Ecological site R036XB017NM
Swale

Accessed: 04/26/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

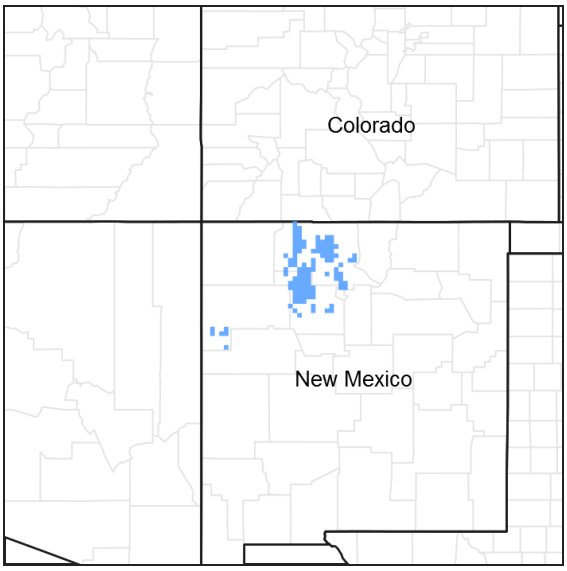

Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 036X–Southwestern Plateaus, Mesas, and Foothills

R036XB017NM – Swale is an ecological site that on flood plains, alluvial fans, valley floors, valley flats, stream terraces, broad valley bottoms, depressions (swales) and other low-lying areas which receive runoff moisture from adjacent sites in MLRA 36 (Southwestern Plateaus Mesas and Foothills). The southern portion MLRA 36 is illustrated yellow color on the map where this site occurs. The site concept was established in the Southwestern Plateaus. Mesas, and Foothills – Warm Semiarid Mesas and Plateaus LRU (Land Resource Area). This LRU has 10 to 16 inches of precipitation and has a mesic temperature regime. Lower part of MLRA 36 is dominated by summer precipitation for monsoons, unlike the upper part of MLRA 36 which is almost an equal split.

Classification relationships

NRCS & BLM:
Major Land Resource Area 36, Southwestern Plateaus Mesas and Foothills (United States Department of Agriculture, Natural Resources Conservation Service, 2006).

USFS:
313Bd Chaco Basin High Desert Shrubland and 313Be San Juan Basin North subsections < 313B Navaho Canyonlands Section < 313 Colorado Plateau Semi-Desert (Cleland, et al., 2007).

315Ha Central Rio Grande Intermontane, and 315Hb North Central Rio Grande Intermontane subsections <315H Central Rio Grande Intermontane Section < 315 Southwest Plateau and Plains Dry Steppe and Shrub (Cleland, et al., 2007).

315Ad Chupadera High Plains Grassland subsections <315A Pecos Valley Section < 315 Southwest Plateau and Plains Dry Steppe and Shrub (Cleland, et al., 2007).

331Jb San Luis Hills and 331Jd Southern San Luis Grasslands subsections <331J Northern Rio Grande Basin Section < 331 Great Plains- Palouse Dry Steppe (Cleland, et al., 2007).

M313Bd Manzano Mountains Woodland subsection < Sacramento-Monzano Mountains Section < M313 Arizona-New Mexico Mountains Semi-Desert - Open Woodland - Coniferous Forest - Alpine Meadow

M331Fg Sangre de Cristo Mountains Woodland and M331Fh Sangre de Cristo Mountains Coniferous Forest subsection < M331F Southern Parks and Rocky Mountain Range Section< M331 Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow

M331Gk Brazos Uplift and M331Gm Jemez and San Pedro Mountains Coniferous Forest subsections < M331G South Central Highlands Section < M331 Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow

EPA:
21d Foothill Shrublands and 21f Sedimentary Mid-Elevation Forests < 21 Southern Rockies < 6.2 Western Cordillera < 6 Northwestern Forested Mountains (Griffith, 2006).

20c Semiarid Benchlands and Canyonlands < 20 Colorado Plateaus < 10.1 Cold Deserts < 10 North American Deserts (Griffith, 2006).

22m Albuquerque Basin, 22i San Juan/Chaco Tablelands and Mesas, 22h North Central New Mexico Valleys and Mesas, 22f Taos Plateau, and 22g Rio Grande Floodplain, < 22 Arizona/New Mexico Plateau < 10.1 Cold Deserts < 10 North American Deserts (Griffith, 2006).

USGS:
Colorado Plateau Province (Navajo and Datil Section) Southern Rocky Mountains
Basin and Range (Mexican Highland and Sacramento Section)

Ecological site concept

The 36XB ecological site was drafted from the existing R036XB008NM – Meadow range site MLRA 36XB (NRCS, 2003). This site is commonly located on flood plains, alluvial fans, valley floors, valley flats, stream terraces, broad valley bottoms, depressions (swales) and other low-lying areas which receive runoff moisture from adjacent sites. The soils are deep. The surface layers are silty clay loam, clay loam, silt loam, and fine sandy loam with clay ranging from 18-38%. Subsurface layers range in clay from 32-50%. It has an aridic ustic/ustic arid moisture regime and mesic temperature regime. The effective precipitation ranges from 10 to 16 inches.

Associated sites

F036XA001NM	**Pinyon Upland** Pinyon Upland (south of Gallup 13-16) - Slope 1-35%; Soils are very shallow to shallow and non-skeletal; soil surface is loam, channery loam or clay loam. Landforms are broad mesas, cuestas, and hills interspersed with numerous deep canyons and dry washes.
F036XB133NM	**Pinyon-Utah juniper/skunkbush sumac** Pinyon-Juniper/Skunkbush Sumac - Slopes are 1-65%; Soils are moderately deep to deep and skeletal and non-skeletal. Surface texture of gravelly to very gravelly sandy loam, very gravelly loam, loam, para-gravelly-ashy loamy coarse sand, and extremely cobbly coarse sandy loam with a sandy subsoil. Landform is mesas, hills, fan piedmonts, valley sides, plateaus, mountain slopes, structural benches, breaks and ridges.

R036XB002NM	**Clayey** Clayey - Slopes are 0-15%; Soils are moderately deep to deep; soil surface loam, clay loam, silty clay loam, and silty clay over clayey subsoil with textures of clay loam, clay to silty clay loam or silty clay. Landforms are stream terraces, valley floors, fan remnants, alluvial fans, dipslopes on cuestas, mesas, hills, and valley floors.
R036XB005NM	**Limy** Limy - Calcareous (very calcareous throughout the profile); Slopes are 3-8%; soils are deep; surface is generally a silt loam and subsoil textures range from loam to silt loam. Landforms are gently alluvial fans and valley sides.
R036XB006NM	**Loamy** Loamy - Slopes are 1-15%; Soils are moderately deep to deep; soil surface range from loam, gravelly loam, loamy fine sand, fine sandy loam, sandy loam, silt loam and clay loam. Subsoil is loamy and range from loam to clay loam. Landforms are mesas, plateaus, fan remnant, terraces, dipslopes on cuestas, and broad upland valley sides.
R036XB008NM	**Meadow** Meadow - Water table 28-72” in depth; slopes 1-5%; soils are deep, Surface textures are silty clay loam, and clay loam with a subsoil of stratified loams, silt loams, silty clay loams, clay loams, very gravelly sand and gravelly sand. Landform is nearly level to gently sloping floodplains.
R036XB009NM	**Salt Meadow** Water table 36-72” in depth; slopes are 1-5%; soils are deep, Surface textures are loam, fine sandy loam, clay loam, silty clay loam with a subsoil of clay or clay loam. Landform is nearly level to gently sloping floodplains. This site is dependent on sub-irrigation and overflow for its moist condition. This site is affected by sodium.
R036XB010NM	**Salty Bottomland** Water table 42-72” in depth; soils are deep, high in sodium, soils are gravelly to skeletal (15-35% rock fragments). Surface textures are loam, fine sandy loam, clay loam and silty clay loam with a subsoil of clay or clay loam. Landform is floodplain.
R036XB011NM	**Sandy** Sandy - Slopes are 1-15%; soils are deep to very deep; Surface textures are loamy sand, gravelly loamy sand, loamy fine sand, fine sandy loam and sandy loam with sandy subsoil. Landforms are nearly level to gently sloping landscapes on dunes, fan remnant and alluvial fans.
R036XB132NM	**Gravelly Hills** Gravelly Hills - Slopes are (10-65%); Soils are very deep and skeletal and non-skeletal. Surface texture of gravelly to very gravelly fine sandy loam, very gravelly sandy loam, very cobbly loam, or gravelly loam with a sandy subsoil. Landforms are escarpments, fan piedmonts, mesas, hills, ridges and knolls.

Similar sites

R036XB008NM	**Meadow** Meadow - Water table 28-72” in depth; slopes 1-5%; soils are deep, Surface textures are silty clay loam, and clay loam with a subsoil of stratified loams, silt loams, silty clay loams, clay loams, very gravelly sand and gravelly sand. Landform is nearly level to gently sloping floodplains.
R036XB009NM	**Salt Meadow** Water table 36-72” in depth; slopes are 1-5%; soils are deep, Surface textures are loam, fine sandy loam, clay loam, silty clay loam with a subsoil of clay or clay loam. Landform is nearly level to gently sloping floodplains. This site is dependent on sub-irrigation and overflow for its moist condition. This site is affected by sodium.
R036XB010NM	**Salty Bottomland** Water table 42-72” in depth; soils are deep, high in sodium, soils are gravelly to skeletal (15-35% rock fragments). Surface textures are loam, fine sandy loam, clay loam and silty clay loam with a subsoil of clay or clay loam. Landform is floodplain.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This site occurs on flood plains, alluvial fans, valley floors, valley flats, stream terraces, broad valley bottoms,depressions (swales) and other low-lying areas which receive runoff moisture from adjacent sites. Slopes range from 0 to 5 percent. Elevation ranges from 6,400 to 7,800 feet above sea level.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Alluvial fan (3) Valley floor
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	Rare to frequent
Ponding frequency	None
Elevation	6,400–7,800 ft
Slope	0–5%
Aspect	Aspect is not a significant factor

Climatic features

This site has a semi-arid continental climate. There are distinct seasonal temperature variations. Mean annual precipitation varies from 10 to 16 inches. The overall climate is characterized by cold dry winters in which winter moisture is less than summer. Wide yearly and seasonal fluctuations are common for this climatic zone which can range from 5 to 25 inches. Of this, approximately 25-35% falls as snow, and 65-75% falls as rain between April 1 and November 1. The growing season is April through September. As much as half or more of the annual precipitation can be expected to come during the period of July through September. August is typically the wettest month of the year. The driest period is usually from November to April; and February is normally the driest month. During July, August, and September, 4 to 6 inches of precipitation influence the presence and production of warm-season plants. Fall and spring moisture is conducive to the growth of cool-season herbaceous plants and maximum shrub growth. Growth usually begins in March and ends with plant maturity and seed dissemination when the moisture deficiency and warmer temperatures occur in early June. There is also a period of growth in the fall. Summer precipitation is characterized by brief thunderstorms, normally occurring in the afternoon and evening. Winter moisture usually occurs as snow, which seldom lies on the ground for more than a few days. The average annual total snowfall is 29.1 inches. The snow depth usually ranges from 0 to 1 inches during the winter months. The highest snowfall record is 57.1 inches during the 1993-1994 winter. The frost- free period typically ranges from 110 to 145 days and the freeze free period is from 140 to 170 days. The last spring freeze is the middle of April to the first week of May. The first fall freeze is the middle of October to the first week of November. Mean daily annual air temperature is about 29ºF to 69ºF, averaging about 37ºF for the winter and 67ºF in the summer. The coldest winter temperature recorded was -20ºF on January 6, 1971 and the warmest winter temperature recorded was 70ºF on February 28, 1965. The coldest summer temperature recorded was 26ºF on June 1, 1980. The hottest day on record is 100ºF on July 9, 2003 and June 21, 1968. Data taken from Western Regional Climate Center (2017) for El Rito, New Mexico Climate Station.

Table 3. Representative climatic features

Frost-free period (average)	126 days
Freeze-free period (average)	145 days
Precipitation total (average)	13 in

Climate stations used

- (1) ABIQUIU DAM [USC00290041], Gallina, NM
- (2) CUBA [USC00292241], Cuba, NM
- (3) EL RITO [USC00292820], El Rito, NM

- (4) NAVAJO DAM [USC00296061], Navajo Dam, NM
- (5) SANTA FE 2 [USC00298085], Santa Fe, NM
- (6) LYBROOK [USC00295290], Dulce, NM
- (7) COCHITI DAM [USC00291982], Pena Blanca, NM

Influencing water features

This site may be influenced by water from a wetland or stream. Some overflow flooding may occur. It occurs in a run-in position on the landscape.

Soil features

The soils are deep from recent alluvium, stream alluvium from igneous, sedimentary (shale and sandstone) and/or volcanic rocks, alluvium from shale and/or sandstone. The surface layers are silty clay loam, clay loam, silt loam, and fine sandy loam with clay ranging from 18-38%. Subsurface layers range in clay from 32-50%. The minimum depth to a water table is greater than 6 feet.

This ecological site is associated with the map units and soil components in the soil surveys listed below. Future updates to this soil survey may affect these associations. For up-to-date associations between soil components and this ecological site, refer to NASIS. Associations between ecological sites and soil components are maintained in NASIS via the ecological site ID.

This site is found in NM606, NM678, NM656 NM672, NM698 and NM650 soil survey. This ecological site has been correlated to the following soils with the listed particle control sections:

Fine-Loamy:
Hickman, Manzano, Teromote

Fine-Silty
Billings

Fine:
Ruson, Sparham

Table 4. Representative soil features

Parent material	(1) Alluvium–shale (2) Alluvium–sandstone and shale
Surface texture	(1) Silty clay loam (2) Clay loam (3) Silt loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Very slow to moderate
Soil depth	60 in
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	4.9–7.1 in
Calcium carbonate equivalent (0-40in)	0–10%
Electrical conductivity (0-40in)	0–4 mmhos/cm
Sodium adsorption ratio (0-40in)	0–5

Soil reaction (1:1 water) (0-40in)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

MLRA 36 occurs on the higher elevation portion of the Colorado Plateau. The Colorado Plateau is a physiographic province which exists throughout eastern Utah, western Colorado, western New Mexico and northern Arizona. It is characterized by uplifted plateaus, canyons and eroded features. The Colorado Plateau lies south of the Uintah Mountains, north of the Mogollon transition area, west of the Rocky Mountains, and east of the central Utah highlands. The higher elevation portion of the Colorado Plateau which is represented by MLRA 36 is characterize by broken topography, and lack of perennial water sources. This area has a long history of past prehistoric human use for years. MLRA 36 shows archaeological evidence indicating that pinyon-juniper woodlands where modified by prehistoric humans and not pristine and thus where altered at the time of European settlement (Cartledge & Propper, 1993). This area also included natural influences of herbivory, fire, and climate. This area rarely served as habitat for large herds of native herbivores or large frequent historic fires due to the broken topography. This site is extremely variable and plant community composition will vary with the water fluctuations on this site.

The lower part MLRA 36 developed under climatic conditions that include hot, dry summers with summer rains showers and little to no snow with the mild winter temperatures. This area has climatic fluctuations and prolonged droughts are common occurrences. Between an above average year and a drought year. Forbs are the most dynamic component of this community and can vary up to 4 fold (Passey et.al. 1982). The precipitation and climate of MLRA 36 are conducive to producing Pinyon/juniper, and sagebrush complexes with high productive sites in the bottoms of the canyons. Predominant species on the Colorado Plateau are Wyoming big sagebrush (*Artemisia tridentata* var. wyomingensis), mountain big sagebrush (*A. tridentata* var. vaseyana), and black sagebrush (*A. nova*), basin big sagebrush (*A. tridentata* var. tridentata), Utah juniper (Juniperus utahensis), one-seed juniper (*Juniperus monosperma*), and two-needle pinyon (*Pinus edulis*). One-seed juniper has the capability to discontinue active growth when moisture is limited but can resume growth when moisture availability improves. This growth pattern may represent an important adaptation allowing them to survive on very arid sites. It is possible that small trees may be killed by drought; mature one-seed junipers are resilient to drought, especially in comparison to two-needle pinyon (Johnsen, 1962).

This ecological site is located in draws, small valley bottoms and drainage-ways on the Colorado Plateau. Herbivory and fire are the dominant disturbance factors in the sagebrush biome (Boyd et. al., 2014). Removal or repeatedly detrimental application of either of these disturbances on the system and/or the landscape can result in a shift of the ecological dynamics of this system. The ecological dynamics of the associated uplands are influential to the dynamics of this site. Excessive runoff and erosion from degraded uplands can increase concentrated flow and increased potential erosion towards gully formation. This site is located in the bottoms where fire occurred more frequently, removing brush and keeping it in a grassland state.

The plant community on this site is very productive and relatively resilient compared to its surrounding uplands. It has deep soils with good water holding capacity that receive a large amount of moisture from run-in and overflow water. Because of these factors many of these sites are now or once were cleared and converted to agricultural lands depending on their accessibility.

This site is dominated by perennial grasses but shrub species are present with Basin Big Sagebrush. Although, this site evolved with grazing and is relatively durable, it will be affected negatively with continuous heavy grazing pressure. Livestock are attracted to these sites because they are so productive and these sites lie in low areas with gentle slopes. Proper distribution of livestock is critical. Appropriate placement of fencing, water, and salt/supplement is necessary. Heavy grazing combined with drought and/or lack of fire, will cause this site to become shrub dominant. As shrubs increase and perennials are weakened due to heavy grazing and/or drought, undesirable annuals such as cheatgrass may invade the site. As perennial grasses with fibrous root systems are

replaced by weaker annuals, erosion may occur more rapidly. Runoff from the uplands can cause channels to form and incise dropping the water table. As soils dry out, greasewood may begin to invade into these sites. This seems to occur more frequently at lower elevations.

Soils, topographic location, climate, periodic droughts and fire influenced the stabilization of the Reference State on this site as was the case on most drainage-ways and draws ecological sites. The Reference State is presumed to be as found by European settlers in the early 1800's developed under the prevailing climate over time along with the soils in their topographic location. Grazing and/or browsing by wildlife influenced the plant community as well. Sagebrush below 8500 feet has been slower to recover from settlement of the west (Winward, 2004). This site has been found to have basin big sagebrush.

Fire size prior to 1850 were most likely a large number of small to medium size mosaic burns and since 1980 can be typified by a few very large fires due to human caused changes (Evers, et al, 2011). This change in fire return intervals and intensities was cause by fire suppression and reduced fine-fuels from livestock grazing practices around the late 1800’s and early 1900’s. Since fire is not always available to be applied, then other shrub management may necessary from time to time to help keep the community in balance. Treatment response will vary among sites due to differences in vegetation composition and abundance, soils, elevation, aspect, slope and climate (McIver, et al, 2010).

Natural fire played an important role in the function of most upland sites. Fire keeps sagebrush stands from getting too dense, while invigorating other sprouting shrubs. Fire helped to keep a balance between the grasses, forbs and shrubs. Plant community dynamics were improved by opening up canopies and stimulating forb growth creating a mosaic of different age classes and species composition. Shrubs which re-sprout (yellow rabbitbrush, rubber rabbitbrush), are suppressed for a time allowing grasses to dominate. If periodic fire or some other method of brush control is not used, then sagebrush will slowly increase and can begin to dominate the site.

There has been shrub die-off in several sagebrush taxa in the past 10-15 years due to several factors. The two dominant factors are disease/pathogens and drought. Die-off due to disease/pathogens is believed to be tied to disease or stem/root pathogens occurring in dense over-mature sagebrush stands throughout the west. While in some areas, when the factors of drought and heavy browsing occurring in conjunction with disease/pathogens complete areas are dying.

Small wet areas can occur occasionally when the bottoms are very narrow and small, allowing for more water accumulation. This may support willows, sedges and rushes and may be a small inclusion of a wet meadow or salt meadow ecological site. Cottonwoods (Fremont and/or Narrowleaf) can occasionally be found in these inclusion areas. Cottonwood are reported to be a facultative wetland species which are tolerant of frequent and prolonged flooding and are not drought resistant (Simonin, 2001). This site is typically too dry to sustain cottonwoods.

A weedy community that has not been depicted on the model can arise if domestic grazing is completely excluded or if there is repetitive, season-long, heavy domestic or wild ungulate use. With grazing exclusion, a thick thatch of residual litter build-up results in shading and a reduction of health, vigor and production of all plants. Improper domestic and wild ungulate grazing use results in preferred species being repeatedly clipped which decreases their health, vigor and production. Both make a site susceptible to invasion by noxious and/ unsuited species.

Few, of any fire histories have been conducted on basin big sagebrush. It is suggests that fire return intervals in basin big sagebrush are intermediate between mountain big sagebrush and Wyoming big sagebrush (Tirmenstein, 1999). Wyoming big sagebrush communities are less prone to fire than mountain big sagebrush. Wyoming big sagebrush communities in the western United States have fire return intervals ranging from 10-115 years (West and Hassan 1985, Evers, et al, 2011, Johnson, 2000). Fire return intervals for Wyoming big sagebrush vary greatly depending on locale differences in precipitation and temperature. The fire return interval habitats with mountain big sagebrush is 10 to 40 years (Boyd et. al., 2014, Johnson, 2000). Johnson (2000) states that basin big sagebrush fire regime is 12 to 43 years. LANDFIRE models fire regimes of Basin and Wyoming Big Sagebrush communities have been found to have a fire interval of 33 to 116 years (USDA, 2012). LANDFIRE data is for general vegetation types in the United States: no specific data for basin big sagebrush dominated sites exist on Colorado Plateau at available at this time.

Variability in climate, soils, aspect and complex biological processes will cause the plant communities to differ. These factors contributing to annual production variability include wildlife use, drought, and insects. Factors

contributing to special variability include soil texture, depth, rock fragments, slope, aspect, and micro-topography. The species lists are representative and not a complete list of all occurring or potentially occurring species on this site. The species lists are not intended to cover the full range of conditions, species and responses of the site. The State & Transition model depicted for this site is based on available research, field observations and interpretations by experts and could change as knowledge increases. As more data is collected, some of these plant communities may be revised or removed, and new ones may be added. The following diagram does not necessarily depict all the transitions and states that this site may exhibit, but it does show some of the most common plant communities.

State and transition model

R036XY017NM – Swale

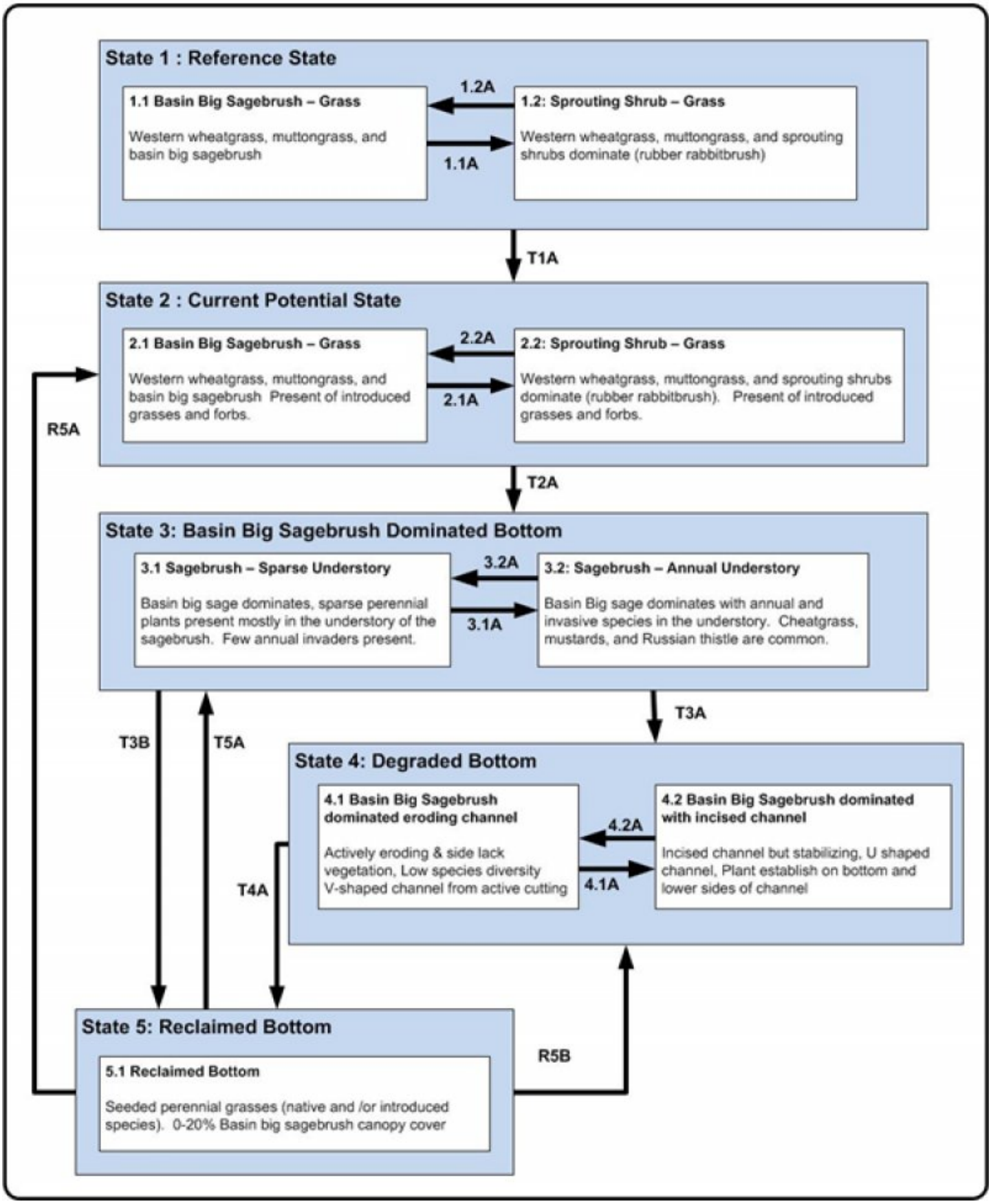

Figure 6. STM

Legend

1.1A, 2.1A – disturbance, fire, insect outbreak, prolonged drought, improper grazing

1.2A, 2.2A – time without disturbance, lack of fire, wetter climatic cycles, proper grazing

T1A – Establishment of non-native invasive plants

T2A, T3A, T5A, R5B – Improper grazing, drought, lack of fire, lack of disturbance,

3.1A – lack of fire, lack of disturbance, invasive annuals increase

3.2A - proper grazing of understory species, insect out break, wetter climatic cycles

T3B, 4.1A, T4A, R5A – reseeding, brush management, proper grazing, erosion control structures

4.2A – disturbance, fire, insect outbreak, prolonged drought, improper grazing, large flow events

Figure 7. legend

State 1
Reference State

The reference state contains plant communities presumed to occur prior to the introduction of nonnative plants, livestock grazing, and other modern disturbances. Basin big sagebrush dominance depends on time since fire, insect outbreak or extended drought. In both communities the grasses are the dominant component. It is a very diverse community with 10-20 or more species present throughout the site. This diversity adds to a site's stability. Often, decreasing diversity can be one of the first indicators of site deterioration. Key species that indicate a pristine and functioning system include. Species that often act as increasers with disturbance and indicate a deteriorating site include: basin big sagebrush, white sagebrush, squirreltail, foxtail barley, broom snakeweed, and rabbitbrush. This site has less than 20% big sagebrush canopy cover. The percentage of shrubs in this state will fluctuate depending on frequency and intensity of disturbances such as fire, or grazing. Typically the sage brush increases until fire is introduced to the system. Following the fire, rabbitbrush and annual forbs will increase creating a rabbitbrush phase that will be phased out as perennial grasses and sagebrush reestablish themselves Grazing distribution on adjacent sites may be a problem since grazing animals are attracted to this site due to early green-up. Such continuous, heavy grazing pressure, as well as trampling damage on wet soils, may lead to deterioration of the potential plant community. The result is a decrease in western wheatgrass, spike muhly, muttongrass, prairie junegrass, and fourwing saltbush. Plant species that increase include blue grama, mat muhly, basin big sagebrush, rubber rabbitbrush, and broom snakeweed. Serious deterioration is represented by a sodbound cover of blue grama or total dominance by basin big sagebrush, both in low in production.

Community 1.1
Basin Big Sagebrush-Grass

Typically, this is a grassland site with scattered shrubs. Western wheatgrass is the dominant grass on this site with basin big sagebrush and fourwing saltbush providing a shrub savannah aspect. Forbs are a minor component on the site.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	680	1063	1445
Shrub/Vine	80	125	170
Forb	40	62	85
Total	**800**	**1250**	**1700**

Table 6. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	3-13%
Grass/grasslike basal cover	25-35%
Forb basal cover	1-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	25-35%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	32-43%

Figure 9. Plant community growth curve (percent production by month). NM0017, R036XB017NM Swale HCPC. R036XB017NM Swale HCPC Grassland with scattered shrubs and a minor forb component..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	5	10	10	25	30	12	5	0	0

Community 1.2
Sprouting Shrub – Grass

Sprouting shrubs make up most of the shrub component. Rabbitbrush is a re-sprouter and will increase after disturbance. This phase is usually the result of fire that eliminates basin big sagebrush dominance for the space of several years. Sagebrush will begin to re-establish in the community following fire, and will steadily increase in the community until it becomes co-dominant with the perennial grass. However it can be difficult to move this community back to the community phase 1.1.

Pathway 1.1A
Community 1.1 to 1.2

Sprouting shrubs increase due to disturbance. Stand-replacing fire of sagebrush is the most common historical cause of this community pathway. Sagebrush decreases and perennial grasses, forbs, and sprouting shrubs (i.e. rabbitbrush) dominate the site. Insect outbreak, low intensity fires, and prolonged drought may also result in a substantial decrease in sagebrush, but do not necessarily eliminate it from the community. Repetitive burning of big sagebrush favors rabbitbrush and perennial grasses. Mechanical and chemical removal of sagebrush can often release rabbitbrush on this site. This may be a timing of treatment issue or one related to the weather patterns in years surrounding the treatment. Chemical treatment, physical means (i.e. mowing) and/or prescribed fire often are attempted to remove invading sagebrush.

Pathway 1.2A

Community 1.2 to 1.1

This pathway results from the establishment and natural increase of basin big sagebrush into the plant community years following a fire. Proper grazing use, herbivory on sprouting shrubs, and time should allow this community to transition to plant community 1.1. Brush management practices may be necessary if the rabbitbrush and bareground has increased. Repetitive brush treatment may be needed.

State 2
Current Potential State

The current potential state is similar to the reference state, however invasive species are present in all community phases. This state is generally dominated by big sagebrush, however depending on disturbance history, native grasses, forbs, or other shrubs may dominate the site. Primary disturbance mechanisms include fire, native herbivore grazing, insect outbreak, domestic livestock grazing and surface disturbances, (i.e. road and pipeline development and off road vehicle (OHV) use). Timing of these disturbances dictates the ecological dynamics that occur. The current potential state is self-sustaining; but is losing resistance to change due to lower resistance to disturbances and lower resilience following disturbances. When disturbances occur, the rate of recovery is variable depending on severity. The current potential state is similar in structure and function to the reference state, however invasive and non-natives species are present in all community phases. The current potential state is generally dominated by perennial grasses.

Community 2.1
Basin Big Sagebrush – Grass

Phase 2.1 is similar to the reference plant community in composition and ecological function, but it allows for the presence of non-native/invasive species.

Community 2.2
Sprouting Shrub – Grass

Sprouting shrubs make up most of the shrub component. Phase 2.2 annual production is dominated by perennial grasses. It is similar to phase 1.2 in composition and ecological function, but allows for non-native/invasive species to be present. Sprouting shrubs make up most of the shrub component. Rabbitbrush is a re-sprouter and will increase after disturbance. This phase is usually the result of fire that eliminates basin big sagebrush dominance for the space of several years. Sagebrush will begin to re-establish in the community following fire, and will steadily increase in the community until it becomes co-dominant with the perennial grass. However it can be difficult to move this community back to the community phase 2.1.

Pathway 2.1A
Community 2.1 to 2.1

Sprouting shrubs increase due to disturbance. Stand-replacing fire of sagebrush is the most common historical cause of this community pathway. Sagebrush decreases and perennial grasses, forbs, and sprouting shrubs (i.e. rabbitbrush) dominate the site. Insect outbreak, low intensity fires, and prolonged drought may also result in a substantial decrease in sagebrush, but do not necessarily eliminate it from the community. Repetitive burning of big sagebrush favors rabbitbrush and perennial grasses. Mechanical and chemical removal of sagebrush can often release rabbitbrush on this site. This may be a timing of treatment issue or one related to the weather patterns in years surrounding the treatment. Chemical treatment, physical means (i.e. mowing) and/or prescribed fire often are attempted to remove invading sagebrush.

State 3
Basin Big Sagebrush Dominated Bottom

This is a degraded state and the hydrology of this site has been altered. The plant community and surface debris are no longer capable of slowing runoff and dissipating the water's erosive energy. In flow events, fine organic materials are not present to stabilize soil, slow water and allow infiltration. Instead, water from the uplands builds energy as it collects in the bottom and begins to form a channel. As the water becomes more channelized, the bottom becomes even less capable of dissipating the energy and channelization increases moving down the system

and a head-cut start moving up the system. This state has two fluctuating phases. Both phases have an entrenched channel where water has no access to the bottom floodplain and although vegetation in the channel may return to a community similar to the current potential (if not a little wetter), the majority of the bottom remains in the degraded sagebrush dominated state producing only a fraction of its original potential. The first community is the least stable with high levels of erosion occurring with any flow event. There is no vegetation on the sidewalls or the bottom of the channel. It has a distinctly V shaped channel profile that widens and deepens with every flow event. The second community is where healing is occurring and he bottom of the channel has become re-vegetated. The vegetation is similar to that of the current potential community with some exception. Since there is the same amount of water consolidated to a smaller area, the soils have a greater potential to show gleying and redoximorphic features that indicate low oxygen environments that are associated with the presence of a water table. Thus, plants that often inhabit the channel are those that have a greater tolerance for flooding. This means that often the amount of obligate and facultative wetland species are increased beyond that of the reference plant community. The channel vegetation helps to hold the channel in minor to moderate flooding events and prevent further degradation. Often sites in this phase develop U shaped profiles.

Community 3.1
Sagebrush – Sparse Understory

The dominate plants have changed from perennial grasses and forbs to big sagebrush. Most perennial plants have been lost from the understory and the ones that are present are usually found under the shrub canopy. Basin big sagebrush continues to increase beyond the natural fire return interval due to lack of fuel to carry a fire. Moderate and large flow events can result in immense amounts of erosion. A bottom that was once a depositional zone prior to sagebrush invasion can become at risk for developing deeply eroded channels and contribute to higher stream sediment loads.

Community 3.2
Sagebrush – Annual Understory

This phase is dominated by basin big sagebrush in the overstory and annual introduced grasses and/or forbs in the understory.

Pathway 3.1A
Community 3.1 to 3.2

With Basin big sagebrush increasing and sagebrush decadence increasing, cover changes in this communities can brought on by prolonged drought, lack of fire, surface disturbances, (i.e. road and pipeline development and off road vehicle (OHV) use), and improper grazing use can create alterations in the plant community that can leave the soils at risk for erosion and alter the hydrological function. Improper grazing of perennial grasses during growth has favored non-native invasive species, primarily cheatgrass and/or Russian thistle, to co-dominate the understory. Few remnant plants may still persist under shrubs, but re-establishment and dominance by perennial grasses will not occur following a fire, or with the removal of grazing animals in the natural time frame.

Pathway 3.2A
Community 3.2 to 3.1

This pathway occurs when basin big sagebrush is reduced by fire, insect outbreak, wetter climatic cycles or other another disturbances. As perennial grasses are slowly establishing due to proper grazing and less competition from basin big sagebrush. There still is accelerated erosion that can lead to increased channelization in flow areas.

State 4
Degraded Bottom

This is a degraded state and the hydrology of this site has been altered. The plant community and surface debris are no longer capable of slowing runoff and dissipating the water’s erosive energy. In flow events, fine organic materials are not present to stabilize soil, slow water and allow infiltration. Instead, water from the uplands builds energy as it collects in the bottom and begins to form a channel. As the water becomes more channelized, the bottom becomes even less capable of dissipating the energy and channelization increases moving down the system

and a head-cut start moving up the system. This state has two fluctuating phases. Both phases have an entrenched channel where water has no access to the bottom floodplain and although vegetation in the channel may return to a community similar to the current potential (if not a little wetter), the majority of the bottom remains in the degraded sagebrush dominated state producing only a fraction of its original potential. The first community is the least stable with high levels of erosion occurring with any flow event. There is no vegetation on the sidewalls or the bottom of the channel. It has a distinctly V shaped channel profile that widens and deepens with every flow event. The second community is where healing is occurring and he bottom of the channel has become re-vegetated. The vegetation is similar to that of the current potential community with some exception. Since there is the same amount of water consolidated to a smaller area, the soils have a greater potential to show gleying and redoximorphic features that indicate low oxygen environments that are associated with the presence of a water table. Thus, plants that often inhabit the channel are those that have a greater tolerance for flooding. This means that often the amount of obligate and facultative wetland species are increased beyond that of the reference plant community. The channel vegetation helps to hold the channel in minor to moderate flooding events and prevent further degradation. Often sites in this phase develop U shaped profiles.

Community 4.1
Basin Big Sagebrush dominated eroding channel

This community is the least stable community within this state. This state has actively eroding channel with active head-cuts at the top of the eroding channel. There are high levels of erosion occurring with any flow event due to the lack of vegetation on the sidewalls and the bottom of the channel. Often there is a distinctly V shaped channel that widens and deepens with every flow event. Bareground has increased and herbaceous production has been reduced. There is very low species diversity and a majority of the forbs are gone from the community. The site is eroding to create a partially abandoned bottom that will look like a drier sagebrush bench above a narrower channel (bottom).

Community 4.2
Basin Big Sagebrush dominated with incised channel

The second community is where healing is occurring. The bottom of the channel has become re-vegetated with plants similar to that of the reference community with some exception. Since there is the same amount of water consolidated to a smaller are, the soils have a greater potential to show gleying and redoximorphic features that are associated with the presence of a water table. Thus, plants that often inhabit the channel are those that have a greater tolerance for prolonged flooding. This means that often the amount of obligate and facultative wetland species are increased beyond that of the reference plant community. The channel vegetation helps to stabilize the channel in minor to moderate flooding events. Often sites in this phase develop “U” shaped profiles. Side slopes remain denuded and thus there is still potential for erosion. There can be a sagebrush “bench” (elevated sagebrush topslopes with relict reference state vegetation) along a narrow and entrenched channel.

Pathway 4.2A
Community 4.2 to 4.1

Seasonal drought, improper grazing use, regional and fire, and large flow events can all contribute to this community’s further degradation.

State 5
Reclaimed Bottom

This community is a man-made community. To get to this state requires a lot of inputs and hard work, but it can be done. Time, energy and resources are needed to restore the water table to the floor of the bottom and not the bottom of the channel.

Community 5.1
Reclaimed Bottom

This is the community phase after the work is done to restore the water table to the floor of the bottom. Often a large amount of dirt work, brush removal and the installation of check dams are required to reclaim the bottom

community. Even then, the community may never be that of the reference plant community. Areas directly behind the check structures often have a higher water table and promote facultative and obligate wetland species. Areas directly below the structures are not getting the subterranean flow that was present in the original bottom and thus are drier and promote invasion by upland species that are not typical in the reference plant community. This site will need to be monitored to see if additional work will need to be done once original check dams fill up with sediment. This site could need to be seeded to help stabilize it.

Transition T1A
State 1 to 2

This transition is from the native perennial warm and cool season grass understory in the reference state to a state that contains invasive species. Plant may include cheatgrass, annual mustards, thistles, knotweeds, and dandelion. Events include establishment of invasive plant species, intense continuous grazing of perennial grasses, prolonged drought, and/or surface disturbances, etc. However, invasive species such as cheatgrass have been known to invade intact perennial plant communities with little to no disturbance. Once invasive species are found in the plant community a threshold has been crossed.

Transition T2A
State 2 to 3

This pathway occurs when perennial grasses are reduced in the understory due to improper grazing and/or drought during the growing period. With Basin big sagebrush increasing and sagebrush decadence increasing, cover changes in this communities can brought on by prolonged drought, lack of fire, and improper grazing use can create alterations in the plant community that can leave the soils at risk for erosion and alter the hydrological function. Also, lack of wet periods to drown out big sagebrush and increase completion from the shallower root grasses and forbs can cause this shift from State 2 to State 3 - sagebrush dominated. Few remnant plants may still persist under shrubs, but re-establishment and dominance by perennial grasses will not occur following a fire, or with the removal of grazing animals in the natural time frame. Nonnative species may co-dominate the understory.

Transition T3A
State 3 to 4

The site has become unstable. This is a very quick transition. Due to the lack of soil protection large flow events quickly destabilize the site and it transitions to the state with altered hydrological function (4). Anything that further reduces ground cover, like improper grazing use and continued drought, has potential to quicken this transition. Fire suppression and lack of shrub management in decadent sagebrush uplands continue to promote altered hydrologic function and also aid in destabilizing the bottom. The lack of adequate herbaceous cover to dissipate water velocity and encourage infiltration result in the formation of gullies and head-cuts.

Transition T3B
State 3 to 5

To restore the site to the current potential state extreme inputs are necessary. This transition is from a big sagebrush dominated state, to a state that has been seeded with introduced or native perennial grasses. High energy inputs are needed for this transition. Sagebrush will need to be removed with vegetation treatment techniques (I.e. chemical, mechanical, or fire) and introduced or native species that are adapted to the area and adapted to management needs have been seeded and become established. Proper grazing use by both domestic animal and wildlife needs to occur. Often successful on small scales over very long periods of time, large scale restoration projects are not often able to be fully restored. This pathway would require continued sedimentation, proper grazing use, and proper hydrologic contributions. Management practices that restore upland community health and functioning are critical to restoring a sagebrush dominated bottom to the current potential state. Such practices can include shrub management, and reseeding. Erosion control structures may be necessary. This needs to be used in conjunction with proper grazing management. Several wet years in a row can also decrease big sagebrush, as big sagebrush does not like to have it roots in water for extended periods of time.

Restoration pathway R5A
State 5 to 2

This restorative pathway from the State 5 to the State 2 is very intensive. Often successful on small scales over very long periods of time, large scale restoration projects are not often able to be fully restored. This pathway would require continued sedimentation, proper grazing use, and proper hydrologic contributions. This community may reestablish the same hydrological function as in the reference state if the contributing upland sites provide the hydrologic contributions.

Transition T5A
State 5 to 3

Sagebrush encroachment with increasing sagebrush decadence and cover in adjacent upland communities brought on by prolonged drought, lack of fire, and improper grazing use can create alterations in the plant community that can leave the soils at risk for erosion and alter the hydrological function.

Restoration pathway R5B
State 5 to 4

This community becomes unstable, affects soil health and the hydrologic function as it is invaded by big sagebrush. The lack of adequate herbaceous cover to dissipate water velocity and encourage infiltration result in the formation of gullies and head-cuts. This is a very quick transition. Due to the lack of soil protection large flow events quickly destabilize the site and it transitions to the state with altered hydrological function (3). Anything that further reduces ground cover, like improper grazing use and continued drought, has potential to quicken this transition. Fire suppression and lack of shrub management in decadent sagebrush uplands continue to promote altered hydrologic function and also aid in destabilizing the bottom.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1				375–500	
	western wheatgrass	PASM	*Pascopyrum smithii*	375–500	–
2				63–188	
	spike muhly	MUWR	*Muhlenbergia wrightii*	63–188	–
3				63–188	
	alkali sacaton	SPAI	*Sporobolus airoides*	63–188	–
4				68–125	
	squirreltail	ELEL5	*Elymus elymoides*	68–125	–
5				38–88	
	blue grama	BOGR2	*Bouteloua gracilis*	38–88	–
	James' galleta	PLJA	*Pleuraphis jamesii*	38–88	–
6				38–88	
	prairie Junegrass	KOMA	*Koeleria macrantha*	38–88	–
	muttongrass	POFE	*Poa fendleriana*	38–88	–
7				68–88	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	68–88	–
Forb					
8				38–68	
	Forb (herbaceous, not grass nor grass-like)	2FORB	*Forb (herbaceous, not grass nor grass-like)*	38–68	–
	Douglas' sagewort	ARDO3	*Artemisia douglasiana*	38–68	–
	sagebrush	ARTEM	*Artemisia*	38–68	–
	thistle	CIRSI	*Cirsium*	38–68	–
	Rocky Mountain beeplant	CLSE	*Cleome serrulata*	38–68	–
Shrub/Vine					
9				38–68	
	fourwing saltbush	ATCA2	*Atriplex canescens*	38–68	–
10				38–68	
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	38–68	–
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	38–68	–
11				38–68	
	Shrub, deciduous	2SD	*Shrub, deciduous*	38–68	–
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	38–68	–

Animal community

Habitat for Wildlife:
No Data

Hydrological functions

The runoff curve numbers are determined by field investigations using hydrologic cover conditions and hydrologic soil groups.

Hydrologic Interpretations
Soil Series----------Hydrologic Group
Billings----------B
Hickman----------B
Manzano----------B
Ruson----------C
Sparham----------D
Teromote----------B

Recreational uses

This site is not usually thought of as having much recreational value. The site may be well adapted to horseback riding and hunting.

Wood products

This site produces no significant wood products in its potential plant community.

Other products

Grazing:
Approximately 95 percent of the vegetation produced on this site is suitable for grazing or browsing by domestic livestock and wildlife. Grazing distribution on adjacent sites may be a problem since grazing animals are attracted to this site due to early green-up. Such continuous, heavy grazing pressure, as well as trampling damage on wet soils, may lead to deterioration of the potential plant community. The result is a decrease in western wheatgrass, spike muhly, muttongrass, prairie junegrass, and fourwing saltbush. Plant species that increase include blue grama, mat muhly, basin big sagebrush, rubber rabbitbrush, and broom snakeweed. Serious deterioration is represented by a sodbound cover of blue grama or total dominance by basin big sagebrush, both in low in production. A planned grazing system, which prevents repetitive grazing of the most desirable species and allows a periodic replenishment of the root reserves, is best to maintain the desirable balance between plant species and high production. In addition to domestic livestock, this site is used by deer, elk, pronghorn antelope, small mammals, and birds.

Other information

Guide to Suggested Initial Stocking Rate Acres per Animal Unit Month

Similarity----------Index Ac/AUM
100 - 76----------1.7 – 2.2
75 – 51----------2.1 – 3.4
50 – 26----------3.3 – 6.7
25 – 0----------6.7+

Other references

Boyd, Chad S., Beck, J. L., Tanaka, J. A. 2014. Livestock Grazing and Sage Grouse Habitat: Impacts and Opportunities. Journal of Rangeland Applications Vol. 1. 58-77.

Cartledge, T. R., and J. G. Propper. 1993. Pinon-Juniper Ecosystems through Time: Information and Insights from the Past. In Gen. Tech. RM-236 - Managing Pinon-Juniper Ecosystems for Sustainability and Social Needs.

Cleland, D.T.; Freeouf, J.A.; Keys, J.E., Jr.; Nowacki, G.J.; Carpenter, C; McNab, W.H. 2007. Ecological Subregions: Sections and Subsections of the Conterminous United States.[1:3,500,000], Sloan, A.M., cartog. Gen. Tech. Report WO-76. Washington, DC: U.S. Department of Agriculture, Forest Service.

Evers, L., R. F. Miller, M. Hemstrom, J. Merzenich, and R. Neilson. 2011. Estimating historical sage-grouse habitat

abundance using state-and-transition model. Natural Resources and Environmental Issues Vol. 17 Article 16. 1-13 p.

Griffith, G.E.; Omernik, J.M.; McGraw, M.M.; Jacobi, G.Z.; Canavan, C.M.; Schrader, T.S.; Mercer, D.; Hill, R.; and Moran, B.C., 2006. Ecoregions of New Mexico (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,400,000).

Johnson, K. A. 2000. *Artemisia tridentata* subsp. vaseyana. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us/database/feis/plants/shrub/arttriv/all.html [2017, August 24].

LANDFIRE: LANDFIRE National Vegetation Dynamics Models. (2007, January - last update). [Homepage of the LANDFIRE Project, U.S. Department of Agriculture, Forest Service; U.S. Department of Interior], [Online]. [2017, August 8]. Landfire Biophysical Setting Model 2311640: Page 218-223.

Natural Resources Conservation Service (NRCS). 2003. Ecological Site Description for Swale R036XB017NM: USDA, Albuquerque. New Mexico.

Passey, H. B., W. K. Hugie, E. W. Williams, and D. E. Ball. 1982. Relationships between soil, plant community, and climate on rangelands of the Intermountain west. USDA, Soil Conservation Service, Tech. Bull. No. 1669.

Simonin, Kevin A. 2001. Populus angustifolia. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2013, August 12].

Tirmenstein, D. 1999. *Artemisia tridentata* subsp. tridentata. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us/database/feis/plants/shrub/arttrit/all.html [2017, August 24].

USDA, Forest Service, Missoula Fire Sciences Laboratory. 2012. Information from LANDFIRE on fire regimes of basin and Wyoming big sagebrush communities. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us/database/feis/fire_regimes/basin_WY_big_sagebrush/all.html [2017, August 24].

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

West, N.E. and M.A. Hassan. 1985. Recovery of sagebrush-grass vegetation following wildfire. Journal of Range Management 38(2):131-134.

Western Regional Climate Center. Retrieved from http://www.wrcc.dri.edu/summary/Climsmco.html on December 27, 2017.

Winward, A. H. 2004. Sagebrush of Colorado: taxonomy, distribution, ecology and management. Colorado Division of Wildlife, Department of Natural Resources, Denver, Colorado 46pp.

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--Site Development and Testing Plan--:

Future work to validate and further refine the information in this Provisional Ecological Site Description is necessary. This will include field activities to collect low-, medium-, and high-intensity sampling, soil correlations, and analysis of that data.

Additional information and data is required to refine the Plant Production and Annual Production tables for this ecological site. The extent of MLRA 36 must be further investigated.

Field testing of the information contained in this Provisional ESD is required. As this ESD is moved to the Approved ESD level, reviews from the technical team, quality control, quality assurance, and peers will be conducted.

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	
Approved by	
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:**

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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):**

---

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

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:**

17. **Perennial plant reproductive capability:**