

Ecological site R081AY319TX Steep Rocky 14-19 PZ

Last updated: 9/19/2023
Accessed: 05/13/2025

General information

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

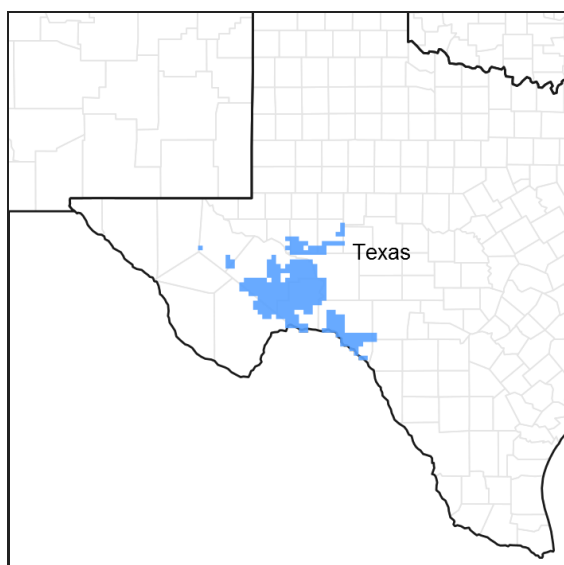


Figure 1. Mapped extent

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): 081A—Edwards Plateau, Western Part

This area is entirely in Texas. It makes up about 16,550 square miles (42,885 square kilometers). The cities of San Angelo and Fort Stockton and the towns of Big Lake, McCamey, Ozona, and Sheffield are in this MLRA. Interstate 20 crosses the northern part of the area, and Interstate 10 crosses the middle of the area. The eastern part of Amistad National Recreation Area is in this MLRA.

Classification relationships

USDA-Natural Resources Conservation Service, 2006.

-Major Land Resource Area (MLRA) 81A

Ecological site concept

The Steep Rocky sites are comprised of shallow soils with lithic contact. The sites are filled with gravels, cobbles, and flagstones and occur on steep slopes with greater than 20 percent slopes.

Associated sites

R081AY311TX	Shallow 14-19 PZ The Shallow ecological site occur on slopes less than 5 percent.
R081AY309TX	Low Stony Hill 14-19 PZ The Low Stony Hill ecological site are on slopes less than 20 percent.

Similar sites

R081AY309TX	Low Stony Hill 14-19 PZ The Low Stony Hill ecological sites occurs on slopes less than 20 percent.
-------------	--

Table 1. Dominant plant species

Tree	(1) <i>Quercus buckleyi</i> (2) <i>Quercus virginiana</i>
Shrub	Not specified
Herbaceous	(1) <i>Schizachyrium scoparium</i> (2) <i>Bouteloua curtipendula</i>

Physiographic features

The soils are on steep uplands and slopes range from 20 to 60 percent. The sites are found on hillsides and scarps that maybe 100 to 400 yards wide and several miles long. The landscape is undulating and characterized by broad ridges and shallow valleys.

Table 2. Representative physiographic features

Landforms	(1) Plateau > Ridge
Runoff class	High to very high
Flooding frequency	None
Elevation	274–1,676 m
Slope	20–60%
Aspect	Aspect is not a significant factor

Climatic features

The climate is semiarid and is characterized by hot summers and dry, relatively mild winters. The average relative humidity in mid-afternoon ranges from 25 to 50 percent. Humidity is higher at night, and the average at dawn is around 70 to 80 percent. The sun shines 80 percent of the time during the summer and 60 percent in winter. The prevailing wind is from the south-southwest. Approximately two-thirds of annual rainfall occurs during the May to October period. Rainfall during this period generally falls during thunderstorms, and fairly large amounts of rain may fall in a short time. The climate is one of extremes, which exert much more influence on plant communities than averages. Timing and amount of rainfall are critical. High temperatures and dry westerly winds have a tremendously negative impact on precipitation effectiveness, as well as length of time since the last rain. Records since the mid-1900's, as well as geological and archaeological findings, indicate wet and dry cycles going back many thousands of years and lasting for various lengths of time with enormous influence on the flora and fauna of the area.

Table 3. Representative climatic features

Frost-free period (characteristic range)	210-270 days
Freeze-free period (characteristic range)	240-300 days
Precipitation total (characteristic range)	381-483 mm
Frost-free period (actual range)	210-270 days
Freeze-free period (actual range)	240-300 days

Precipitation total (actual range)	381-584 mm
Frost-free period (average)	225 days
Freeze-free period (average)	255 days
Precipitation total (average)	457 mm

Climate stations used

- (1) GARDEN CITY [USC00413445], Garden City, TX
- (2) PANDALE 11 NE [USC00416781], Comstock, TX
- (3) SANDERSON [USC00418022], Dryden, TX
- (4) BAKERSFIELD [USC00410482], Iraan, TX
- (5) BIG LAKE 2 [USC00410779], Big Lake, TX
- (6) COPE RCH [USC00411974], Big Lake, TX
- (7) MCCAMEY [USC00415707], Mc Camey, TX
- (8) PAINT ROCK [USC00416747], Paint Rock, TX
- (9) PANDALE 1 N [USC00416780], Comstock, TX
- (10) SHEFFIELD [USC00418252], Sheffield, TX

Influencing water features

No wetlands or streams exist on this site.

Wetland description

N/A

Soil features

The soils are shallow, well drained, moderately permeable and formed over indurated limestone. They are calcerous. Available water is low and texture modifiers include very gravelly and very cobbly. Soil series correlated to this site include: Ector, Langtry, and Lozier.

Table 4. Representative soil features

Parent material	(1) Residuum–limestone
Surface texture	(1) Very gravelly loam (2) Very cobbly clay loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	10–51 cm
Soil depth	10–51 cm
Surface fragment cover ≤3"	30–40%
Surface fragment cover >3"	15–30%
Available water capacity (0-50.8cm)	0.76–3.05 cm
Calcium carbonate equivalent (0-50.8cm)	40–70%
Electrical conductivity (0-50.8cm)	0–2 mmhos/cm

Soil reaction (1:1 water) (0-50.8cm)	7.9–8.4
Subsurface fragment volume <=3" (10.2-50.8cm)	20–40%
Subsurface fragment volume >3" (10.2-50.8cm)	20–40%

Ecological dynamics

The plant communities are dynamic entities. In pre-settlement times, the site would most likely be a savannah dotted with mesquite trees, occasional shrubs and, in some areas, live oaks. The surface would be mostly covered by mid-size bunch grasses and perennial forbs. This reference plant community was greatly influenced by grazing, climate (including periodic extended periods of drought) and, to a lesser degree, fire. Reference community plants developed ways to withstand periods of drought. The midgrasses and forbs shaded the ground, reduced soil temperature, improved infiltration of what little moisture might fall and maintained soil moisture longer. Their roots reached deeper into the soil, utilizing deep soil moisture no longer available to short-rooted plants. In extreme cases many species could go virtually dormant, preserving the energy stored in underground roots, crowns and stems until wetter weather arrived. Their seeds could stay viable in the soil for long periods, sprouting when conditions improved.

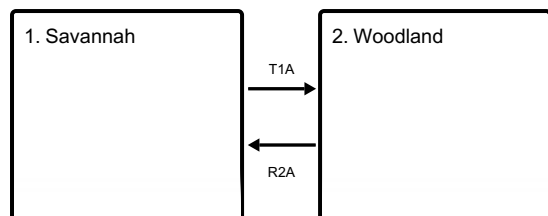
Extensive herds of pronghorns, large towns of black-tailed prairie dogs, as well as smaller populations of elk, white-tailed deer, and desert mule deer were present and had an impact on the plant community. Bison, a migratory herd animal, would come into an area, graze on the move, and not come back for many months or even years. This long deferment period allowed the plants to recover from the heavy grazing. Bison grazing on this site was probably intermittent, occurring during wetter periods. Very few bison were reported in the area after 1830. There were no recorded sightings after 1860. Fire has an influence on plant community structure and was probably a factor in maintaining the original savannah vegetation. Mesquite were present on the site, but not at the level seen today. Periodic fires may have helped keep mesquite as a scattered savannah and other woody species a small part of the composition. Grazing patterns by native herbivores and prairie dog activities were probably more significant factors in maintaining a well-balanced plant community.

While grazing is a natural component of this ecosystem, overstocking and thus overgrazing by domesticated animals has had a tremendous impact on the site. Early settlers, accustomed to farming and ranching in more temperate zones of the eastern United States or even Europe, misjudged the capacity of the site for sustainable production and expected more than could be delivered. Moreover, there was a gap of time between the extirpation of bison and the introduction of domestic livestock which resulted in an accumulation of plant material. This may have given the illusion of higher production than was actually being produced. Overgrazing and fire suppression disrupted ecological processes that took hundreds or thousands of years to develop. Instead of grazing and moving on, domestic livestock were present on the site most of the time, particularly after the practice of fencing arrived. Another influence on grazing patterns was the advent of wells and windmills. They opened up large areas that were previously unused by livestock due to lack of natural surface water. The more palatable plants were selected repeatedly and eventually began to disappear from the ecosystem to be replaced by lower successional, less palatable species. As overgrazing continued, overall production of grasses and forbs declined, more bare ground appeared, soil erosion increased, and woody and succulent increasers began to multiply. The elimination of fire due to the lack of fine fuel or by human interference assisted the rapid encroachment of mesquite and other woody increasers and a concurrent reduction of usable forage.

Extremes in climate exerted tremendous influence on the site long before European man arrived. Geologic formations, archeological findings, and rainfall records since the mid-1900's show wide variations in precipitation with cycles of long, dry periods going back thousands of years with corresponding variations in kind and amount of flora and fauna species. The mineral content and reaction of the soils enable the site to produce diverse, highly nutritious forage. Loss of cover and soil robs the site the site of this capability and promotes rapid water shed, erosion and crusting. Pedestalling, terracetes, and water flow patterns are range health indicators that will be present if the site begins to deteriorate.

State and transition model

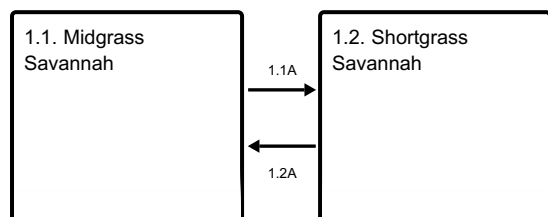
Ecosystem states



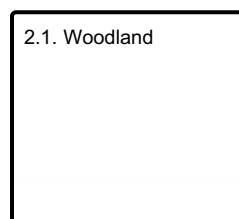
T1A - Absence of wildfire and natural regeneration overtime. Maybe be coupled with prolonged excessive grazing.

R2A - Reintroduction of historic disturbance return intervals

State 1 submodel, plant communities



State 2 submodel, plant communities



State 1 Savannah

Dominant plant species

- oak (*Quercus*), tree
- little bluestem (*Schizachyrium scoparium*), grass
- sideoats grama (*Bouteloua curtipendula*), grass

Community 1.1 Midgrass Savannah

The reference plant community for the site is dominated by little bluestem, sideoats grama, and other midgrasses. There is a canopy of 10 to 20 percent oaks and understory shrubs. The composition is highly variable, depending on the geologic formations. The trees often follow ridges and fissures. The woody component consists primarily of Texas red oak and live oak. Northerly slopes supported as much as a 35 percent canopy of trees. Occasional fires and grazing maintain the mosaic pattern of the plant community. Nutrient cycling, as expressed by vegetative production, litter accumulation and soil organic matter development is postulated to have been at near maximum for the climate, soils, and topography. The density and frequency of woody vegetation are strongly dependent on the presence or absence of fractured limestone. Where non-fractured limestone parent material exists, short rooted plants were common and large deep-rooted tree vegetation rare. The integrity of the reference plant community can be maintained with limiting grazing and browsing by all classes of herbivores and brush management practices such as burning and individual plant treatment (IPT). Due to the steep topography and erosion hazard, only a few management practices are applicable. Hand cutting of seedling, or re-growth, juniper is an example of a viable practice. When overgrazing occurs, brush management is not practiced and/or fire is excluded, the site transitions toward to the Shortgrass/Savannah Community (1.2).

Community 1.2 Shortgrass Savannah

As grazing and browsing pressure increases, secondary herbaceous species of shrubs and tree seedlings begin replacing the more palatable grasses and forbs. The plant community develops into grassland with increased presence of trees and shrubs. In this phase tree and shrub canopy can be high as 35 percent. Reference community midgrasses begin being replaced by shortgrasses. The shortgrasses are generally less palatable and increase in the presence of overgrazing. Less palatable forbs also begin to appear in this community. This phase is productive for multi-species livestock and wildlife husbandry. The balance of forage is still herbaceous, and the increasing shrub component furnishes browse and cover. The hydrologic functions and ecological processes are normal for the site. Water runoff is rapid due to slope, but sediment load is very low. Maintenance of this condition, however, requires careful grazing management and maintenance brush control. Individual plant treatments and fire are the best brush management methods. Unless grazing management and brush management are practiced this phase will transition into Woodland State (2).

Pathway 1.1A

Community 1.1 to 1.2

Heavy abusive grazing, no fire, and no brush management will transition to the Shortgrass Savannah Community (1.2).

Pathway 1.2A

Community 1.2 to 1.1

Prescribed grazing, return of fire, and brush management, in the form of IPT or hand cutting, will restore the Midgrass Savannah Community (1.1).

State 2

Woodland

Dominant plant species

- juniper (*Juniperus*), tree

Community 2.1

Woodland

In this state, the woody canopy, especially juniper species, dominates. This state begins when woody plant canopy exceeds 35 percent and increases with maturity. At maturity the canopy approaches or exceeds 70 percent with junipers occupying 35 to 45 percent. The oak species have also expanded their position and stature along ridges, crevices, and limestone outcrops. Grassland vegetation and low stature shrubs occupy the non-fractured areas, especially on south slopes. Herbaceous species consist of sparse shortgrasses and unpalatable forbs. There is less diversity and abundance compared to the reference state. Desertification is ongoing and groundwater recharge is reduced. With its depauperate forage base, the mature Woodland Community (2.1) provides only cover and low-quality food for livestock and deer. Only expensive brush management, grazing management, and range planting will reverse this state. The rockiness and steep slopes on the site will preclude all but hand methods of plant control and range planting. This state is vulnerable to severe wildfires during extreme drought conditions.

Transition T1A

State 1 to 2

Continued heavy abusive grazing, lack of fire, and lack of brush management will transition the site to the Woodland State (2). This is evidenced by over 35 percent canopy cover by woody species and an overall reduction in production by herbaceous species.

Restoration pathway R2A

State 2 to 1

Grazing management, prescribed fire, and brush management can potentially restore the reference community. The steep sloping nature of the site often causes difficulty with mechanical brush management. Therefore, individual plant treatments and hand cutting may be the only considerations. Range planting of native seeds can quicken the

sites ability to assimilate towards the reference community.

Additional community tables

Animal community

This site is suitable for the production of domestic livestock and to provide habitat for native wildlife. Cow-calf, stocker cattle, sheep, and goats can utilize this site. Carrying capacity has declined drastically over the past 100 years due to deterioration of the reference plant community. An assessment of vegetation is needed to determine the site's current carrying capacity. Calculations used to determine livestock stocking rate should be based on forage production remaining after determining use by resident wildlife, then refined by frequent and careful observation of the plant community's response to animal foraging.

A large diversity of wildlife is native to this site. In the historic plant community, migrating bison, grazing primarily during wetter periods, resident pronghorns, and smaller populations of white-tailed deer, desert mule deer, quail and prairie chickens were the more predominant species. With the subsequent transformation of the plant community, due primarily to the influence of man and climate change, the kind and proportion of wildlife species have been altered.

With the eradication of the screwworm fly, increase in woody vegetation, and man-suppressed natural predation, deer numbers have increased and are often in excess of carrying capacity. Where deer numbers are excessive, overbrowsing and overuse of preferred forbs causes deterioration of the plant community. Progressive management of deer populations through hunting can keep populations in balance and provide an economically important ranching enterprise. Achieving a balance between brushy cover and more open plant communities on this and adjacent sites is important to deer management. Competition among deer, sheep, and goats must be a consideration in livestock and wildlife management to prevent damage to preferred vegetation.

Smaller mammals include many kinds of rodents, jackrabbit, cottontail rabbit, raccoon, skunks, possum and armadillo. Mammalian predators include coyote, red fox, gray fox, bobcat, and mountain lion. Wolves were common in earlier times, bears resided in some areas and an occasional jaguar was encountered. Many species of snakes and lizards are native to the site.

Many species of birds are found on this site including game birds, songbirds and birds of prey. Major game birds that are economically important are bobwhite quail, scaled (blue) quail and mourning dove. Quail prefer a combination of low shrubs, bunch grass (critical for nesting cover), bare ground and low successional forbs. Turkeys visit the site to feed. The different species of songbirds vary in their habitat preferences. Habitat on this site that provides a large diversity of grasses, forbs and shrubs will support a good variety and abundance of songbirds. Birds of prey are important to keep the numbers of rodents, rabbits and snakes in balance.

Inventory data references

Information provided here has been derived from limited NRCS clipping data, and from field observations of range trained personnel.

Other references

Archer, S. 1994. Woody plant encroachment into southwestern grasslands and savannas: Rates, patterns, and proximate causes. Ecological implications of livestock herbivory in the West, 13-68.

Archer, S. and F. E. Smeins. 1991. Ecosystem-level processes. Grazing Management: An Ecological Perspective. Edited by R.K. Heischmidt and J.W. Stuth. Timber Press, Portland, OR.

Bestelmeyer, B. T., J. R. Brown, K. M. Havstad, R. Alexander, G. Chavez, and J. E. Herrick. 2003. Development and use of state-and-transition models for rangelands. Journal of Range Management, 56(2):114-126.

Bracht, V. 1931. Texas in 1848. German-Texan Heritage Society, Department of Modern Languages, Southwest Texas State University, San Marcos, TX.

- Bray, W. L. 1904. The timber of the Edwards Plateau of Texas: Its relations to climate, water supply, and soil. No. 49. US Department of Agriculture, Bureau of Forestry.
- Briske, D. D., S. D. Fuhlendorf, and F. E. Smeins. 2005. State-and-transition models, thresholds, and rangeland health: A synthesis of ecological concepts and perspectives. *Rangeland Ecology and Management*, 58(1):1-10.
- Brothers, A., M. E. Ray Jr., and C. McTee. 1998. Producing quality whitetails, revised edition. Texas Wildlife Association, San Antonio, TX.
- Brown, J. K. and J. K. Smith. 2000. Wildland fire in ecosystems, effects of fire on flora. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: US Department of Agriculture, Forest Service, Rocky Mountain Research Station, 257:42.
- Davis, W. B. 1974. The Mammals of Texas. Texas Parks and Wildlife Department, 41.
- Foster, J. H. 1917. The spread of timbered areas in central Texas. *Journal of Forestry* 15(4):442-445.
- Frost, C. C. 1998. Presettlement fire frequency regimes of the United States: A first approximation. Fire in ecosystem management: Shifting the paradigm from suppression to prescription. Tall Timbers Fire Ecology Conference Proceedings, 20:70-81.
- Gould, F. W. 1975. The grasses of Texas. The Texas Agricultural Experiment Station, Texas A&M University Press, College Station, TX.
- Hatch, S. L. and J. Pluhar. 1993. Texas Range Plants. Texas A&M University Press, College Station, TX.
- Hamilton, W. and D. Ueckert. 2005. Rangeland woody plant control--past, present, and future. Texas A&M University Press. College Station, TX.
- Hart, C. R., A. McGinty, and B. B. Carpenter. 1998. Toxic plants handbook: Integrated management strategies for West Texas. Texas Agricultural Extension Service, The Texas A&M University, College Station, TX.
- Heitschmidt, R. K. and J. W. Stuth. 1991. Grazing management: An ecological perspective. Timberline Press, Portland, OR.
- Loughmiller, C. and L. Loughmiller. 1984. Texas wildflowers. University of Texas Press, Austin, TX.
- Milchunas, D. G. 2006. Responses of plant communities to grazing in the southwestern United States. Gen. Tech. Rep RMRS-GTR-169. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station, 126:169.
- Niehaus, T. F. 1998. A field guide to Southwestern and Texas wildflowers (Vol. 31). Houghton Mifflin Harcourt, Boston, MA.
- Ramsey, C. W. 1970. Texotics. Texas Parks and Wildlife Department, Austin, TX.
- Roemer, F. translated by O. Mueller. 1995. Roemer's Texas, 1845 to 1847. Texas Wildlife Association, San Antonio, TX.
- Scifres, C. J. and W. T. Hamilton. 1993. Prescribed burning for brushland management: The South Texas example. Texas A&M Press, College Station, TX.
- Smeins, F. E., S. Fuhlendorf, and C. Taylor, Jr. 1997. Environmental and land use changes: A long term perspective. *Juniper Symposium*, 1-21.
- Taylor, C. A. and F. E. Smeins. 1994. A history of land use of the Edwards Plateau and its effect on the native vegetation. *Juniper Symposium*, 94:2.

Thurrow, T. L. 1991. Hydrology and erosion. Grazing Management: An Ecological Perspective. Edited by R.K. Heitschmidt and J.W. Stuth. Timber Press, Portland, OR.

Tull, D. and G. O. Miller. 1991. A field guide to wildflowers, trees and shrubs of Texas. Texas Monthly Publishing, Houston, TX.

USDA-NRCS. 1997. National range and pasture handbook. Washington, DC: United States Department of Agriculture. Natural Resources Conservation Service, Grazing Lands Technology Institute.

Weniger, D. 1997. The explorers' Texas: The animals they found. Eakin Press, Austin, TX.

Weniger, D. 1984. The explorers' Texas: The lands and waters. Eakin Press, Austin, TX.

Vines, R. A. 1984. Trees of Central Texas. University of Texas Press, Austin, TX.

Vines, R. A. 1960. Trees, shrubs and vines of the Southwest. University of Texas Press, Austin, TX.

Contributors

Edits by Travis Waiser, MLRA Leader, NRCS, Kerrville, TX

Approval

Bryan Christensen, 9/19/2023

Acknowledgments

QC/QA completed by:

Bryan Christensen, SRESS, NRCS, Temple, TX

Erin Hourihan, ESDQS, NRCS, Temple, TX

Rangeland health reference sheet

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

Author(s)/participant(s)	
Contact for lead author	
Date	05/13/2025
Approved by	Bryan Christensen
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:**
