USDA Natural Resources Conservation Service

Ecological site R040XB232AZ
Sandy Slopes, Dunes 7"-10" p.z.

Last updated: 10/17/2024
Accessed: 05/10/2025

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 on relict fan remnants with a moderate amount of desert pavement. 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 Sandy Slopes, Dunes, 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

Sandy Slopes, Dunes, 7-10" p.z., occur in upland positions, with slopes greater than 15%, and windblown (eolian) fine sand forming large dunes greater than 10' in height.

Associated sites

R040XB207AZ	**Limy Fan 7"-10" p.z.** inter-dune areas; loamy soils are alluvial

Similar sites

R040XC329AZ	**Sandy Slopes, Dunes 3"-7" p.z.** Elevations 300' - 1,200'; less precipitation

Table 1. Dominant plant species

Tree	(1) *Parkinsonia florida*
Shrub	(1) *Fouquieria splendens* (2) *Larrea tridentata*
Herbaceous	(1) *Pleuraphis rigida*

Physiographic features

This site occurs as dunes. Slopes are generally greater than 15%.

Table 2. Representative physiographic features

Landforms	(1) Dune field (2) Dune

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 most 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)	240-365 days
Freeze-free period (characteristic range)	344-365 days
Precipitation total (characteristic range)	7-10 in
Frost-free period (actual range)	217-365 days
Freeze-free period (actual range)	282-365 days

Precipitation total (actual range)	7-10 in
Frost-free period (average)	291 days
Freeze-free period (average)	344 days
Precipitation total (average)	8 in

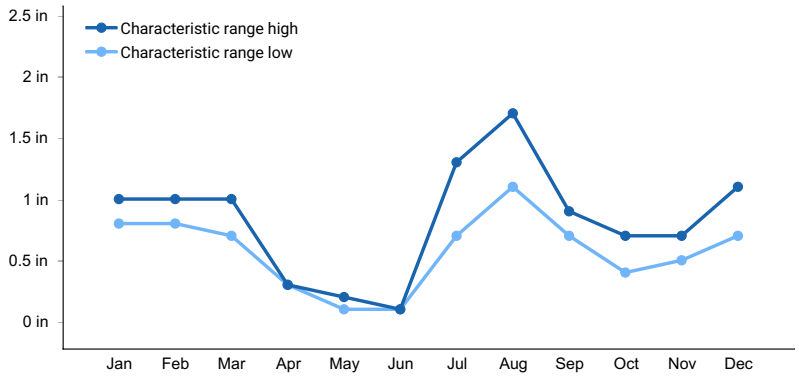


Figure 1. Monthly precipitation range

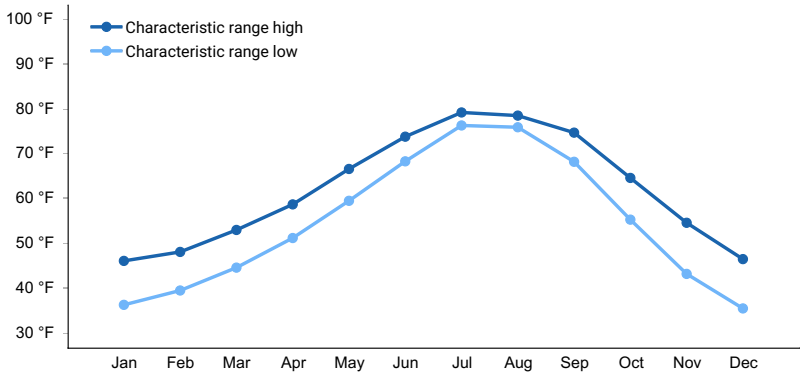


Figure 2. Monthly minimum temperature range

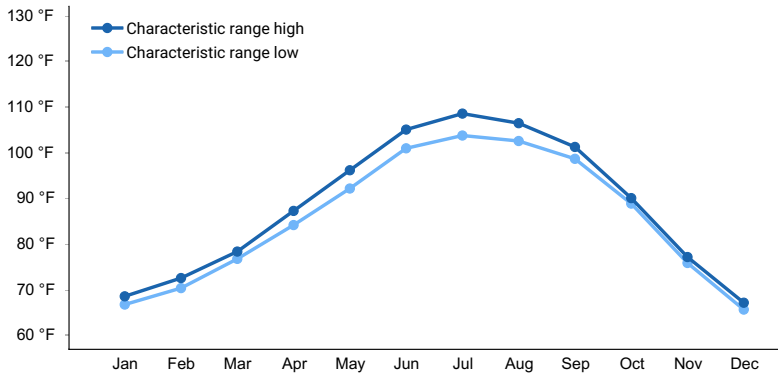


Figure 3. Monthly maximum temperature range

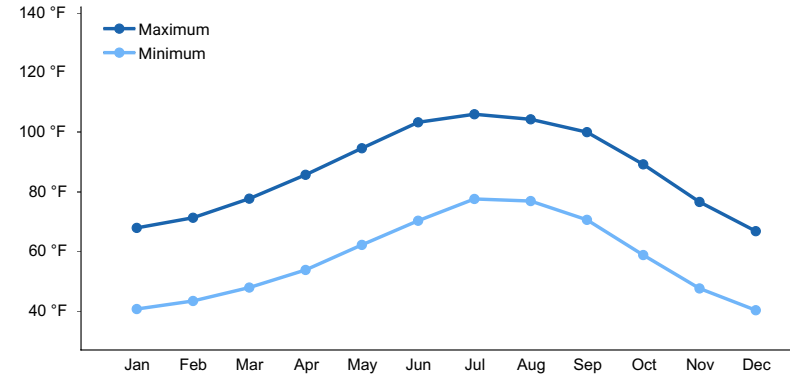


Figure 4. Monthly average minimum and maximum temperature

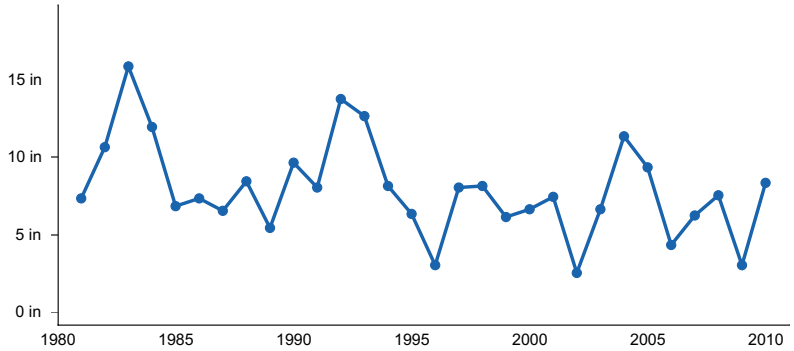


Figure 5. Annual precipitation pattern

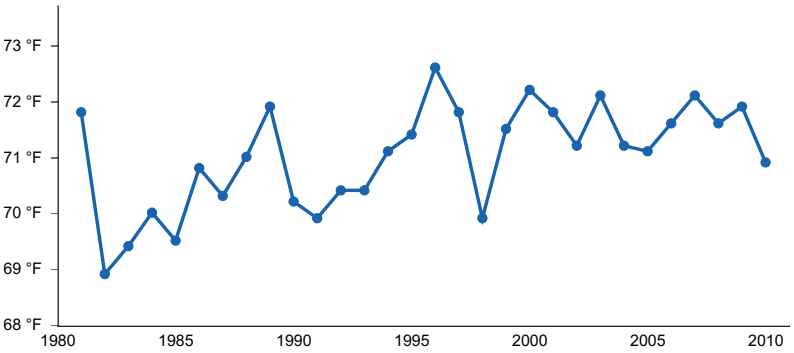


Figure 6. Annual average temperature pattern

Climate stations used

- (1) AJO [USC00020080], Ajo, AZ
- (2) ALAMO DAM [USC00020100], Salome, AZ
- (3) ARIZONA CITY [USC00020404], Arizona City, AZ
- (4) KOFA MINE [USC00024702], Wellton, AZ
- (5) MARICOPA 4 N [USC00025270], Laveen, AZ
- (6) ORGAN PIPE CACTUS NM [USC00026132], West Pima County, AZ

Influencing water features

Soil features

These deep, fine sand soils absorb and hold precipitation, making water readily available to plants on the site.

Table 4. Representative soil features

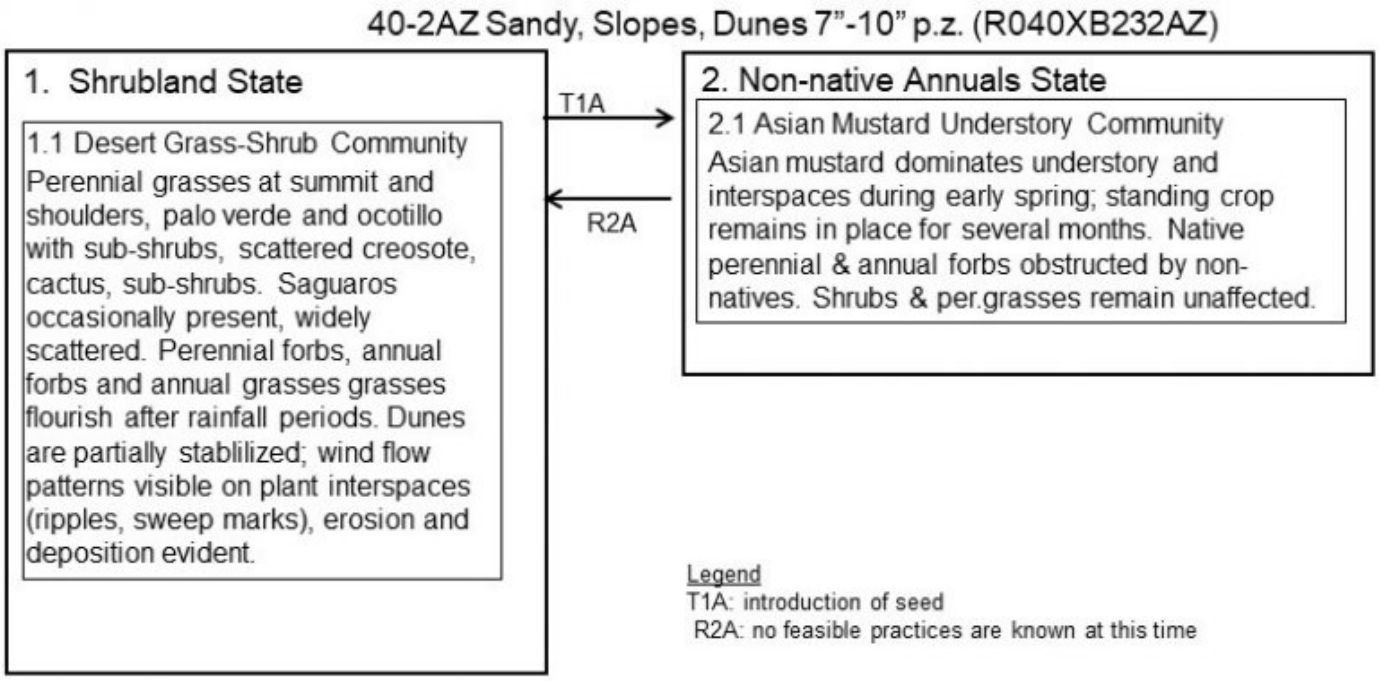
Surface texture	(1) Fine sand

Family particle size	(1) Fine
Drainage class	Well drained
Permeability class	Very rapid
Soil depth	60 in
Available water capacity (0-40in)	3.6–4.8 in
Calcium carbonate equivalent (0-40in)	0–3%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	7.4–8.4

Ecological dynamics

Sandy Slopes, Dunes, 7"-12" p.z., is a mixed desert community on wind-blown fine sands with two ecological states, Shrubland and Non-Native Annuals. Shrubland cover is predominantly big galleta, with abundant palo verde, ocotillo, shrubs and cactus. Wet winters support very productive early spring growth of annual and showy perennial forbs, such as desert lily and birdcage evening primrose. The Non-native Annuals state is easiest to discern during spring growing period when Asian mustard, the predominant non-native species, proliferates. It readily breaks up and disperses with wind following maturity. Fire is not a typical disturbance, though Non-native Annuals may carry a fire under the right weather and fuel conditions. Lightning is an unlikely ignition source as Asian mustard biomass is typically dispersed prior to the occurrence of summer convective thunderstorms. Current field observations indicate burned areas are confined to roadsides. Plant-soil relationships are excellent. Aspect is desert shrubland.

State and transition model



State 1
Shrubland (Reference)

Shrubland is a mixed desert plant community occurring on wind-blown fine sands. The plant community is highly productive since all rainfall is captured and retained in the soil for long periods. Some very large shrub specimens can be found on this site. Palo verde, cholla and ocotillo are widely scattered, mostly occurring on more stable side-slope and interdune areas, while big galleta and white bursage are well-distributed on the less stable, windblown summit and shoulder positions. Creosote is sparsely present. Spring annuals and spring seasonal perennials (such as desert lily and birdcage evening primrose) flourish with sufficient winter precipitation as an ephemeral understory within persistent shrub and grass canopies.

Community 1.1
Desert Grass-Shrub

Figure 7. Sandy Slopes, Dunes, 7"-10" pz. (remnants of non-native forbs visible at lower right)

The plant community is a mixture of perennial and annual grasses, forbs and desert shrubs. When plant cover is depleted, these soils are very susceptible to wind erosion.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	33	67	188
Forb	70	110	150
Shrub/Vine	20	93	150
Tree	10	33	50
Total	**133**	**303**	**538**

State 2
Non-native Annuals

Community 2.1
Asian Mustard-Grass-Shrub

Figure 9. Asian mustard (light brown standing dead stems) flourish after wet winter

Non-native Annuals occurs primarily after Asian mustard seeds are introduced to the site. Asian mustard germinates early in the season, uses available moisture, and spreads a dense, low canopy that may impede germination and growth of native annual forbs such as birdcage primrose and desert lily. Other non-native annual forbs or grasses may be present, but seem to not affect ecosystem dynamics as much as Asian mustard. Seed transport mechanisms are mechanical, either via wind-blown transport (the entire mature plant will tumble) or via animal

transport of sticky (mucilaginous) seeds. Non-native Annuals will look much like native Shrubland for except during, and for a short time after, wet springs when Asian mustard flourishes. Currently, no conservation practices have succeeded in removing Asian mustard, thus, no restoration pathway R2A.

Transition T1A
State 1 to 2

Introduction of non-native seed by wind or animal transport.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Perennial Grass**			33–188	
	big galleta	PLRI3	*Pleuraphis rigida*	33–150	–
	bush muhly	MUPO2	*Muhlenbergia porteri*	0–50	–
3	**Annual Grasses**			35–70	
	needle grama	BOAR	*Bouteloua aristidoides*	0–10	–
	sixweeks grama	BOBA2	*Bouteloua barbata*	0–10	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–10	–
	Arizona brome	BRAR4	*Bromus arizonicus*	0–1	–
	Arizona signalgrass	URAR	*Urochloa arizonica*	0–1	–
Forb					
4	**Perennial Forbs**			7–35	
	birdcage evening primrose	OEDE2	*Oenothera deltoides*	0–7	–
	desert lily	HEUN2	*Hesperocallis undulata*	0–7	–
	whitemargin sandmat	CHAL11	*Chamaesyce albomarginata*	1–4	–
	desert sand verbena	ABVI	*Abronia villosa*	0–3	–
5	**Annual Forbs**			35–70	
	desert Indianwheat	PLOV	*Plantago ovata*	0–10	–
	common fiddleneck	AMMEI2	*Amsinckia menziesii var. intermedia*	0–5	–
	bristly fiddleneck	AMTE3	*Amsinckia tessellata*	0–5	–
	Coulter's globemallow	SPCO2	*Sphaeralcea coulteri*	0–5	–
	Booth's evening primrose	CABOI	*Camissonia boothii ssp. intermedia*	0–3	–
	chuckwalla combseed	PEHE	*Pectocarya heterocarpa*	0–3	–
	broadfruit combseed	PEPL	*Pectocarya platycarpa*	0–2	–
	wingnut cryptantha	CRPT	*Cryptantha pterocarya*	0–2	–
	hairy prairie clover	DAMO	*Dalea mollis*	0–1	–
	soft prairie clover	DAMO2	*Dalea mollissima*	0–1	–
	California shieldpod	DICA7	*Dithyrea californica*	0–1	–
	miniature woollystar	ERDI2	*Eriastrum diffusum*	0–1	–
	kidneyleaf buckwheat	ERRE3	*Eriogonum reniforme*	0–1	–
	Thomas' buckwheat	ERTH	*Eriogonum thomasii*	0–1	–
	little deserttrumpet	ERTR8	*Eriogonum trichopes*	0–1	–

	spurge	EUPHO	*Euphorbia*	0–1	–
	shaggyfruit pepperweed	LELA	*Lepidium lasiocarpum*	0–1	–
	Bigelow's linanthus	LIBI2	*Linanthus bigelovii*	0–1	–
	desert deervetch	LOMI	*Lotus micranthus*	0–1	–
	bajada lupine	LUCO	*Lupinus concinnus*	0–1	–
	Coulter's lupine	LUSP2	*Lupinus sparsiflorus*	0–1	–
	onyxflower	ACCO3	*Achyronychia cooperi*	0–1	–
	small wirelettuce	STEX	*Stephanomeria exigua*	0–1	–
	manybristle chinchweed	PEPA2	*Pectis papposa*	0–1	–
	New Mexico plumeseed	RANE	*Rafinesquia neomexicana*	0–1	–
	California desertdandelion	MACA6	*Malacothrix californica*	0–1	–
	yellowcomet	MEAF2	*Mentzelia affinis*	0–1	–
	whitestem blazingstar	MEAL6	*Mentzelia albicaulis*	0–1	–
	cottonheads	NEDE	*Nemacaulis denudata*	0–1	–
	glandular threadplant	NEGL	*Nemacladus glanduliferus*	0–1	–
	desert evening primrose	OEPR	*Oenothera primiveris*	0–1	–
	giant Spanish needle	PAARG	*Palafoxia arida var. gigantea*	0–1	–
	brittle spineflower	CHBR	*Chorizanthe brevicornu*	0–1	–
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–1	–
	Panamint cryptantha	CRAN4	*Cryptantha angustifolia*	0–1	–
	spiderling	BOERH2	*Boerhavia*	0–1	–
	redroot cryptantha	CRMI	*Cryptantha micrantha*	0–1	–
Shrub/Vine					
6	**Shrubs**			35–70	
	ocotillo	FOSP2	*Fouquieria splendens*	30–110	–
	burrobush	AMDU2	*Ambrosia dumosa*	2–22	–
	creosote bush	LATR2	*Larrea tridentata*	5–20	–
	white ratany	KRGR	*Krameria grayi*	0–8	–
7	**Cactus**			7–35	
	Wiggins' cholla	CYEC3	*Cylindropuntia echinocarpa*	2–12	–
	jumping cholla	CYFU10	*Cylindropuntia fulgida*	0–2	–
	Arizona pencil cholla	CYAR14	*Cylindropuntia arbuscula*	0–2	–
	Christmas cactus	CYLE8	*Cylindropuntia leptocaulis*	0–1	–
Tree					
7	**Tree**			10–50	
	blue paloverde	PAFL6	*Parkinsonia florida*	5–15	–
	yellow paloverde	PAMI5	*Parkinsonia microphylla*	5–15	–

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, 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	05/10/2025
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:**