USDA Natural Resources Conservation Service

Ecological site F040XB214AZ
Loamy Bottom, Woodland 7"-10" p.z.

Last updated: 10/17/2024
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General information

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

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 as desert scrub vegetation with a moderate percentage of desert pavement on relic fan remnants; trees are common to all sized washes, bottoms and hillslopes. Elevations range from 1200 to 2000 feet and precipitation averages 7 to 10 inches per year. Upland vegetation includes saguaro, palo verde, creosotebush, white bursage, brittlebush, prickly pear, cholla, desert saltbush, wolfberry, 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 Loamy Bottom, Woodland, 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, 81l, 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

Loamy Bottom, Woodland, 7"-10" p.z., occurs on stream terraces with a deep water table. Soils do not have visible redoximorphic features. Soil texture ranges from sandy to loamy to silty. The reference plant community is mesquite dominated; understory vegetation is largely absent in areas with dense mesquite canopy cover. Aspect is woodland.

Associated sites

F040XB215AZ	**Sandy Bottom, Woodland 7" - 10" p.z.** adjacent stream channels, redox features present in top 80 inches of soil surface

Similar sites

R040XA124AZ	**Loamy Bottom, Woodland 10"-13" p.z.** Elevations 2,000' - 3,800', higher precipitation, soils are thermic
F040XC328AZ	**Loamy Bottom, Woodland 3"-7" p.z.** Elevations 300' - 1,200', lower precipitation

Table 1. Dominant plant species

Tree	(1) *Prosopis velutina*
Shrub	(1) *Prosopis velutina*
Herbaceous	Not specified

Physiographic features

This ecological site occurs on floodplains and stream terraces of major drainageways. The site regularly floods, and typically has a water table at depths from 10 to 50 feet. Slopes range from 0%–5%.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Stream terrace
Slope	0–1%

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°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)	248-309 days
Freeze-free period (characteristic range)	285-365 days
Precipitation total (characteristic range)	178-229 mm

Frost-free period (actual range)	241-351 days
Freeze-free period (actual range)	251-365 days
Precipitation total (actual range)	178-254 mm
Frost-free period (average)	281 days
Freeze-free period (average)	326 days
Precipitation total (average)	203 mm

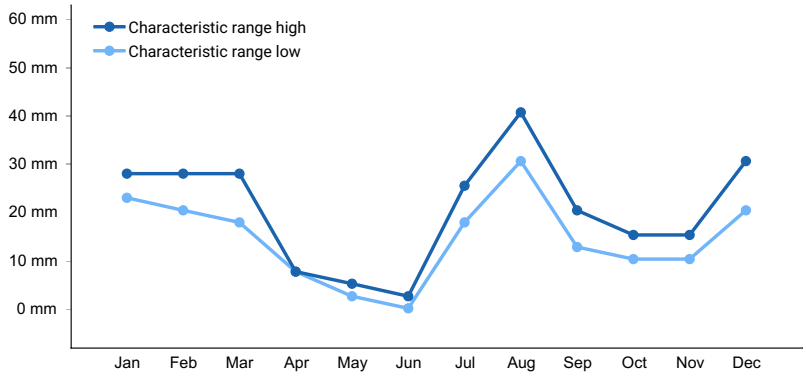


Figure 1. Monthly precipitation range

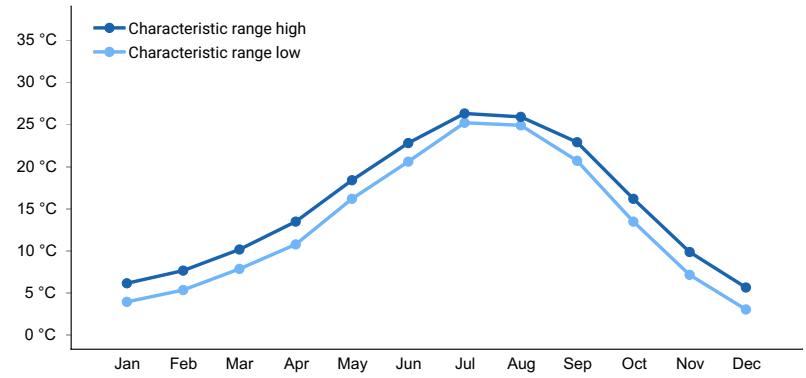


Figure 2. Monthly minimum temperature range

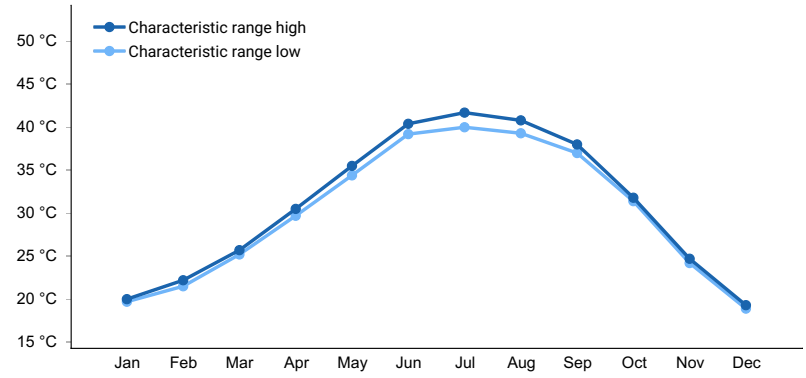


Figure 3. Monthly maximum temperature range

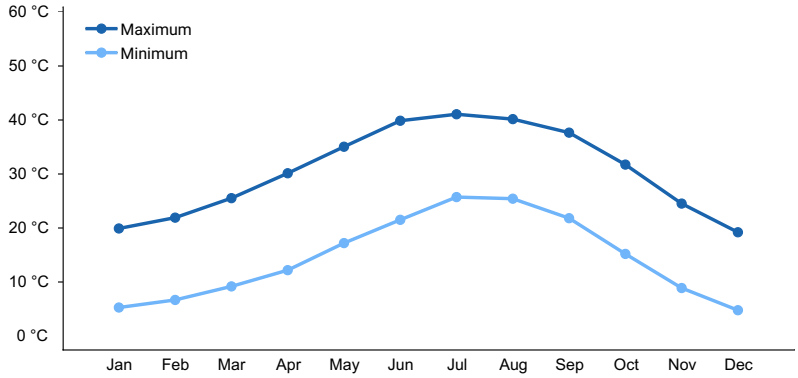


Figure 4. Monthly average minimum and maximum temperature

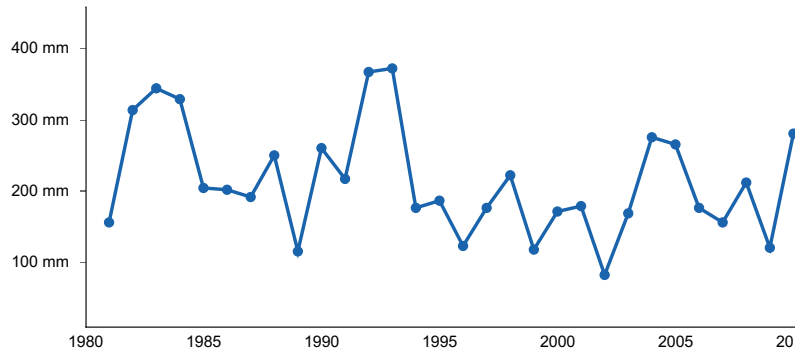


Figure 5. Annual precipitation pattern

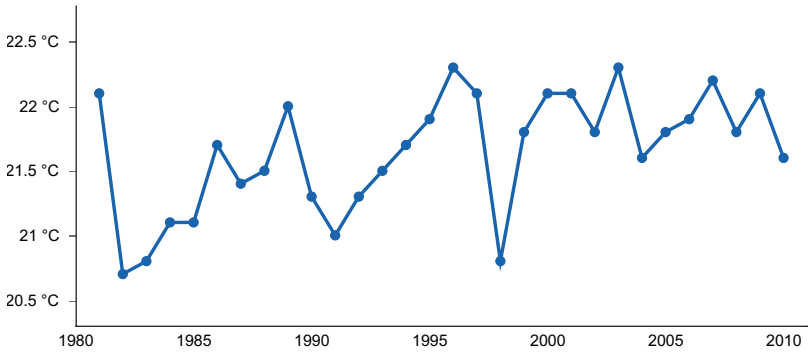


Figure 6. Annual average temperature pattern

Climate stations used

- (1) CASA GRANDE [USC00021306], Casa Grande, AZ
- (2) AJO [USC00020080], Ajo, AZ
- (3) YOUNGTOWN [USC00029634], Sun City, AZ
- (4) FLORENCE [USC00023027], Florence, AZ
- (5) TONOPAH [USC00028641], Tonopah, AZ

Influencing water features

Soil features

These are young soils formed in loamy, sandy or silty alluvium of mixed origin. Surface textures may include silty loam, sandy loam, fine sandy loam, silty clay loam, or loam. Subsurface texture groups vary widely, depending on alluvium origin. Soils are deep and well drained. Deep-rooted trees and shrubs do well on these soils due to the additional water received as runoff from surrounding landscapes. Rapid infiltration down through surface soil layers makes moisture largely unavailable for shallow-rooted plants.

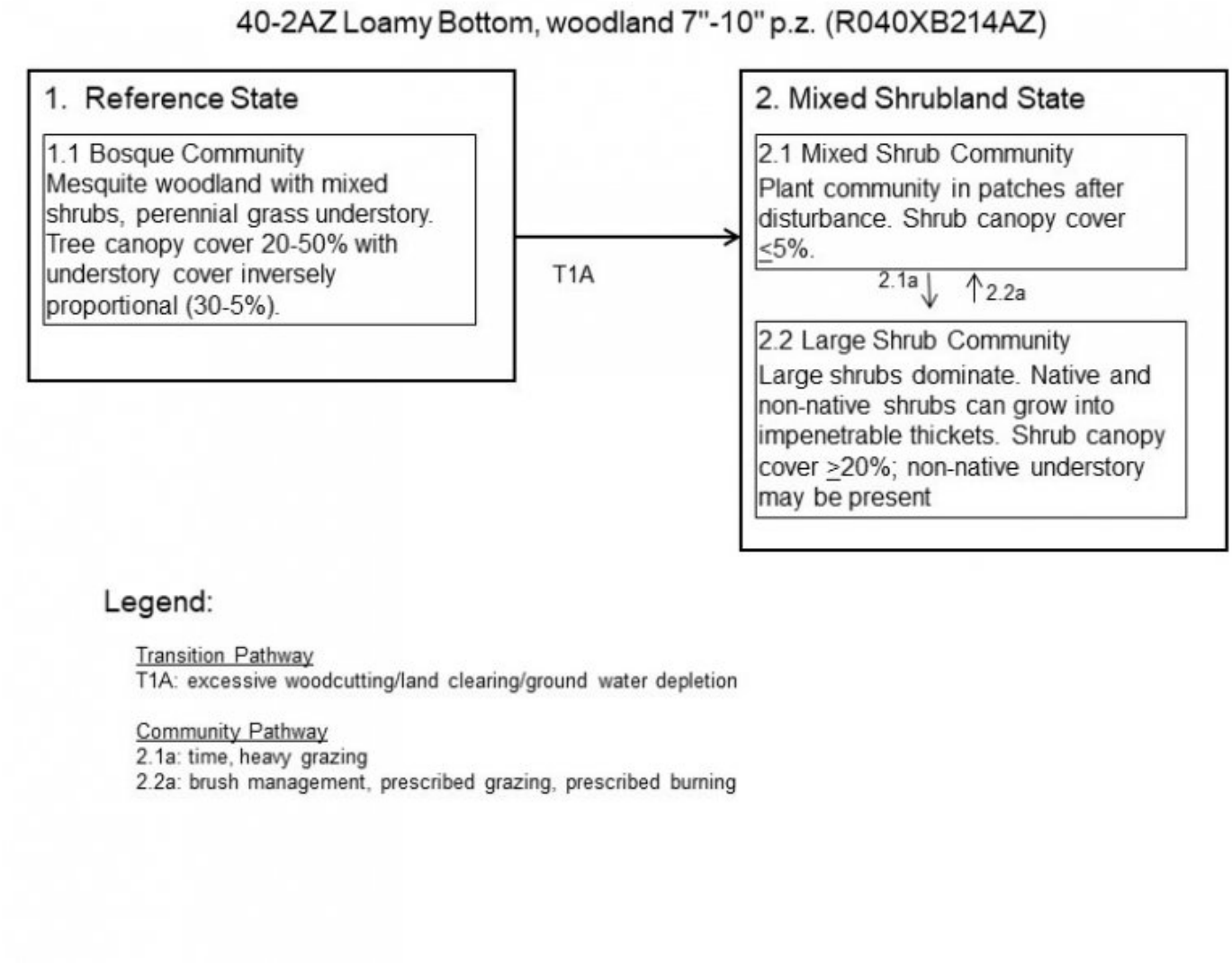
Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Loam (2) Very fine sandy loam (3) Sandy loam
Family particle size	(1) Loamy (2) Coarse-loamy (3) Sandy
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Soil depth	152 cm
Available water capacity (0-101.6cm)	21.34–28.96 cm
Calcium carbonate equivalent (0-101.6cm)	1–10%
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

Ecological dynamics

Loamy Bottom, woodland, 7”-10” p.z. is a robust site with few natural disturbance events. The reference plant community is a mesquite bosque; the aspect is deciduous woodland. Velvet mesquite is the dominant species but western honey or screwbean mesquites may be locally present. A mixed understory of half shrubs, shrubs and perennial grasses occurs but diminishes as mesquite canopy increases. When the mesquite canopy is removed or significantly reduced, understory shrubs will come to dominate in the Mixed Shrubland state. Salt cedar, a common non-native shrub that dominates watercourses, can establish on this site. Non-native annual forbs and grasses will establish and flourish with wet seasons. Fire is an uncommon disturbance on this ecological site due to patchy vegetative cover, but a continuous bed of fine fuels is possible in the Mixed Shrubland state.

State and transition model



State 1
Mesquite Woodland (Reference)

This site has a mixed plant community with an overstory of mesquite and an understory of shrubs and perennial and annual grasses and forbs. Mesquite leafs out in midspring after the last frost, flowers in late spring and has mature fruits dropping by July. The trees lose their leaves with the first hard frost in the fall. The aspect is deciduous woodland.

Community 1.1
Historical Climax Plant Community

Cryptogam cover can be quite high especially under dense mesquite canopies. Mosses (Musci), algae (Chara, Oscillatoria and Spirogya spp.), and fungi (Phycomicetes, Sacomycetes and Basidiomycetes) are all common on this site. Plant density values range from 300 to 500 trees per acre for mesquite, and 5 to 20 plants per acre for desert hackberry.

State 2
Mixed Shrubland

If the mesquite overstory is removed, large shrubs such as salt cedar will come to dominate the site. Mesquite and large shrubs will sprout on low-lying areas of abandoned cropland. Excessive groundwater pumping from areas adjacent to this site can, over time, lower the water table beyond the reach of mesquite roots and cause extensive loss of trees. In high water table areas, saltcedar can invade and become dominant following disturbance of the native tree cover. Bermudagrass and Johnsongrass are introduced perennials commonly found on this site. Foxtail barley, London rocket mustard and Carolina canarygrass are introduced annuals commonly found on this site. Cocklebur can become a problem weed in response to overgrazing.

Community 2.1
Mixed Shrub

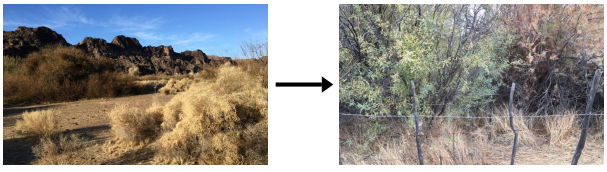
Figure 7. Loamy Bottom, woodland, in Mixed Shrub plant community after cropland abandonment

Shrub canopy cover is typically less than 5%. Community structure and composition varies with disturbance type and regime on this site: if the site is abandoned cropland, shrubs will initially sprout in low-lying areas such as field ends; following excessive woodcutting, mesquite will begin to vigorously sprout and grow into a multi-stem shrub; opening the canopy also allows other large shrubs an opportunity to expand in size and number; non-native shrubs and annuals will rapidly colonize after any flood event following disturbance.

Community 2.2
Dense Mixed Shrub

Over time following any disturbance, large shrubs will dominate the site. Native and non-native shrubs can grow into impenetrable thickets. Annual forbs flourish following favorable rains. Shrub canopy cover is typically less than 20%; non-native understory may be present.

Pathway 2.1a
Community 2.1 to 2.2



Mixed Shrub **Dense Mixed Shrub**

Over time, large shrubs will come to dominate the site.

Pathway 2.2a
Community 2.2 to 2.1

Dense Mixed Shrub

Mixed Shrub

Brush management to selectively remove undesired large shrubs. Prescribed grazing and prescribe burning.

Transition T1A
State 1 to 2

Any disturbance that removes significant mesquite canopy cover will drive site transition to the Mixed Shrubland. Common disturbances include land clearing for irrigated cropland (and subsequent cessation of field maintenance), excessive mesquite wood harvesting, and lowering the water table.

Constraints to recovery. Restoration would require 50-100 years of repeated brush management treatments to control undesirable shrubs. If the water table has been lowered or groundwater has been depleted, restoration is not possible. Thus, a restoration pathway is not included in the state and transition model at this time.

Additional community tables

Animal community

This well-wooded site has ample seasonal water availability in natural charcos and discontinuous gullies. These elements make the site important to a variety of desert wildlife, including numerous bird species and large mammals like mule deer and javelina during the summer.

Forage diversity is low but seed production is high. This site can produce large quantities of spring annual forbs and grasses as trees do not leaf out until April, allowing sunlight to reach the understory. If summer bean crops are harvested by livestock, care should be taken to avoid overgrazing warm season grasses. Horses should not be grazed when a bean crop is on the ground during the summer rainy season. In sparse canopies overuse of perennial grasses will result in understories of unpalatable or poisonous perennial forbs and shrubs.

Wood products

To control undesirable shrubs, fuelwood harvest levels should not reduce tree canopy cover to less than 15%. Typical coppice production cutting cycles should occur every 20 to 30 years. Thinning coppice sprouts to 1 or 2 per stump can shorten cutting cycles. Sprouts achieve canopy dominance more quickly if stump heights are not less than 30 inches. Trees should not be cut near streambanks. There are no soil-site factors limiting wood production.

Type locality

Location 1: Maricopa County, AZ	
Township/Range/Section	T1S R3W S4
General legal description	Avonda - Cultivated field east of Buckeye.
Location 2: Maricopa County, AZ	
Township/Range/Section	T1N R2W S34
General legal description	Avondale soil - cultivated field.

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

Dan Robinett, original author, 1992
Wilma Renken, revisions, 2019

Approval

Kendra Moseley, 10/17/2024

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:**

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:**