trees have developed tall, straight, clear stems with short, narrow dome-like crowns that develop greater at the edge of the stand. Dominant crown class ages range from 50 to about 100 years. Growth rates slow during this stage. Self-thinning is common as co-dominant, intermediate and suppressed classes are overtopped and lose competitive position. Despite considerable forage production in most cottonwood communities, the overstory canopy is highly competitive with the understory plants for moisture, light, nutrients and space. Even moderately shade tolerant shrubs undergo reduced growth and recruitment at this stage. Shade intolerant shrubs, such as willows, are drastically reduced when compared to earlier growth stages. Vegetative shoots and/or saplings of cottonwood occur in the understory, but they are inconspicuous and have a high mortality rate. Rapid growth rate and relatively young age of reproductive maturity of narrowleaf cottonwood can produce a mature forest community relatively quickly.

Forest overstory. Overstory tree canopy is dominated by narrowleaf cottonwood (Populus angustifolia) with up to 5% canopy cover of water birch (Betula occidentalis), and less than 1% black cottonwood (Populus balsamifera ssp. tricocarpa), western juniper (Juniperus occidentalis), quaking aspen (Populus tremuloides) or other trees may be present in the canopy.

Forest understory. Understory vegetative composition is about 50 percent grasses, 20 percent forbs and 30 percent shrubs and young trees when the average overstory canopy is medium. Common understory shrubs include Woods' rose (Rosa woodsii), willow species (Salix spp.), currant species (Ribes spp.) and skunkbrush sumac (Rhus trilobata). Young trees (<13 feet in height) can be found among the shrub-herbaceous understory and should be considered part of the understory production. Perennial native grasses common to this side include; Basin wildrye (Leymus cinereus), streambank wheatgrass (Elymus lanceolatus), tufted hairgrass (Deschampsia cespitosa) and bluegrass (Poa spp.). Forbs found in the understory may include milkvetch (Astragalus spp.), horsetail (Equisetum spp.), columbine (Aquilegia spp.) and aster (Aster spp.).

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	500	750	1500
Shrub/Vine	230	345	690
Forb	200	300	600
Tree	70	105	210
Total	**1000**	**1500**	**3000**

Community 1.2

Herbaceous

The visual aspect of this community phase is dominated by cottonwoods that have reached or are near to maximal heights for the site. Tree heights range from 35 to 50 feet, depending on site and clonal genotype. Tree canopy ranges from 20 to 35 percent. Trees have developed tall, straight, clear stems with short, narrow dome-like crowns that develop greater at the edge of the stand. Dominant crown class ages range from 50 to about 100 years. Growth rates slow during this stage. Self-thinning is common as co-dominant, intermediate and suppressed classes are overtopped and lose competitive position. Despite considerable forage production in most cottonwood communities, the overstory canopy is highly competitive with the understory plants for moisture, light, nutrients and space. Even moderately shade tolerant shrubs undergo reduced growth and recruitment at this stage. Shade intolerant shrubs, such as willows, are drastically reduced when compared to earlier growth stages. Vegetative shoots and/or saplings of cottonwood occur in the understory, but they are inconspicuous and have a high mortality rate. Rapid growth rate and relatively young age of reproductive maturity of narrowleaf cottonwood can produce a mature forest community relatively quickly.

Community 1.3
Shrub-Herbaceous

Shrub-Herbaceous- Herbaceous vegetation and woody shrubs dominate this community phase. Various amounts of tree seedlings (less than 20 inches in height) may be present up to the point where they are obviously a major component of the vegetal structure. Narrowleaf cottonwood is a rapidly growing pioneer species, but shade intolerant seedlings are not competitive with established vegetation (Gom and Rood 1999). Shrubs common to this community phase include shade intolerant, obligate initial community species; such as willows, skunkbrush, water birch and redosier dogwood. Water birch typically establishes on streamside floodplains second only to narrowleaf cottonwood. Perennial native forbs thrive in early seral conditions are a common in this community phase. Prolonged drought will result in an overall reduction in the herbaceous component of the plant community. Shrubs and deep rooted perennials persist under drought conditions.

Community 1.4
Sapling

In the absence of disturbance, the cottonwood seedlings and suckers develop into saplings with a canopy cover (trees greater than 13') of up to 10 percent. Cottonwood seedlings and suckers at this stage of development are characterized by a rapid growth rate. Understory vegetation consists of perennial grasses, perennial forbs and shrubs, shade intolerant species are common and vigorous. Narrowleaf cottonwood trees are shade intolerant and exclusion of less vigorous individuals are common at this stage of development. This community phase typically occurs in the years shortly following disturbance. Cottonwood seedlings and suckers typically arise over a period of several years, resulting in a even aged stand.

Community 1.5
Immature Forest (pole stage)

The visual aspect and vegetal structure are dominated by cottonwood trees. Understory vegetation is moderately influenced by a tree canopy of about 20 percent. Cottonwood stands are self-thinning, especially at young ages. This stage is characterized by rapid growth of the cottonwood trees, both in height and canopy. The branching pattern of a young tree is excurrent, with clearly defined main bole and conical crown (Burns and Honkala 1990).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 disproportionate number of trees, mostly those overtopped, dying within a short time. The visual aspect and vegetal structure are dominated by cottonwood greater than 20 feet in height. Willow species are not tolerant of shady condition and begin to experience reduced vigor and density during this stage of development. Narrow leaf cottonwood reaches reproductive maturity around 10 years of age (Braatne et al. 1996). Trees making up the dominant crow class in this community phase are beginning to reach reproductive maturity.

Community 1.6
Over-mature Forest

This stage is dominated by cottonwood trees that have reached maximal heights for the site. Trees have straight,

clear stems with short, high-rounded crowns. Tree canopy cover is greater than 35 percent. Understory production and composition are influenced by the overstory shading, duff accumulation and competition for water and nutrients. Growth rates have slowed considerably. Shade tolerant forbs, including sweetroot and horsetail persist. Dominant perennial grasses, mountain brome, basin wildrye and wheatgrass, occur in minor amounts. Shade tolerant shrubs that persist throughout the successional process include Woods' rose, redoiser dogwood and currant. Without periodic wildfire, flood or other naturally occurring disturbances, the tree canopy on this site can become quite dense. In the absence of disturbance, over-mature, even-aged stands slowly die and create canopy gaps. 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. Narrowleaf cottonwoods are capable of reaching ages of up to 200 years

Pathway 1.1a
Community 1.1 to 1.2

Stand replacing fire, harvest, flood or other large scale disturbance that removes canopy cover of mature trees

Pathway 1.1b
Community 1.1 to 1.6

Absence from disturbance, slowing of growth rates and lack of wide spread cottonwood reproduction

Pathway 1.2a
Community 1.2 to 1.3

Natural regeneration and absence from disturbance

Pathway 1.3b
Community 1.3 to 1.2

Fire, flood or other disturbance that removes tree seedlings and other woody perennials

Pathway 1.3a
Community 1.3 to 1.4

Natural regeneration and absence from disturbance

Pathway 1.4b
Community 1.4 to 1.2

Fire, flood or other stand replacing disturbance

Pathway 1.4a
Community 1.4 to 1.5

Natural regeneration and absence from disturbance

Pathway 1.5a
Community 1.5 to 1.1

Natural regeneration and absence from disturbance

Pathway 1.5b
Community 1.5 to 1.2

Fire, flood or other stand replacing disturbance

Pathway 1.5c

Community 1.5 to 1.4

Low intensity fire, flood, insect attack, disease and/or partial blow down

Pathway 1.6a
Community 1.6 to 1.2

Fire, flood or other stand replacing disturbance

Pathway 1.6b
Community 1.6 to 1.4

Low intensity fire, flood, insect attack, disease and/or partial blow down

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 Perennial Grasses**			400–1200	
	basin wildrye	LECI4	*Leymus cinereus*	150–350	–
	bluegrass	POA	*Poa*	150–350	–
	mountain brome	BRMA4	*Bromus marginatus*	75–130	–
	thickspike wheatgrass	ELLA3	*Elymus lanceolatus*	75–130	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	75–130	–
2	**Secondary Perennial Grasses/Grasslikes**			50–225	
	Nebraska sedge	CANE2	*Carex nebrascensis*	15–75	–
	tufted hairgrass	DECE	*Deschampsia cespitosa*	15–75	–
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	15–75	–
Forb					
3	**Perennial Forbs**			200–600	
	columbine	AQUIL	*Aquilegia*	75–130	–
	aster	ASTER	*Aster*	75–130	–
	milkvetch	ASTRA	*Astragalus*	75–130	–
	horsetail	EQUIS	*Equisetum*	15–75	–
	starry false lily of the valley	MAST4	*Maianthemum stellatum*	15–75	–
	western sweetroot	OSOC	*Osmorhiza occidentalis*	15–75	–
	stinging nettle	URDI	*Urtica dioica*	15–75	–
Shrub/Vine					
4	**Primary Shrubs**			115–275	
	skunkbush sumac	RHTR	*Rhus trilobata*	75–135	–
	Woods' rose	ROWO	*Rosa woodsii*	75–135	–
5	**Secondary Shrubs**			150–525	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	15–75	–
	redosier dogwood	COSE16	*Cornus sericea*	15–75	–
	creeping barberry	MARE11	*Mahonia repens*	15–75	–
	chokecherry	PRVI	*Prunus virginiana*	15–75	–
	Booth's willow	SABO2	*Salix boothii*	15–75	–
	narrowleaf willow	SAEX	*Salix exigua*	15–75	–
	shining willow	SALU	*Salix lucida*	15–75	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	1–15	–
Tree					
6	**Trees**			30–200	
	water birch	BEOC2	*Betula occidentalis*	15–75	–
	narrowleaf cottonwood	POAN3	*Populus angustifolia*	15–75	–
	black cottonwood	POBAT	*Populus balsamifera ssp. trichocarpa*	1–15	–
	quaking aspen	POTR5	*Populus tremuloides*	1–15	–

Table 7. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
narrowleaf cottonwood	POAN3	*Populus angustifolia*	Native	–	90–95	–	–
water birch	BEOC2	*Betula occidentalis*	Native	–	1–5	–	–
black cottonwood	POBAT	*Populus balsamifera ssp. trichocarpa*	Native	–	1–3	–	–

Animal community

Livestock: This site is suited to light to moderate cattle and sheep grazing during the summer and early fall. Livestock use this ecological site for forage, shade and a water source. Browsing has a direct impact on cottonwood. Through the early sapling stage, browsing reduces growth, vigor and numbers. If grazing by cattle is light to moderate, the effect on aspen will be also. This, however, is less true for sheep. Heavy browsing by sheep can eliminate cottonwood sucker regeneration. Grazing management should allow saplings to attain a minimum height of 55 to 60 inches before use to prevent destructive browsing by livestock. Harvesting trees under a sound management can open up the tree canopy to allow increased production of understory species desirable for grazing and browsing.

Mountain brome is an excellent grazing plant for cattle and horses, but cannot withstand heavy late-season grazing pressure. Basin wildrye is a valuable forage for livestock, due to it early growth and abundant production. It is readily grazed by cattle and horses in the early spring. Nutritional content and moisture of basin wildrye generally decreases as the plant matures throughout the growing season. Slender wheatgrass is grazed by all classes of livestock and is readily used when available. Streambank wheatgrass is highly palatable to livestock in the spring. Palatability decreases as the season progresses. Its extensive rhizomes allow established stands to withstand grazing and trampling pressure. Perennial forbs are occasionally used by domestic livestock. Palatability of columbine is fair for domestic sheep, but unpalatable to poor for cattle and horses. The palatability of milkvetch species growing on this site are undocumented at this time, but many milkvetch species are toxic to livestock. Willow species are moderately palatable to domestic livestock. Skunkbrush sumac is occasionally browsed by domestic livestock, but is generally considered to have poor palatability. Wood’s rose is considered to be fairly good livestock forage, especially for domestic sheep. Currant is considered to have fair palatability for cattle, horses and domestic sheep. Palatability of basin big sagebrush is low. It serves as an emergency food source for domestic livestock in the winter months, but is not usually sought out by livestock.

Wildlife:

Narrowleaf cottonwood communities provided habitat, food and cover for a variety of wildlife. Common inhabitants include small mammals, beavers, bears, wild ungulates and many bird species. Twigs and leaves are browsed by rabbits, deer and mouse. The buds and catkins are preferred by quail and grouse. Beavers use all age classes of cottonwood to build and maintain lodges and dams, as well as, using the bark for immediate food or storage in winter caches (USDA-NRCS). Because of the presence of water either at or near the surface, riparian systems are the most productive habitats in the state. This includes production of seeds, fruits, insects, arthropods, reptiles, amphibians, and vegetation for wildlife food, and often abundant plant growth that provides nest and den sites, cavity sites, hiding cover, and thermal cover. Another critical function of riparian areas is to provide corridors for either long-distance migration (birds, bats) or short-distance wildlife movements (e.g., deer, bobcat). By facilitating such movements, riparian corridors connect populations and improve the genetic health of wildlife populations. Wetted backwaters along streams provide excellent habitat for amphibian species, provided that these areas receive adequate water during high flows in the spring. Because of the relative scarcity of aquatic systems in Nevada’s landscape, and the naturally disconnected and fragmented nature of these systems in an arid climate, individual lotic systems in this habitat type become critically important for aquatic species because of the unique species and species assemblages that they support. Healthy narrowleaf cottonwood communities benefit all types of wildlife indirectly through maintenance of healthy streamside habitats (Simonin 2001).

Heavy browsing by sheep or deer can eliminate cottonwood sucker regeneration. Wild ungulates prefer narrowleaf cottonwood throughout most of its range. Suckers can be drastically reduced or eliminated by big game browsing on winter ranges. Basin wildrye provides winter forage for elk and mule deer, although palatably is greatest in the spring. Basin wildrye remains green and is commonly used by small mammals throughout the summer. The palatably of mountain brome is good to excellent for wildlife, it is used by deer, elk and pronghorn. The seedheads provide food for many birds and small mammals. Slender wheatgrass is eaten by various wildlife species and is preferred forage of elk and bighorn sheep. Streambank wheatgrass is palatable to all classes and wildlife,

especially in the spring. It is used occasionally in the fall and winter. Streambank wheatgrass also provided fair to good cover for small mammals, small nongame birds, upland gamebirds and waterfowl.
Willow species are considered to be high palatable to deer, elk, beaver and moose. The fruits of Woods' rose are a good source of energy and protein and are eaten by small mammals, wild ungulates, birds and other wildlife. Skunkbrush sumac is browsed by elk, bighorn sheep, pronghorn and mule deer. It is also utilized by small mammals, including porcupines, jackrabbits and cottontails. The fruits are an important winter food source for a variety of birds including; songbirds, sage-grouse and quail. Black bears also eat the fruits. Currant provides food and cover for wildlife. It is only fair browse, but is important where little else is available. Basin big sagebrush is readily used by sage grouse, mule deer and pronghorn. It serves as an emergency food source in the winter months, although it is considered to be the least palatable of big sagebrush species.

Hydrological functions

The hydrologic cover condition of this site is fair in a representative stand. The average runoff curve is about 55 for group B soils. (See Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves.)

Recreational uses

Aesthetic value is derived from the rich hues and textures of cottonwood 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.

Wood products

Narrowleaf cottonwood is strong, light weight and resistant to impact and splitting, but is susceptible to decay. Historically, it was used for crates, boxes and pallets.

Other information

Native Americans used redosier dogwood for a variety of purposes. Tribes ate the white sour berries, used the branches for bow and arrow-making, stakes, baskets and other tools. Peeled twigs were used as toothbrushes for their whitening effect on teeth and the inner bark was used for tanning and drying hides. Several tribes used the bark in a tobacco mixture smoked in the sacred pipe ceremony. Dogwood was also used a tonic, a laxative, emetic and cathartic by Native Americans (Stevens and Dozier 2002).

Inventory data references

NASIS soil component data.

Type locality

Location 1: White Pine County, NV	
Township/Range/Section	T16N R66E S28
UTM zone	N
UTM northing	4343991
UTM easting	710659
Latitude	39° 13′ 10″
Longitude	114° 33′ 35″
General legal description	Humbolt-Toiyabe National Forest, east side of the Schell Creek Range.

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Contributors

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Approval

Kendra Moseley, 2/19/2025

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	05/12/2025
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:

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

decadence):

---

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:**
