USDA Natural Resources
Conservation Service

Ecological site F036XA005NM
Riverine Riparian

Accessed: 05/05/2024

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.

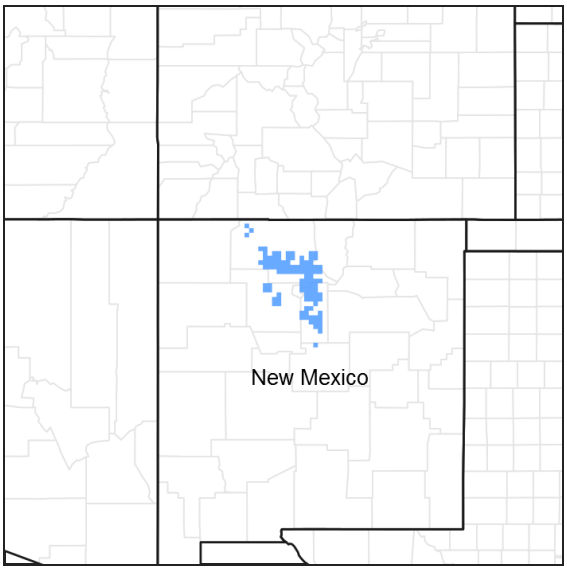

Figure 1. Mapped extent

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

F036XA005NM – Riverine Riparian is an ecological site that is found on flood plains, stream terraces, flood-plain steps on valley floors, natural levees flood plains on valley floors and swales 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 ection) Southern Rocky Mountains Basin and Range (Mexican Highland and Sacramento Section)

Ecological site concept

The 36XA Riverine Riparian ecological site was drafted from the existing Riverine Riparian(R036XA005NM) range site MLRA 36XA (NRCS, 2003). This site occurs on plains, stream terraces, flood-plain steps on valley floors, natural levees flood plains on valley floors and swales. The surface soil is a very fine sandy loam, fine sandy loam or very gravelly coarse sand loam in texture. It has an aridic ustic/ustic aridic moisture regime and mesic temperature regime. The effective precipitation ranges from 10 to 16 inches.

Associated sites

F036XA136NM	**Pinyon-Utah 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.
R036XB006NM	**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.

R036XB008NM	**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.
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** 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.
R036XY347CO	**Foothill Valley** Precipitation is 12-16”; slopes 0-15%; Soils are deep to very deep. Soil surface ranges from sandy loam to a loam. Subsoil textures are clay loam, sandy clay loam, or loam. Landforms are concave upland valley bottoms and floors, stream terraces, toe-slopes, and alluvial fans. It is dissected in many places by gullies and draws running down the valleys.

Similar sites

R036XB017NM	**Swale** This 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. Landforms are broad valley bottoms, floodplains, and in depressions.
R036XB008NM	**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.
R036XB138NM	**Marshy** Water table 0-12” in depth; soils are deep; with soil textures from sandy loam to loamy sand with loamy subsoil. Landform stream and marsh on abandon channels on floodplains of valley floors with intermittent streams.

Table 1. Dominant plant species

Tree	(1) *Populus fremontii*
Shrub	(1) *Salix exigua*
Herbaceous	(1) *Pascopyrum smithii* (2) *Carex nebrascensis*

Physiographic features

This site occurs on flood plains, stream terraces, flood-plain steps on valley floors, natural levees flood plains on valley floors and swales. Slopes range from 0 to 3 percent. Elevation ranges from 5,400 to 7,200 feet above sea level.

Area adjacent to channel of Rio Puerco or other perennial streams in this MLRA.

Table 2. Representative physiographic features

Landforms	(1) Natural levee (2) Flood-plain step (3) Flood plain
Flooding duration	Very brief (4 to 48 hours) to long (7 to 30 days)
Flooding frequency	Rare to frequent
Ponding frequency	None

Elevation	1,646–2,195 m
Slope	0–3%
Water table depth	30–91 cm
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) COCHITI DAM [USC00291982], Pena Blanca, NM
- (2) SANTA FE 2 [USC00298085], Santa Fe, NM
- (3) LYBROOK [USC00295290], Dulce, NM
- (4) ABIQUIU DAM [USC00290041], Gallina, NM
- (5) CUBA [USC00292241], Cuba, NM
- (6) EL RITO [USC00292820], El Rito, NM
- (7) NAVAJO DAM [USC00296061], Navajo Dam, NM

Influencing water features

Site immediatly adjacent to perennial stream

Soil features

The soils in this site are deep (60" or greater in depth. The surface soil is a very fine sandy loam, fine sandy loam, very gravelly coarse sand, and ashy loam. Surface texture range in clay percent averages from 2 to 17% clay. Subsoil at 20" in depth range from 2 to 17% clay. Parent materials are micaceous alluvium derived from sandstone

and siltstone and/or alluvium derived from granite and/or alluvium derived from gneiss and/or alluvium derived from schist; mixed alluvium; alluvium derived from granite, gneiss, schist, and granitic sandstone; alluvium derived from granite over gneiss over schist over sandstone; alluvium derived from granite and quartzite; alluvium derived from tuff and/or dacite; alluvium derived from micaceous sandstone and siltstone, and granite, gneiss, or schist;alluvium derived from micaceous sandstone and siltstone over alluvium derived from granite, gneiss, or schist; or alluvium derived from sandstone and shale over alluvium derived from granite, gneiss, schist, or monzonite.

This site is found in NM630, NM672, NM686, NM687, and NM678 soil surveys.

This ecological site has been correlated to the following soils with the following soil particle size control section.

Coarse-Loamy:

Bosquecito
Bosquecito family

Sandy-Skeletal:

Cuyamungue

Ashy:

Metate

Coarse-loamy over sandy or sandy-skeletal:

Jaralosa
Scogg

Table 4. Representative soil features

Parent material	(1) Alluvium–granite (2) Alluvium–gneiss (3) Alluvium–sandstone and siltstone
Surface texture	(1) Very fine sandy loam (2) Very gravelly coarse sand (3) Fine sandy loam
Family particle size	(1) Sandy
Drainage class	Somewhat poorly drained to moderately well drained
Permeability class	Moderately rapid to very rapid
Soil depth	152 cm
Surface fragment cover <=3"	0–35%
Surface fragment cover >3"	0–10%
Available water capacity (0-101.6cm)	8.13–16.51 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–4
Soil reaction (1:1 water) (0-101.6cm)	7.4–9

Subsurface fragment volume <=3" (Depth not specified)	0–40%
Subsurface fragment volume >3" (Depth not specified)	0–15%

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*).

This site covers perennial riparian complexes in southern portion of MLRA 36. Stream flow occurs year round with high water occurring during spring runoff and throughout the summer monsoon season. Episodic high flow duration is variable during the summer monsoon season and can vary on a daily or hourly basis depending on rainfall within the watershed. The episodic flooding of this site is typical of streams in the Colorado Plateau that are influenced by monsoonal climate patterns.

Large magnitude floods are capable of occurring July through October within MLRA 36 in the riparian areas. These floods are generally the result of heavy rain in the summer or fall. Channel morphology can remain stable with large floods, although vegetation can be scoured as a result. However, vegetation found in this type of flashy system is adapted to this type of disturbance. Dominant herbaceous vegetation that is usually rhizomatous which occur on this site have the ability to survive frequent high flow and can send stems up through freshly deposited sediment.

Vegetation composition is influenced by flood frequency, flow duration and length of inundation. Fluvial surfaces that are closer to the channel are inundated frequently with floods, thus generally have less woody vegetation, although coyote willow can tolerate frequent inundation. The vegetation growing on the fluvial surfaces close to the channel have more access to ground water, allowing more obligate wetland species to dominate. Fluvial surfaces further from the channel are inundated less frequently and have greater woody vegetation cover and also have less access to ground water except through deep roots. Dominant vegetation in this ecological site is adapted to yearly variations in flow and sediment deposition, cottonwoods and willows particular to this site are adapted to frequent disturbance and are known to be aggressive colonizers of disturbed sites (Richenbacher 1984). Willows and cottonwoods also require fresh wet sediment that is devoid of other vegetation to germinate (Braatne et al. 1996).

Perennial water in this region is a rare and valuable resource and is often developed for human use. Perennial channels in this region have commonly been altered by irrigation withdrawals, impoundments, and channelization. These uses can influence the channel geomorphology and vegetation structure of this ecological site. Altered hydrology can affect the establishment of cottonwoods because cottonwood germination is dependent on timing and magnitude of flooding.

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

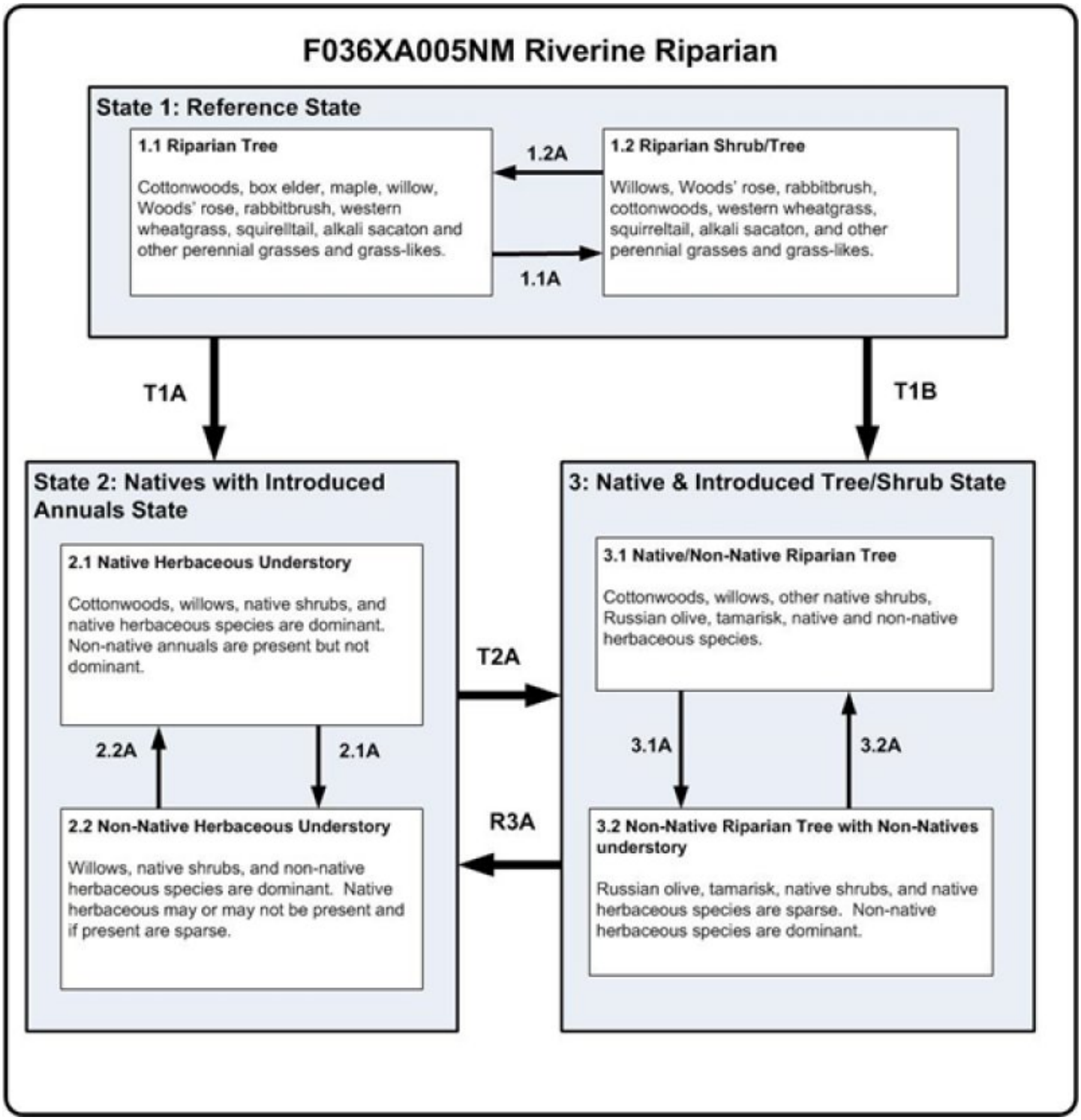

Figure 6. STM

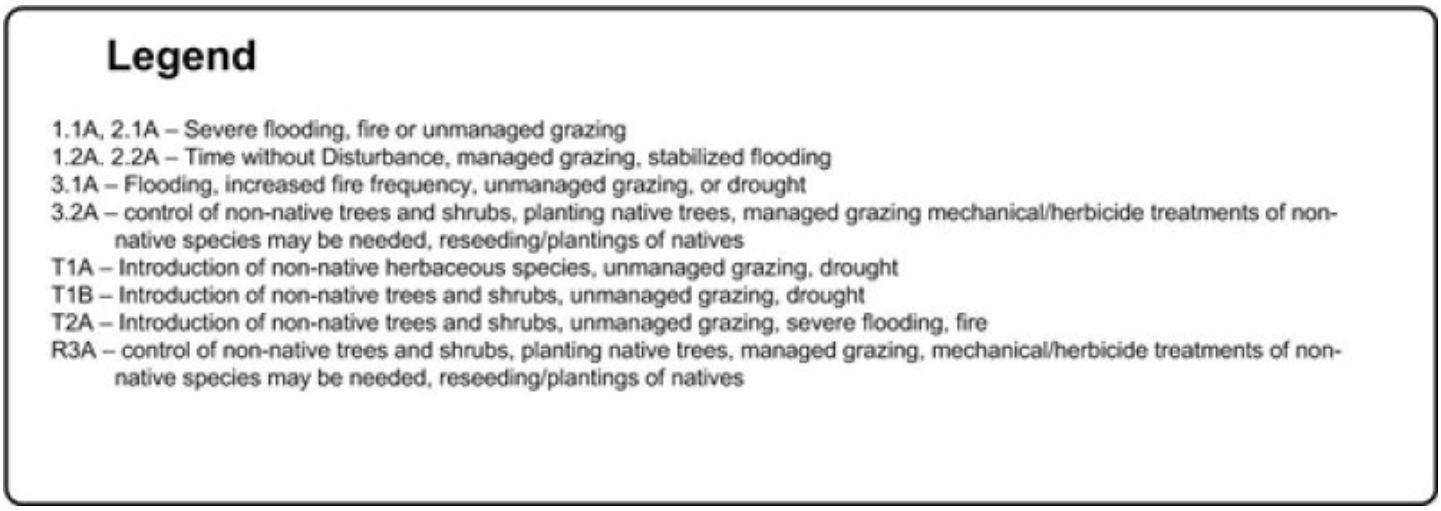

Figure 7. Legend

State 1
Reference State

This site is made up from the consolidated and unconsolidated depositional sediments found immediatly adjacent to perennial streams like the Rio Puerco. Plant community structure and function are determined largely by the hydrology of the stream, the frequency of flooding and ponding and the occasional complete altering of the stream channel position and function by flood events as the stream channel constantly seeks equilibrium with its flow regime and constraining landscape features. Plant communities in this system fluctuate widely across the site in responce to routine disturbence but reestablish quickly in predictable patterns in relation to available water and depositional features. Potential vegetation on this site is dominated by tall and mid cool-season perennial grasses and cottonwood species, which are adapted to occasional periodic flooding and overflow and a fluctuating water table. Other significant vegetation includes a variety of riparian shrubs and forbs. The overstory is dominated by cottonwood and other native shrubs. The understory is comprised of a sparse mix of native grasses, shrubs and forbs. Occasional flooding is important for establishment and maintenance of cottonwood and willows along the streambanks. Fire is not common on this site due to the moist nature of the soils and vegetation, but may occur in rare events. Cottonwood species of various age classes are the primary tree species, while basin big sagebrush and a variety of riparian shrubs comprise the main shrub species. A variety of forbs also occurs in this state and plant diversity is high. Willow has flexible branches that are able to bend with the water force during flow events without too much damage to the plants (Karrenberg et al. 2002; McBride & Strahan 1984; Anderson 2006). Also, Branches can re-sprout if buried by sediment and they may also regenerate vegetatively from broken stems and roots (Anderson 2006). Willows and mesic forbs often are found on the upper edge of the flood plain away from the active channel because it is an intermediate location with access to the water table below high flow. Willow seeds are non-dormant and quickly loose viability. Seedlings generally establish close enough to a water supply and far enough from the channel to be protected from scouring during floods (Anderson 2006). Initially willows grow faster than cottonwood, but given time cottonwood overtops the willows. Seedlings of willow and cottonwood require the same germination conditions, bare, moist soil so they often germinate together. Yearly variations in flow and large floods that scour vegetation and deposit sediment on floodplains are microsites for willow and cottonwood seeds. The adaptations of willows and cottonwoods are: they produce a large number of seeds, the seedlings have a high growth rate, stem fragments can regenerate, and willow root systems are extensive and allow the plant to anchor and bind the soil (Karrenberg et al. 2002).

Community 1.1
Riparian Tree

The Riparian Tree Community is dominated by a canopy of cottonwood and willow, with an understory of young cottonwood, willow, and other shrubs. The understory is a mix of shrubs such as willows, cottonwood saplings, wood’s rose, rubber rabbitbush and Gambel’s oak. Cool-season and warm season grasses, sedges, rushes, and forbs are also present in the understory. Overstory canopy cover fluctuates with flood events under natural conditions. These fluctuations allow gaps in the canopy that are important for the recruitment of young cottonwoods and willows into the overstory. Coyote willow (*Salix exigua*) is drought resistant and very tolerant of flooding (Anderson 2006). Coyote willow is shade intolerant and is shaded out once cottonwoods grow tall enough to dominate the overstory (Karrenberg et al. 2002). Plant Species, plant composition and pounds per acres was

developed from data stored in NASIS at the time this site was written.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	790	1185	1580
Grass/Grasslike	673	1009	1345
Forb	168	252	336
Shrub/Vine	50	76	101
Total	**1681**	**2522**	**3362**

Community 1.2
Riparian Shrub/Tree

The overstory is dominated by coyote willow. There may be some mature and decadent cottonwood and other willows in the community, but they do not dominate the overstory. There is an understory of cottonwood, and other shrubs. There are scattered cool-season and warm season grasses and forbs in the understory. Herbaceous plants can establish between flooding events and can often come up though sediment if they are buried during a flood event. Roots of graminoids and coyote willow hold the stream banks during typical flood events, but may be scoured during large floods. Young cottonwoods and coyote willow, typically establish after a flood. These young cottonwoods established close to the channel and the likelihood of reaching is low because of the close proximity to the stream channel and susceptibility of the streambank to high flow. Parts of the floodplain and low terraces may appear disconnected from the active channel, but they continue to be hydrologically linked by the water table and flood events (Braatne et al. 1996).

Pathway 1.1A
Community 1.1 to 1.2

Severe flood or fire, unmanaged grazing. Wildfires will convert this plant community to the Riparian Shrub/Tree with Cottonwood saplings.

Pathway 1.2A
Community 1.2 to 1.1

Natural regrowth of native trees such as cottonwood and willow. Managed grazing and stabilized flood regimes.

State 2
Natives with Introduced Annuals State

This community is dominated by a canopy of cottonwood and some willows, with an understory of young cottonwood, willow, and other shrubs. The herbaceous understory consists of a mix of the native herbaceous species with non-native species present. The herbaceous understory consists of a mix of the native herbaceous species with non-native grasses, including ripgut brome (*Bromus diandrus*), cheatgrass (*Bromus tectorum*) and Kentucky bluegrass (*Poa pratensis*). Overstory canopy cover would fluctuate with flood events under natural conditions.

Community 2.1
Native Herbaceous Understory

Cottonwoods and other native shrubs dominate the overstory. Exotic annual grasses are present in the understory but the amount of native perennial grasses remains relatively unchanged. Non-native perennial plants may be present in small amounts. The overstory canopy would be similar to community 1.1

Community 2.2

Non-Native Herbaceous Understory

Willows, native shrubs, and non-native herbaceous species are dominant. Native herbaceous may or may not be present and if present are sparse. This is similar plant community structure to community 1.2 except that non-native will be a co-dominant.

Pathway 2.1A
Community 2.1 to 2.2

Severe flood or fire, unmanaged grazing, and/or fires will convert this plant community to the Riparian Shrub/Tree with Cottonwood saplings. This can allow the invasion of Russian Olive and Tamarisk seedlings.

Pathway 2.2A
Community 2.2 to 2.1

Natural regrowth of native trees such as cottonwood and willow. Managed grazing and stabilized flood regimes.

State 3
Native & Introduced Tree/Shrub State

Tamarisk (saltcedar) and/or Russian olive dominate or co-dominate the overstory with native trees. Native shrubs and grasses can occur in the understory, but non-native annuals are present. Russian Olive and Tamarisk can readily establish and replace the willows and cottonwood. Tamarisk is more tolerant of drought and salinity than native species (Horton et al. 2001). The timing of seed dispersal is also different for tamarisk than native shrubs. Tamarisk produces seed from April to October (Horton et al. 2001) and with high summer flows could be at a seed dispersal advantage over cottonwoods and willows, which produce seed from February to April (Braatne et al. 1996). Tamarisk seedlings can establish midsummer on fresh sediment deposits from runoff during summer rain storms, months after cottonwood and willows dispersed seed (Stromberg et al. 2007). Tamarisk invasion can create a feedback loop that is difficult to reverse. Once tamarisk invades and begins to replace willows and cottonwoods, bare soil begins to decrease and shade increases, further decreasing the chance that cottonwoods and willows will regenerate in the site. The introduction of non-native trees and shrubs could have also aided in channel stabilization. A series of years with lower flow could have also allowed for stabilization, establishing riparian veg (native and non-native). Coyote willow, and tamarisk are known for their bank stabilization capacity.

Community 3.1
Native/Non-Native Riparian Tree

The overstory consists of a mix of cottonwood and some willow species, with non-native trees including Russian olive and/or Tamarisk (saltcedar). The herbaceous understory consists of native shrubs and a mix of native and non-native perennial and annual grasses and forbs. Non-native grasses include ripgut brome (*Bromus diandrus*), cheatgrass (*Bromus tectorum*) and Kentucky bluegrass (*Poa pratensis*).

Community 3.2
Non-Native Riparian Tree with Non-Natives understory

This is a riparian plant community dominated by non-native trees such as Tamarisk (salt cedar) and/or Russian olive. Native willows may be present in lesser amounts. The understory includes a mix of native and non-native shrubs and herbaceous species. The herbaceous understory consists of native shrubs with non-native grasses and forbs, including ripgut brome (*Bromus diandrus*), cheatgrass (*Bromus tectorum*) and Kentucky bluegrass (*Poa pratensis*).

Pathway 3.1A
Community 3.1 to 3.2

Loss of native trees from flooding, fire, or drought. Increased fire frequency, drought, unmanaged grazing.

Pathway 3.2A

Community 3.2 to 3.1

Control of non-native trees and shrubs, and planting of native trees. Grazing by livestock and wildlife must be managed. Mechanical and/or herbicide treatments for non-native woody and herbaceous species, managed grazing, reseeding/planting native species.

Transition T1A
State 1 to 2

Introduction of non-native herbaceous species into the plant community. Unmanaged grazing, drought, non-native species such as cheatgrass and ripgut brome are introduced into the site.

Transition T1B
State 1 to 3

Unmanaged grazing, drought, Tamarisk and/or Russian olive and annuals such as cheatgrass and ripgut brome are introduced to the site.

Transition T2A
State 2 to 3

Introduction of non-native trees such as Russian olive and Tamarisk into the plant community. Significant disturbances, unmanaged grazing, severe flood event or fire favors non-native annual grasses and forbs.

Restoration pathway R3A
State 3 to 2

Control of non-native trees and planting of native trees. Grazing by livestock and wildlife must be properly managed. Mechanical and/or herbicide treatments for non-native woody and herbaceous species, managed grazing, reseeding/planting native species.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1				252–504	
	western wheatgrass	PASM	*Pascopyrum smithii*	252–504	–
2				28–252	
	squirreltail	ELEL5	*Elymus elymoides*	22–252	–
	alkali sacaton	SPAI	*Sporobolus airoides*	22–252	–
3				123–504	
	Grass, perennial	2GP	*Grass, perennial*	0–56	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–56	–
	sedge	CAREX	*Carex*	0–56	–
	saltgrass	DISP	*Distichlis spicata*	0–56	–
	rush	JUNCU	*Juncus*	0–56	–
	vine mesquite	PAOB	*Panicum obtusum*	0–56	–
	bulrush	SCIRP	*Scirpus*	0–56	–
Forb					
4				123–392	
	Forb, annual	2FA	*Forb, annual*	0–56	–

	Forb, annual	2FA	*Forb, annual*	0–56	
	Forb, perennial	2FP	*Forb, perennial*	0–56	–
	silverweed cinquefoil	ARAN7	*Argentina anserina*	0–56	–
	brickellbush	BRICK	*Brickellia*	0–56	–
	tall buttercup	RAAC3	*Ranunculus acris*	0–56	–
	broadleaf cattail	TYLA	*Typha latifolia*	0–56	–
	American speedwell	VEAM2	*Veronica americana*	0–56	–
Shrub/Vine					
5				28–168	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–28	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–28	–
	rubber rabbitbrush	ERNAB2	*Ericameria nauseosa ssp. nauseosa var. bigelovii*	0–28	–
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	0–28	–
	Gambel oak	QUGA	*Quercus gambelii*	0–28	–
	Woods' rose	ROWO	*Rosa woodsii*	0–28	–
Tree					
6				56–504	
	narrowleaf cottonwood	POAN3	*Populus angustifolia*	56–504	–
	Rio Grande cottonwood	PODEW	*Populus deltoides ssp. wislizeni*	56–504	–
	Fremont cottonwood	POFR2	*Populus fremontii*	56–504	–
	cottonwood	POPUL	*Populus*	56–504	–
7				123–757	
	narrowleaf willow	SAEX	*Salix exigua*	123–757	–
	Goodding's willow	SAGO	*Salix gooddingii*	123–757	–
	willow	SALIX	*Salix*	123–757	–
8				0–56	
	Rocky Mountain maple	ACGL	*Acer glabrum*	0–56	–
	boxelder	ACNE2	*Acer negundo*	0–56	–
	ponderosa pine	PIPO	*Pinus ponderosa*	0–56	–

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Contributors

John Tunberg
Suzanne Mayne Kinney

Acknowledgments

Project Staff:

Suzanne Mayne-Kinney, Ecological Site Specialist, NRCS MLRA, Grand Junction Colorado SSO Chuck Peacock, MLRA Soil Survey Leader, NRCS MLRA Grand Junction Colorado SSO
Alan Stuebe, MLRA Soil Survey Leader, NRCS MLRA Alamosa Colorado SSO Program Support:
Brenda Simpson, NRCS NM State Rangeland Management Specialist, Albuquerque, NM Scott Woodhall, NRCS MLRA Ecological Site Specialist-QA Phoenix, AZ
Eva Muller, Regional Director, Rocky Mountain Regional Soil Survey Office, Bozeman, MT Rick Strait, NM State Soil Scientist, Albuquerque, NM
Steve Kadas, CO State Resource Conservationist, Albuquerque, NM

--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:**

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:**