USDA Natural Resources
Conservation Service

Ecological site R041XA110AZ
Sandy Loam Upland 16-20" p.z.

Last updated: 4/09/2021
Accessed: 05/12/2025

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.

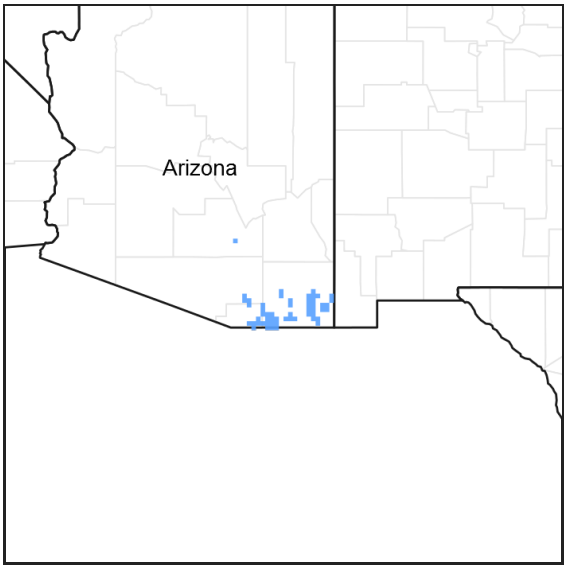

Figure 1. Mapped extent

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 41-1, Mexican Oak-Pine Forest and Oak Savannah. Elevations range from 4500 to 5500 feet and precipitation ranges from 16 to 20 inches. Vegetation includes Emory oak, Mexican blue oak, Arizona white oak,

one-seed juniper, alligator juniper, sacahuista, California bricklebush, skunkbush sumac, Arizona rosewood, wait-a-bit mimosa, sideoats grama, blue grama, purple grama, wooly bunchgrass, plains lovegrass, squirreltail, and pinyon ricegrass. The soil temperature regime is thermic; the soil moisture regime is aridic ustic.

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 41-1, Semi-Desert Grassland; Ecological Site Loamy Upland, 16"-20" 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, 16”-20” p.z., ecological site is found on gently sloping uplands with deep soils. An argillic or clay cambic horizon is below 4 or more inches of sandy loam textured soils.

Associated sites

F041XA112AZ	**Sandy Wash 16-20" p.z. woodland**
F041XA113AZ	**Sandy Bottom 16-20" p.z. woodland**
R041XA102AZ	**Shallow Hills 16-20" p.z.**
R041XA114AZ	**Loamy Bottom 16-20" p.z.**
R041XA115AZ	**Loamy Swale 16-20" p.z.**

Similar sites

R041XC319AZ	**Sandy Loam Upland 12-16" p.z.**
F041XA122AZ	**Sandy Loam Upland 20-23" p.z.**
R041XC318AZ	**Sandy Loam 12-16" p.z. Deep**

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *baccharis pteronioides*
Herbaceous	(1) *bouteloua curtipendula* (2) *bouteloua gracilis*

Physiographic features

This site occurs in the middle elevations of the Madrean Basin and Range Province. It occurs on fan terraces, old stream terraces and valley plains.

Table 2. Representative physiographic features

Landforms	(1) Fan piedmont (2) Plain (3) Terrace
Flooding frequency	None

Ponding frequency	None
Elevation	4,700–5,500 ft
Slope	1–10%
Aspect	Aspect is not a significant factor

Climatic features

Precipitation in this zone of the common resource area ranges from 16-20 inches per year with elevations from 4700-5500 feet. Approximately 40% of this moisture comes as gentle rain or snow during the winter-spring (Oct-Apr) season; originates in the north Pacific and Gulf of California and comes as frontal storms with long duration and low intensity. The remaining 60% falls in the summer season(May-Sep); originates in the Gulf of Mexico and are convective, usually brief, intense thunderstorms. Snow is common Dec-Mar, averaging 5-15 inches per year, but rarely lasts more than a week. May and June are the driest months. Humidity is low.

Temperatures are mild. Freezing temperatures are common at night from Oct-May, but daytime temperatures are almost always over 40 F. Below 0 F temperatures can occur Dec-Feb. Daytime summer highs rarely exceed 95 F.

Species like plains lovegrass, yerba de pasmo, shrubby buckwheat and ratany begin growth in late March to April. Warm season grasses begin growth in July or August with receipt of the first summer rains.

Table 3. Representative climatic features

Frost-free period (average)	200 days
Freeze-free period (average)	
Precipitation total (average)	20 in

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 cobbly sandy loams. Course textured surfaces must be at least four inches thick (eight inches for CBV-SL). These soils have clayey textured argillic horizons at shallow depths. Soil surfaces are dark colored. Although several soil series are correlated in map unit components to this ecological site, Terrarosa soil series is most representative of Loamy Upland, 16-20” p.z.. Plant-soil moisture relationships are very good.

Table 4. Representative soil features

Parent material	(1) Alluvium–igneous, metamorphic and sedimentary rock
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate
Soil depth	60 in
Surface fragment cover <=3"	5–15%
Surface fragment cover >3"	0–5%
Available water capacity (0-40in)	7.2–9.6 in
Calcium carbonate equivalent (0-40in)	0–5%

Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–2
Soil reaction (1:1 water) (0-40in)	6.1–7.8
Subsurface fragment volume <=3" (Depth not specified)	3–10%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

The historic native state includes the native plant communities that occur on the site, including historic climax plant community. This state includes other plant communities that naturally occupy the site following fire, drought, flooding, herbivores, and other natural disturbances. The historic plant community represents the natural climax community that eventually reoccupies the site with proper management.

The potential plant community on this site is dominated by warm-season, perennial midgrasses. The major perennial species are well dispersed throughout the plant community. Perennial forbs, several species of low shrubs and succulents are well represented in the plant community. The aspect is open grassland to oak-grass savannah.

Mesquite and Lehmann lovegrass are at the upper limits of their elevation range, but can increase to dominance on this site, especially with climatic warming. Naturally occurring fires in Jun-Aug are an important factor in shaping this plant community. Fire-free intervals range from 10-20 years.

Periodic drought can occur in this LRA and cause significant grass mortality. Droughts in the early 30s, mid-50s, 1975-76 and 1988-89 resulted in the loss of much of the perennial grass cover on this site. This site recovers very rapidly, however, due to the favorable climate prevailing in this sub-resource area and thick, coarse textured soil surfaces.

State and transition model

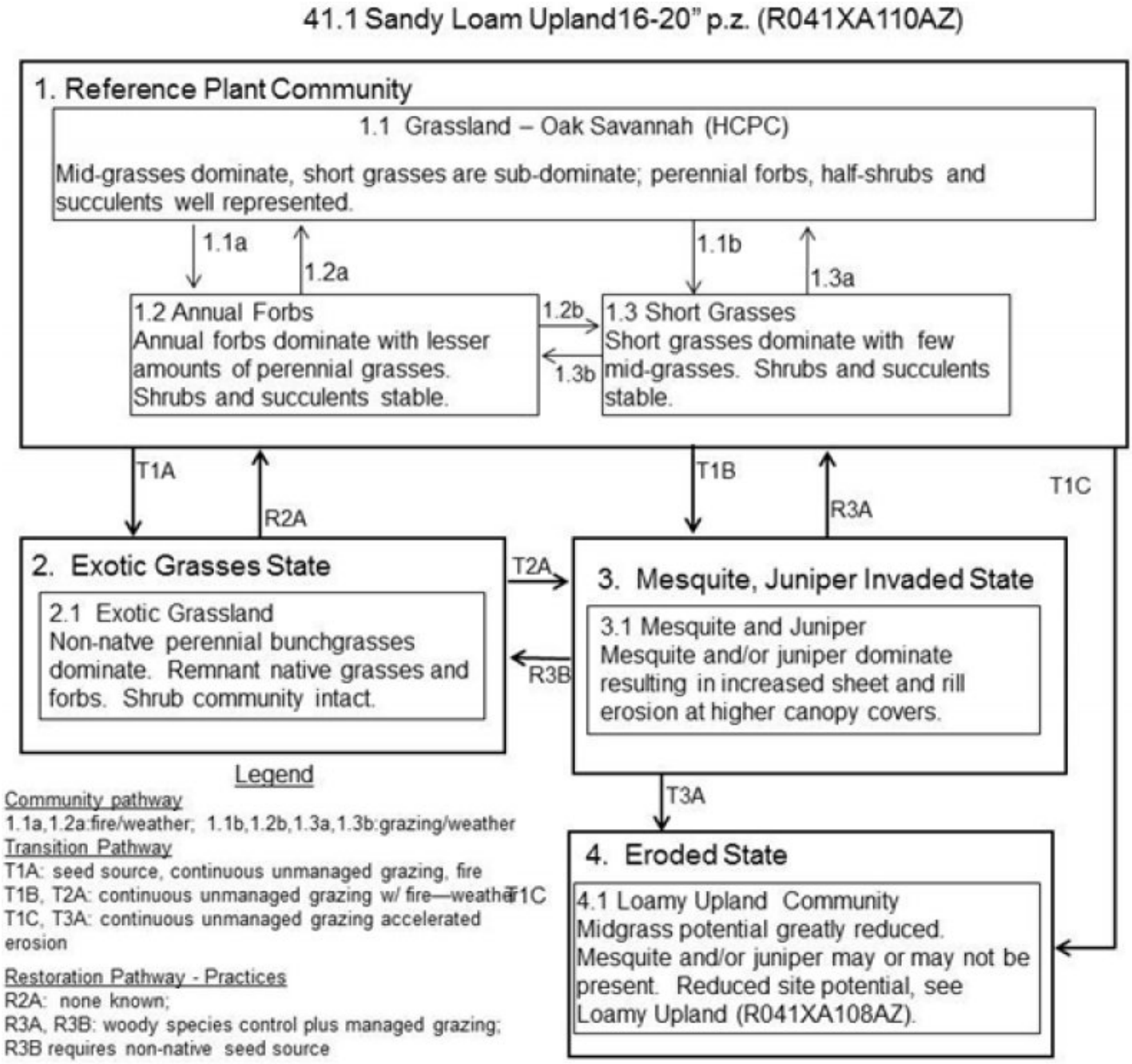

Figure 4. Sandyloam Upland 41-1 STM diagram

State 1
Reference

Community 1.1
Grassland-Oak Savannah (HCPC)

Figure 5. Sandy Loam Upland 16-20" pz. HCPC

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Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1065	1600	2112
Forb	17	30	205
Tree	0	5	30
Shrub/Vine	2	10	27
Total	**1084**	**1645**	**2374**

Table 6. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	0-1%
Grass/grasslike basal cover	10-20%
Forb basal cover	0-1%
Non-vascular plants	0-1%
Biological crusts	1-5%
Litter	25-65%
Surface fragments >0.25" and <=3"	5-15%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%

Bare ground	10-40%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-1%	1-5%	0-5%
>0.5 <= 1	–	0-1%	10-20%	1-5%
>1 <= 2	–	0-3%	20-40%	0-10%
>2 <= 4.5	–	0-1%	5-15%	0-1%
>4.5 <= 13	0-1%	–	0-1%	–
>13 <= 40	0-5%	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Figure 7. Plant community growth curve (percent production by month). AZ4111, 41.1 16-30. Growth begins in the spring, semi-dormancy occurs during the June drought, most growth occurs during the summer rainy season..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	10	0	15	45	20	5	0	0

Community 1.2
Annual Forbs

Annual forbs like camphorweed, annual goldeneye, gumweed and sorrel buckwheat dominate the plant community with marked reduction in mid-grass canopies. Short grasses are somewhat reduced.

Community 1.3
Short Grasses

Continuous, unmanaged grazing at high utilization levels removes midgrasses from the plant community. Midgrasses are replaced by a sod-bound form of blue grama and annual grasses and forbs. With severe deterioration, shrubby species like burroweed, wooly groundsel and yerba-de-pasmo can increase to dominate the plant community.

Pathway 1.1a
Community 1.1 to 1.2

Extended periods with no disturbance (fire or grazing) allow the build-up of perennial grass biomass that result in plant decadence. Periodic drought also causes significant grass mortality.

Pathway 1.1b
Community 1.1 to 1.3

Continuous, unmanaged, grazing with heavy to severe utilization removes perennial mid-grasses and affects natural fire cycles.

Pathway 1.2a
Community 1.2 to 1.1

With managed grazing, this site recovers moderately well in 2 to 3 years due to the favorable climate prevailing in this sub-resource area.

Pathway 1.2b
Community 1.2 to 1.3

Unmanaged grazing during a favorable precipitation period inhibits perennial midgrass recruitment.

Pathway 1.3a
Community 1.3 to 1.1

With managed grazing, midgrasses regain their dominance of the plant communities.

Pathway 1.3b
Community 1.3 to 1.2

Natural fire cycles are interrupted from lack of fine fuels caused by continuous, unmanaged grazing at high utilization levels.

State 2
Exotic Grasses

Community 2.1
Exotic Grassland

Figure 8. Sandy Loam Upland 16-20" pz. Lehmann lovegrass

This state occurs where African lovegrass species either have invaded from established stands or from direct seeding of these areas. Lehmann, Boer, weeping lovegrass, and in some places the yellow bluestems, are dominant and native perennial grasses and forbs exist only in trace amounts. Cover and production of these species is very high and site stability and hydrologic function are good.

State 3
Mesquite, Juniper Invaded

Community 3.1
Mesquite and Juniper

Figure 9. Sandy Loam Upland 16-20" pz. Mesquite

With continuous grazing, a nearby seed source, and in the absence of fire for long periods of time; velvet mesquite, western honey mesquite, alligator juniper and / or one seed juniper can invade and increase to dominate the site. Canopy cover ranges from 1 to 30%. Sheet and rill erosion can begin to accelerate at the higher canopy levels.

State 4
Eroded

Community 4.1
Loamy Upland Community

This state occurs where accelerated sheet and rill erosion has removed the soil surface (A horizon). This can be due to the interactions of fire, continuous grazing and drought; resulting in compaction and loss of grass cover. On those soils with argillic horizons; erosion that removes all but 3 inches of the surface has reduced the site potential to something similar to that of Loamy Upland ecological site (R041XA108AZ). On those soils with sandyloam textures throughout; erosion has left a patterns of rills that change the hydrology of the site and reduce production and cover.

Transition T1A
State 1 to 2

Non-native bunchgrass seed is purposely planted or inadvertently introduced into the plant community (wind-blown or mechanical transport). Disturbances such as fire or drought can disrupt the native perennials allowing the non-native grasses an opportunity to expand their range from disturbed or planted areas. Long term events such as continuous unmanaged grazing or community phase pathway 1.1a (shift to the Annual Forbs community phase 1.2) allow non-native bunchgrasses a competitive advantage over natives.

Transition T1B
State 1 to 3

Continuous unmanaged grazing with heavy to severe utilization results in persistently low perennial grass cover and extended fire free periods. Mesquite and juniper increase in size and number. Remnant native perennial grasses cannot re-colonize areas with shrub competition.

Transition T1C
State 1 to 4

Long-term, continuous, unmanaged grazing with heavy to severe utilization affects soil site stability and hydrologic functioning. Reduced soil cover, compaction, and A Horizon loss compound the effect of plant community changes (increased shrub/decreased perennial grass community) to increase surface water run-off rather than infiltration. Drought conditions accelerate this transition. Persistent reduced infiltration severely limits perennial grass recruitment.

Restoration pathway R2A
State 2 to 1

No restoration pathway known at this time. Perhaps future development of herbicide or biological treatment to remove perennial exotics will occur.

Transition T2A
State 2 to 3

Continuous unmanaged grazing with heavy to severe utilization results in persistently low perennial grass cover and extended fire free periods. Mesquite and juniper increase in size and number. Remnant native perennial grasses cannot re-colonize areas with shrub competition.

Restoration pathway R3A
State 3 to 1

Woody species control, native species seeding (as needed) supported by managed grazing. Shrub control maintained with herbicide and/or prescribed burning.

Restoration pathway R3B
State 3 to 2

Restoration activities conducted when a non-native seed bank is present on site (African lovegrasses or yellow bluestem present along trails, roads or in disturbed areas) can result in an exotic grassland community. Native species seeding may enhance the native grass component. Restoration practices are woody species control and native species seeding (as needed) supported by managed grazing. Shrub control maintained with herbicide may favor the native grasses while prescribed burning may favor non-natives. Burning the mixed shrub community with a non-native grass seed source present can result in an exotic grassland co-dominant with shrubs.

Transition T3A
State 3 to 4

Long-term, continuous, unmanaged grazing with heavy to severe utilization affects soil site stability and hydrologic functioning. Reduced soil cover, compaction, and A Horizon loss compound the effect of plant community changes (increased shrub/decreased perennial grass community) to increase surface water run-off rather than infiltration. Drought conditions accelerate this transition. Persistent reduced infiltration severely limits perennial grass recruitment.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Dominant mid-grasses**			800–1300	
	sideoats grama	BOCU	*Bouteloua curtipendula*	200–600	–
	plains lovegrass	ERIN	*Eragrostis intermedia*	200–600	–
	green sprangletop	LEDU	*Leptochloa dubia*	100–300	–
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	50–300	–

	Arizona cottontop	DICA8	*Digitaria californica*	25–200	–
	spiked crinkleawn	TRSP12	*Trachypogon spicatus*	0–200	–
2	**Dominant short grasses**			250–500	
	blue grama	BOGR2	*Bouteloua gracilis*	100–400	–
	black grama	BOER4	*Bouteloua eriopoda*	10–200	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–50	–
	fall witchgrass	DICO6	*Digitaria cognata*	10–50	–
	common wolfstail	LYPH	*Lycurus phleoides*	5–50	–
3	**Perennial threeawns**			10–80	
	Orcutt's threeawn	ARSCO	*Aristida schiedeana var. orcuttiana*	0–50	–
	spidergrass	ARTE3	*Aristida ternipes*	5–40	–
	spidergrass	ARTEG	*Aristida ternipes var. gentilis*	0–20	–
	Santa Rita threeawn	ARCAG	*Aristida californica var. glabrata*	0–5	–
	poverty threeawn	ARDI5	*Aristida divaricata*	0–5	–
	Havard's threeawn	ARHA3	*Aristida havardii*	0–5	–
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	0–5	–
	blue threeawn	ARPUN	*Aristida purpurea var. nealleyi*	0–5	–
	Parish's threeawn	ARPUP5	*Aristida purpurea var. parishii*	0–5	–
	Wright's threeawn	ARPUW	*Aristida purpurea var. wrightii*	0–5	–
4	**Annual Grasses**			5–100	
	prairie threeawn	AROL	*Aristida oligantha*	1–15	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–15	–
	Mexican panicgrass	PAHI5	*Panicum hirticaule*	1–10	–
	feather fingergrass	CHVI4	*Chloris virgata*	0–10	–
	tapertip cupgrass	ERACA	*Eriochloa acuminata var. acuminata*	0–10	–
	pitscale grass	HAGR3	*Hackelochloa granularis*	1–10	–
	sweet tanglehead	HEME	*Heteropogon melanocarpus*	0–10	–
	Mexican sprangletop	LEFUU	*Leptochloa fusca ssp. uninervia*	0–10	–
	Arizona signalgrass	URAR	*Urochloa arizonica*	1–10	–
	mucronate sprangeltop	LEPAB	*Leptochloa panicea ssp. brachiata*	0–5	–
	tufted lovegrass	ERPEP2	*Eragrostis pectinacea var. pectinacea*	0–5	–
	witchgrass	PACA6	*Panicum capillare*	0–5	–
	needle grama	BOAR	*Bouteloua aristidoides*	0–5	–
	sixweeks grama	BOBA2	*Bouteloua barbata*	0–5	–
	little grapefern	BOSI	*Botrychium simplex*	0–2	–
	matted grama	BOSI2	*Bouteloua simplex*	0–2	–
	Arizona brome	BRAR4	*Bromus arizonicus*	0–2	–
	sixweeks threeawn	ARAD	*Aristida adscensionis*	0–2	–
	Mexican lovegrass	ERME	*Eragrostis mexicana*	0–2	–
	desert lovegrass	ERPEM	*Eragrostis pectinacea var. miserrima*	0–2	–
	delicate muhly	MUFR	*Muhlenbergia fragilis*	0–1	–
	littleseed muhly	MUMI	*Muhlenbergia microsperma*	0–1	–
	poverty dropseed	SPVA	*Sporobolus vaginiflorus*	0–1	–
	prairie false oat	TRIN5	*Trisetum interruptum*	0–1	–

5	**Cool season grasses**			2–50	
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	1–30	–
	pinyon ricegrass	PIFI	*Piptochaetium fimbriatum*	0–25	–
	sedge	CAREX	*Carex*	1–10	–
	flatsedge	CYPER	*Cyperus*	0–10	–
	densetuft hairsedge	BUCA2	*Bulbostylis capillaris*	0–2	–
6	**Miscellaneous perennial grasses**			5–100	
	Rothrock's grama	BORO2	*Bouteloua rothrockii*	1–50	–
	silver bluestem	BOSA	*Bothriochloa saccharoides*	0–50	–
	tanglehead	HECO10	*Heteropogon contortus*	1–50	–
	spike dropseed	SPCO4	*Sporobolus contractus*	1–50	–
	slender grama	BORE2	*Bouteloua repens*	0–25	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	1–20	–
	sprucetop grama	BOCH	*Bouteloua chondrosioides*	0–15	–
	purple grama	BORA	*Bouteloua radicosa*	0–15	–
	woolyspike balsamscale	ELBA	*Elionurus barbiculmis*	0–10	–
	curly-mesquite	HIBE	*Hilaria belangeri*	0–10	–
	bullgrass	MUEM	*Muhlenbergia emersleyi*	0–10	–
	bush muhly	MUPO2	*Muhlenbergia porteri*	1–10	–
	creeping muhly	MURE	*Muhlenbergia repens*	0–10	–
	purple muhly	MURI3	*Muhlenbergia rigida*	0–10	–
	bulb panicgrass	PABU	*Panicum bulbosum*	0–10	–
	Hall's panicgrass	PAHA	*Panicum hallii*	0–10	–
	big sacaton	SPWR2	*Sporobolus wrightii*	0–10	–
	Texas bluestem	SCCI2	*Schizachyrium cirratum*	0–10	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–10	–
	plains bristlegrass	SEVU2	*Setaria vulpiseta*	0–10	–
	Arizona muhly	MUAR3	*Muhlenbergia arizonica*	0–5	–
	vine mesquite	PAOB	*Panicum obtusum*	0–5	–
	Porter's melicgrass	MEPO	*Melica porteri*	0–2	–
	nineawn pappusgrass	ENDE	*Enneapogon desvauxii*	0–1	–
Forb					
7	**Perennial forbs**			15–55	
	Cooley's bundleflower	DECO2	*Desmanthus cooleyi*	1–10	–
	bluedicks	DICA14	*Dichelostemma capitatum*	1–10	–
	orange fameflower	PHAU13	*Phemeranthus aurantiacus*	0–10	–
	wild dwarf morning-glory	EVAR	*Evolvulus arizonicus*	0–5	–
	spreading snakeherb	DYSCD	*Dyschoriste schiedeana var. decumbens*	0–5	–
	rose heath	CHER2	*Chaetopappa ericoides*	0–5	–
	leatherweed	CRPO5	*Croton pottsii*	0–5	–
	Texas snoutbean	RHSET	*Rhynchosia senna var. texana*	0–5	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–2	–

	shrubby purslane	POSU3	*Portulaca suffrutescens*	0–2	–
	brownplume wirelettuce	STPA4	*Stephanomeria pauciflora*	0–2	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–2	–
	Rocky Mountain zinnia	ZIGR	*Zinnia grandiflora*	0–2	–
	tuber anemone	ANTU	*Anemone tuberosa*	0–2	–
	Missouri gourd	CUFO	*Cucurbita foetidissima*	0–2	–
	largeflower onion	ALMA4	*Allium macropetalum*	0–2	–
	weakleaf bur ragweed	AMCO3	*Ambrosia confertiflora*	1–2	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–2	–
	spreading fleabane	ERDI4	*Erigeron divergens*	0–2	–
	trailing fleabane	ERFL	*Erigeron flagellaris*	0–2	–
	small matweed	GUDE	*Guilleminea densa*	0–2	–
	Rutter's false goldenaster	HERU3	*Heterotheca rutteri*	0–2	–
	Wright's deervetch	LOWR	*Lotus wrightii*	0–2	–
	silver dwarf morning-glory	EVSE	*Evolvulus sericeus*	0–2	–
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–2	–
	locoweed	OXYTR	*Oxytropis*	0–1	–
	beardlip penstemon	PEBA2	*Penstemon barbatus*	0–1	–
	Cochise beardtongue	PEDA	*Penstemon dasyphyllus*	0–1	–
	longstalk chinchweed	PELO	*Pectis longipes*	0–1	–
	Parry's beardtongue	PEPA24	*Penstemon parryi*	0–1	–
	slimleaf bean	PHAN3	*Phaseolus angustissimus*	0–1	–
	ivyleaf groundcherry	PHHE4	*Physalis hederifolia*	0–1	–
	white milkwort	POAL4	*Polygala alba*	0–1	–
	velvetseed milkwort	POOB	*Polygala obscura*	0–1	–
	Arizona snakecotton	FRAR2	*Froelichia arizonica*	0–1	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–1	–
	pearly globe amaranth	GONI	*Gomphrena nitida*	0–1	–
	variableleaf bushbean	MAGI2	*Macroptilium gibbosifolium*	0–1	–
	shaggy dwarf morning-glory	EVNU	*Evolvulus nuttallianus*	0–1	–
	Indian rushpea	HOGL2	*Hoffmannseggia glauca*	0–1	–
	red bluet	HORU	*Houstonia rubra*	0–1	–
	babyslippers	HYVE	*Hybanthus verticillatus*	0–1	–
	ragged nettlespurge	JAMA	*Jatropha macrorhiza*	0–1	–
	San Pedro daisy	LAPO4	*Lasianthaea podocephala*	0–1	–
	Fendler's bladderpod	LEFE	*Lesquerella fendleri*	0–1	–
	narrowleaf stoneseed	LIIN2	*Lithospermum incisum*	0–1	–
	Lewis flax	LILE3	*Linum lewisii*	0–1	–
	Greene's bird's-foot trefoil	LOGR4	*Lotus greenei*	0–1	–
	Mexican fireplant	EUHE4	*Euphorbia heterophylla*	0–1	–

	sun spurge	EURA2	*Euphorbia radians*	0–1	–
	Torrey's craglily	ECFL	*Echeandia flavescens*	0–1	–
	perennial rockcress	ARPE2	*Arabis perennans*	0–1	–
	Watson's dutchman's pipe	ARWA	*Aristolochia watsonii*	0–1	–
	Arizona milkvetch	ASAR6	*Astragalus arizonicus*	0–1	–
	spider milkweed	ASAS	*Asclepias asperula*	0–1	–
	chaparral asphead	ASHI3	*Aspicarpa hirtella*	0–1	–
	broadleaf milkweed	ASLA4	*Asclepias latifolia*	0–1	–
	woolly locoweed	ASMOB	*Astragalus mollissimus var. bigelovii*	0–1	–
	sheep milkvetch	ASNO3	*Astragalus nothoxys*	0–1	–
	horsetail milkweed	ASSU2	*Asclepias subverticillata*	0–1	–
	dense ayenia	AYMI	*Ayenia microphylla*	0–1	–
	hairyseed bahia	BAAB	*Bahia absinthifolia*	0–1	–
	lyreleaf greeneyes	BELY	*Berlandiera lyrata*	0–1	–
	scarlet spiderling	BOCO	*Boerhavia coccinea*	0–1	–
	dwarf stickpea	CAHUR	*Calliandra humilis var. reticulata*	0–1	–
	wholeleaf Indian paintbrush	CAIN14	*Castilleja integra*	0–1	–
	desert mariposa lily	CAKE	*Calochortus kennedyi*	0–1	–
	sego lily	CANU3	*Calochortus nuttallii*	0–1	–
	Indian paintbrush	CASTI2	*Castilleja*	0–1	–
	whitemargin sandmat	CHAL11	*Chamaesyce albomarginata*	0–1	–
	Mexican yellowshow	AMPA3	*Amoreuxia palmatifida*	0–1	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–1	–
	birdbill dayflower	CODI4	*Commelina dianthifolia*	0–1	–
	Texas bindweed	COEQ	*Convolvulus equitans*	0–1	–
	whitemouth dayflower	COER	*Commelina erecta*	0–1	–
	coyote gourd	CUPA	*Cucurbita palmata*	0–1	–
	whiteflower prairie clover	DAAL	*Dalea albiflora*	0–1	–
	James' prairie clover	DAJA	*Dalea jamesii*	0–1	–
	dwarf prairie clover	DANA	*Dalea nana*	0–1	–
	downy prairie clover	DANE	*Dalea neomexicana*	0–1	–
	melon loco	APUN	*Apodanthera undulata*	0–1	–
	fingerleaf gourd	CUDI	*Cucurbita digitata*	0–1	–
	copper globemallow	SPAN3	*Sphaeralcea angustifolia*	0–1	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–1	–
	jewels of Opar	TAPA2	*Talinum paniculatum*	0–1	–
	Coulter's wrinklefruit	TECO	*Tetraclea coulteri*	0–1	–
	hairy fournwort	TENE	*Tetramerium nervosum*	0–1	–
	longstalk greenthread	THLO	*Thelesperma longipes*	0–1	–
	Hopi tea greenthread	THME	*Thelesperma megapotamicum*	0–1	–
	pinewoods spiderwort	TRPI	*Tradescantia pinetorum*	0–1	–

	branched noseburn	TRRA5	*Tragia ramosa*	0–1	–
	Fort Huachuca vervain	VEGR2	*Verbena gracilis*	0–1	–
	American vetch	VIAM	*Vicia americana*	0–1	–
	Louisiana vetch	VILUL2	*Vicia ludoviciana ssp. ludoviciana*	0–1	–
	copper zephyrlily	ZELO	*Zephyranthes longifolia*	0–1	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–1	–
	buffpetal	RHPH2	*Rhynchosida physocalyx*	0–1	–
	Mexican star	MIBI2	*Milla biflora*	0–1	–
	lemon beebalm	MOCIA	*Monarda citriodora ssp. austromontana*	0–1	–
	slimleaf plainsmustard	SCLI12	*Schoenocrambe linearifolia*	0–1	–
	twinleaf senna	SEBA3	*Senna bauhinioides*	0–1	–
	Lemmon's ragwort	SELE8	*Senecio lemmonii*	0–1	–
	salt spring checkerbloom	SINE3	*Sidalcea neomexicana*	0–1	–
	silverleaf nightshade	SOEL	*Solanum elaeagnifolium*	0–1	–
	trailing windmills	ALIN	*Allionia incarnata*	0–1	–
8	**Annual Forbs**			2–150	
	longleaf false goldeneye	HELOA2	*Heliomeris longifolia var. annua*	1–50	–
	camphorweed	HESU3	*Heterotheca subaxillaris*	1–50	–
	Arizona poppy	KAGR	*Kallstroemia grandiflora*	0–25	–
	warty caltrop	KAPA	*Kallstroemia parviflora*	0–10	–
	intermediate pepperweed	LEVIM	*Lepidium virginicum var. medium*	0–10	–
	slender goldenweed	MAGR10	*Machaeranthera gracilis*	1–10	–
	tanseyleaf tansyaster	MATA2	*Machaeranthera tanacetifolia*	0–10	–
	whitestem blazingstar	MEAL6	*Mentzelia albicaulis*	0–10	–
	sweet four o'clock	MILO2	*Mirabilis longiflora*	0–10	–
	pitseed goosefoot	CHBE4	*Chenopodium berlandieri*	0–10	–
	New Mexico goosefoot	CHNE3	*Chenopodium neomexicanum*	0–10	–
	sensitive partridge pea	CHNI2	*Chamaecrista nictitans*	0–10	–
	New Mexico thistle	CINE	*Cirsium neomexicanum*	0–10	–
	smallflowered milkvetch	ASNU4	*Astragalus nuttallianus*	0–10	–
	Thurber's milkvetch	ASTH	*Astragalus thurberi*	0–10	–
	carelessweed	AMPA	*Amaranthus palmeri*	0–5	–
	western tansymustard	DEPI	*Descurainia pinnata*	0–5	–
	Abert's buckwheat	ERAB2	*Eriogonum abertianum*	0–5	–
	sorrel buckwheat	ERPO4	*Eriogonum polycladon*	0–5	–
	Arizona popcornflower	PLAR	*Plagiobothrys arizonicus*	0–5	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–5	–
	Thurber's morning-glory	IPTH	*Ipomoea thurberi*	0–2	–
	sawtooth sage	SASU7	*Salvia subincisa*	0–2	–
	spreading fanpetals	SIAB	*Sida abutifolia*	0–2	–
	Fendler's	MAFE	*Malacothrix fendleri*	0–2	–

	desertdandelion				
	golden crownbeard	VEEN	*Verbesina encelioides*	0–2	–
	wedgeleaf draba	DRCU	*Draba cuneifolia*	0–2	–
	redstar	IPCO3	*Ipomoea coccinea*	0–2	–
	scrambled eggs	COAU2	*Corydalis aurea*	0–2	–
	New Mexico copperleaf	ACNE	*Acalypha neomexicana*	0–2	–
	crested anoda	ANCR2	*Anoda cristata*	0–1	–
	southwestern pricklypoppy	ARPL3	*Argemone pleiacantha*	0–1	–
	halfmoon milkvetch	ASAL6	*Astragalus allochrous*	0–1	–
	wheelscale saltbush	ATEL	*Atriplex elegans*	0–1	–
	fewflower beggarticks	BILE	*Bidens leptocephala*	0–1	–
	Coulter's spiderling	BOCO2	*Boerhavia coulteri*	0–1	–
	erect spiderling	BOER	*Boerhavia erecta*	0–1	–
	hoary bowlesia	BOIN3	*Bowlesia incana*	0–1	–
	purple spiderling	BOPU	*Boerhavia purpurascens*	0–1	–
	fringed redmaids	CACI2	*Calandrinia ciliata*	0–1	–
	cryptantha	CRYPT	*Cryptantha*	0–1	–
	Chihuahuan prairie clover	DAEX2	*Dalea exigua*	0–1	–
	American wild carrot	DAPU3	*Daucus pusillus*	0–1	–
	sacred thorn-apple	DAWR2	*Datura wrightii*	0–1	–
	poorjoe	DITE2	*Diodia teres*	0–1	–
	miner's lettuce	CLPEP	*Claytonia perfoliata ssp. perfoliata*	0–1	–
	threadstem sandmat	CHRE4	*Chamaesyce revoluta*	0–1	–
	thymeleaf sandmat	CHSE6	*Chamaesyce serpyllifolia*	0–1	–
	slimseed sandmat	CHST8	*Chamaesyce stictospora*	0–1	–
	royal sandmat	CHDI5	*Chamaesyce dioica*	0–1	–
	pillpod sandmat	CHHI3	*Chamaesyce hirta*	0–1	–
	hyssopleaf sandmat	CHHY3	*Chamaesyce hyssopifolia*	0–1	–
	flaxflowered ipomopsis	IPLOL	*Ipomopsis longiflora ssp. longiflora*	0–1	–
	crestrib morning-glory	IPCO2	*Ipomoea costellata*	0–1	–
	miniature woollystar	ERDI2	*Eriastrum diffusum*	0–1	–
	spreading fleabane	ERDI4	*Erigeron divergens*	0–1	–
	California poppy	ESCAM	*Eschscholzia californica ssp. mexicana*	0–1	–
	Arizona blanketflower	GAAR2	*Gaillardia arizonica*	0–1	–
	red dome blanketflower	GAPI	*Gaillardia pinnatifida*	0–1	–
	lesser yellowthroat gilia	GIFL	*Gilia flavocincta*	0–1	–
	El Paso gilia	GIME	*Gilia mexicana*	0–1	–
	Dakota mock vervain	GLBIB	*Glandularia bipinnatifida var. bipinnatifida*	0–1	–
	curlytop gumweed	GRNUA	*Grindelia nuda var. aphanactis*	0–1	–
	sleepy silene	SIAN2	*Silene antirrhina*	0–1	–
	El Paso skyrocket	IPTH2	*Ipomopsis thurberi*	0–1	–

	desert evening primrose	OEPR	*Oenothera primiveris*	0–1	–
	Arizona phacelia	PHAR13	*Phacelia arizonica*	0–1	–
	Mangas Spring phacelia	PHBO4	*Phacelia bombycina*	0–1	–
	purslane	PORTU	*Portulaca*	0–1	–
	yerba porosa	PORU6	*Porophyllum ruderale*	0–1	–
	desert unicorn-plant	PRAL4	*Proboscidea althaeifolia*	0–1	–
	doubleclaw	PRPA2	*Proboscidea parviflora*	0–1	–
	Wright's cudweed	PSCAC2	*Pseudognaphalium canescens ssp. canescens*	0–1	–
	Abert's creeping zinnia	SAAB	*Sanvitalia abertii*	0–1	–
	dotted blazing star	LIPU	*Liatris punctata*	0–1	–
	plains flax	LIPU4	*Linum puberulum*	0–1	–
	foothill deervetch	LOHU2	*Lotus humistratus*	0–1	–
	coastal bird's-foot trefoil	LOSAB	*Lotus salsuginosus var. brevivexillus*	0–1	–
	shortstem lupine	LUBR2	*Lupinus brevicaulis*	0–1	–
	bajada lupine	LUCOC	*Lupinus concinnus ssp. concinnus*	0–1	–
	Gordon's bladderpod	LEGO	*Lesquerella gordonii*	0–1	–
	broadleaved pepperweed	LELA2	*Lepidium latifolium*	0–1	–
Shrub/Vine					
9	**Dominant half shrubs**			2–20	
	bastardsage	ERWR	*Eriogonum wrightii*	1–20	–
	dwarf milkweed	ASIN14	*Asclepias involucrata*	1–15	–
	milkvetch	ASTRA	*Astragalus*	1–15	–
	lyreleaf greeneyes	BELY	*Berlandiera lyrata*	1–15	–
	scarlet spiderling	BOCO	*Boerhavia coccinea*	1–15	–
	fringed redmaids	CACI2	*Calandrinia ciliata*	1–15	–
	Indian paintbrush	CASTI2	*Castilleja*	1–15	–
	lambsquarters	CHAL7	*Chenopodium album*	1–15	–
	hyssopleaf sandmat	CHHY3	*Chamaesyce hyssopifolia*	1–15	–
	New Mexico thistle	CINE	*Cirsium neomexicanum*	1–15	–
	smooth babybonnets	COGL7	*Coursetia glabella*	1–15	–
	leatherweed	CRPOP	*Croton pottsii var. pottsii*	1–15	–
	fingerleaf gourd	CUDI	*Cucurbita digitata*	1–15	–
	coyote gourd	CUPA	*Cucurbita palmata*	1–15	–
	American wild carrot	DAPU3	*Daucus pusillus*	1–15	–
	New Mexico ticktrefoil	DENE	*Desmodium neomexicanum*	1–15	–
	western tansymustard	DEPI	*Descurainia pinnata*	1–15	–
	Torrey's craglily	ECFL	*Echeandia flavescens*	1–15	–
	miniature woollystar	ERDI2	*Eriastrum diffusum*	1–15	–
	Bessey's stickseed	HABE3	*Hackelia besseyi*	1–15	–
	Indian rushpea	HOGL2	*Hoffmannseggia glauca*	1–15	–

	rubberweed	HYMEN7	*Hymenoxys*	1–15	–
	ragged nettlespurge	JAMA	*Jatropha macrorhiza*	1–15	–
	Arizona poppy	KAGR	*Kallstroemia grandiflora*	1–15	–
	Coulter's horseweed	LACO13	*Laennecia coulteri*	1–15	–
	Fendler's bladderpod	LEFE	*Lesquerella fendleri*	1–15	–
	Goodding's bladderpod	LEGO2	*Lesquerella gooddingii*	1–15	–
	intermediate pepperweed	LEVIM	*Lepidium virginicum var. medium*	1–15	–
	Lewis flax	LILE3	*Linum lewisii*	1–15	–
	plains flax	LIPU4	*Linum puberulum*	1–15	–
	woodland-star	LITHO2	*Lithophragma*	1–15	–
	Greene's bird's-foot trefoil	LOGR4	*Lotus greenei*	1–15	–
	foothill deervetch	LOHU2	*Lotus humistratus*	1–15	–
	coastal bird's-foot trefoil	LOSAB	*Lotus salsuginosus var. brevivexillus*	1–15	–
	lupine	LUPIN	*Lupinus*	1–15	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	1–15	–
	slender goldenweed	MAGR10	*Machaeranthera gracilis*	1–15	–
	whitestem blazingstar	MEAL6	*Mentzelia albicaulis*	1–15	–
	lemon beebalm	MOCIA	*Monarda citriodora ssp. austromontana*	1–15	–
	green carpetweed	MOVE	*Mollugo verticillata*	1–15	–
	desert evening primrose	OEPR	*Oenothera primiveris*	1–15	–
	Drummond's woodsorrel	OXDR	*Oxalis drummondii*	1–15	–
	palafox	PALAF	*Palafoxia*	1–15	–
	longstalk chinchweed	PELO	*Pectis longipes*	1–15	–
	phacelia	PHACE	*Phacelia*	1–15	–
	ivyleaf groundcherry	PHHE4	*Physalis hederifolia*	1–15	–
	phlox	PHLOX	*Phlox*	1–15	–
	Arizona popcornflower	PLAR	*Plagiobothrys arizonicus*	1–15	–
	desert Indianwheat	PLOV	*Plantago ovata*	1–15	–
	little hogweed	POOL	*Portulaca oleracea*	1–15	–
	doubleclaw	PRPA2	*Proboscidea parviflora*	1–15	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	1–15	–
	chia	SACO6	*Salvia columbariae*	1–15	–
	twinleaf senna	SEBA3	*Senna bauhinioides*	1–15	–
	sleepy silene	SIAN2	*Silene antirrhina*	1–15	–
	silverleaf nightshade	SOEL	*Solanum elaeagnifolium*	1–15	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	1–15	–
	jewels of Opar	TAPA2	*Talinum paniculatum*	1–15	–
	Hopi tea greenthread	THME	*Thelesperma megapotamicum*	1–15	–
	Palmer's crinklemat	TIPA	*Tiquilia palmeri*	1–15	–
	pinewoods spiderwort	TRPI	*Tradescantia pinetorum*	1–15	–
	branched noseburn	TRRA5	*Tragia ramosa*	1–15	–

	branched noseburn	TRRA5	*Tragia ramosa*	1–15	–
	Fort Huachuca vervain	VEGR2	*Verbena gracilis*	1–15	–
	American vetch	VIAM	*Vicia americana*	1–15	–
	Louisiana vetch	VILUL2	*Vicia ludoviciana ssp. ludoviciana*	1–15	–
	Rocky Mountain zinnia	ZIGR	*Zinnia grandiflora*	1–15	–
	yerba de pasmo	BAPT	*Baccharis pteronioides*	1–10	–
	fairyduster	CAER	*Calliandra eriophylla*	0–10	–
	prairie acacia	ACAN	*Acacia angustissima*	0–5	–
10	**Miscellanous shrubs**			0–5	
	catclaw acacia	ACGR	*Acacia greggii*	0–2	–
	Apache plume	FAPA	*Fallugia paradoxa*	0–2	–
	burroweed	ISTE2	*Isocoma tenuisecta*	0–1	–
	littleleaf ratany	KRER	*Krameria erecta*	0–1	–
	trailing krameria	KRLA	*Krameria lanceolata*	0–1	–
	pale desert-thorn	LYPA	*Lycium pallidum*	0–1	–
	catclaw mimosa	MIACB	*Mimosa aculeaticarpa var. biuncifera*	0–1	–
	velvetpod mimosa	MIDY	*Mimosa dysocarpa*	0–1	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–1	–
	threadleaf ragwort	SEFL3	*Senecio flaccidus*	0–1	–
	pointleaf manzanita	ARPU5	*Arctostaphylos pungens*	0–1	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–1	–
	longleaf jointfir	EPTR	*Ephedra trifurca*	0–1	–
	rubber rabbitbrush	ERNAC3	*Ericameria nauseosa ssp. consimilis var. ceruminosa*	0–1	–
11	**Succulents**			0–2	
	sacahuista	NOMI	*Nolina microcarpa*	0–2	–
	cactus apple	OPEN3	*Opuntia engelmannii*	0–1	–
	twistspine pricklypear	OPMA2	*Opuntia macrorhiza*	0–1	–
	soaptree yucca	YUEL	*Yucca elata*	0–1	–
	Palmer's century plant	AGPA3	*Agave palmeri*	0–1	–
	Parry's agave	AGPA4	*Agave parryi*	0–1	–
	walkingstick cactus	CYSP8	*Cylindropuntia spinosior*	0–1	–
	pinkflower hedgehog cactus	ECFEF3	*Echinocereus fendleri ssp. fendleri*	0–1	–
	white fishhook cactus	ECIN2	*Echinomastus intertextus*	0–1	–
	rainbow hedgehog cactus	ECRI3	*Echinocereus rigidissimus*	0–1	–
	spinystar	ESVI2	*Escobaria vivipara*	0–1	–
	Macdougal's nipple cactus	MAHEM	*Mammillaria heyderi var. macdougalii*	0–1	–
Tree					
12	**Trees**			0–30	
	Arizona white oak	QUAR	*Quercus arizonica*	0–30	–
	Emory oak	QUEM	*Quercus emoryi*	0–30	–
	alligator juniper	JUDE2	*Juniperus deppeana*	0–1	–
	oneseed juniper	JUMO	*Juniperus monosperma*	0–1	–

Animal community

The plant community on this site is suitable for grazing by all classes of livestock at any season. The plant community will be low in digestable protein in the winter. Phosphorous may be deficient throughout the year. Grazing should be managed to maintain a vigorous stand of midgrasses to keep Lehmann lovegrass out of the community and to prevent forbs like camphorweed and annual buckwheat from becoming dominant in the plant community. Annual goldeneye can cause problems in the fall after unusually wet winter-spring season.

The site is a primary habitat for pronghorn antelope in southeastern Arizona. Water developments are very important to both large and small wildlife species on the site. The site is open grassland and rich in both grass and forb species, making it home to a great variety of insect, bird, small mammal and reptile species.

In areas adjacent to woodlands, this site is heavily used as a forage area for large mammals like mule deer and whitetail deer. Natural water is lacking on this site.

Hydrological functions

Due to thick, coarse textured soil surfaces this site is a poor producer of runoff.

Recreational uses

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

Wood products

None unless the area has been invaded by mesquite or juniper.

Other products

Grass seed, medicinal herbs like yerba de pasmo and mormon tea.

Inventory data references

Range 417s include 1 in excellent condition and 2 in good condition.

Type locality

Location 1: Cochise County, AZ	
Township/Range/Section	T22S R20E S28
General legal description	NE 1/2 of section. Douglas FO - Ft. Huachuca - South Range
Location 2: Pima County, AZ	
Township/Range/Section	T20S R17E S11
General legal description	SE 1/2 of section. Tucson - Empire Ranch
Location 3: Santa Cruz County, AZ	
Township/Range/Section	T21S R18E S23
General legal description	Audubon Research Ranch

Other references

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Contributors

Steve Barker
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Approval

Curtis Talbot, 4/09/2021

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)	Wilma Renken, Dan Robinett, Larry Humphrey, Scott Stratton, Linda Kennedy
Contact for lead author	USDA-NRCS Tucson MLRA Soil Survey Office
Date	05/01/2014
Approved by	Curtis Talbot
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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2. **Presence of water flow patterns:** No water flow patterns evident. Reference site is nearly flat terrain (1-2% slope) lending to sheet flow across site. Expect waterflow pattern presence to increase in length and continuity with increasing slope; at the steepest slopes (10-15% slope), short, discontinuous water flow patterns may occupy up to 15% of the area.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals (<1") common on perennial grasses; no terracettes.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground after fire was 55% and decreased to 30% within 4 years. Bare (unvegetated) areas are uncommon and small (3-5 ft diameter)

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

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

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7. **Amount of litter movement (describe size and distance expected to travel):** Most litter stays in place with some fine litter moving off bare areas.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Highly stable soil surface with cryptobiotic crust. Soil slake test value was "6" for all samples.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface horizon was a gravelly sandy loam, 0-4" depth, color 5YR 6/4 dry, 5YR 3/3 moist, granular structure immediately below a platy surface.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Perennial grass basal cover (7-15%) is evenly distributed across site. Low perennial grass basal cover is expected after fire or drought. Well-dispersed perennial grasses slow rainfall run-off allowing infiltration.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction. Average depth of penetration from an ARS field penetrometer with a 2.2 kg. sliding hammer was 4.2 cm. Argillic horizon at 4" depth may be mistaken for compaction.

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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: Mid-grasses > short-grasses

    Sub-dominant: Perennial forbs > low shrubs

    Other: few succulents

    Additional: annual grasses and annual forbs fluctuate with rainfall

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little mortality during periods between fire and drought. Mortality from fire depends upon season and intensity of burn.

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14. **Average percent litter cover (%) and depth (in):** 30-50% litter cover with fire dynamic from 10 years of monitoring data encompassing 2 burns. Litter cover on the low end of the range is expected immmediately post-burn and increases with favorable weather and time.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1084 lbs/ac. in a below average year; 1645 lbs/ac. in an average year; 2374 lbs/ac. in an above average year.

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 lovegrass, Boer lovegrass, yellow bluestem, velvet mesquite

17. **Perennial plant reproductive capability:** Not impaired.