USDA Natural Resources Conservation Service

Ecological site R041XC319AZ
Sandy Loam Upland 12-16" p.z.

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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.

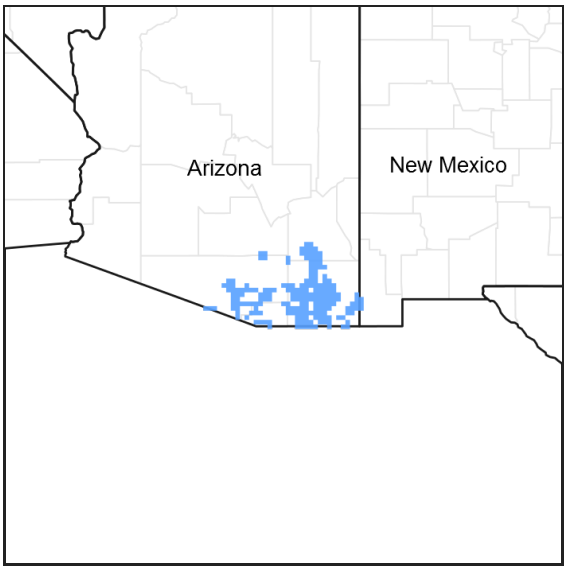


Figure 1. Mapped extent

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): 041X–Madrean Archipelago

Major Land Resource Area (MLRA) 41 represents the most northern extent of the Sierra Madre Occidental, or in English, the “mother mountains of the west.” The Sierra Madre Occidental is a massive, rugged mountain system that runs northwest from the Rio Grande de Santiago, in the state of Jalisco, Mexico, through the states of Sonora and Chihuahua, and ending in Arizona and New Mexico. Through Mexico, this mountain system runs parallel to the Pacific coast and, as it crosses into the United States and confronts the tectonic folding and rifting of the Basin and Range Physiographic Province, the land mass geographically breaks into smaller, isolated mountain ranges, called “sky islands.” The centralizing theme for this MLRA can be summed up as a series of inland islands extending from their mainland, the Sierra Madre Occidental, surrounded by a sea of desert grassland. To the west, the Madrean Archipelago bounds the Sonoran Basin and Range where several sky islands in southern Arizona grade into Sonoran Desert basins; to the north it bounds the contiguous mountains and geology of the Mogollon Transition area; and to the east, in New Mexico, it bounds the geology of the Rio Grande Rift. MLRA 41 is primarily a rangeland subdivision with small amounts of irrigated cropland. It encompasses approximately 13M acres.

LRU notes

Land Resource Unit 41-3, Southern Arizona Semidesert Grassland. Elevations range from 3200 to 5000 feet and precipitation ranges from 12 to 16 inches per year. Vegetation includes mesquite, catclaw acacia, netleaf hackberry, palo verde, false mesquite, range ratany, fourwing saltbush, tarbush, littleleaf sumac, sideoats grama, black grama,

plains lovegrass, cane beardgrass, tobosa, vine mesquite, threeawns, Arizona cottontop and bush muhly. The soil temperature regime is thermic and the soil moisture regime is ustic 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 41, Southeastern Arizona Basin and Range; Land Resource Unit 41-3, Semi-Desert Grassland; Ecological Site Sandy Loam Upland, 12"-16" p.z.

U.S. Environmental Protection Agency, Ecological Regions of North America: Level I, Region 12, Southern Semi-Arid Highlands; Level II, 12.1 Western Sierra Madre Piedmont, Level III, Ecoregion 79 Madrean Archipelago, 79a, Apachian Valleys and Low Hills.

USDA-USFS Ecological Subregions: Sections of the Conterminous United States: Section 321 Basin and Range; Section 321A, Basin and Range Section.

Ecological site concept

Sandy Loam Upland, 12”-16” p.z., ecological site is found on gently sloping uplands with deep soils. An argillic horizon is below 4”-16” of sandy loam textured soils. While surface soils are non-calcareous (upper 10 inches), calcic horizons may be found below the argillic horizon.

Associated sites

R041XC308AZ	**Limy Slopes 12-16" p.z.**
R041XC313AZ	**Loamy Upland 12"-16" p.z.**
R041XC318AZ	**Sandy Loam 12-16" p.z. Deep**

Similar sites

R041XA110AZ	**Sandy Loam Upland 16-20" p.z.**
R040XA116AZ	**Sandy Upland 10"-13" p.z.**

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *eriogonum wrightii* (2) *calliandra eriophylla*
Herbaceous	(1) *bouteloua eriopoda* (2) *bouteloua curtipendula*

Physiographic features

This site occurs in the middle elevations of the Madrean Basin and Range province in southeastern Arizona. It occurs on fan terraces and old stream terraces. It is always in an upland position.

Table 2. Representative physiographic features

Landforms	(1) Terrace (2) Fan piedmont (3) Plain
Flooding frequency	None
Ponding frequency	None
Elevation	1,006–1,524 m

Slope	1–8%
Aspect	Aspect is not a significant factor

Climatic features

Precipitation in this land resource unit ranges from 12-16 inches yearly in the eastern part with elevations from 3600-5000 feet, and 13-17 inches in the western part where elevations are 3300-4500 feet. Winter-Summer rainfall ratios are 40-60% in the west and 30-70% in the east. Summer rains fall July-September, originate in the Gulf of Mexico and are convective, usually brief, intense thunderstorms. Cool season moisture tends to be frontal, originates in the Pacific and Gulf of California, and falls in widespread storms with long duration and low intensity. Snow rarely lasts more than one day. May and June are the driest months of the year. Humidity is generally very low.

Temperatures are mild. Freezing temperatures are common at night from December-April; however temperatures during the day are frequently above 50 F. Occasionally in December-February, brief 0 F temperatures may be experienced some nights. During June, July and August, some days may exceed 100 F.

Cool season plants start growth in early spring and mature in early summer. Warm season plants take advantage of summer rains and are growing and nutritious July-September. Warm season grasses may remain green throughout the year.

Table 3. Representative climatic features

Frost-free period (average)	220 days
Freeze-free period (average)	
Precipitation total (average)	406 mm

Influencing water features

There are no water features associated with this site.

Soil features

These are deep soils which have formed in loamy alluvium of mixed origin. Surface textures range from sandy loam to very gravelly sandy loam and must be at least 4 inches or thicker, (8 inches for Grv-SL). These soils have clayey (argillic) horizons at shallow depths. They are not calcareous in the upper 20 inches. Soil surfaces are dark colored. Plant-soil relationships are good. Although several soil series are correlated in map unit components to this ecological site, Sasabe soil series is most representative of Sandy Loam Upland, 12"-16" p.z.

Table 4. Representative soil features

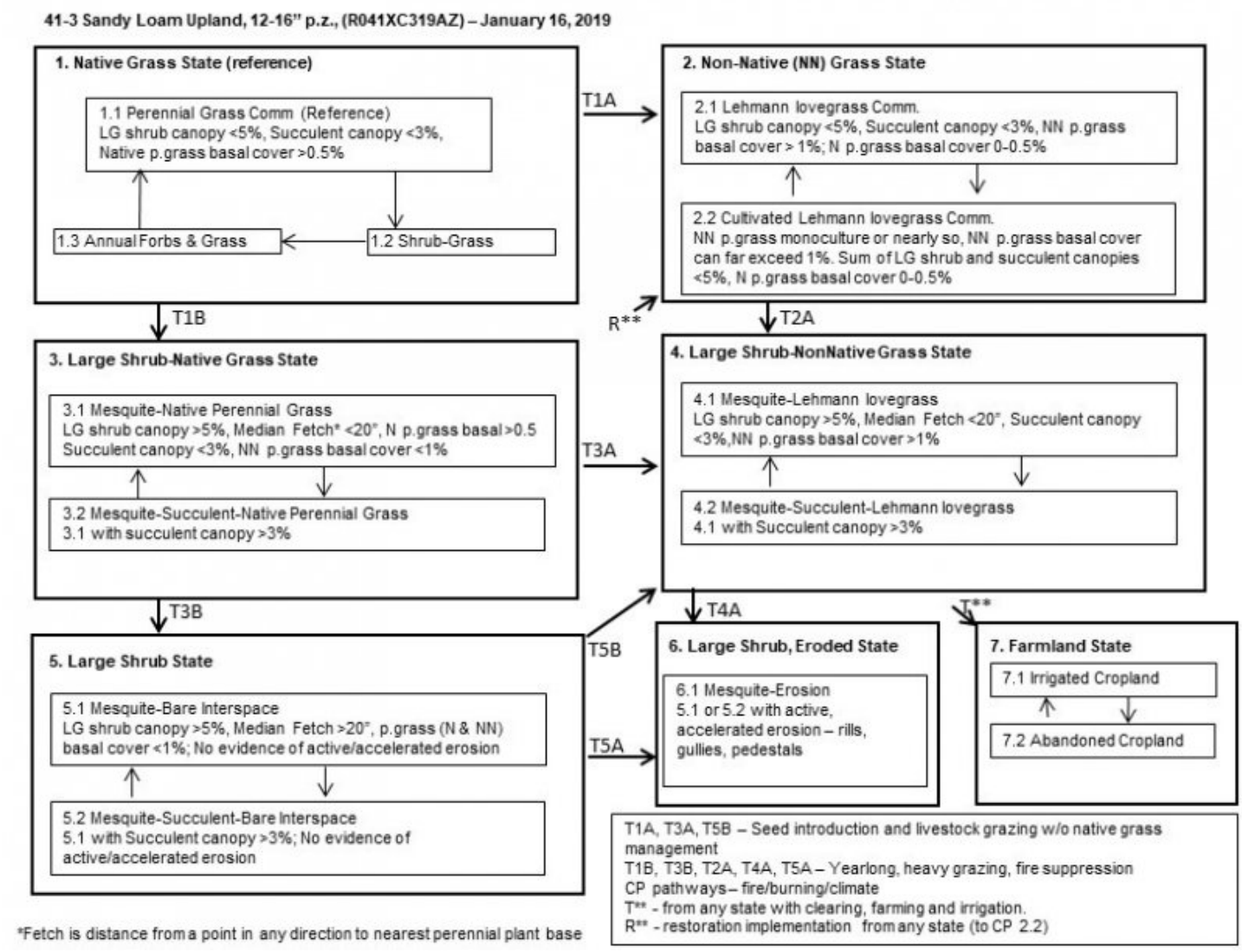
Surface texture	(1) Sandy loam (2) Gravelly sandy loam (3) Very gravelly sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate to moderately slow
Soil depth	152 cm
Surface fragment cover <=3"	5–40%
Surface fragment cover >3"	0–5%
Available water capacity (0-101.6cm)	12.19–24.38 cm

Calcium carbonate equivalent (0-101.6cm)	1–25%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	5–40%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

Sandy Loam Upland, 12" - 16" p.z., ecological site is found on upland landscapes. Soils are deep and have a thick sandy loam surface horizon with an underlying argillic horizon, making excellent plant-soil conditions; the porous surface horizon allows rainfall infiltration that is slowed and perched by less porous argillic horizon. Natural fires are thought to have shaped the native grassland aspect of this ecological site. Heavy livestock grazing removes fine fuels for fire and changes plant community composition and distribution. As fire intervals become extended, woody species, such as mesquite, grow in size until they are no longer killed by fire; thus, the grassland aspect gives way to shrubland. African lovegrasses are the non-native plants that have impacted this ecological site the most of the many non-natives occurring in this LRU. Lehmann lovegrass, the most adapted non-native perennial grass, will maintain the site's grassland aspect but its dominance will decimate species diversity.

State and transition model



State 1
Native Grass

The potential plant community on this site is dominated by warm season perennial grasses. All the major perennial grass species on the site tend to be well dispersed throughout the plant community. Perennial forbs and shrubs are minor on the site. The aspect is open grassland.

Characteristics and indicators. Native perennial grass basal cover ≥ 0.5%, large shrub (mesquite) canopy <5%, and succulent canopy <3%.

Community 1.1
Perennial Grass

The potential plant community on this site is dominated by warm season perennial grasses. All the major perennial grass species on the site tend to be well dispersed throughout the plant community. Perennial forbs are seasonal and diverse; they may be overlooked or unseen as they proliferate the understory after each rainy season. Shrubs and subshrubs, also diverse, are minor on the site. The aspect is open grassland. With continuous heavy grazing, palatable perennial grasses are removed from the plant community and species like Rothrock grama and threeawns will increase. With severe deterioration, shrubby species will increase or invade and dominate the plant community. This is the most productive upland site in the LRU, excluding altered, non-native lovegrass dominated sites. Natural fire was important in the development of the potential plant community. Stable areas of this site can produce effective herbaceous covers with up to 10% canopy cover of mesquite. In areas where half-shrubs dominate the under-story, the potential production of perennial grasses is equal to present production of half-shrubs once they are removed by fire or another type of brush management.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	639	1121	1659
Forb	22	45	179
Shrub/Vine	13	28	123
Tree	–	1	6
Total	**674**	**1195**	**1967**

Table 6. Soil surface cover

Tree basal cover	0-1%
Shrub/vine/liana basal cover	0-1%
Grass/grasslike basal cover	8-15%
Forb basal cover	0-1%
Non-vascular plants	0-1%
Biological crusts	1-10%
Litter	20-75%
Surface fragments >0.25" and <=3"	5-40%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	10-20%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	1-5%	1-15%	0-5%
>0.15 <= 0.3	–	1-10%	10-25%	0-2%
>0.3 <= 0.6	–	0-5%	15-25%	0-1%
>0.6 <= 1.4	–	0-1%	0-5%	–
>1.4 <= 4	0-1%	0-1%	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Figure 5. Plant community growth curve (percent production by month). AZ4134, 41.3 12-16" p.z. other sites. Growth begins in the spring, semi-dormancy occurs during the May through June drought, most growth occurs during the summer rains..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	10	0	0	30	35	15	5	0	0

Community 1.2
Shrub-Grass

As time between natural fire cycles lengthens or during drought periods, perennial grasses become decadent with litter build-up. Shrubs and half-shrubs continue growth with winter moisture. Half shrubs, snakeweed and burroweed, respond positively with high germination following winter moisture; in contrast, both species have high mortality following dry winters.

Community 1.3
Annual Forbs and Grasses

Post fire, or after extended drought, the plant community is dominated by annual forbs and grasses.Perennial grasses and shrubs are greatly diminished. This Community Phase is extremely vulnerable to both Transitions T1A (non-native perennial grass invasion) and T1B (permanent depletion of perennial grass understory). Lehmann lovegrass may spontaneously germinate from a latent soil seedbank with open, bare areas exposed (T1A) or existing perennial grasses will be grazed out (T1B).

Pathway P1.1a
Community 1.1 to 1.2

No burning or drought, disturbance free plant growth and decadence.

Pathway P1.1b
Community 1.1 to 1.3

Fire

Pathway P1.2a
Community 1.2 to 1.3

Fire, extended drought

Pathway P1.3a
Community 1.3 to 1.1

No burning/no fire

State 2
Non-Native (NN) Grass

Non-native perennial grasses introduced from South Africa are well-adapted within this LRU. Once introduced to this site, the non-native perennial grasses will come to dominate when livestock grazing is not managed to ensure native perennial grass vigor. This State has two plant community phases.

Community 2.1
Lehmann Lovegrass

A suite of African lovegrasses can become entrenched on this ecological site; Lehmann lovegrass is the most common and has been seen to persist in the plant community once its basal cover exceeds 1%. The native perennial grasses can remain until a disturbance, such as drought, fire, yearlong or heavy growing season grazing, depletes vigor or causes perennial grass mortality. Large shrub and succulent canopy percentages are similar to State 1.

Community 2.2
Cultivated Lehman lovegrass

Restoration practices applied to any Sandy Loam Upland state, will likely result in a Cultivated Lehmann lovegrass community phase. Lehmann lovegrass, as well as several other non-native perennial grasses, has proliferated a robust seedbank throughout the LRU and will germinate following soil disturbance or burning. Most commonly,

brush management or mechanical land treament (ripping) is applied to remove mesquite dominance and reduce erosion (from States 4 or 5, for example). While species like Lehmann, Boer, Wilman and Cochise lovegrass may be seeded, non-native perennial grasses will likely invade the site regardless because of their overwhelming presence across this LRU. With good grazing management, hydrologic relationships are good and non-native grass productivity remains high (although protein and nutrient values of LL are negligible). Treated areas typically have reduced runoff for long periods of time, depending on grazing management. Mesquite and other shrubs will re-invade these areas making brush management maintenance treatment necessary within 10-15 years.

State 3
Large Shrub-Native Grass

Unmanaged or heavy livestock grazing impairs the perennial grass vigor and removes fuel loading for natural fire cycling. Large shrubs and cactus grow without the periodic reduction by burning. The open aspect is interrupted by large shrubs. The perennial grass community is diminished in diversity and basal cover.

Characteristics and indicators. Large shrub canopy >5%, median fetch* <20”, native perennial grass basal cover 0.5%, NN p.grass basal cover <1%; succulents may or may not be dominant, see CPs.

Community 3.1
Mesquite-Native Perennial Grass

Mesquite increases in the absence of fire for long periods of time. Native perennial grasses maintain dominance with good grazing management; mesquite canopy levels are from 5 to 10%. Native perennial grasses are present in herbaceous understory. Lehmann lovegrass may be present with less than 1% basal cover.

Community 3.2
Mesquite-Succulent-Native Perennial Grass

Succulents, usually prickly pear species, established within the plant community expand in canopy coverage until removed by fire.

State 4
Large Shrub-NonNative Grass

Large shrubs and non-native lovegrasses are co-dominant. Native perennial grasses may remain intact, generally under large shrub canopies. Non-native perennial grasses include African lovegrasses (most commonly Lehmann and Cochise lovegrasses) and, at the low and high elevations of this LRU, bufflegrass and yellow bluestem, respectively. The large shrubs are resistant to fire mortality and burning will not affect their removal from the plant community. Repeated burning or heavy grazing negatively affects the perennial grasses and puts the site at risk of excessive soil erosion. In these areas, mechanical brush management will likely result in transitioning the site to State 2, with a loss of native grasses, both their productivity and diversity.

Community 4.1
Mesquite-Lehmann lovegrass

Community 4.2
Mesquite-Succulent-Lehmann lovegrass

State 5
Large Shrub State

Mesquite and other large shrubs have increased and are dominant with canopies greater than 5%. Native and non-native annual forbs and grasses, both cool and warm season, dominate the under-story. Snakeweed and burroweed cycle with climate, but both remain important in the plant community. Native perennial grasses are largely gone, due to the interactions of drought, fire and continuous, heavy grazing. Areas located close to mountains usually have higher soil cover of cobbles and gravel, thus, exhibit inherent soil and site stability. Hydrologic relationships have changed to increase the amount of runoff. Sandy loam upland in this State is at risk to transition to State 6 (Large

Shrub, Eroded).

Characteristics and indicators. Large shrub canopy >5%, Median Fetch* >20”, perennial grass basal cover <1%, no evidence of active, accelerated erosion *Fetch is distance from a point in any direction to nearest perennial plant base

Community 5.1
Mesquite-Bare Interspace

The Mesquite-Bare Interspace Plant community is dominated by mesquite and other large shrubs with and understory of half-shrubs, snakeweed and burroweed; miscellaneous perennial forbs and annuals occur within the confines of the shrubs. Interspaces are open, herbaceous litter is moved by wind and water until obstructed. Remnant perennial grasses, such as bush muhly and plains bristlegrass, may occur well within protection of shrubs and indicate a seed source. Succulents are not dominant in this community phase.

Community 5.2
Mesquite-Succulent-Bare Interspace

The Mesquite-Succulent-Bare Interspace Plant community is dominated by mesquite and other large shrubs with and understory of half-shrubs and succulents (prickly pear and cane cholla). Interspaces are open, herbaceous litter is moved by wind and water until obstructed. Remnant perennial grasses, such as bush muhly and plains bristlegrass, may occur well within protection of shrubs and indicate a seed source. Succulents will continue growth until fine fuels accumulate to carry fire, such as after extremely wet spring flourish of annual forbs.

Pathway P5.1a
Community 5.1 to 5.2

Introduction of cactus, time without fire

Pathway P5.2a
Community 5.2 to 5.1

burning

State 6
Large Shrub, Eroded

The Large Shrub, Eroded State is very similar in structure to States 4 and 5 (mesquite dominated, half-shrub understory), however, the soil erosion threshold has been crossed; active, extreme soil loss (exposed argillic horizon, rills, pedestals, gullies) is occurring. Snakeweed and burroweed cycle with climate, but both remain important in the plant community. Native perennial grasses are largely gone, due to the interactions of drought, fire and continuous, heavy grazing. Remnant non-native lovegrasses may be present. Hydrologic relationships are permanently altered. Restoration practices can be applied to slow erosion rates and trap sediments; paired with prescribed grazing, non-native lovegrasses will colonize the site resulting in Plant Community 2.2, Cultivated Lehmann lovegrass Community.

Characteristics and indicators. Large shrub canopy >5%, Median Fetch* >20”, perennial grass basal cover <1%, active, accelerated erosion as indicted by water flow patterns, litter dams, and rills *Fetch is distance from a point in any direction to nearest perennial plant base

Community 6.1
Mesquite-Erosion

Transition T1A
State 1 to 2

Seed introduction and livestock grazing without native perennial grass management

Transition T1B
State 1 to 3

Yearlong, heavy livestock grazing, fire suppression

Transition T2A
State 2 to 4

Yearlong, heavy livestock grazing, fire suppression

Restoration pathway R3A
State 3 to 2

brush management, seeding, do not do this

Transition T3A
State 3 to 4

Yearlong,heavy livestock grazing, fire suppression

Transition T3B
State 3 to 5

Yearlong, heavy livestock grazing, fire absent

Restoration pathway R4A
State 4 to 2

brush management, seeding

Transition T4A
State 4 to 6

frequent burning, extreme grazing

Restoration pathway R5A
State 5 to 2

brush management, seeding

Restoration pathway R5A
State 5 to 4

Seed introduction, prescribed grazing

Transition T5A
State 5 to 6

Yearlong,heavy livestock grazing, fire suppression

Restoration pathway R6A
State 6 to 2

brush management, seeding

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**dominant mid-grasses**			224–538	
	sideoats grama	BOCU	*Bouteloua curtipendula*	112–336	–
	Arizona cottontop	DICA8	*Digitaria californica*	112–336	–
	plains lovegrass	ERIN	*Eragrostis intermedia*	0–112	–
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	0–112	–
2	**suffrutescent grasses**			224–336	
	black grama	BOER4	*Bouteloua eriopoda*	112–336	–
	bush muhly	MUPO2	*Muhlenbergia porteri*	0–112	–
	Santa Rita threeawn	ARCAG	*Aristida californica var. glabrata*	0–112	–
3	**short lived grasses**			17–135	
	Rothrock's grama	BORO2	*Bouteloua rothrockii*	17–112	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–56	–
	slender grama	BORE2	*Bouteloua repens*	0–56	–
4	**short gramas**			90–202	
	blue grama	BOGR2	*Bouteloua gracilis*	34–112	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–50	–
	common wolfstail	LYPH	*Lycurus phleoides*	11–50	–
	sprucetop grama	BOCH	*Bouteloua chondrosioides*	0–50	–
5	**Perennial threeawns**			11–112	
	spidergrass	ARTEG	*Aristida ternipes var. gentilis*	6–50	–
	spidergrass	ARTE3	*Aristida ternipes*	6–45	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–17	–
	poverty threeawn	ARDI5	*Aristida divaricata*	0–17	–
	Havard's threeawn	ARHA3	*Aristida havardii*	0–11	–
	Parish's threeawn	ARPUP5	*Aristida purpurea var. parishii*	0–11	–
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	0–6	–
	Wooton's threeawn	ARPA9	*Aristida pansa*	0–6	–
6	**miscellaneous perennial grasses**			56–224	
	plains bristlegrass	SEVU2	*Setaria vulpiseta*	17–67	–
	squirreltail	ELEL5	*Elymus elymoides*	0–56	–
	whiplash pappusgrass	PAVA2	*Pappophorum vaginatum*	0–56	–
	tanglehead	HECO10	*Heteropogon contortus*	6–50	–
	green sprangletop	LEDU	*Leptochloa dubia*	6–50	–
	Arizona muhly	MUAR3	*Muhlenbergia arizonica*	0–28	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–28	–
	mesa dropseed	SPFL2	*Sporobolus flexuosus*	0–17	–
	slim tridens	TRMU	*Tridens muticus*	0–17	–
	Hall's panicgrass	PAHA	*Panicum hallii*	0–17	–
	curly-mesquite	HIBE	*Hilaria belangeri*	0–17	–

	fall witchgrass	DICO6	*Digitaria cognata*	0–17	–
	nineawn pappusgrass	ENDE	*Enneapogon desvauxii*	0–6	–
	low woollygrass	DAPU7	*Dasyochloa pulchella*	0–6	–
7	**annual grasses**			11–112	
	prairie threeawn	AROL	*Aristida oligantha*	1–56	–
	needle grama	BOAR	*Bouteloua aristidoides*	1–56	–
	Parry's grama	BOPA2	*Bouteloua parryi*	0–56	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	1–56	–
	Mexican panicgrass	PAHI5	*Panicum hirticaule*	0–28	–
	tapertip cupgrass	ERACA	*Eriochloa acuminata var. acuminata*	0–28	–
	sixweeks grama	BOBA2	*Bouteloua barbata*	1–28	–
	sixweeks threeawn	ARAD	*Aristida adscensionis*	1–28	–
	feather fingergrass	CHVI4	*Chloris virgata*	1–17	–
	desert lovegrass	ERPEM	*Eragrostis pectinacea var. miserrima*	0–17	–
	tufted lovegrass	ERPEP2	*Eragrostis pectinacea var. pectinacea*	0–17	–
	mucronate sprangeltop	LEPAB	*Leptochloa panicea ssp. brachiata*	0–17	–
	Bigelow's bluegrass	POBI	*Poa bigelovii*	0–17	–
	Arizona signalgrass	URAR	*Urochloa arizonica*	0–17	–
	Mexican sprangletop	LEFUU	*Leptochloa fusca ssp. uninervia*	0–11	–
	Mexican lovegrass	ERME	*Eragrostis mexicana*	0–11	–
	littleseed muhly	MUMI	*Muhlenbergia microsperma*	0–6	–
	Arizona brome	BRAR4	*Bromus arizonicus*	0–6	–
	witchgrass	PACA6	*Panicum capillare*	1–4	–
	delicate muhly	MUFR	*Muhlenbergia fragilis*	0–4	–
Forb					
8	**perennial forbs**			11–67	
	weakleaf bur ragweed	AMCO3	*Ambrosia confertiflora*	1–28	–
	spreading fleabane	ERDI4	*Erigeron divergens*	1–28	–
	wild dwarf morning-glory	EVAR	*Evolvulus arizonicus*	3–22	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	1–22	–
	scarlet spiderling	BOCO	*Boerhavia coccinea*	1–17	–
	desert globemallow	SPAM2	*Sphaeralcea ambigua*	3–17	–
	brownplume wirelettuce	STPA4	*Stephanomeria pauciflora*	1–17	–
	hairy fournwort	TENE	*Tetramerium nervosum*	0–11	–
	desert marigold	BAMU	*Baileya multiradiata*	0–11	–
	petite flamboyant bauhinia	BAMU3	*Bauhinia multinervia*	0–11	–
	leatherweed	CRPO5	*Croton pottsii*	0–11	–
	trailing windmills	ALIN	*Allionia incarnata*	0–11	–
	New Mexico fanpetals	SINE	*Sida neomexicana*	1–11	–
	silverleaf nightshade	SOEL	*Solanum elaeagnifolium*	1–11	–
	southwestern mock vervain	GLGO	*Glandularia gooddingii*	0–11	–
	Wright's deervetch	LOWR	*Lotus wrightii*	1–11	–

	wishbone-bush	MILAV	*Mirabilis laevis var. villosa*	0–7	–
	ivyleaf groundcherry	PHHE4	*Physalis hederifolia*	0–6	–
	velvetseed milkwort	POOB	*Polygala obscura*	0–6	–
	shrubby purslane	POSU3	*Portulaca suffrutescens*	0–6	–
	Wright's cudweed	PSCAC2	*Pseudognaphalium canescens ssp. canescens*	0–6	–
	twinleaf senna	SEBA3	*Senna bauhinioides*	0–6	–
	Lemmon's ragwort	SELE8	*Senecio lemmonii*	0–6	–
	variableleaf bushbean	MAGI2	*Macroptilium gibbosifolium*	0–6	–
	whitemouth dayflower	COER	*Commelina erecta*	0–6	–
	bluedicks	DICA14	*Dichelostemma capitatum*	0–6	–
	Trans-Pecos thimblehead	HYWI	*Hymenothrix wislizeni*	0–6	–
	ragged nettlespurge	JAMA	*Jatropha macrorhiza*	0–6	–
	Greene's bird's-foot trefoil	LOGR4	*Lotus greenei*	0–6	–
	dwarf desertpeony	ACNA2	*Acourtia nana*	0–6	–
	brownfoot	ACWR5	*Acourtia wrightii*	0–6	–
	New Mexico silverbush	ARNE2	*Argythamnia neomexicana*	0–6	–
	Watson's dutchman's pipe	ARWA	*Aristolochia watsonii*	0–6	–
	dense ayenia	AYMI	*Ayenia microphylla*	0–6	–
	fingerleaf gourd	CUDI	*Cucurbita digitata*	0–6	–
	coyote gourd	CUPA	*Cucurbita palmata*	0–6	–
	Rocky Mountain zinnia	ZIGR	*Zinnia grandiflora*	0–6	–
	Arizona wrightwort	CAAR7	*Carlowrightia arizonica*	0–2	–
	hairyseed bahia	BAAB	*Bahia absinthifolia*	0–2	–
	southwestern pricklypoppy	ARPL3	*Argemone pleiacantha*	0–2	–
	orange fameflower	PHAU13	*Phemeranthus aurantiacus*	0–2	–
	onion	ALLIU	*Allium*	0–1	–
	desert larkspur	DEPA	*Delphinium parishii*	0–1	–
9	**annual forbs**			11–112	
	sensitive partridge pea	CHNI2	*Chamaecrista nictitans*	1–56	–
	New Mexico thistle	CINE	*Cirsium neomexicanum*	1–28	–
	milkvetch	ASTRA	*Astragalus*	1–28	–
	Coulter's spiderling	BOCO2	*Boerhavia coulteri*	0–28	–
	carelessweed	AMPA	*Amaranthus palmeri*	1–28	–
	California poppy	ESCAM	*Eschscholzia californica ssp. mexicana*	1–28	–
	Arizona poppy	KAGR	*Kallstroemia grandiflora*	0–28	–
	spreading fanpetals	SIAB	*Sida abutifolia*	1–28	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–28	–
	Arizona popcornflower	PLAR	*Plagiobothrys arizonicus*	0–28	–
	slender goldenweed	MAGR10	*Machaeranthera gracilis*	1–28	–
	tanseyleaf tansyaster	MATA2	*Machaeranthera tanacetifolia*	0–28	–
	Arizona adder's-mouth	MATE2	*Malaxis tenuis*	0–28	–

	orchid				
	whitestem blazingstar	MEAL6	*Mentzelia albicaulis*	1–28	–
	intermediate pepperweed	LEVIM	*Lepidium virginicum var. medium*	0–28	–
	desert Indianwheat	PLOV	*Plantago ovata*	0–22	–
	western tansymustard	DEPI	*Descurainia pinnata*	0–22	–
	miniature woollystar	ERDI2	*Eriastrum diffusum*	0–22	–
	cryptantha	CRYPT	*Cryptantha*	0–22	–
	scrambled eggs	COAU2	*Corydalis aurea*	0–17	–
	bristly fiddleneck	AMTE3	*Amsinckia tessellata*	0–17	–
	sorrel buckwheat	ERPO4	*Eriogonum polycladon*	0–17	–
	shaggyfruit pepperweed	LELA	*Lepidium lasiocarpum*	0–17	–
	sacred thorn-apple	DAWR2	*Datura wrightii*	0–17	–
	New Mexico plumeseed	RANE	*Rafinesquia neomexicana*	0–17	–
	Arizona lupine	LUAR4	*Lupinus arizonicus*	0–17	–
	Coulter's lupine	LUSP2	*Lupinus sparsiflorus*	0–17	–
	Texas bluebonnet	LUSU	*Lupinus subcarnosus*	0–17	–
	hollowleaf annual lupine	LUSU3	*Lupinus succulentus*	0–17	–
	combseed	PECTO	*Pectocarya*	0–17	–
	manybristle chinchweed	PEPA2	*Pectis papposa*	0–17	–
	longleaf false goldeneye	HELOA2	*Heliomeris longifolia var. annua*	0–11	–
	camphorweed	HESU3	*Heterotheca subaxillaris*	0–11	–
	wheelscale saltbush	ATEL	*Atriplex elegans*	0–11	–
	hoary bowlesia	BOIN3	*Bowlesia incana*	0–7	–
	goosefoot	CHENO	*Chenopodium*	0–7	–
	American wild carrot	DAPU3	*Daucus pusillus*	0–7	–
	anoda	ANODA	*Anoda*	0–7	–
	rockcress	ARABI	*Arabidopsis*	0–7	–
	aster	ASTER	*Aster*	0–7	–
	blanketflower	GAILL	*Gaillardia*	0–7	–
	Lemmon's linanthus	LELE29	*Leptosiphon lemmonii*	0–7	–
	Gordon's bladderpod	LEGO	*Lesquerella gordonii*	0–7	–
	Texas stork's bill	ERTE13	*Erodium texanum*	0–7	–
	spurge	EUPHO	*Euphorbia*	0–7	–
	woolly sunflower	ERIOP2	*Eriophyllum*	0–7	–
	phacelia	PHACE	*Phacelia*	0–7	–
	bean	PHASE	*Phaseolus*	0–7	–
	phlox	PHLOX	*Phlox*	0–7	–
	four o'clock	MIRAB	*Mirabilis*	0–7	–
	Nuttall's povertyweed	MONU	*Monolepis nuttalliana*	0–7	–
	green carpetweed	MOVE	*Mollugo verticillata*	0–7	–
	desert evening primrose	OEPR	*Oenothera primiveris*	0–7	–
	sage	SALVI	*Salvia*	0–7	–
	ragwort	SENEC	*Senecio*	0–7	–

	slender poreleaf	POGR5	*Porophyllum gracile*	0–7	–
	purslane	PORTU	*Portulaca*	0–7	–
	sleepy silene	SIAN2	*Silene antirrhina*	0–7	–
	woolly tidestromia	TILA2	*Tidestromia lanuginosa*	0–7	–
	doubleclaw	PRPA2	*Proboscidea parviflora*	0–7	–
	verbena	VEPO4	*Verbena polystachya*	0–7	–
	golden crownbeard	VEEN	*Verbesina encelioides*	0–6	–
	desert unicorn-plant	PRAL4	*Proboscidea althaeifolia*	0–6	–
	Fendler's desertdandelion	MAFE	*Malacothrix fendleri*	0–6	–
	poorjoe	DITE2	*Diodia teres*	0–6	–
	wedgeleaf draba	DRCU	*Draba cuneifolia*	0–6	–
	Arizona blanketflower	GAAR2	*Gaillardia arizonica*	0–6	–
Shrub/Vine					
10	**half shrubs**			11–56	
	bastardsage	ERWR	*Eriogonum wrightii*	11–56	–
	fairyduster	CAER	*Calliandra eriophylla*	0–22	–
11	**increaser half-shrubs**			1–39	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–28	–
	burroweed	ISTE2	*Isocoma tenuisecta*	0–28	–
	threadleaf snakeweed	GUMI	*Gutierrezia microcephala*	0–11	–
	turpentine bush	ERLA12	*Ericameria laricifolia*	0–6	–
12	**miscellaneous shrubs**			1–28	
	soaptree yucca	YUEL	*Yucca elata*	1–17	–
	littleleaf ratany	KRER	*Krameria erecta*	0–11	–
	trailing krameria	KRLA	*Krameria lanceolata*	0–11	–
	spiny hackberry	CEEH	*Celtis ehrenbergiana*	1–11	–
	catclaw acacia	ACGR	*Acacia greggii*	0–6	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–6	–
	shortleaf baccharis	BABR	*Baccharis brachyphylla*	0–6	–
	yerba de pasmo	BAPT	*Baccharis pteronioides*	0–6	–
	walkingstick cactus	CYSP8	*Cylindropuntia spinosior*	0–6	–
	desert zinnia	ZIAC	*Zinnia acerosa*	0–6	–
	cactus apple	OPEN3	*Opuntia engelmannii*	0–6	–
	longleaf jointfir	EPTR	*Ephedra trifurca*	0–6	–
	banana yucca	YUBA	*Yucca baccata*	0–6	–
	candy barrelcactus	FEWI	*Ferocactus wislizeni*	0–2	–
	purple pricklypear	OPMAM	*Opuntia macrocentra var. macrocentra*	0–2	–
	jumping cholla	CYFU10	*Cylindropuntia fulgida*	0–2	–
	desert-thorn	LYCIU	*Lycium*	0–2	–
	whitethorn acacia	ACCO2	*Acacia constricta*	0–2	–
	beehive cactus	CORYP	*Coryphantha*	0–1	–
	catclaw mimosa	MIACB	*Mimosa aculeaticarpa var. biuncifera*	0–1	–
	velvetpod mimosa	MIDY	*Mimosa dysocarpa*	0–1	–

	sacahuista	NOMI	*Nolina microcarpa*	0–1	–
	purple coneflower	ECHIN	*Echinacea*	0–1	–
	hedgehog cactus	ECHIN3	*Echinocereus*	0–1	–
	Santa Rita pricklypear	OPSA	*Opuntia santa-rita*	0–1	–
	whitestem paperflower	PSCO2	*Psilostrophe cooperi*	0–1	–
	spinystar	ESVI2	*Escobaria vivipara*	0–1	–
	lotebush	ZIOB	*Ziziphus obtusifolia*	0–1	–
Tree					
13	**native trees**			0–6	
	beehive cactus	CORYP	*Coryphantha*	7–10	–
	common sotol	DAWH2	*Dasylirion wheeleri*	7–10	–
	hedgehog cactus	ECHIN3	*Echinocereus*	7–10	–
	candy barrelcactus	FEWI	*Ferocactus wislizeni*	7–10	–
	ocotillo	FOSP2	*Fouquieria splendens*	7–10	–
	limestone adderstongue	OPEN	*Ophioglossum engelmannii*	7–10	–
	western honey mesquite	PRGLT	*Prosopis glandulosa var. torreyana*	0–2	–
	velvet mesquite	PRVE	*Prosopis velutina*	0–2	–
	Jerusalem thorn	PAAC3	*Parkinsonia aculeata*	0–1	–
	blue paloverde	PAFL6	*Parkinsonia florida*	0–1	–

Animal community

The plant community on this site is suitable for grazing by all classes of cattle at any season. Due to thick, course textured surfaces which absorb most of the rainfall and an argillic horizon below to slowly release this moisture to the plants, this site has a long summer green season. This site occurs on soils that are extremely well suited to producing grassland vegetation and, thus, are fairly resilient to grazing and respond very well to improved grazing management. This is a site that Lehman lovegrass invades aggressively. At the first signs of invasion, management must shift to light or proper use of the palatable native perennials on this site to avoid letting lovegrass become dominant. Herbaceous forage will be deficient in protein in the winter.

Water developments are very important to wildlife species on the site. Being grassland, the site is home to a number of small herbivores, birds, and their associated predators. With the exception of antelope, larger wildlife species use the site mainly as a foraging area.

Hydrological functions

Thick coarse textured surfaces act to catch intense summer rainfall. Shallow, clayey horizons prevent deep moisture penetration and allow shallow rooted plants to utilize most of the moisture.

Recreational uses

Hunting, hiking, horseback riding, photography, bird-watching.

Wood products

Where mesquite has increased and grown to tree size, it provides some fuel-wood and posts.

Inventory data references

Range 417s include 12 in excellent condition, 7 in good condition and 14 in fair condition.

Type locality

Location 1: Pima County, AZ	
Township/Range/Section	T19S R17E S9
General legal description	KA # 8 on Empire ranch in the North pasture. Trend monitoring transect and range health plot.
Location 2: Pinal County, AZ	
Township/Range/Section	T9S R14E S34
General legal description	Page-Towbridge Ranch
Location 3: Pima County, AZ	
Township/Range/Section	T21S R8E S18
General legal description	Buenos Aires Refuge
Location 4: Cochise County, AZ	
Township/Range/Section	T21S R19E S20
General legal description	Un-surveyed. Fort Huachuca
Location 5: Cochise County, AZ	
Township/Range/Section	T17S R28E S27
General legal description	Oak Ranch

Contributors

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Unknown

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)	Womack, Robinett, Carrillo, Buono
Contact for lead author	NRCS Tucson Area Office
Date	03/04/2005
Approved by	S. Cassady
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None present

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2. **Presence of water flow patterns:** Water flow paths occupy 10-15% of area; short (3-5 feet) in length and discontinuous and sinuous

3. **Number and height of erosional pedestals or terracettes:** Pedestals are infrequent on long lived perennial grasses; Approximately 10% of perennial grass plants have pedestals no more than 1 inch above surrounding soil surface; Black grama dominated areas have formed terracettes 2-5 feet apart with a 1 inch elevation difference from above to below the terracette; Bunchgrass dominated areas have formed terracettes 10-15 feet apart with a 1 inch elevation difference from above to below the terracette.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare soil 15-25%, gravel and rock 10%, litter 20-30%, vegetation canopy/basal 45-50%; bare patches 1-3ft in diameter

5. **Number of gullies and erosion associated with gullies:** None

6. **Extent of wind scoured, blowouts and/or depositional areas:** None

7. **Amount of litter movement (describe size and distance expected to travel):** All size classes remaining in place and masking water flow patterns, no loss of litter from the site

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Aggregate stability test average >5.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface ranges from fine sandyloam to loamy sand; slight physical crust in interspaces, weak granular structure, OM throughout (greater under perennial plants), A-horizon 4-8+ in

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Canopy 25-30%, Basal 5-10%, Litter 65-75%; 75-80% of canopy cover is perennial grasses and 5-10% is trees and shrubs. Cover is well dispersed throughout site

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None, unrestricted root development throughout profile

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: Perennial mid-grasses > annual forbs & grasses > shrubs > succulents > short grasses Mesquite canopy >= 10% may inhibit grass cover/production

    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):** Some scattered mortality/decadence of low shrubs and smaller perennial grasses as may be expected for drought. May exhibit high degree of decadence due to lack of fire on the site.

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14. **Average percent litter cover (%) and depth (in):** 20-30% litter cover in canopy interspaces (65-75% total litter cover) with depths of 0.25 – 0.5in. Cover much higher under vegetation, some litter persisting since last season, uniform distribution throughout site. Almost all litter is herbaceous

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** annual production 2000 lbs/ac in favorable rainfall years, 1200 lbs/ac in normal years and 700 lbs/ac in poor years

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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:** Lehmann's love grass can dominate site to the exclusion of other grasses, Mesquite can also dominate site and tend to inhibit grass cover/production after roughly 10% canopy cover, prickly pear also be invasive

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17. **Perennial plant reproductive capability:** Not impaired in anyway, even in prolonged drought black gramma producing stolons

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