USDA Natural Resources
Conservation Service

Ecological site R070CY101NM
Swale

Last updated: 10/21/2024
Accessed: 11/24/2024

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.

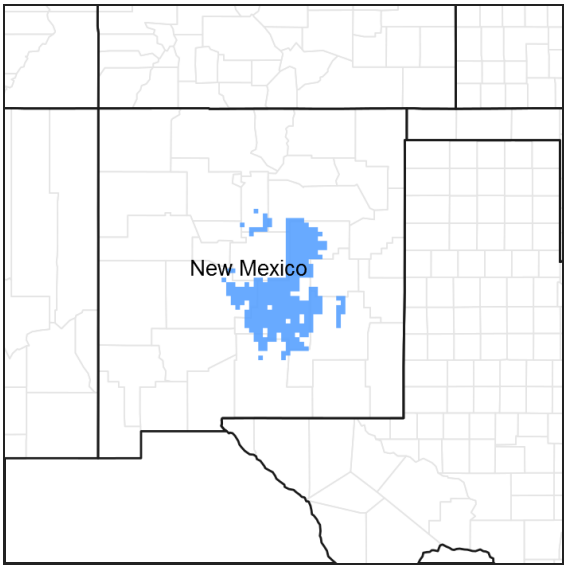


Figure 1. Mapped extent

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): 042C–Central New Mexico Highlands

Major Land Resource Area (MLRA) 70C - will become 42C - is a high elevation portion of central New Mexico that is the convergence of four major physiographic provinces: Basin and Range, Southern Rocky Mountains, Great Plains, and Colorado Plateau. As such, it contains parts or characteristics of each, though tectonically, as a region, it is the easternmost extent of the Basin and Range Province and, more specifically, a structural expression of the Rio Grande Rift. It consists mostly of rangeland with some forested areas associated with numerous disconnected mountain ranges such as the Guadalupe, Sacramento, and Manzano Mountains. Other major physiographic features include the Galisteo Basin or the enclosed Estancia Basin, the structural Chupadera and Glorieta Mesas, and the piedmonts of the Buchanan and Guadalupe Mesas.

LRU notes

This site does not yet have an LRU designation.

Ecological site concept

Landforms that collect water are important ecological refuges within arid to semi-arid climates. In severe drought years, they can serve as critical vestiges of viable feed for foraging wildlife. These landscape positions are typically

the last good opportunity to retain localized soil moisture during significant rain events before being lost to surface water networks. Therefore, it is important that these areas are properly recognized and conserved in as high a functioning condition as possible.

The Swale ecological site occurs on concave "swales" which occur as ephemeral drainageways, valley bottoms, terraces, or similar run-on sites that occur on landscape slopes ranging from 0 to 8 percent at an elevation ranging from 5000 to 7000 feet. The central concept for the Swale site is the subtle patterns of water collecting positions that extend across the landscape concentrating moisture from uplands and conveying it to lower terrain. The enhanced moisture in these sites extends the period of available plant moisture during dryer periods of the growing season. This site typically occurs in deeper sediment deposits as concave positions that typically have a high water holding capacity allowing them to efficiently store the extra moisture they receive. During heavy rainfall events, which typically happen during intense summer storms, these landscape positions can act as broad channels and may experience flooding for brief periods. These sites are also important contributors to regional water table recharge.

Soil depth for the Swale site is generally over 200 cm to root-restrictive layers. Slope gradient ranges from 0 to 8 percent, with slopes rarely dipping below 3 percent. Aspect has very little effect on site dynamics. Surface textures are loam, silty clay loam and clay loam.

Vegetation includes western wheatgrass, vine-mesquite, alkali sacaton, silver and cane bluestem, bottlebrush squirreltail, tabosa, galleta, blue grama, scarlet globemallow, prairie coneflower, smooth four o’clock, cudweed sagewort, fourwing saltbush, Apache plume, winterfat, walkingstick cholla, and broom snakeweed.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex canescens* (2) *Fallugia paradoxa*
Herbaceous	(1) *Pascopyrum smithii* (2) *Panicum obtusum*

Physiographic features

This site is on concave or depressional positions of valleys, alluvial fans, swales, drainageways, stream terraces or gypsic-sinkholes. This site receives significant runoff from adjacent sites to increase the effective moisture. Because of extra water, the plant community "stands out" due to increases production. Slopes range from 0 to 8 percent but are not generally less than 3 percent. Direction of slope varies and is not significant. Elevations range from 5,000 to 7,000 feet above sea level.

The properties of this site will exist within the ranges of the following soil series, but are not necessarily characterized by their full range.
The Manzano soils are along drainageways, flood plains,valley floors, valley sides, and stream terraces, and the lower parts of alluvial fans. Slopes range from 0 to 10 percent. The soils formed in alluvium or slope alluvium derived from sedimentary rocks. elevation ranges from 4,700 to 8,000 feet.
The Gabaldon soils are on alluvial fans and in swales. The soils formed in silty sediments derived from mixed sedimentary and igneous rocks. elevation ranges from 4,000 to 7,800 feet.
Asparas soils are on broad, nearly level valleys with slopes that are dominantly 0 to 3 percent. They have formed in alluvium from surrounding limestone-dominated landscapes. The elevation is 5,000 to 7,000 feet.

Table 2. Representative physiographic features

Landforms	(1) Depression (2) Valley (3) Drainageway
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Very rare to occasional
Ponding frequency	None

Elevation	1,524–2,195 m
Slope	0–8%
Water table depth	25–102 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate of the area is "semi-arid continental."

The average annual precipitation ranges from 13 to 16 inches. Variations of 5 inches, more or less, are not uncommon. Seventy-five percent of the precipitation falls from April to October. Most of the summer precipitation comes in the form of high intensity-short duration thunderstorms.

Temperatures are characterized by distinct seasonal changes and large annual and diurnal temperature changes. The average annual temperature is about 50 degrees F with extremes of -29 degrees F in the winter and 103 degrees F in the summer.

The average frost-free season is 130 to 160 days. The last killing frost is in early May and the first killing frost is in early October.

Both temperature and precipitation favor warm-season species. However, about 40 percent of the precipitation is favorable to cool-season species. This allows the cool-season plants to occupy an important component of this site. The effective precipitation of this site is increased, due to its position on the landscape, by runoff from adjoining sites. This site also serves as a cold air drainageway. These two factors are both favorable to cool-season species and also increase the variety and production of the vegetative community. Strong winds that carry dust from the west and southwest blow across the area from February to June and dry the soil during a critical period for plant growth.

Climate data was obtained from http://www.wrcc.sage.dri.edu/summary/climsmnm.html web site using 50% probability for freeze-free and frost-free seasons using 28.5 degrees F and 32.5 degrees F respectively.

The properties of this site will exist within the ranges of the following soil series, but are not necessarily characterized by their full range.
Manzano - Mean annual precipitation ranges from 11 to 14 inches and mean annual temperature ranges from 47 to 57 degrees F. The frost-free season ranges from 100 to 180 days.
Gabaldon - The climate is semiarid continental. Mean annual precipitation ranges from 11 to 17 inches with a pronounced summer maximum. Mean annual temperature temperature ranges from 45 to 57 degrees F. Frost free season ranges from 140 to 180 days.
Asparas -The mean annual precipitation is l2 to l7 inches and the mean annual air temperature is 50 to 55 degrees F. The frostfree season is about l50 to l70 days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	130-160 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	330-406 mm
Frost-free period (actual range)	100-180 days
Freeze-free period (actual range)	
Precipitation total (actual range)	279-432 mm

Influencing water features

This site is not influenced by water from wetland or perennial stream. However, this site does occupy water-

collecting areas and, thus, is periodically flooded.

Soil features

Soils are deep or very deep. Surface textures are loam, silty clay loam and clay loam. Subsurface textures are silty clay loam, clay loam, silt loam, sandy clay loam, or loam. Underlying textures are loam, silt loam, sandy clay loam, clay loam, silty clay loam, fine sandy loam, or gravelly loamy sand. These soils, once wetted, can store water for relatively long periods. Soil blowing hazard is moderate and water erosion hazard could be severe.

Characterized soils:
Asparas
Calabasas
Gabaldon
Glenburg
Kwhe
Manzano
Revernton
Rune
Partri
Sampson
San Mateo

The Manzano series consists of very deep, well drained, moderately slowly or moderately permeable soils that formed in alluvium or slope alluvium derived from limestone, shale, and sandstone. Manzano soils are along drainageways, on valley floors, valley sides, stream terraces and the lower parts of the alluvial fans. Slope ranges from 0 to 10 percent. Mean annual precipitation is about 13 inches and mean annual air temperature is about 52 degrees F. Well drained. Permeability is moderate. Runoff is negligible on slopes less than 1 percent, very low on 1 to 3 percent slopes, low on 3 to 5 percent slopes and medium on 5 to 10 percent slopes.
The Gabaldon series consists of very deep, well drained, moderately slowly permeable soils that formed in silty sediments derived from mixed sedimentary and igneous rocks. These soils are on alluvial fans and swales. Slope ranges from 0 to 8 percent. Mean annual precipitation is about 15 inches and mean annual air temperature is about 51 degrees F. Well drained. Permeability is moderately slow. Runoff is negligible on slopes less than 1 percent, very low on 1 to 3 percent slopes, low on 3 to 5 percent slopes, and medium on 3 to 8 percent slopes.
The Asparas series consists of deep, well drained soils that formed in alluvium derived mainly from limestone. Asparas soils are on broad, nearly level valleys and have slopes of 0 to 5 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 52 degrees F. Well drained; slow runoff; moderately slow permeability.

Table 4. Representative soil features

Surface texture	(1) Loam (2) Clay loam (3) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Somewhat poorly drained to well drained
Permeability class	Slow to moderately slow
Soil depth	152–183 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	22.86–30.48 cm
Calcium carbonate equivalent (0-101.6cm)	5–20%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm

Sodium adsorption ratio (0-101.6cm)	0–3
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.6
Subsurface fragment volume <=3" (Depth not specified)	15–35%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This site is characterized by its moisture collecting position in the landscape, and therefore has associated soil features that help define the plant community dynamics. Its deep, organic rich materials encourage moisture retention, nutrient cycling, and organic carbon storage and in some places can help jumpstart anaerobic conditions during short periods of the season where areas of soils become saturated. Any smaller patches of hydric soils are important for helping attenuate dissolved nutrient loads in groundwater such as nitrates or sulfates and can further encourage higher plant diversity.

The extra moisture availability promotes plant species diversity and density by extending the growing period when the uplands become dry or by allowing more drought sensitive species to inhabit the site. A dense vegetative canopy shades the ground, keeping it cooler, armored from rainsplash erosion, and erosion during overland flow events. In these conditions, where soil surfaces are plant-armored and shallow roots are somewhat dense, infiltration is higher, runoff is lower, allowing more moisture to be absorbed and thus retained in the landscape, and which further encourages resilience to drought periods.

This higher diversity and density of plant foliar and rooting activity further encourages the turnover of organic matter and therefore cycling of nutrients in what is functionally a positive feedback loop of fertility. Long-term rates of erosion and organic matter cycling are in equilibrium and only fluctuate slightly year-to-year due to normal climatic variability. Fire is a natural cycle that also encourages recycling of nutrients and helps maintain a grass and forb advantage over shrub encroachment.

In a degraded state, shrubs and forbs increase. They gain a competitive advantage, primarily by out-competing the grasses for water and nutrients, especially during periods of short and long duration drought. Fire had been a natural event in these areas thwarting shrub species from gaining a competitive advantage and facilitating greater colonization by grasses. Historic continuous grazing has prevented the fuel loads in these grasslands from being able to carry a fire, therefore giving shrubs and annuals their advantage.

As shrubs increase, root density and turnover in the soil begins to lessen causing a decrease in decomposition rates which are a source of nutrient supply to plants. In return, storage of labile and sequestered carbon pools decline causing a decrease in soil organic matter. Soil organic matter decline coincides with lower infiltration capacity, water holding capacity, and higher bulk density, all which lead to decreased resiliency to drought and heat stress. It also increases erosion rates and may lead to gully formation.

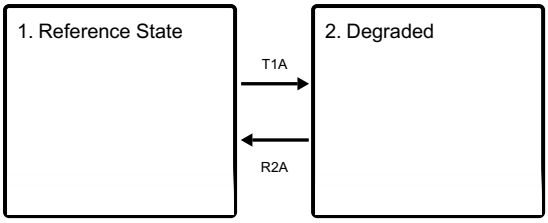
Grazing:

Continuous mismanagement by any animal species will cause a decrease in vigor and abundance of western wheatgrass, vine-mesquite, bluestems, winterfat, and fourwing saltbush. This will cause a corresponding increase of creeping and mat muhly, tobosa and cholla. This will amount to a greatly reduced grazing value and reduced ground cover. The reduced ground cover leaves this site open for severe water erosion that may require expensive structural measures to correct. Grazing when the soil surface is wet will result in severe soil compaction which will greatly reduce water intake and would be a detriment to the entire site, especially the deeper rooted, more productive species. A system of grazing which varies the seasons of use and deferred grazing will allow for a balanced plant community providing higher-quality forage during all seasons of the year.

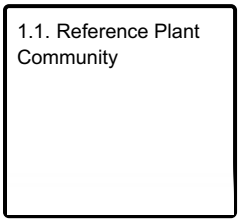
Vegetation includes western wheatgrass, vine-mesquite, alkali sacaton, silver and cane bluestem, bottlebrush squirreltail, tobosa, galleta, blue grama, scarlet globemallow, prairie coneflower, smooth four o’clock, cudweed sagewort, fourwing saltbush, Apache plume, winterfat, walkingstick cholla, and broom snakeweed.

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 1
Reference State

This state includes western wheatgrass, vine-mesquite, bluestems, winterfat, and fourwing saltbush.

Community 1.1
Reference Plant Community

The aspect of this site is that of a grassland. Mid-grasses are dominant with short grasses and a variety of forbs evenly distributed. The landscape is dotted with occasional shrubs or half-shrubs. This site occurs in a position to receive and transport surface water from uplands to bottomlands. This extra water makes the vegetation noticeably denser, stand higher, and is heavier than adjoining upland sites. Other grasses which could appear on this site would include: sideoats grama, black grama, ear muhly, ring mugly, threeawn spp., sixweeks grama and wolftail. Other woody species would include: englemann pricklypear and wolfberry. Other forbs would include: berbena, senna, and annual sunflower.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	706	1138	1569
Forb	202	325	448
Shrub/Vine	50	112	224
Total	**958**	**1575**	**2241**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	5%
Grass/grasslike foliar cover	30-35%
Forb foliar cover	5-7%
Non-vascular plants	0%
Biological crusts	0%
Litter	30%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0-2%
Bedrock	0%

Water	0%
Bare ground	33%

Figure 5. Plant community growth curve (percent production by month). NM4301, R070CY101NM Swale HCPC. R070CY101NM Swale HCPC Mixed cool/warm-season grassland.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	7	10	15	25	25	8	5	0	0

State 2
Degraded

In general, mismanagement of cattle grazing will cause a decrease in palatable mid-grasses and forbs with a corresponding increase in low-value grasses, forbs and shrubs. Sheep grazing will cause a decrease in short grasses and forbs. Continuous mismanagement by any animal species will cause a decrease in vigor and abundance of western wheatgrass, vine-mesquite, bluestems, winterfat, and fourwing saltbush. This will cause a corresponding increase of creeping and mat muhly, tobosa and cholla. This will amount to a greatly reduced grazing value and reduced ground cover. The reduced ground cover leaves this site open for severe water erosion that may require expensive structural measures to correct. Grazing when the soil surface is wet will result in severe soil compaction which will greatly reduce water intake and would be a detriment to the entire site, sepecially the deeper rooted, more productive species. A system of grazing which varies the seasons of use and deferred grazing will allow for a balanced plant community providing higher-quality forage during all seasons of the year.

Transition T1A
State 1 to 2

Season-long grazing providing little rest and recovery for preferred grazed plants during critical growing periods, coupled with high utilization.

Restoration pathway R2A
State 2 to 1

"Restoration pathway resulting from the implementation of prescribed grazing." Note: while not stated in the legacy ESD, it stands to reason that prescribed grazing alone may not reduce the cover of woody plants. Rather, a combination of brush control and prescribed grazing is likely necessary to effect this restoration.

Conservation practices

Grazing Management Plan - Applied

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				244–488	
	western wheatgrass	PASM	*Pascopyrum smithii*	244–488	–
2				163–325	
	vine mesquite	PAOB	*Panicum obtusum*	163–325	–
3				163–244	
	alkali sacaton	SPAI	*Sporobolus airoides*	163–244	–
4				114–163	

	cane bluestem	BOBA3	*Bothriochloa barbinodis*	114–163	–
	silver bluestem	BOSA	*Bothriochloa saccharoides*	114–163	–
5				114–163	
	squirreltail	ELEL5	*Elymus elymoides*	114–163	–
6				163–244	
	James' galleta	PLJA	*Pleuraphis jamesii*	163–244	–
	tobosagrass	PLMU3	*Pleuraphis mutica*	163–244	–
7				82–163	
	blue grama	BOGR2	*Bouteloua gracilis*	82–163	–
8				82–163	
	creeping muhly	MURE	*Muhlenbergia repens*	82–163	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	82–163	–
9				82–163	
	switchgrass	PAVI2	*Panicum virgatum*	82–163	–
10				82–163	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	82–163	–
Forb					
11				49–82	
	upright prairie coneflower	RACO3	*Ratibida columnifera*	49–82	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	49–82	–
12				49–82	
	smooth four o'clock	MIGL3	*Mirabilis glabra*	49–82	–
13				49–82	
	dwarf desertpeony	ACNA2	*Acourtia nana*	49–82	–
14				49–82	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	49–82	–
	New Mexico thistle	CINE	*Cirsium neomexicanum*	49–82	–
	silverleaf nightshade	SOEL	*Solanum elaeagnifolium*	49–82	–
15				17–82	
	Forb (herbaceous, not grass nor grass-like)	2FORB	*Forb (herbaceous, not grass nor grass-like)*	17–82	–
Shrub/Vine					
16				49–82	
	fourwing saltbush	ATCA2	*Atriplex canescens*	49–82	–
	Apache plume	FAPA	*Fallugia paradoxa*	49–82	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	49–82	–
	Apache plume	FAPA	*Fallugia paradoxa*	49–82	–
17				49–82	
	winterfat	KRLA2	*Krascheninnikovia lanata*	49–82	–
18				17–82	
19				17–82	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	171–82	–
20				17–49	
	Shrub, deciduous	2SD	*Shrub, deciduous*	17–49	–

Type locality

Location 1: Chaves County, NM
Location 2: De Baca County, NM
Location 3: Guadalupe County, NM
Location 4: Lincoln County, NM
Location 5: San Miguel County, NM
Location 6: Santa Fe County, NM
Location 7: Torrance County, NM

Other references

Data collection for this site was done in conjunction with the progressive soil surveys within the Pecos-Canadian Plains and Valleys 70 Major Land Resource Area of New Mexico. This site has been mapped and correlated with soils in the following soil surveys: Chaves, De Baca, Guadalupe, Lincoln, Sna Miguel, Santa Fe, Torrance.

Characteristic Soils Are:
Asparas, Partri, Aridic Argiustolls, Albinas Corona Other Soils included are: Gabaldon, Manzano, Reventon, Rock Outcrop Ruidoso, Rune, Sampson

Contributors

Christine Bishop
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John Tunberg

Approval

Kendra Moseley, 10/21/2024

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	11/24/2024
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

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

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

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

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

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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:

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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:**