

Ecological site R040XB234AZ

Limy Fan, Gypsum 7" -10" p.z.

Last updated: 3/11/2025
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.

MLRA notes

Major Land Resource Area (MLRA): 040X–Sonoran Basin and Range

Major Land Resource Area (MLRA) 40 is the portion of Sonoran Desert that extends from northwest Mexico into southwestern Arizona and southeastern California. This MLRA is hot desert characterized by bimodal precipitation coupled with hot summers and mild winters. These conditions give rise to a rich biological diversity visually dominated by columnar cactus (saguaro) and leguminous trees (palo verde). This unit occurs within the Basin and Range Physiographic Province and is characterized by numerous mountain ranges that rise abruptly from broad, plain-like valleys and basins. Igneous and metamorphic rock classes dominate the mountain ranges, and basin sediments are combinations of fluvial, lacustrine, colluvial and alluvial deposits.

LRU notes

Land Resource Unit (LRU) 40-2, Middle Sonoran Desert, is characterized by desert scrub vegetation with a moderate amount of desert pavement on relict fan remnants. Trees are common in washes, bottoms and hillslopes. Elevations range from 1200 to 2000 feet, and precipitation averages 7 to 10 inches per year. Vegetation includes saguaro, palo verde, creosotebush, triangle bursage, brittlebush, prickly pear, cholla, desert saltbush, wolfberry bush muhly, threeawns, and big galleta. The soil temperature regime is hyperthermic and the soil moisture regime is typic aridic.

Classification relationships

USDA-NRCS Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin: Western Range and Irrigated Region D Major Land Resource Area 40 - Sonoran Basin and Range Land Resource Unit 2 - Middle Sonoran Desert Ecological Site Limy Fan, Gypsum, 7-10" p.z.

U.S. Environmental Protection Agency, Ecological Regions of North America: Level I, Region 10 North American Deserts Level II, 10.2 Warm Deserts Level III, Ecoregion 81, Sonoran Basin and Range Level IV, 81i, 81n, 81o

USDA-USFS Ecological Subregions: Sections of the Conterminous United States Section 322 American Semidesert and Desert Province Section 322B, Sonoran Desert

Ecological site concept

Limy fan, Gypsum, 7-10" p.z., occurs on gently sloping uplands (slopes less than 8%). Soils are deep, calcareous, non-skeletal and have gypsum crystals and masses in subsurface horizons.

Associated sites

R040XB233AZ	Limy Slopes, Gypsum 7"-10" p.z. adjacent slopes
-------------	---

Similar sites

R040XB207AZ	Limy Fan 7"-10" p.z. soils without high gypsum
-------------	--

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Larrea tridentata</i> (2) <i>Ambrosia deltoidea</i>
Herbaceous	(1) <i>Pleuraphis rigida</i>

Physiographic features

This site occurs on fan terraces and stream terraces.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Stream terrace
Aspect	Aspect is not a significant factor

Climatic features

Annual precipitation ranges from 7 to 10 inches. Annual rainfall is bimodal, with distinct rainy seasons occurring from December to March (winter) and July to September (summer). Rainfall ratios range from 40:60 (winter:summer) in the southern part, and 60:40 in the central and northern parts. Rainfall intensity differs between rainfall seasons. Winter frontal storms develop in the Pacific Ocean and Gulf of California, producing widespread, low-intensity and long duration precipitation events. Winter precipitation is the more dependable water source for vegetation, and snowfall is very rare. During summer months, atmospheric activity in the Gulf of Mexico produces convective thunderstorms when crossing over the mountains in the afternoon. These storms travel across the plains and valleys, producing precipitation of short duration, usually less than 30 minutes, but of moderate to heavy intensity. Between these two seasons, little to no effective precipitation can occur for several months at a time. May and June are the driest months, and overall humidity is very low. Overall, average annual rainfall is variable, but increases in variability from east to west across the region. For long-term precipitation data, the coefficient of variation, the ratio of the standard deviation to the mean expressed as a percentage, increases from 38% at Florence (east) to 46% at Aguila (west).

Winter temperatures are very mild, with very few days having short periods of freezing temperatures. Summertime temperatures are hot to very hot, with many days in June and July exceeding 105 degrees F. The number of frost-free days ranges from 280 in major river valleys with cold air drainage to between 320 and 350 in upland areas.

Spring and the summer growing seasons are equally important for perennial grass, forb and shrub growth. With above average precipitation, cool and warm season annual forbs and grasses can be common in their respective seasons. Perennial forage species can remain green throughout the year with sufficient available moisture.

Table 3. Representative climatic features

Frost-free period (characteristic range)	248-346 days
Freeze-free period (characteristic range)	365 days
Precipitation total (characteristic range)	203-254 mm
Frost-free period (actual range)	242-365 days

Freeze-free period (actual range)	277-365 days
Precipitation total (actual range)	178-254 mm
Frost-free period (average)	286 days
Freeze-free period (average)	347 days
Precipitation total (average)	229 mm

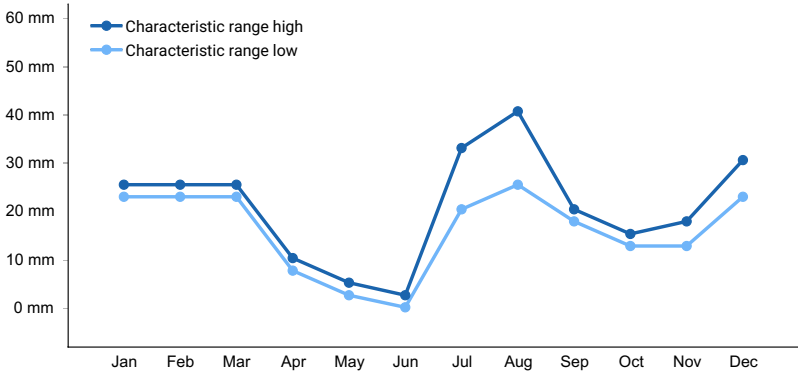


Figure 1. Monthly precipitation range

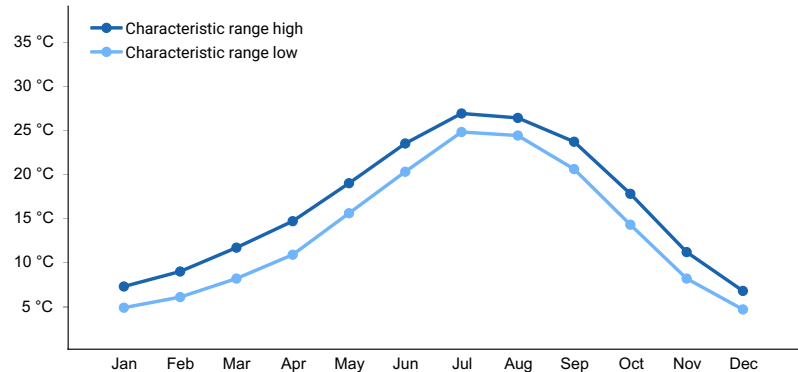


Figure 2. Monthly minimum temperature range

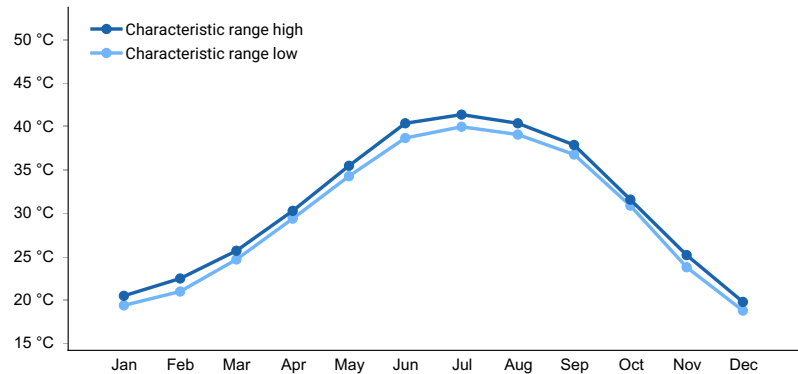


Figure 3. Monthly maximum temperature range

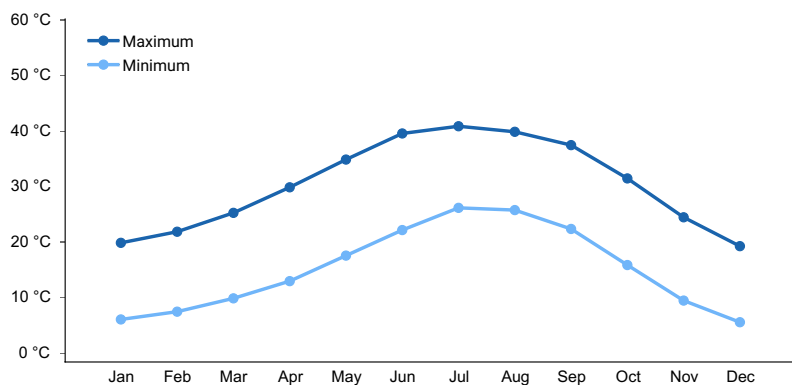


Figure 4. Monthly average minimum and maximum temperature

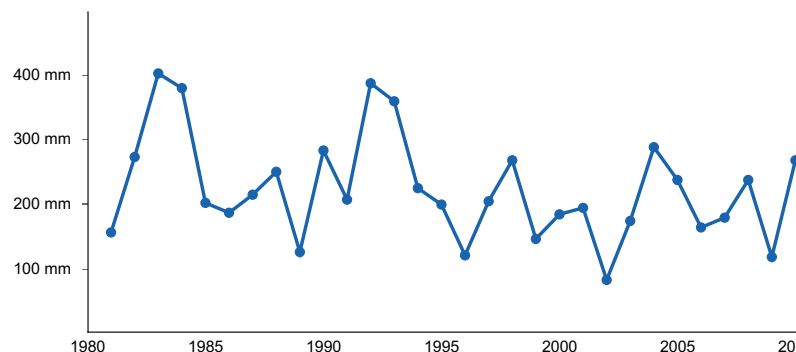


Figure 5. Annual precipitation pattern

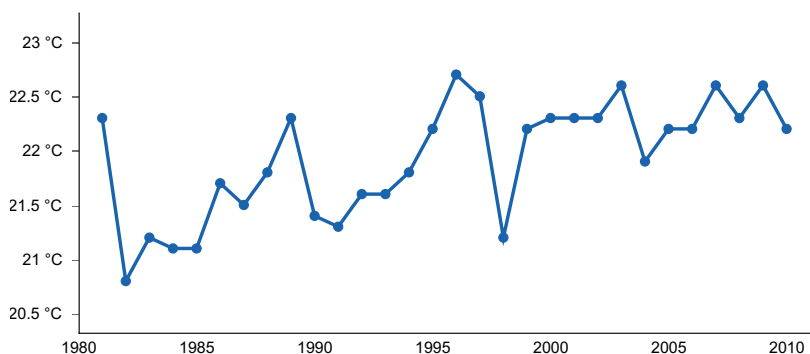


Figure 6. Annual average temperature pattern

Climate stations used

- (1) CASA GRANDE [USC00021306], Casa Grande, AZ
- (2) LITCHFIELD PARK [USC00024977], Goodyear, AZ
- (3) KOFA MINE [USC00024702], Wellton, AZ
- (4) LAVEEN 3 SSE [USC00024829], Phoenix, AZ
- (5) ORGAN PIPE CACTUS NM [USC00026132], West Pima County, AZ
- (6) FLORENCE [USC00023027], Florence, AZ
- (7) PHOENIX SKY HARBOR INTL AP [USW00023183], Phoenix, AZ

Influencing water features

Soil features

These deep soils form in young, loamy alluvium of mixed origin. Surface textures range from sandy loam to sandy. These soils are not skeletal nor compacted, but they are calcareous and gypsiferous. Plant-soil moisture relationships are poor. On areas without gravel cover, two to five inch pedestals form under woody plant species. Intact cryptobiotic crusts do offer some erosion resistance, but the high gypsum content makes the soil extremely vulnerable to erosion if the crust is disturbed.

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Gravelly sandy loam (2) Gravelly fine sandy loam (3) Gravelly loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Soil depth	152 cm
Surface fragment cover <=3"	0–15%
Available water capacity (0-101.6cm)	21.34–27.43 cm
Calcium carbonate equivalent (0-101.6cm)	3–25%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	7.9–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–15%

Ecological dynamics

Limy Fan, Gypsum, 7 - 10" p.z., has vegetation dynamics similar to Limy Fan, 7 - 10" p.z., but is differentiated by a high gypsum content in the soil. This ecological site is limited in areal extent relative to similar sites. The only observed state, Mixed Shrubland, is dominated by creosotebush, bursage and ratany. Cryptobiotic crusts form a robust cover over large areas. Perennial grasses, such as big galleta and bush muhly, are generally confined to rills or small depressions that retain additional moisture. Several species of shrubs, cacti, other succulents and forbs are present in the plant community. Annual forbs and grasses can proliferate after a substantial rainfall. Alternative states and disturbance processes were not observed during soil mapping. The aspect is open shrubland.

State and transition model

40-2AZ Limy Fan, Gypsum, 7-10" p.z. (R040XB234AZ)

1. Mixed Shrubland State

1.1 Desert Shrub-Grass Community

Creosote interspersed with half-shrubs, perennial grasses, cactus and perennial forbs. Cryptobiotic crust robust in extensive patches. Trees are widely scattered. Saguaros are more so. Annual forbs and grasses flourish after rainfall periods.

Figure 7. Limy Fan, Gypsum, 7-12 in. p.z.

State 1

Mixed Shrubland

Community 1.1

Desert Shrub-Grass



Figure 8. Limy Fan, Gypsum, 7-10 in p.z.

The potential plant community is a mixture of desert shrubs and sub-shrubs with cacti, perennial grasses and annuals well represented throughout. Desert trees are sparsely present. Creosotebush is the dominant shrub, with a wide range of other shrubs present, such as wolfberry, palo verde, and graythorn. An even mix of bursage and

ratany make up the sub-dominant, woody shrub understory. Perennial grasses, like big galleta, are primarily restricted to rills and flow paths. A variety of succulents, cholla, prickly pears, cereus and barrel cacti occur sporadically, and saguaro may or may not be present. A wide variety of annual forbs and grasses can occur at any time of year with sufficient precipitation. Annual production from annuals forbs and grasses can exceed 100 lbs/acre during a wet year. The aspect is open shrubland. The soil surface generally lacks a protective gravel cover, but usually has extensive cryptogam cover. Cryptobiotic crust cover ranges from 10%–15%, and if left intact can reduce the potential for wind and water erosion. Sheet and rill erosion can accelerate, and dust blowing can become a problem if these crusts are severely disturbed.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	157	235	314
Forb	20	68	118
Grass/Grasslike	20	47	78
Total	197	350	510

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	Perennial Grasses			17–34	
	bush muhly	MUPO2	<i>Muhlenbergia porteri</i>	2–6	–
	big galleta	PLRI3	<i>Pleuraphis rigida</i>	0–2	–
	slim tridens	TRMU	<i>Tridens muticus</i>	0–2	–
	spidergrass	ARTE3	<i>Aristida ternipes</i>	0–2	–
2	Annual Grasses			3–56	
	sixweeks threeawn	ARAD	<i>Aristida adscensionis</i>	0–11	–
	needle grama	BOAR	<i>Bouteloua aristidoides</i>	0–11	–
	sixweeks grama	BOBA2	<i>Bouteloua barbata</i>	0–6	–
	Arizona brome	BRAR4	<i>Bromus arizonicus</i>	0–1	–
Forb					
3	Perennial Forbs			39–56	
	evening primrose	OENOT	<i>Oenothera</i>	0–6	–
	desert globemallow	SPAM2	<i>Sphaeralcea ambigua</i>	0–6	–
	pricklyleaf dogweed	THAC	<i>Thymophylla acerosa</i>	0–1	–
	dwarf desertpeony	ACNA2	<i>Acourtia nana</i>	0–1	–
	weakeaf bur ragweed	AMCO3	<i>Ambrosia confertiflora</i>	0–1	–
	southern Sierra pincushion	CHAL	<i>Chaenactis alpigena</i>	0–1	–
	whitemargin sandmat	CHAL11	<i>Chamaesyce albomarginata</i>	0–1	–
	shrubby deervetch	LORI3	<i>Lotus rigidus</i>	0–1	–
4	Annual Forbs			17–118	
	common fiddleneck	AMMEI2	<i>Amsinckia menziesii</i> var. <i>intermedia</i>	0–11	–
	bristly fiddleneck	AMTE3	<i>Amsinckia tessellata</i>	0–11	–
	desert Indianwheat	PLOV	<i>Plantago ovata</i>	0–11	–

	buckwheat	ERIOG	<i>Eriogonum</i>	0–11	–
	Coulter's globemallow	SPCO2	<i>Sphaeralcea coulteri</i>	0–6	–
	western tansymustard	DEPI	<i>Descurainia pinnata</i>	0–6	–
	cryptantha	CRYPT	<i>Cryptantha</i>	0–3	–
	hairy prairie clover	DAMO	<i>Dalea mollis</i>	0–1	–
	touristplant	DIWI2	<i>Dimorphocarpa wislizeni</i>	0–1	–
	flatcrown buckwheat	ERDE6	<i>Eriogonum deflexum</i>	0–1	–
	miniature woollystar	ERDI2	<i>Eriastrum diffusum</i>	0–1	–
	erigenia	ERIGE	<i>Erigenia</i>	0–1	–
	Coulter's spiderling	BOCO2	<i>Boerhavia coulteri</i>	0–1	–
	hoary bowlesia	BOIN3	<i>Bowlesia incana</i>	0–1	–
	yellow tackstem	CAPA7	<i>Calycoseris parryi</i>	0–1	–
	white tackstem	CAWR	<i>Calycoseris wrightii</i>	0–1	–
	devil's spineflower	CHRI	<i>Chorizanthe rigida</i>	0–1	–
	New Mexico plumeseed	RANE	<i>Rafinesquia neomexicana</i>	0–1	–
	chia	SACO6	<i>Salvia columbariae</i>	0–1	–
	sleepy silene	SIAN2	<i>Silene antirrhina</i>	0–1	–
	common woolly sunflower	ERLA6	<i>Eriophyllum lanatum</i>	0–1	–
	California poppy	ESCAM	<i>Eschscholzia californica</i> ssp. <i>mexicana</i>	0–1	–
	hairy desertsunflower	GECA2	<i>Geraea canescens</i>	0–1	–
	California goldfields	LACA7	<i>Lasthenia californica</i>	0–1	–
	Gordon's bladderpod	LEGO	<i>Lesquerella gordonii</i>	0–1	–
	shaggyfruit pepperweed	LELA	<i>Lepidium lasiocarpum</i>	0–1	–
	Bigelow's linanthus	LIBI2	<i>Linanthus bigelovii</i>	0–1	–
	disc mayweed	MADI6	<i>Matricaria discoidea</i>	0–1	–
	blazingstar	MENTZ	<i>Mentzelia</i>	0–1	–
	lineleaf whitepuff	OLLI	<i>Oligomeris linifolia</i>	0–1	–
	Florida pellitory	PAFL3	<i>Parietaria floridana</i>	0–1	–
	combseed	PECTO	<i>Pectocarya</i>	0–1	–
	manybristle chinchweed	PEPA2	<i>Pectis papposa</i>	0–1	–
	phacelia	PHACE	<i>Phacelia</i>	0–1	–

Shrub/Vine

5	Dominant Shrubs			118–235	
	creosote bush	LATR2	<i>Larrea tridentata</i>	118–235	–
6	Dominant Half-Shrubs			39–78	
	burrobush	AMDU2	<i>Ambrosia dumosa</i>	11–28	–
	white ratany	KRGR	<i>Krameria grayi</i>	6–17	–
7	Miscellaneous Shrubs			3–8	
	cattle saltbush	ATPO	<i>Atriplex polycarpa</i>	0–1	–
	crucifixion thorn	CAEM4	<i>Castela emoryi</i>	0–1	–
	ocotillo	FOSP2	<i>Fouquieria splendens</i>	0–1	–
	crown of thorns	KOSP	<i>Koeberlinia spinosa</i>	0–1	–
	water jacket	LYAN	<i>Lyceum andersonii</i>	0–1	–

	water jacket	LYAN	<i>Lycium andersonii</i>	0–1	–
	Berlandier's wolfberry	LYBE	<i>Lycium berlandieri</i>	0–1	–
	Arizona desert-thorn	LYEX	<i>Lycium exsertum</i>	0–1	–
	desert ironwood	OLTE	<i>Olneya tesota</i>	0–1	–
	yellow paloverde	PAMI5	<i>Parkinsonia microphylla</i>	0–1	–
	whitestem paperflower	PSCO2	<i>Psilostrophe cooperi</i>	0–1	–
	lotebush	ZIOB	<i>Ziziphus obtusifolia</i>	0–1	–
8	Succulents			3–11	
	candy barrelcactus	FEWI	<i>Ferocactus wislizeni</i>	0–1	–
	branched pencil cholla	CYRA9	<i>Cylindropuntia ramosissima</i>	0–1	–
	devil's cholla	GRKU	<i>Grusonia kunzei</i>	0–1	–
	teddybear cholla	CYBI9	<i>Cylindropuntia bigelovii</i>	0–1	–
	buck-horn cholla	CYAC8	<i>Cylindropuntia acanthocarpa</i>	0–1	–

Other references

Griffith, G.E., Omernik, J.M., Johnson, C.B., and Turner, D.S., 2014, Ecoregions of Arizona (poster): U.S. Geological Survey Open-File Report 2014-1141, with map, scale 1:1,325,000, <https://dx.doi.org/10.3133/ofr20141141>. ISSN 2331-1258 (online)

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

Contributors

Wilma Renken

Approval

Kendra Moseley, 3/11/2025

Acknowledgments

Acknowledgments to the NRCS soil scientists for their discerning soil survey work and to the MRLA 40 Workgroup Team for their review and comments in developing this ESD.

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	10/22/2019
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:**

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:** none

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:**
-