Ecological site R035XE503AZ
Mudstone Hills 6-10" p.z. Gypsiferous

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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): 035X–Colorado Plateau

AZ CRA 35.5 – Grand Canyon Corridor

Elevations range from 1600 to 4500 feet and precipitation averages 6 to 10 inches per year. Extreme elevation and aspect changes make this area unique. Vegetation includes Mormon tea, catclaw, white brittlebush, blackbrush, prickly pear, cholla species, big galleta, and blue threeawn. The soil temperature regime ranges from thermic to mesic and the soil moisture regime is typic aridic. This unit occurs within the Colorado Plateau Physiographic Province and is characterized by extreme vertical escarpments and strong aspect differences over short distances. Sedimentary rock classes dominate the Grand Canyon and exposures consist of a thick sequence of relatively undeformed formations.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex confertifolia* (2) *Lycium andersonii*
Herbaceous	(1) *Pleuraphis jamesii* (2) *Cryptantha fulvocanescens*

Physiographic features

This site occurs as hummocky and dissected hills and plains of complez gypsiferous shales, mudstones and siltstones. Soil depths range from shallow with lithic outcrop, to deep pockets of alluvium. Slopes are typically 10-30%, but can range from 2-40%. The

site occurs on all aspects.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Ridge (3) Fan remnant
Flooding frequency	None
Ponding frequency	None
Elevation	488–1,402 m
Slope	2–40%
Aspect	Aspect is not a significant factor

Climatic features

The climate of the land resource unit is arid to semiarid with warm summers and cool winters. The mean annual precipitation ranges from 6 – 10 inches, but it is very erratic, often varying substantially from year to year. The majority of the precipitation falls during the between October through May. This precipitation comes as gentile rain or occasionally snow from frontal storms coming out to the Pacific Ocean. Snow is infrequent and rarely last more than 1-2 days. The remaining precipitation comes from July through September as spotty, unreliable and sometimes violent thunderstorms. The moisture for this precipitation originates in the Gulf of Mexico (and the Pacific Ocean in the fall) and flows into the area on the north end of the Mexican monsoon. Late May through late June is generally a dry period. The mean annual air temperature ranges from 55 to 69 degrees Fahrenheit (F). The frost-free period (air temperature > 32 degrees F) ranges from 180 to 220 days (@ 50 percent probability).

Table 3. Representative climatic features

Frost-free period (average)	200 days
Freeze-free period (average)	220 days
Precipitation total (average)	254 mm

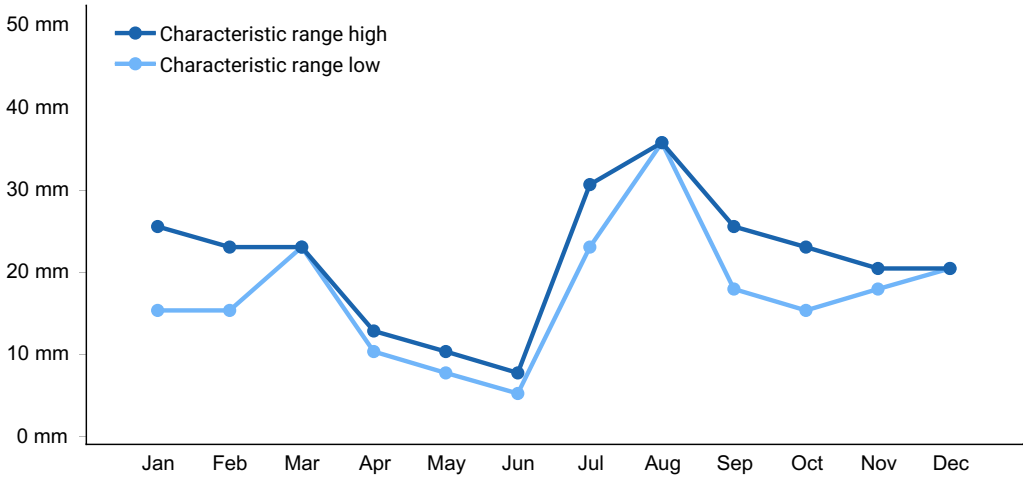

Figure 1. Monthly precipitation range

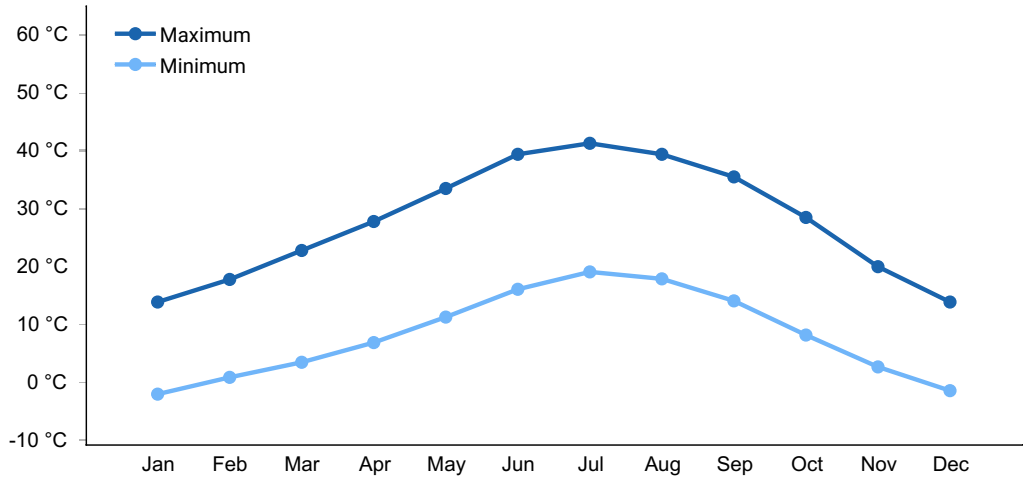

Figure 2. Monthly average minimum and maximum temperature

Influencing water features

Soil features

Soil surface textures are loamy very fine to very fine sandy loam and are gravelly to very gravelly. Soil depth can vary from 4-5- inches; it is typically less than 20 inches to a bedrock (paralithic) contact. The surface is strongly to violently effervescent with a significant amount of gypsum content in the A horizon(s). Geologic formation is Hermit formation, Galleros foundation.

Soil temperature regime is Thermic; moisture regime is typic aridic. Water erosion hazard is high; wind erosion hazard is moderate.

Soil diagnostic horizon is Gypsic horizon. Soil restrictive layer is bedrock (paralithic). Soils are slightly alkaline (7.8-8.8), have strong to violent surface effervescence (10-30), are not sodic and very slightly saline.

Soils mapped on this site include:

SSA-701 Grand Canyon Area MU's 129 Torriorthents, 140 Typic haplogypsids (Hermit formation), 141 Haplogypsids, 146 Typic torriorthents and 148 Typic haplogypsids (Hermit formation) & Typic torriorthents (Hermit formation).

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone and shale (2) Residuum–siltstone
Surface texture	(1) Gravelly loamy very fine sand (2) Very gravelly very fine sandy loam (3) Sandy loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderate to moderately rapid
Soil depth	10–127 cm
Surface fragment cover <=3"	5%
Surface fragment cover >3"	5%
Electrical conductivity (0-101.6cm)	2–8 mmhos/cm
Soil reaction (1:1 water) (0-101.6cm)	7.8–8.8
Subsurface fragment volume <=3" (Depth not specified)	15%
Subsurface fragment volume >3" (Depth not specified)	5%

Ecological dynamics

For state and transition model see ecological group DX035X02DESG19, Grand Canyon - Typic Aridic - Gypsic Hills.

This site developed under historic Colorado Plateau conditions and reflects the natural influence of herbivores, climate fluctuations, and occasional fire (rare on this site). This state includes the native plant communities that occurred on the site prior to European immigration and settlement.

State and transition model

Ecosystem states

1. Historic Climax Plant Community

State 1 submodel, plant communities

1.1. Historic Climax Plant Community

State 1
Historic Climax Plant Community

Community 1.1
Historic Climax Plant Community

This community is characterized by widely scattered shrubs that are tolerant of the soil conditions. Dominant species are shadscale saltbush and wolfberry with a variety of other shrubs and sub-shrubs occasionally represented. Perennial grasses can be found in scattered pockets, often in small rills where run-in moisture is a benefit.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	118	–	146
Forb	11	–	28
Grass/Grasslike	11	–	28
Total	**140**	**–**	**202**

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				6–11	

	James' galleta	PLJA	*Pleuraphis jamesii*	2–6	–
	big galleta	PLRI3	*Pleuraphis rigida*	2–6	–
2				2–6	
	black grama	BOER4	*Bouteloua eriopoda*	2–6	–
	low woollygrass	DAPU7	*Dasyochloa pulchella*	2–6	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	2–6	–
	gyp dropseed	SPNE	*Sporobolus nealleyi*	2–6	–
3				2–6	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	2–6	–
	desert needlegrass	ACSP12	*Achnatherum speciosum*	2–6	–
	blue threeawn	ARPUN	*Aristida purpurea var. nealleyi*	2–6	–
	smooth oxeye	HEHE5	*Heliopsis helianthoides*	2–6	–
4				0–3	
	Grass, annual	2GA	*Grass, annual*	0–3	–
Forb					
5				9–17	
	tawny cryptantha	CRFU	*Cryptantha fulvocanescens*	2–9	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	2–9	–
	globemallow	SPHAE	*Sphaeralcea*	2–9	–
6				0–6	
	Forb, perennial	2FP	*Forb, perennial*	0–6	–
	sand verbena	ABRON	*Abronia*	0–6	–
	slender poreleaf	POGR5	*Porophyllum gracile*	0–6	–
	brownplume wirelettuce	STPA4	*Stephanomeria pauciflora*	0–6	–
	Mojave woodyaster	XYTO2	*Xylorhiza tortifolia*	0–6	–
7				0–6	
	Forb, annual	2FA	*Forb, annual*	0–6	–
	milkvetch	ASTRA	*Astragalus*	0–6	–
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–6	–

	pincushion				
	fleabane	ERIGE2	*Erigeron*	0–6	–
	desertdandelion	MALAC3	*Malacothrix*	0–6	–
	blazingstar	MENTZ	*Mentzelia*	0–6	–
	popcornflower	PLAGI	*Plagiobothrys*	0–6	–
Shrub/Vine					
8				2–17	
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–6	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–6	–
	mountain phlox	PHAU3	*Phlox austromontana*	0–6	–
	Mojave seablite	SUMO	*Suaeda moquinii*	0–6	–
	pricklyleaf dogweed	THAC	*Thymophylla acerosa*	0–6	–
	turpentinebroom	THMO	*Thamnosma montana*	0–6	–
	American threefold	TRCA8	*Trixis californica*	0–6	–
9				50–67	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	34–45	–
	water jacket	LYAN	*Lycium andersonii*	34–45	–
	Arizona desert-thorn	LYEX	*Lycium exsertum*	34–45	–
10				28–45	
	catclaw acacia	ACGR	*Acacia greggii*	3–11	–
	honey mesquite	PRGL2	*Prosopis glandulosa*	3–11	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	3–11	–
	mormon tea	EPVI	*Ephedra viridis*	2–9	–
	Fremont's dalea	PSFR	*Psorothamnus fremontii*	2–9	–
	button brittlebush	ENFR	*Encelia frutescens*	2–9	–
11				3–11	
	Shrub, other	2S	*Shrub, other*	0–3	–
	burrobush	AMDU2	*Ambrosia dumosa*	0–3	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–3	–
	shortleaf baccharis	BABR	*Baccharis brachyphylla*	0–3	–

	brickellbush	BRICK	*Brickellia*	0–3	–
	blackbrush	CORA	*Coleogyne ramosissima*	0–3	–
	brittlebush	ENFA	*Encelia farinosa*	0–3	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–3	–
	alkali goldenbush	ISAC2	*Isocoma acradenia*	0–3	–
12				6–13	
	beavertail pricklypear	OPBA2	*Opuntia basilaris*	6–13	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	6–13	–

Contributors

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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	12/08/2025
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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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:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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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:**

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17. **Perennial plant reproductive capability:**
