USDA Natural Resources Conservation Service

Ecological site R036XB011NM
Sandy

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General information

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

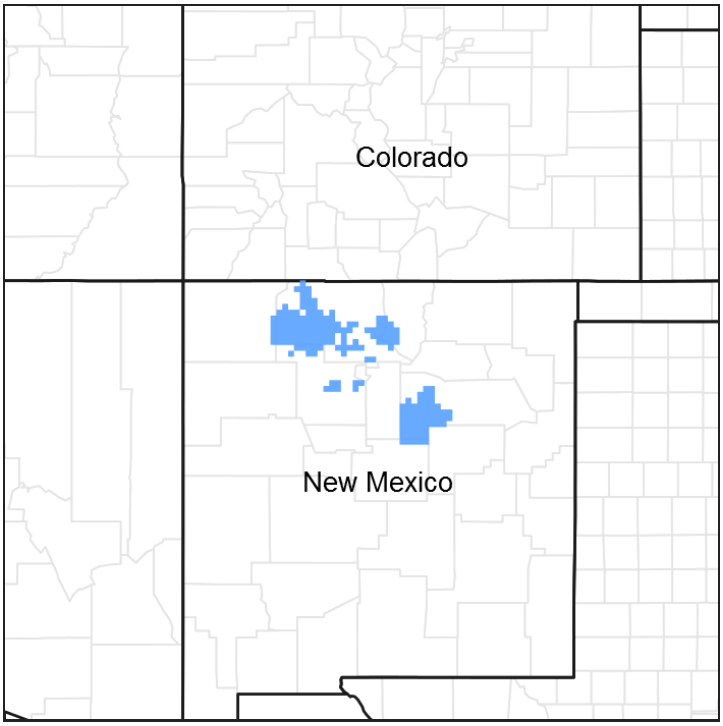

Figure 1. Mapped extent

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

MLRA notes

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

R036XB011NM – Sandy is an ecological site that is found on dunes, fan remnant and alluvial fans 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 (Cleland, et al., 2007).

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 (Cleland, et al., 2007).

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 R036XB011NM – Sandy range site MLRA 36XB (NRCS, 2003). This site occurs on dunes, fan remnant and alluvial fans. The typical surface soil textures are from loamy sand, gravelly loamy sand, or loamy fine sand. It has an aridic ustic/ustic arid moisture regime and mesic temperature regime. The effective precipitation ranges from 10 to 16 inches.

Associated sites

F036XA136NM	**Pinyon-Utah juniper/Apache plume** Pinyon-Juniper-Apache Plume - Slopes are 1-35%; Soils are moderately deep to very deep and can be skeletal/non-skeletal. Soil surface textures are gravelly to extremely loam, loam, very gravelly clay loam, very gravelly to extremely gravelly coarse sandy loam, extremely cobbly fine sandy loam, extremely gravelly sandy clay loam, fine sandy loam, very gravelly fine sandy loam, sandy loam, gravelly sandy loam, and ashy loamy coarse sand with subsoil that are loamy. Landforms are escarpments, fan remnants, mesas, hills, cuestas, benches, fan piedmonts, valley sides, eroded fan remnants, and mountain slopes.
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.

R036XB006NM	**Loamy** Loamy - Slopes 1-15%; soils are very shallow to shallow and skeletal and not skeletal; soil surface are loam, stony to very stony loam, very cobbly loam, fine sandy loam, very cobbly fine sandy loam, stony silt loam, stony silty clay loam, and cobbly silty clay loam; Parent materials are basalt influences but can have sometimes influence from sandstone and/or shale. Landforms nearly level to gently sloping mesas, lava plateaus, lava flows, lava flows on valley floors, and ridges.
R036XB007NM	**Malpais** Malpais - Slopes 1-15%; soils are very shallow to shallow and skeletal and not skeletal; soil surface are loam, stony to very stony loam, very cobbly loam, fine sandy loam, very cobbly fine sandy loam, stony silt loam, stony silty clay loam, and cobbly silty clay loam; Parent materials are basalt influences but can have sometimes influence from sandstone and/or shale. Landforms nearly level to gently sloping mesas, lava plateaus, lava flows, lava flows on valley floors, and ridges.
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** 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.
F036XA001NM	**Pinyon Upland** Pinyon Upland (Formerly South of Gallup) - 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.
F036XA005NM	**Riverine Riparian** Riverine Riparian - Site has a water table at 12-36” Landforms are V-shaped valleys, U-shaped valleys and Overflow Stream (channel).
R036XB010NM	**Salty Bottomland** 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.
R036XB015NM	**Shallow Savanna** Shallow Savanna - Slopes 1-55%; very shallow to shallow soils and non-skeletal; very cobbly loam, very cobbly sandy loam, loam, cobbly clay loam, and channery clay loam over a clayey subsoil. Bedrock can be sandstone, shale or basalt. Landforms narrow ridges, hills, breaks and mesas of bedrock controlled landscapes.

R036XB017NM	**Swale** Swale - his site is enhanced by runoff during periods of high runoff (intermittent). The water table depth is greater than 6 ft. Soils are deep to very deep soils that have surface textures of loams, silt loams to clays with loamy subsoil.

Similar sites

R036XB012NM	**Sandy Savanna** Sandy Savanna (Formerly Sand Plains) - Slopes are 1-25%; soils are deep; Surface textures are loamy sand, loamy fine sand, and sandy loam with sandy subsoil. Landforms are plateaus, mesas, upland plains.
R036XB111NM	**Sandy Slopes** Sandy Slopes - Slopes are 15-40% Soils are moderately deep to deep; Surface textures are loamy fine sand, loamy very fine sand, sandy loam and loamy sand with sandy subsoil. Landforms are hills, ridges, escarpments on cuestas, and escarpments on plateaus.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This site occurs on nearly level to gently sloping landscapes on dunes, fan remnant and alluvial fans. Slopes range from 1 to 15 percent. Elevation ranges from 5,400 to 7,300 feet above sea level.

Table 2. Representative physiographic features

Landforms	(1) Dune (2) Alluvial fan (3) Fan remnant
Flooding frequency	None
Ponding frequency	None
Elevation	1,646–2,225 m
Slope	1–15%
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)	330 mm

Climate stations used

- (1) CUBA [USC00292241], Cuba, NM
- (2) SANTA FE 2 [USC00298085], Santa Fe, NM
- (3) ABIQUIU DAM [USC00290041], Gallina, NM
- (4) COCHITI DAM [USC00291982], Pena Blanca, NM
- (5) LYBROOK [USC00295290], Dulce, NM
- (6) EL RITO [USC00292820], El Rito, NM

- (7) NAVAJO DAM [USC00296061], Navajo Dam, NM

Influencing water features

This site is not influenced by water from a wetland or stream.

Soil features

The soils are deep to very deep (60+ inches in depth). The surface layers range from loamy sand, gravelly loamy sand, loamy fine sand, fine sandy loam and sandy loam. Surface texture range in clay percent from 6 to 15% clay. The clay percentage at 20 inches in depth ranges from 6 to 12%. The parent material consists of slope alluvium derived from igneous and sedimentary rock; eolian deposits derived from sandstone; eolian deposits and alluvium derived from sandstone and shale; and/or alluvium derived from igneous and metamorphic rock.

This site is found in NM678, NM698, NM650, NM672, NM670, and NM630 soil surveys. This ecological site has been correlated to the following soils with the listed particle control sections:

Sandy-Skeletal:
Bamac

Not used (Torripsamments/Ustipsamments):
Pinavetes
Royosa

Fine-Loamy: (These may not be typical of this site. This needs investigation. This are the fine sandy loam and sandy loam surface texture soil.)

Vibo

Table 4. Representative soil features

Parent material	(1) Eolian deposits–sandstone (2) Alluvium–sandstone and shale
Surface texture	(1) Gravelly sandy loam (2) Loamy sand (3) Loamy fine sand
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained to excessively drained
Permeability class	Rapid to very rapid
Soil depth	152–183 cm

Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	1.52–10.16 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–35%
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.

The ability for an ecological site to carry fire depends primarily on the present fuel load and plant moisture content—sites with small fuel loads will burn more slowly and less intensely than sites with large fuel loads. Fire is an important aspect of grass dominated ecological sites. LANDFIRE modelled southwest desert grasslands fire return interval as 10 to 833 years (USFS, 2012). Historically, fires were of mixed severity, and various patchy sizes which formed mosaics. Fires varied in intensity and frequency depending on the site's productivity. So, the variability in severity, patchy sizes, intensity and frequency has led to large variabilities in the fire regimes and fire return intervals.

Shrub vegetation is able to reestablish from seed dispersal from the adjacent non burned shrub stands; however the process is relatively slow. Fire also decreases the extent of One-seed juniper/pinyon pine invasions, which allows the historic plant community to maintain integrity. When the plant community is burned shrubs decrease, while perennial and annual grasses increase. The perennial shrubs associated with this site are able to recover at a faster rate than the invading trees. When the site is degraded by the presence of invasive annuals, the fire return interval is shortened due to increased fuels. The shortened fire return interval is often sufficient to suppress the native plant community.

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

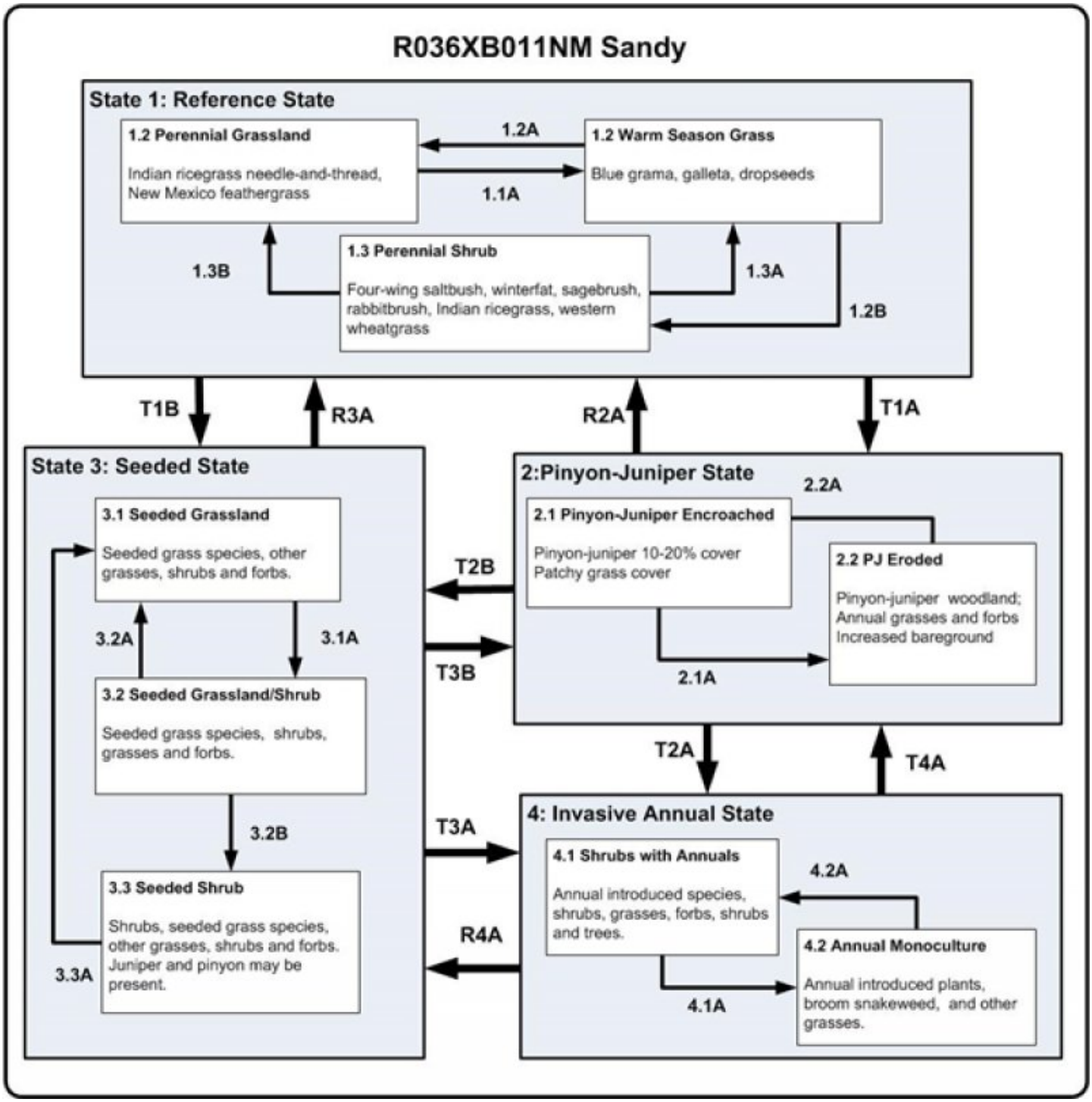

Figure 6. STM

Legend

1.2A, 3.2A – fire, insect herbivory, and/or drought; proper grazing
1.2B, 1.1A, 3.1A, 3.2B – lack of fire, drought, time without disturbance and improper grazing
1.3A, 1.3B, 2.2A, R2A, 3.3A – fire, vegetation treatments, insect herbivory, drought, and/or tree/shrub encroachment removal
T2A - invasive species establishment, improper grazing, fire, surface disturbances, brush and/or tree management; and/or extended droughts.
T1A, 2.1A, T3B – fire suppression, time without disturbance, insect herbivory, and tree encroachment
T3A – invasive species establishment, frequent fire and/or long term drought
4.1A – Frequent fire, and/or drought; increased invasive species present
4.2A, R4A, R4B – fire suppression and/or seeding, treat invasive species
T1B, T2B – Seeding and removal of tree and shrub encroachment
R3A – increase in native species present and/or native plant seedings, wet climatic years, lack of surface disturbance, tree/brush management

Figure 7. Legend

State 1
Reference

The reference state represents the plant communities and ecological dynamics of the Sandy site. This state includes the biotic communities that become established on the ecological site under the natural disturbance regime prior to pre-European settlement. The main pathways on this site are fire and drought. This is a grassland-shrub site predominantly characterized by perennial grasses and shrubs. Grasses are dominant and cover is fairly uniform with few large bare areas present. Indian ricegrass, needle-and-thread and New Mexico feathergrass are the dominant grass species. Dropseeds, galleta, squirreltail, western wheatgrass and blue gramacan also occur in significant amounts. Shrubs typical of this site may include fourwing saltbush, winterfat, big sagebrush, and sand sagebrush. In some areas, rubber rabbitbrush or spineless horsebrush may be more common. Annual forbs occur in high abundance in spring and summer month during years of above-average precipitation. Typically, species such as western wheatgrass, Indian ricegrass, New Mexico feathergrass, and winterfat decrease in response to a combination of heavy grazing and drought. Reference state is self-sustaining and resistant to change due to high resistance to natural disturbances and high resilience following natural disturbances. When natural disturbances occur, the rate of recovery is variable due to disturbance intensity. Once invasive plants establish, return to the reference state may not be possible. Continuous, yearlong grazing, which allows repetitive grazing of the desirable species, eventually leads to a decrease in these species from the plant community. Such deterioration is indicated by a decrease in Indian ricegrass, needlegrasses, winterfat, and four-wing saltbush. Species that increase include blue grama, galleta, threeawns, sagebrush, and rubber rabbitbrush. One-seed juniper may invade this site from adjacent sites if the vigor of the herbaceous species decreases significantly.

Community 1.1
Perennial Grassland

This is a grassland-shrub site predominantly characterized by perennial grasses and shrubs. Grasses are dominant and cover is fairly uniform with few large bare areas present. This site provides a mixed grass-shrub aspect. Four-wing saltbush and winterfat are the dominant shrubs with big sagebrush and rubber rabbitbrush occurring in lesser amounts. Few, if any, trees occur on this site. Forbs are a minor component except during spring emergence. Indian ricegrass, needle-and-thread and New Mexico feathergrass are the dominant grass species.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	420	588	757
Shrub/Vine	118	165	212
Forb	22	31	40
Total	**560**	**784**	**1009**

Table 6. Soil surface cover

Tree basal cover	1-5%
Shrub/vine/liana basal cover	10-25%
Grass/grasslike basal cover	15-25%
Forb basal cover	1-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	10-20%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	50-70%

Figure 9. Plant community growth curve (percent production by month). NM0011, R036XB011NM Sandy HCPC. R036XB011NM Sandy HCPC Mixed grass-shrubland with 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
Warm Season Grass

Blue grama is both drought and grazing resistant and may persist, but in a less productive, less vigorous form. This is a plant community phase that is dominated by blue grama with galleta and threeawns as subdominants may result. Western wheatgrass, blue grama, galleta will have increased while needle-and-thread, squirreltail and Indian ricegrass have decreased in abundance. Scattered shrubs, such as sagebrush, one-seed juniper and maybe two-needle pinyon might have encroached. Two-needle pinyon and One-seed juniper are natural invaders if stands are found adjacent to this site. Trees left

uncontrolled can form dense stands and eventually dominate the site. Nonnative invasive species, such as cheatgrass may be present but in insignificant amounts. Bare ground is most common in this community phase.

Community 1.3
Perennial Shrub

This community consists mature shrubs with sparse understory. Scattered one-seed juniper and maybe two-needle pinyon might be present. Bare ground is most common in this community phase. Improper grazing use can aid the establishment of pinyon and juniper seedlings through reduced competition, exposure of mineral soil, and reduction of fuel to carry fires. This combined with increasing control of fires has caused large portions of the site to be taken over by pinyon and juniper since the coming of livestock. Two-needle pinyon and one-seed juniper are natural invaders if stands are found adjacent to this site. Trees left uncontrolled can form dense stands and eventually dominate the site. Sandy surface textures make this site susceptible to accelerated erosion if adequate herbaceous cover is not maintained. The loss of herbaceous cover due to overgrazing, fire suppression, and consequent surface soil horizon loss from water or wind facilitate the transition Pinyon-juniper state.

Pathway 1.1A
Community 1.1 to 1.2

This pathway favors shrub establishment. Events that cause this pathway are cause by time without disturbance (i.e. lack of fire), wet winter cycles, drought and improper grazing.

Pathway 1.2A
Community 1.2 to 1.1

This transition is caused by naturally occurring fires and/or drought. With a mature shrub community, this pathway can be caused by high intensity fire that burns hot enough to remove the mature shrubs. Low-intensity fire after the shrubs has had a chance to set seed, improper grazing and or browsing by native ungulates, and possible stem-root pathogens will revert a young shrubs community to a grassland with the potential to become a shrub-grass community once again.

Pathway 1.2B
Community 1.2 to 1.3

This transition is from the native shrub and perennial warm and cool season grass state, to a state that is dominated by mature shrubs. This pathway happens when fire does not occur within the historical fire regime interval for the site. Improper continuous grazing of perennial grasses will speed up this pathway. This will lead to an old decadent stand of shrubs with little to no understory. This allows the possibility of one-seed juniper and/or two-needle pinyon to become established on the site.

Pathway 1.3B
Community 1.3 to 1.1

Pathways can be one or more of the following: brush treatments, seeding, insect herbivory/pathogen, proper grazing, drought, and fire. Insect herbivory and/or root and stem pathogen die-off will thin the stands and allow perennial plants to establish if it is properly grazed.

Pathway 1.3A
Community 1.3 to 1.2

This pathway is caused by naturally occurring fires, drought and/or insect herbivory removes the shrubs and possible trees if they have encroached on this site. It reverts the system back to a grassland phase. Vegetation treatments can mimic this natural pathway.

State 2
Pinyon-Juniper

This state is characterized by a loss of grass cover and an increase in pinyon and juniper. Shrub species such as rubber rabbitbrush, spineless horsebrush, big sagebrush, and Bigelow sagebrush may also increase in representation. It is thought that pinyon and juniper, with an understory of mostly perennial grasses, may dominate the site in the longtime absence of fire, but lightning fires following warm dry early summer weather are a natural feature of the region. This could have maintained much of the site in a grassland cover, as reported by many early settlers except for occasional trees and isolated patches. Such vegetation is the basis for the potential described here. Without fire, simulated clearing methods may be necessary to maintain it (Miller and Tausch 2002). This state typically occurs when there is a long time span between fires. The transition to this state also has a reduction in fine fuels plays a part in increasing the fire return intervals once the site has transition to this pinyon-juniper state. Thus, state can persist for long time periods until the conditions needed for a fire occur or vegetation treatments are done to move the community to a different state.

Community 2.1
Pinyon-Juniper Encroached

It is dominated by a dense closed canopy of one-seed juniper and pinyon. They will be with a sparse understory of shrubs with little to no grass or forbs. Blue grama is typically the dominant grass. Galleta and dropseeds may also make up a significant proportion of the grass community. Evidence of erosion such as pedestalling of plants, elongated water flow patterns, litter dams, and rills may be common. Also, Invasive annuals grasses and forbs will be present in the understory.

Community 2.2
Pinyon-Juniper Eroded

This state has an overstory of one-seed juniper and/or two-needle pinyon with a very little understory of shrubs and few perennial grasses and forbs. There is very little herbaceous or other plant growth on this site. Grass cover is extremely sparse usually restricted to a few scattered patches of blue grama or widely scattered individual bunchgrasses. Large areas of bareground are present. The production and infiltration is low. Rills and small gullies are common. Litter is concentrated beneath pinyon-juniper canopies. Erosion is high, and the associated watersheds will become less stable and have more runoff.

State 3
Seeded

This state results from seeding introduced perennial grasses (i.e. crested wheatgrass and Russian wildrye). Native perennial grasses, forbs and shrubs may be included in the seed mix. This state behave similar community dynamics to the current potential state community. Other vegetation treatments may be necessary to get to this state, they include chaining, mowing, disking, prescribed burning and other techniques which manipulate the plant community. Applying vegetation treatments to plant communities to either the invasive annuals or pinyon-juniper encroachment states to create a seeded state is often the first step in assisted restoration to plant communities an intermediate step to get to the Reference State. The seeded state could persist for long periods of time with proper management. Native grasses and forbs may reestablish over time from nearby seed sources.

Community 3.1
Seeded Grassland

This community is dominated by seeded plants such as crested wheatgrass, Russian wildrye, smooth brome, and intermediate and pubescent wheatgrasses. Shrubs have little to no production in this phase. This site has high production due to the seed grass production. This production typically is higher than the current potential or reference state. This site usually has low species diversity.

Community 3.2
Seeded Grassland and Shrubland

This phase has shrubs co-dominant with the seeded grass.

Community 3.3
Seeded Shrubland

This community consists shrub overstory with sparse understory. Scattered one-seed

juniper and maybe two-needle pinyon might have encroached. Two-needle pinyon and one-seed juniper are natural invaders if stands are found adjacent to this site. Trees left uncontrolled can form dense stands and eventually dominate the site. Nonnative invasive species, such as cheatgrass are present but in insignificant amounts. Bare ground is most common in this community phase.

Pathway 3.2A
Community 3.2 to 3.3

This pathway is caused by naturally occurring fires, herbivory of shrub, and/or drought that suppresses shrub establishment. These events tend to favor grass establishment. With a mature shrub community, this pathway can be caused by high intensity fire that burns hot enough to remove the shrubs and pinyon-juniper, if it has started to encroach. Low-intensity fire after the shrubs has had a chance to set seed, improper grazing and or browsing by native ungulates, and possible stem-root pathogens will revert a young shrub community back to a grassland with the potential to become a grassland community once again. Vegetation treatments (mechanically, prescribed fire, chemically, etc.) can also be employed to imitate the natural disturbances regime.

Pathway 3.3A
Community 3.3 to 3.3

This pathway is caused by naturally occurring fires, vegetation treatments (chemical and mechanical), and/or insect herbivory removes the shrubs and possible trees if they have encroached on this site. It reverts the system back to a grassland phase. Depending on the amount of understory present, grasses and forbs may need to be reseeded to aid reestablishment.

State 4
Invaded

This state is dominated by invasive annual species. Invasive annual species can including cheatgrass, Russian thistle, kochia, halogeton, storksbill geranium, and annual mustards. Generally as ecological conditions deteriorate and perennial vegetation decreases due to disturbance (fire, over grazing, drought, off road vehicle overuse, erosion, etc.) annual forbs and grasses will invade the site. The presence of these species will depend on soil properties and moisture availability; however, these invaders are highly adaptive and can flourish in many locations. Once established, complete removal is difficult but suppression may be possible.

Community 4.1
Shrubs with Annuals

This phase will look like shrub overstory with an invasive annual species understory. Frequently, shrub canopy cover will be dense due to little to none perennial understory

being present. Cheatgrass, and other annual introduced species are now present in the understory. With repeated fire, it will then transition to an annual species plant community phase (4.2). This phase is at risk for becoming an annual grass-dominated community.

Community 4.2
Annual Monoculture

This community is characterized by an almost a complete monoculture of cheatgrass and/or other invasive annuals. This community can be long-lasting phase if fires and disturbance continue to be frequent.

Transition T1A
State 1 to 2

This transition is from the native shrub and perennial warm and cool season grass state, to a state that is dominated by two-needle pinyon and one-seed juniper. Events include time without disturbance, insect herbivory, continuous season long grazing of perennial grasses, drought, and tree invasion. As canopy density increase, bare ground will increase in size and frequency further increasing the fire return interval, accelerating erosion, increasing run-off and further affecting the watershed functionality. Loss of herbaceous cover can also reduce fuel levels beyond the point capable of carrying fire. This transition also favors the establishment of invasive annual species such as cheatgrass.

Transition T1B
State 1 to 3

This transition is from a shrub dominated state, to a state that has been seeded with introduced perennial grasses. High energy inputs are needed for this transition. Shrubs and/or trees will need to be removed with vegetation treatment techniques (I.e. chemical, mechanical, or fire) and introduced species that are adapted to the area and adapted to management needs have been seeded and become established.

Restoration pathway R2A
State 2 to 1

Pathways can be one or more of the following: brush treatments, seeding, insect herbivory/pathogen, proper grazing, drought, and/or fire. This pathway requires lots of energy input into the system. Prescribed grazing will help ensure adequate deferment period or rest following brush control and/or seeding, and will assist in the establishment and maintenance of grass cover. Erosion control would be necessary to prevent further nutrient and soil loss. The addition of organic matter or other soil amendments may be needed to restore soil fertility and facilitate grass recovery.

Transition T2B

State 2 to 3

Seeding of introduced/native species (grasses and forbs) is the pathway to state 3. Also, trees are usually removed by mechanical or chemical treatments. This transition requires energy input into the system.

Transition T2A
State 2 to 4

This transition is from a two needle pinyon and one-seed juniper state, to a state that is dominated by invasive species. Events would include establishment of invasive species, fire, and other methods of tree removal with an understory that is dominated by invasive annual species (i.e. cheatgrass).

Restoration pathway R3A
State 3 to 1

This return path could possible occur as a result of long time frames without disturbance. Native plants from adjacent site would slow establish in the seeded state. Proper grazing from livestock and wildlife which would favor the establishment of native plants. Removal of the one-seed juniper and pinyon as they encroach would also be necessary

Transition T3B
State 3 to 2

This transition is from the shrub-seeded grass state to a state that is dominated by two-needle pinyon and one-seed juniper. Events include, fire suppression, time without disturbance, insect herbivory, continuous season long grazing of perennial grasses, and tree invasion. As canopy density increase, bare ground will increase further increasing the fire return interval, accelerating erosion, increasing run-off and further affecting the watershed functionality. This transition also favors the establishment of invasive annual species such as cheatgrass.

Transition T3A
State 3 to 4

This transition is from a seeded state, to a state that is dominated by invasive species. Events include increased of invasive species, shortened fire return interval, and long term drought. Improper continuous season long grazing of perennial grasses can reduce the time needed for this pathway.

Transition T4A
State 4 to 2

This transition requires fire return intervals to length and fire suppression may be

necessary to interrupted the shorten fire return intervals that occur when cheatgrass and other annuals invade. Juniper will encroach onto the site with time and lack of fire. Seeding may be necessary to establish perennial plants. This could require significant energy inputs to make this transition happen.

Restoration pathway R4A
State 4 to 3

Invasive annuals will need to be treated and dominance suppress enough to allow desired seeded species the ability to complete so that they can become established. Seeding of introduced species is the pathway to state 3. This transition will be difficult and require substantial inputs and management of the site. It may not be practical on a large scale. Research is needed for species adapted to compete with annual invasive plants, and seeding techniques to add with successful transition from the invasive annual state.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1				118–157	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	118–157	–
	needle and thread	HECO26	*Hesperostipa comata*	118–157	–
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	118–157	–
2				78–118	
	western wheatgrass	PASM	*Pascopyrum smithii*	78–118	–
3				39–78	
	spike dropseed	SPCO4	*Sporobolus contractus*	39–78	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	39–78	–
4				39–78	
	James' galleta	PLJA	*Pleuraphis jamesii*	39–78	–
5				24–39	
	blue grama	BOGR2	*Bouteloua gracilis*	24–39	–
6				24–39	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	24–39	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	24–39	–

	muttongrass	POFE	*Poa fendleriana*	24–39	–
Forb					
7				24–39	
	Forb (herbaceous, not grass nor grass-like)	2FORB	*Forb (herbaceous, not grass nor grass-like)*	24–39	–
	buckwheat	ERIOG	*Eriogonum*	24–39	–
	locoweed	OXYTR	*Oxytropis*	24–39	–
	woolly plantain	PLPA2	*Plantago patagonica*	24–39	–
Shrub/Vine					
8				39–118	
	fourwing saltbush	ATCA2	*Atriplex canescens*	39–118	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	39–118	–
9				24–78	
	sand sagebrush	ARFI2	*Artemisia filifolia*	24–78	–
	big sagebrush	ARTR2	*Artemisia tridentata*	24–78	–
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	24–78	–
	spineless horsebrush	TECA2	*Tetradymia canescens*	24–78	–
10				0–24	
	Shrub, deciduous	2SD	*Shrub, deciduous*	0–24	–
	oneseed juniper	JUMO	*Juniperus monosperma*	0–24	–
	Shrub, deciduous	2SD	*Shrub, deciduous*	0–24	–
	juniper	JUNIP	*Juniperus*	0–24	–

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
Pinavetes----------A
Royosa----------A

Vibo ----------B

Recreational uses

This site is well adapted to hunting and horseback riding, although it is not noted for having scenic beauty.

Wood products

This site produces no significant wood products.

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 is generally not a problem if adequate waterings are properly located. However, continuous grazing leads to a repetitive, selective grazing of the most desirable species, which reduces their vigor and productivity. The result is a deterioration of the potential plant community. This deterioration is indicated by a decrease in Indian ricegrass, needle-and-thread, New Mexico feathergrass, western wheatgrass, fourwing saltbush, and winterfat. Species that increase include dropseed spp., blue grama, ring muhly, big sagebrush, rabbitbrush, and an invasion of juniper from adjacent sites. A planned grazing system, which prevents the repetitive grazing of selected species and allows for periodic replenishment of carbohydrates in the roots, is desirable.

Other information

Guide to Suggested Initial Stocking Rate Acres per Animal Unit Month

Similarity Index----------Ac/AUM
100 - 76---------- 2.8 – 3.9
75 – 51----------3.8 – 5.8
50 – 26----------5.7 – 11.6
25 – 0----------11.6+

Type locality

Location 1: Rio Arriba County, NM
Location 2: Sandoval County, NM
Location 3: San Juan County, NM

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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	04/01/2025
Approved by	Kirt Walstad
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):**

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

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

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

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

    Dominant:

    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:**