USDA Natural Resources Conservation Service

Ecological site R041XA102AZ
Shallow Hills 16-20" 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.

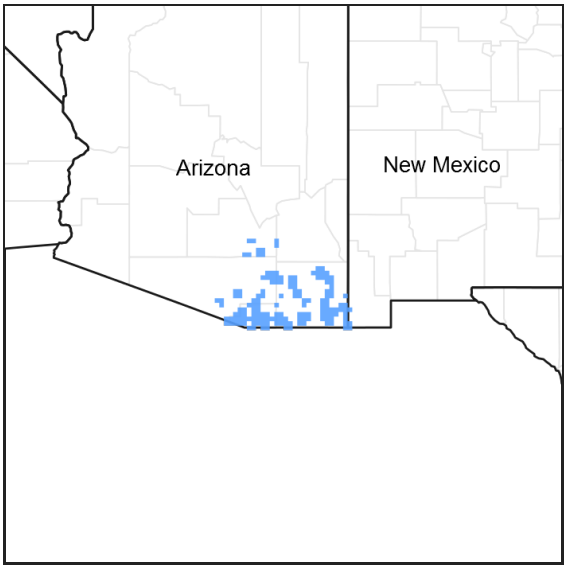

Figure 1. Mapped extent

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

Land Resource Unit: 41-1AZ 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. This unit occurs within the Basin and Range Physiographic Province. It is characterized by numerous mountain ranges that rise abruptly from broad, plain-like valleys and basins. Igneous and metamorphic rock classes dominate the mountain ranges and their sediments fill the basins with representive combinations of fluvial, lacustrine, colluvial and alluvial deposits.

Ecological site concept

Shallow Hills ecological site occurs on steep uplands, all moisture is received from precipitation without additional moisture inputs from on-site surface flow. Slopes are steep exceeding 15 percent. The non-calcareous soils are shallow, less than 20 inches deep. Parent material and bedrock consist of granite, schist, gneiss, or rhyolite (acid igneous).

Associated sites

F041XA112AZ	**Sandy Wash 16-20" p.z. woodland**
F041XA113AZ	**Sandy Bottom 16-20" p.z. woodland**
R041XA103AZ	**Limestone Hills 16-20 p.z.**
R041XA111AZ	**Volcanic Hills 16-20" p.z.**
R041XA117AZ	**Shallow Upland 16-20" p.z.**

Similar sites

R041XC306AZ	**Shallow Hills 12-16" p.z.**

Table 1. Dominant plant species

Tree	(1) *quercus emoryi* (2) *quercus arizonica*
Shrub	(1) *nolina microcarpa* (2) *erythrina flabelliformis*
Herbaceous	(1) *bouteloua curtipendula* (2) *schizachyrium cirratum*

Physiographic features

This site occurs in the middle elevations of the Madrean Basin and Range province in southeastern Arizona. It is on hill-slopes and rolling pediments. Slope aspect is site differentiating at elevations near common resource area boundaries.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Pediment
Flooding frequency	None
Ponding frequency	None
Elevation	4,500–5,500 ft
Slope	15–65%
Aspect	N, E, S

Climatic features

Precipitation in this zone of the common resource area ranges from 16-20 inches per year with elevations from 4500-5500 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.

Table 3. Representative climatic features

Frost-free period (average)	221 days
Freeze-free period (average)	255 days

Precipitation total (average)	20 in

Influencing water features

There are no water features associated with this site.

Soil features

Soils are shallow, non-calcareous, and often skeletal (>35% rock fragments). These soils formed from acid igneous rock like granite and rhyolite or metamorphic rock like schist, gneiss and quartzite. The underlying bedrock is generally weathered 3-5 inches but can be weathered up to 3 to 6 feet. Soils are coarse loamy or loamy and have a well-developed surface cover of gravels, cobbles, stones and boulders. Soil surface horizons are dark colored. Plant-soil moisture relationships are fair to good. Rock outcroppings are common. Soil series correlated to this ecological site include Budlamp, Woodcutter, Magoffin, Turquoise, Nugget and Lutzcan.

Table 4. Representative soil features

Parent material	(1) Slope alluvium–granite (2) Colluvium–rhyolite
Surface texture	(1) Very gravelly sandy loam (2) Cobbly sandy loam (3) Very cobbly loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately rapid to moderate
Soil depth	10–20 in
Surface fragment cover <=3"	10–50%
Surface fragment cover >3"	3–10%
Available water capacity (0-40in)	0.7–2.4 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)	10–45%
Subsurface fragment volume >3" (Depth not specified)	3–10%

Ecological dynamics

The Reference Plant Community (RPC, see State and Transition Model below) of the 41-1AZ Granitic Hills ecological site is a diverse mixture of warm-season perennial grasses, cool-season perennial grasses, ferns, forbs, succulents and shrubs. Trees are common giving the aspect a savanna appearance. Seasonal rainfall amounts affect amounts and composition of plant productivity. After a wet winter, cool season plants (a mixture of perennial grasses, forbs, sub-shrubs and annuals) begin active growth in March. The months of May and June present a period of little to no active plant growth. Warm season species, mostly perennial grasses, begin active growth after the onset of the summer rainy season usually in July; peak annual production occurs in October. Fire, short-term

drought and herbivory (insects and mammals) are recurring disturbances to this ecological site. Historically, these disturbances interacted to shape the plant community phases within the Reference State. Fire reduces shrub cover and maintains the savanna aspect. Between fires, shrub growth continues unimpeded. Prior to historic settlement of the southwest, natural fire-free periods are estimated to have been 10-30 years in length. Today's greatly extended fire-free periods are more influential on plant community dynamics than grazing. Plant community structure (shrub density) and composition is indicative of the length of time since last fire. For example, Mexican pinyon requires shading from shrubs for sapling establishment and are highly susceptible to fire, therefore old, mature pinyon stands indicate that 100+ years have passed since the last fire. Drought can extend the fire-free period by impairing perennial grass productivity and vigor. During extended fire-free periods, small shrubs and succulents can attain dominance of the plant community. When average rainfall resumes, annual forbs flourish while perennial grasses recover. Subsequent fires remove the shrub dominance.

Steep slopes and shallow soils make this ecological site somewhat vulnerable to disturbance. As disturbances increase in intensity, repetition and duration, the effects they have on the site are compounded by slope. The site's hydrology, biotic integrity and soil stability are impacted. The changes, especially to the plant community, can become long-lasting. If non-native perennial bunchgrass seed is present or brought onto this ecological site, any intense disturbance (fire or grazing) may result in a monoculture of non-native lovegrass (Exotic Grass State). The aspect remains a savanna, similar to RPC; however, this plant community does not offer adequate wildlife food and cover.

If the disturbance is not managed, the productivity of the site ultimately declines as hydrology, soil stability and the biotic community all function differently from that in the Reference State. Continuous, unmanaged grazing of either savanna state (Reference or Exotic Grasses) removes fire fuel and reduces perennial bunchgrass vigor. The resulting plant community is dominated by shrubs with less perennial grass cover (Shrub Dominated State). Run-off and erosion is much higher in this state than the savanna.

Drought or fire, coupled with continuous, unmanaged grazing can severely impact soil and plant community functioning from the Reference or Shrub Dominated State. The resulting state has severe erosion and lower potential productivity. The increased run-off also adversely affects ecological sites downslope (see F041XA112AZ Sandy Wash, 16-20" (QUEM, QUAR)).

State and transition model

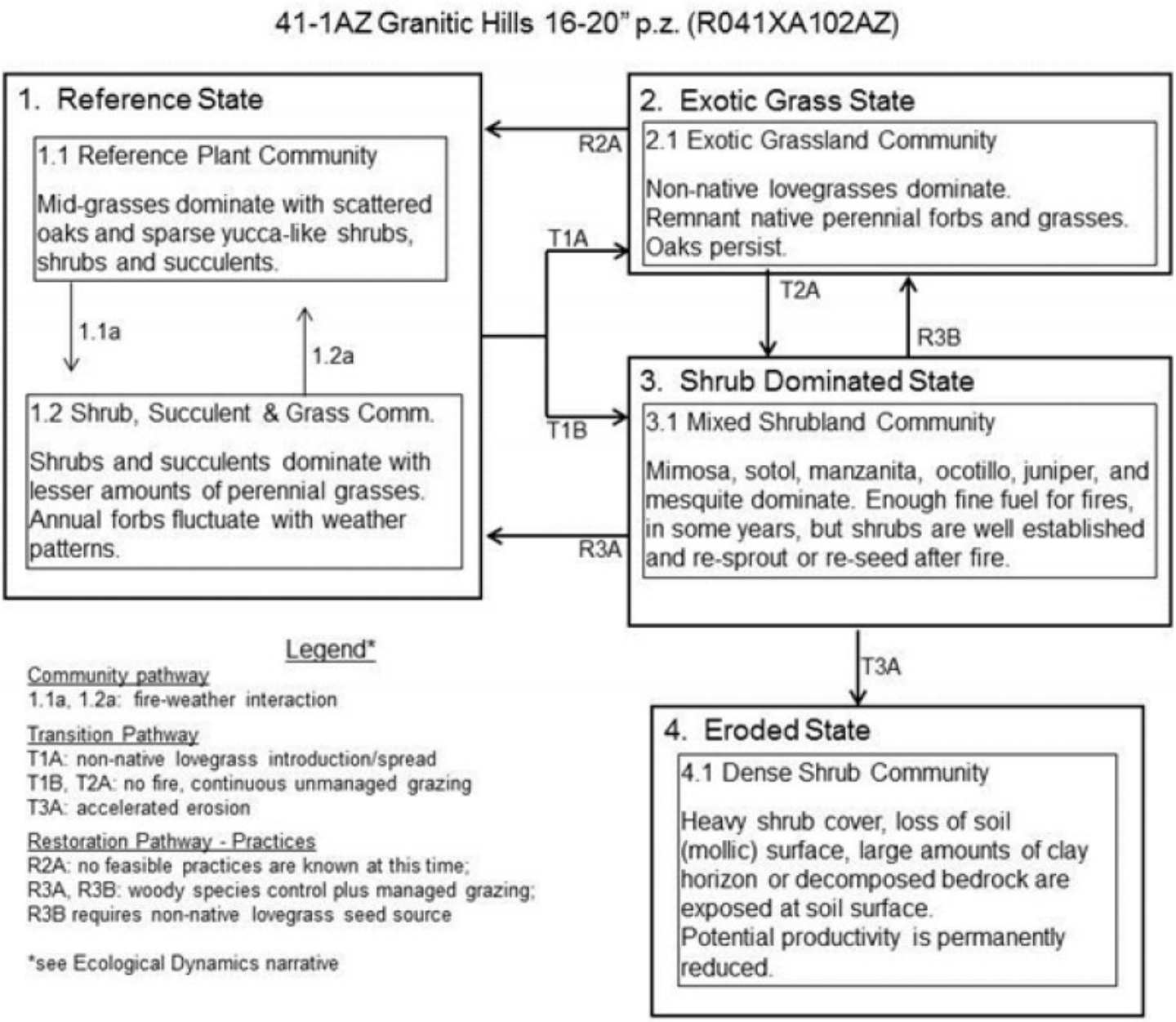

Figure 4. 41-1 Granitic Hills State and Transition

State 1
Reference

Community 1.1
Oak Savannah (RPC)

Figure 5. Granitic Hills 16-20" pz. (on rhyolite) RPC

The potential plant community is a diverse mixture of warm and cool season perennial grasses, ferns, forbs, succulents and shrubs. The tree and shrub component is influenced by the sun exposure of the hillslope. The warm exposures (southern slopes) have more shrubs like mimosa and manzanita where the cooler exposures (northern slopes) have more alligator juniper and pinyon. Mexican pinyon only comes into these plant communities in the absence of fire. A tree canopy of 5-15% Mexican live-oak occurs on the site. Most perennial herbaceous species are well dispersed throughout the plant community with 25%-40% canopy cover. A few species, however, occur only under the canopies of trees. Oak species on the site are very tolerant of fire. Naturally occurring wildfires in June-August are an important factor to shaping this plant community. Fire-free intervals ranging from 10-30 years maintain a savanna aspect. In the absence of fire for longer periods, the site gets shrubbier and shrubbier. Heavy grazing and drought can extend fire intervals by removing fine fuels needed to carry fire. The aspect is savanna. Periodic droughts occur and cause significant grass mortality. Droughts in the early 30s and mid 50s, 1975-76 and 1988-89, 1995-96 and 2002 resulted in the loss of much of the grass cover on this site. The site recovers rapidly when average rainfall resumes due to good ground cover of gravels and cobbles.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	400	900	1055
Tree	100	200	600
Shrub/Vine	13	100	230
Forb	11	40	100
Total	**524**	**1240**	**1985**

Table 6. Soil surface cover

Tree basal cover	0-1%
Shrub/vine/liana basal cover	1-5%

Grass/grasslike basal cover	6-13%
Forb basal cover	0-1%
Non-vascular plants	0-1%
Biological crusts	0-1%
Litter	25-60%
Surface fragments >0.25" and <=3"	10-50%
Surface fragments >3"	3-17%
Bedrock	0-5%
Water	0%
Bare ground	5-20%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-3%	1-5%	0-10%
>0.5 <= 1	–	1-5%	5-10%	1-10%
>1 <= 2	–	1-5%	10-25%	1-5%
>2 <= 4.5	–	1-5%	1-10%	0-5%
>4.5 <= 13	0-2%	0-2%	–	–
>13 <= 40	5-15%	–	–	–
>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
Shrubs, Succulents and Grass

This plant community is characterized by shrubs, succulents, annual grasses and annual forbs. Mid-grasses like sideoats grama, plains lovegrass, crinkleawn and green sprangletop have been reduced in number from extended periods without fire. During extended fire-free periods (20+ years), this site gets shrubby with increases in species like terpentine bush, mimosas, bricklebush, goldeneye, sotol and amole. Well-developed ground cover of stones, cobbles, and gravel protect the soil from erosion after fire or grazing. Trees per acre run from 5-30. Palmer agave plants average 5-60 per acre. Also, without periodic disturbance like fire or grazing, perennial mid-grass plants can become decadent, allowing annuals like goldeneye to flourish especially in the years with wet winter-spring seasons.

Pathway 1.1A
Community 1.1 to 1.2

Drought, absence of disturbance (fire or grazing) or continuous, unmanaged grazing.

Conservation practices

Prescribed Burning
Prescribed Grazing

Pathway 1.2A
Community 1.2 to 1.1

Natural fire, managed grazing, prescribed burning.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Exotic Grass

Community 2.1
Exotic Grassland

Figure 8. Granitic Hills 16-20" pz. Lehmann lovegrass

This state occurs where non-native grass species like Lehmann, Boer and weeping lovegrass dominate the herbaceous understory. Originally seeded in problem areas for soil stabilization, the seed can be transported by vehicles and animals, both wild and domestic, to move in along roads and trails. Established patches of exotic lovegrasses can expand simply from the species' prolific seed production and germination. Continuous unmanaged grazing removes native perennial grasses by selectively increasing grazing pressure on the natives. Once established, non-native grasses can increase to dominate the site. Tree and shrub species remain in the plant community. Repeated fire tends to increase Lehmann lovegrass on this site at the expense of native species. Herbaceous production in this state can exceed that of the RPC; however, exotic lovegrasses are low in nutritional value (low protein, high indigestible carbohydrates) and generally not preferred by livestock. Considering the steeper slopes found on this ecological site, grazing use in this state will be less than adjacent gentler sloped sites, except during early spring green-up on southerly aspects. Exotic lovegrass seed is very small, making it unavailable as a food for wildlife; a monoculture stand can become too dense for small wildlife movement. This state is very stable. The aspect is savanna.

State 3
Shrub Dominated

Community 3.1
Mixed Shrubland

Figure 9. Granitic Hills 16-20" pz., mixed shrubland after burn w/ manzanita

The mixed shrubland plant community occurs where species like mesquite, one-seed and alligator juniper, manzanita, or mimosa species have been introduced to the community or have increased in the absence of fire for long periods of time. Fine fuels still exist, in some years, for fires to carry. Shrubs, however, are well established and re-sprout or re-seed to quickly resume dominance after a fire. Mimosa, sotol, manzanita, ocotillo, juniper and mesquite canopy increases to 5-35%; other shrub and succulents make up 5-20% canopy. The aspect is shrubland with a herbaceous understory.

State 4
Eroded

Community 4.1
Dense Shrubs

The dense shrub plant community is dominated by shrubs with only remnant perennial grasses. Severe hydrologic changes have occurred. Sheet and rill erosion is common due to animal trailing, soil compaction and lack of perennial grass cover. Poorly designed roads and trails also concentrate and accelerate run-off. Underlying argillic horizons or decomposed bedrock are exposed as the dark colored soil surface is lost to erosion. The potential productivity and hydrologic function of the site are permanently reduced. The aspect is shrubland.

Transition T1A
State 1 to 2

This transition occurs when non-native bunchgrass seed is purposely or inadvertently introduced into the plant community. Repeated fire or unmanaged grazing can disrupt the native midgrass community, allowing non-native bunchgrasses to flourish.

Transition T1B
State 1 to 3

Long-term unmanaged grazing reduces perennial grass vigor and removes fine fuels from carrying fire. In the absence of fire, shrub growth is unchecked.

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.

Conservation practices

Prescribed Burning

Upland Wildlife Habitat Management
Prescribed Grazing

Transition T2A
State 2 to 3

Long-term, unmanaged grazing with or without drought-fire interaction opens perennial grass canopy, reduces fuel loads, and allows shrubs to outcompete for resources. Fire-free periods are further extended in the absence of fine fuels.

Restoration pathway R3A
State 3 to 1

Woody species control, native species seeding (as needed) supported by managed grazing. Shrub control needs to be maintained with herbicides or prescribed burning.

Conservation practices

Brush Management
Prescribed Burning
Fence
Range Planting
Prescribed Grazing

Restoration pathway R3B
State 3 to 2

Restoration activities conducted when a non-native seed bank is present (Lehmann lovegrass or other non-natives present along trails, roads or in disturbed areas) can result in an exotic grassland community. Seeding native species may enhance the native grass and forb components. Restoration practices are woody species control and native species seeding (as needed) supported by managed grazing. Shrub control maintained with herbicide favors the native grasses; prescribed burning favors non-native grasses. Burning the mixed shrub community with a non-native grass seed source present can result in an exotic grassland co-dominant with shrubs.

Conservation practices

Brush Management
Prescribed Burning
Range Planting
Upland Wildlife Habitat Management
Prescribed Grazing

Transition T3A
State 3 to 4

Continuous, unmanaged grazing further affects the biotic integrity, soil site stability and hydrologic functioning. Animal trailing and soil surface compaction are compounded with the hydrologic impacts of plant community changes (shrub dominance rather than perennial grasses). Overall, surface water run-off from rainfall events is greatly increased while infiltration is markedly decreased.

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**			350–800	
	sideoats grama	BOCU	*Bouteloua curtipendula*	100–350	–
	Texas bluestem	SCCI2	*Schizachyrium cirratum*	100–200	–
	plains lovegrass	ERIN	*Eragrostis intermedia*	100–200	–
	green sprangletop	LEDU	*Leptochloa dubia*	10–100	–
	bullgrass	MUEM	*Muhlenbergia emersleyi*	5–100	–
	Orcutt's threeawn	ARSCO	*Aristida schiedeana var. orcuttiana*	25–100	–
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	5–50	–
	woolyspike balsamscale	ELBA	*Elionurus barbiculmis*	0–50	–
2	**Dominant short grasses**			25–150	
	hairy grama	BOHI2	*Bouteloua hirsuta*	5–50	–
	purple grama	BORA	*Bouteloua radicosa*	0–25	–
	sprucetop grama	BOCH	*Bouteloua chondrosioides*	0–20	–
	Santa Rita Mountain grama	BOEL	*Bouteloua eludens*	0–20	–
	black grama	BOER4	*Bouteloua eriopoda*	0–20	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–10	–
	slender grama	BORE2	*Bouteloua repens*	0–10	–
	common wolfstail	LYPH	*Lycurus phleoides*	0–10	–
3	**Cool season grasses**			10–50	
	prairie Junegrass	KOMA	*Koeleria macrantha*	1–25	–
	pinyon ricegrass	PIFI	*Piptochaetium fimbriatum*	0–20	–
	sedge	CAREX	*Carex*	5–20	–
	squirreltail	ELEL5	*Elymus elymoides*	1–10	–
	muttongrass	POFE	*Poa fendleriana*	0–5	–
	flatsedge	CYPER	*Cyperus*	0–2	–
	densetuft hairsedge	BUCA2	*Bulbostylis capillaris*	0–2	–
4	**Miscellaneous perennial grasses**			1–30	
	tanglehead	HECO10	*Heteropogon contortus*	1–10	–
	Arizona cottontop	DICA8	*Digitaria californica*	0–10	–
	pine muhly	MUDU	*Muhlenbergia dubia*	0–5	–
	spidergrass	ARTE3	*Aristida ternipes*	0–5	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–5	–
	plains bristlegrass	SEVU2	*Setaria vulpiseta*	0–2	–
	Mexican gamagrass	TRLA11	*Tripsacum lanceolatum*	0–2	–
	curly-mesquite	HIBE	*Hilaria belangeri*	0–2	–
	Porter's melicgrass	MEPO	*Melica porteri*	0–2	–
	smallgrass	MICRO	*Microchloa*	0–2	–
	Arizona muhly	MUAR3	*Muhlenbergia arizonica*	0–2	–
	purple muhly	MURI3	*Muhlenbergia rigida*	0–2	–
	bulb panicgrass	PABU	*Panicum bulbosum*	0–2	–
	silver bluestem	BOSA	*Bothriochloa saccharoides*	0–2	–

	maidencane	PAHE2	*Panicum hemitomon*	0–2	–
	Hall's panicgrass	PAHA	*Panicum hallii*	0–1	–
	bush muhly	MUPO2	*Muhlenbergia porteri*	0–1	–
	fall witchgrass	DICO6	*Digitaria cognata*	0–1	–
	nineawn pappusgrass	ENDE	*Enneapogon desvauxii*	0–1	–
	spidergrass	ARTEG	*Aristida ternipes var. gentilis*	0–1	–
	Rothrock's grama	BORO2	*Bouteloua rothrockii*	0–1	–
	Wright's threeawn	ARPUW	*Aristida purpurea var. wrightii*	0–1	–
	slim tridens	TRMU	*Tridens muticus*	0–1	–
	slim tridens	TRMUE	*Tridens muticus var. elongatus*	0–1	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–1	–
5	**Annual grasses**			2–25	
	sweet tanglehead	HEME	*Heteropogon melanocarpus*	0–10	–
	Eastwood fescue	VUMIC	*Vulpia microstachys var. ciliata*	0–10	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–5	–
	prairie threeawn	AROL	*Aristida oligantha*	0–5	–
	Arizona signalgrass	URAR	*Urochloa arizonica*	0–5	–
	small fescue	VUMI	*Vulpia microstachys*	0–5	–
	witchgrass	PACA6	*Panicum capillare*	0–5	–
	Mexican sprangletop	LEFUU	*Leptochloa fusca ssp. uninervia*	0–2	–
	littleseed muhly	MUMI	*Muhlenbergia microsperma*	0–2	–
	mucronate sprangletop	LEPA6	*Leptochloa panicea*	0–1	–
	pullup muhly	MUFI2	*Muhlenbergia filiformis*	0–1	–
	fragilegrass	AETE	*Aegopogon tenellus*	0–1	–
	sixweeks threeawn	ARAD	*Aristida adscensionis*	0–1	–
	needle grama	BOAR	*Bouteloua aristidoides*	0–1	–
	sixweeks grama	BOBA2	*Bouteloua barbata*	0–1	–
	Arizona brome	BRAR4	*Bromus arizonicus*	0–1	–
	feather fingergrass	CHVI4	*Chloris virgata*	0–1	–
	tapertip cupgrass	ERACA	*Eriochloa acuminata var. acuminata*	0–1	–
	Mexican lovegrass	ERME	*Eragrostis mexicana*	0–1	–
	tufted lovegrass	ERPE	*Eragrostis pectinacea*	0–1	–
	pitscale grass	HAGR3	*Hackelochloa granularis*	0–1	–
	Bigelow's bluegrass	POBI	*Poa bigelovii*	0–1	–
	poverty dropseed	SPVA	*Sporobolus vaginiflorus*	0–1	–
	prairie false oat	TRIN5	*Trisetum interruptum*	0–1	–
Forb					
7	**Perennial Forbs**			10–50	
	white sagebrush	ARLU	*Artemisia ludoviciana*	1–10	–
	weakleaf bur ragweed	AMCO3	*Ambrosia confertiflora*	1–5	–
	firecrackerbush	BOTE2	*Bouvardia ternifolia*	0–5	–
	bluedicks	DICA14	*Dichelostemma capitatum*	1–5	–
	trailing fleabane	ERFL	*Erigeron flagellaris*	1–5	–

	tarragon	ARDR4	*Artemisia dracunculus*	0–5	–
	Wright's deervetch	LOWR	*Lotus wrightii*	0–5	–
	pearly globe amaranth	GONI	*Gomphrena nitida*	0–5	–
	slimleaf bean	PHAN3	*Phaseolus angustissimus*	0–5	–
	Arizona spikemoss	SEAR2	*Selaginella arizonica*	0–5	–
	Arizona bluecurls	TRAR	*Trichostema arizonicum*	0–5	–
	American vetch	VIAM	*Vicia americana*	0–5	–
	Louisiana vetch	VILUL2	*Vicia ludoviciana ssp. ludoviciana*	0–5	–
	Texas snoutbean	RHSET	*Rhynchosia senna var. texana*	0–2	–
	brownplume wirelettuce	STPA4	*Stephanomeria pauciflora*	0–2	–
	Cory's mistletoe	PHCO14	*Phoradendron coryae*	0–2	–
	fineleaf hymenopappus	HYFI	*Hymenopappus filifolius*	0–2	–
	spreading fleabane	ERDI4	*Erigeron divergens*	0–2	–
	Arizona snakecotton	FRAR2	*Froelichia arizonica*	0–2	–
	New Mexico fleabane	ERNE3	*Erigeron neomexicanus*	0–2	–
	Cooley's bundleflower	DECO2	*Desmanthus cooleyi*	0–2	–
	rose heath	CHER2	*Chaetopappa ericoides*	0–2	–
	dwarf stickpea	CAHUR	*Calliandra humilis var. reticulata*	0–2	–
	woolly locoweed	ASMOB	*Astragalus mollissimus var. bigelovii*	0–2	–
	sheep milkvetch	ASNO3	*Astragalus nothoxys*	0–2	–
	bastard toadflax	COUM	*Comandra umbellata*	0–2	–
	carelessweed	AMPA	*Amaranthus palmeri*	0–2	–
	tuber anemone	ANTU	*Anemone tuberosa*	0–2	–
	melon loco	APUN	*Apodanthera undulata*	0–1	–
	trailing windmills	ALIN	*Allionia incarnata*	0–1	–
	largeflower onion	ALMA4	*Allium macropetalum*	0–1	–
	Mexican yellowshow	AMPA3	*Amoreuxia palmatifida*	0–1	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–1	–
	crested anoda	ANCR2	*Anoda cristata*	0–1	–
	perennial rockcress	ARPE2	*Arabis perennans*	0–1	–
	southwestern pricklypoppy	ARPL3	*Argemone pleiacantha*	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	–
	leatherweed	CRPO5	*Croton pottsii*	0–1	–
	fingerleaf gourd	CUDI	*Cucurbita digitata*	0–1	–
	coyote gourd	CUPA	*Cucurbita palmata*	0–1	–
	purplenerve springparsley	CYMU2	*Cymopterus multinervatus*	0–1	–
	whiteflower prairie clover	DAAL	*Dalea albiflora*	0–1	–
	James' prairie clover	DAJA	*Dalea jamesii*	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	–
	horsetail milkweed	ASSU2	*Asclepias subverticillata*	0–1	–
	dense ayenia	AYMI	*Ayenia microphylla*	0–1	–
	scarlet spiderling	BOCO	*Boerhavia coccinea*	0–1	–
	climbing wartclub	BOSC	*Boerhavia scandens*	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	–
	whitemargin sandmat	CHAL11	*Chamaesyce albomarginata*	0–1	–
	mala mujer	CNAN	*Cnidoscolus angustidens*	0–1	–
	birdbill dayflower	CODI4	*Commelina dianthifolia*	0–1	–
	Texas bindweed	COEQ	*Convolvulus equitans*	0–1	–
	whitemouth dayflower	COER	*Commelina erecta*	0–1	–
	desert larkspur	DEPA	*Delphinium parishii*	0–1	–
	Torrey's craglily	ECFL	*Echeandia flavescens*	0–1	–
	Mexican fireplant	EUHE4	*Euphorbia heterophylla*	0–1	–
	sun spurge	EURA2	*Euphorbia radians*	0–1	–
	wild dwarf morning-glory	EVAR	*Evolvulus arizonicus*	0–1	–
	shaggy dwarf morning-glory	EVNU	*Evolvulus nuttallianus*	0–1	–
	silver dwarf morning-glory	EVSE	*Evolvulus sericeus*	0–1	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–1	–
	babyslippers	HYVE	*Hybanthus verticillatus*	0–1	–
	pinkthroat morning-glory	IPLO	*Ipomoea longifolia*	0–1	–
	ragged nettlespurge	JAMA	*Jatropha macrorhiza*	0–1	–
	San Pedro daisy	LAPO4	*Lasianthaea podocephala*	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	–
	variableleaf bushbean	MAGI2	*Macroptilium gibbosifolium*	0–1	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–1	–
	Mexican star	MIBI2	*Milla biflora*	0–1	–
	lemon beebalm	MOCIA	*Monarda citriodora ssp. austromontana*	0–1	–
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–1	–
	locoweed	OXYTR	*Oxytropis*	0–1	–
	beardlip penstemon	PEBA2	*Penstemon barbatus*	0–1	–
	longstalk chinchweed	PELO	*Pectis longipes*	0–1	–
	Parry's beardtongue	PEPA24	*Penstemon parryi*	0–1	–
	ivyleaf groundcherry	PHHE4	*Physalis hederifolia*	0–1	–
	white milkwort	POAL4	*Polygala alba*	0–1	–
	velvetseed milkwort	POOB	*Polygala obscura*	0–1	–

	velvetseed milkwort	POCU	*Polygala obscura*	0–1	
	shrubby purslane	POSU3	*Portulaca suffrutescens*	0–1	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–1	–
	buffpetal	RHPH2	*Rhynchosida physocalyx*	0–1	–
	orange fameflower	PHAU13	*Phemeranthus aurantiacus*	0–1	–
	small matweed	GUDE	*Guilleminea densa*	0–1	–
	red bluet	HORU	*Houstonia rubra*	0–1	–
	twinleaf senna	SEBA3	*Senna bauhinioides*	0–1	–
	Lemmon's ragwort	SELE8	*Senecio lemmonii*	0–1	–
	Huachuca Mountain ragwort	SEMU9	*Senecio multidentatus*	0–1	–
	cardinal catchfly	SILA2	*Silene laciniata*	0–1	–
	New Mexico fanpetals	SINE	*Sida neomexicana*	0–1	–
	silverleaf nightshade	SOEL	*Solanum elaeagnifolium*	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	–
	slimleaf plainsmustard	SCLI12	*Schoenocrambe linearifolia*	0–1	–
	Rocky Mountain zinnia	ZIGR	*Zinnia grandiflora*	0–1	–
8	**Annual Forbs**			1–50	
	longleaf false goldeneye	HELOA2	*Heliomeris longifolia var. annua*	0–15	–
	pitseed goosefoot	CHBE4	*Chenopodium berlandieri*	0–10	–
	New Mexico goosefoot	CHNE3	*Chenopodium neomexicanum*	0–10	–
	sensitive partridge pea	CHNI2	*Chamaecrista nictitans*	0–10	–
	smallflowered milkvetch	ASNU4	*Astragalus nuttallianus*	0–10	–
	Thurber's milkvetch	ASTH	*Astragalus thurberi*	0–10	–
	fewflower beggarticks	BILE	*Bidens leptocephala*	0–10	–
	western tansymustard	DEPI	*Descurainia pinnata*	0–5	–
	southwestern cosmos	COPA12	*Cosmos parviflorus*	0–3	–
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–2	–
	wedgeleaf draba	DRCU	*Draba cuneifolia*	0–2	–
	New Mexico thistle	CINE	*Cirsium neomexicanum*	0–2	–
	New Mexico copperleaf	ACNE	*Acalypha neomexicana*	0–2	–
	spreading fanpetals	SIAB	*Sida abutifolia*	0–2	–
	scrambled eggs	COAU2	*Corydalis aurea*	0–2	–
	slender goldenweed	MAGR10	*Machaeranthera gracilis*	0–2	–
	Wright's cudweed	PSCAC2	*Pseudognaphalium canescens ssp.*	0–2	–

			canescens		
	redstar	IPCO3	*Ipomoea coccinea*	0–2	–
	Thurber's morning-glory	IPTH	*Ipomoea thurberi*	0–2	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–2	–
	Arizona poppy	KAGR	*Kallstroemia grandiflora*	0–2	–
	tanseyleaf tansyaster	MATA2	*Machaeranthera tanacetifolia*	0–2	–
	whitestem blazingstar	MEAL6	*Mentzelia albicaulis*	0–1	–
	sweet four o'clock	MILO2	*Mirabilis longiflora*	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	–
	Arizona popcornflower	PLAR	*Plagiobothrys arizonicus*	0–1	–
	warty caltrop	KAPA	*Kallstroemia parviflora*	0–1	–
	Gordon's bladderpod	LEGO	*Lesquerella gordonii*	0–1	–
	broadleaved pepperweed	LELA2	*Lepidium latifolium*	0–1	–
	intermediate pepperweed	LEVIM	*Lepidium virginicum var. medium*	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	–
	Fendler's desertdandelion	MAFE	*Malacothrix fendleri*	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	–
	El Paso skyrocket	IPTH2	*Ipomopsis thurberi*	0–1	–
	ivyleaf morning-glory	IPHE	*Ipomoea hederacea*	0–1	–
	flaxflowered ipomopsis	IPLOL	*Ipomopsis longiflora ssp. longiflora*	0–1	–
	Abert's creeping zinnia	SAAB	*Sanvitalia abertii*	0–1	–
	sawtooth sage	SASU7	*Salvia subincisa*	0–1	–
	mesa tansyaster	MATA	*Machaeranthera tagetina*	0–1	–
	sleepy silene	SIAN2	*Silene antirrhina*	0–1	–
	carelessweed	AMPA	*Amaranthus palmeri*	0–1	–
	crested anoda	ANCR2	*Anoda cristata*	0–1	–
	halfmoon milkvetch	ASAL6	*Astragalus allochrous*	0–1	–
	royal sandmat	CHDI5	*Chamaesyce dioica*	0–1	–
	pillpod sandmat	CHHI3	*Chamaesyce hirta*	0–1	–
	hyssopleaf sandmat	CHHY3	*Chamaesyce hyssopifolia*	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	–
	Abert's buckwheat	ERAB2	*Eriogonum abertianum*	0–1	–
	sanddune wallflower	ERCA14	*Erysimum capitatum*	0–1	–
	miniature woollystar	ERDI2	*Eriastrum diffusum*	0–1	–
	spreading fleabane	ERDI4	*Erigeron divergens*	0–1	–
	sorrel buckwheat	ERPO4	*Eriogonum polycladon*	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	–
	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	–
	New Mexico ticktrefoil	DENE	*Desmodium neomexicanum*	0–1	–
	western trailing ticktrefoil	DEPR2	*Desmodium procumbens*	0–1	–
	poorjoe	DITE2	*Diodia teres*	0–1	–
	camphorweed	HESU3	*Heterotheca subaxillaris*	0–1	–
	crestrib morning-glory	IPCO2	*Ipomoea costellata*	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	–
Shrub/Vine					
9	**Half shrubs**			5–50	
	tarragon	ARDR4	*Artemisia dracunculus*	20–30	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	20–30	–
	Rincon Mountain rockcress	ARTR6	*Arabis tricornuta*	20–30	–
	milkvetch	ASTRA	*Astragalus*	20–30	–
	copper fern	BOHI	*Bommeria hispida*	20–30	–
	lipfern	CHEIL	*Cheilanthes*	20–30	–
	whitemouth dayflower	COER	*Commelina erecta*	20–30	–
	bastard toadflax	COUM	*Comandra umbellata*	20–30	–
	ashy pipewort	ERCI4	*Eriocaulon cinereum*	20–30	–
	spreading fleabane	ERDI4	*Erigeron divergens*	20–30	–
	trailing fleabane	ERFL	*Erigeron flagellaris*	20–30	–
	New Mexico fleabane	ERNE3	*Erigeron neomexicanus*	20–30	–

	Arizona snakecotton	FRAR2	*Froelichia arizonica*	20–30	–
	gumhead	GYGL	*Gymnosperma glutinosum*	20–30	–
	hairy false goldenaster	HEVIM3	*Heterotheca villosa var. minor*	20–30	–
	fineleaf hymenopappus	HYFIL	*Hymenopappus filifolius var. lugens*	20–30	–
	El Paso skyrocket	IPTH2	*Ipomopsis thurberi*	20–30	–
	Wright's deervetch	LOWR	*Lotus wrightii*	20–30	–
	variableleaf bushbean	MAGI2	*Macroptilium gibbosifolium*	20–30	–
	sweet four o'clock	MILO2	*Mirabilis longiflora*	20–30	–
	cloak fern	NOTHO	*Notholaena*	20–30	–
	creeping woodsorrel	OXCO	*Oxalis corniculata*	20–30	–
	cliffbrake	PELLA	*Pellaea*	20–30	–
	longstalk chinchweed	PELO	*Pectis longipes*	20–30	–
	Parry's beardtongue	PEPA24	*Penstemon parryi*	20–30	–
	tepary bean	PHAC	*Phaseolus acutifolius*	20–30	–
	Wright's cudweed	PSCAC2	*Pseudognaphalium canescens ssp. canescens*	20–30	–
	scarlet globemallow	SPCOE	*Sphaeralcea coccinea ssp. elata*	20–30	–
	brownplume wirelettuce	STPA4	*Stephanomeria pauciflora*	20–30	–
	Arizona bluecurls	TRAR	*Trichostema arizonicum*	20–30	–
	pinewoods spiderwort	TRPI	*Tradescantia pinetorum*	20–30	–
	stalked bur grass	TRRA	*Tragus racemosus*	20–30	–
	branched noseburn	TRRA5	*Tragia ramosa*	20–30	–
	American vetch	VIAM	*Vicia americana*	20–30	–
	fairyduster	CAER	*Calliandra eriophylla*	1–10	–
	Gregg's prairie clover	DAGR2	*Dalea greggii*	0–10	–
	bastardsage	ERWR	*Eriogonum wrightii*	1–10	–
	cliff goldenbush	ERCUS	*Ericameria cuneata var. spathulata*	0–5	–
	turpentine bush	ERLA12	*Ericameria laricifolia*	0–5	–
	Bigelow's false willow	BABI	*Baccharis bigelovii*	0–5	–
	yerba de pasmo	BAPT	*Baccharis pteronioides*	1–5	–
	California brickellbush	BRCA3	*Brickellia californica*	1–5	–
	Bigelow's bristlehead	CABI6	*Carphochaete bigelovii*	0–5	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–2	–
	prairie acacia	ACAN	*Acacia angustissima*	0–2	–
	trailing krameria	KRLA	*Krameria lanceolata*	0–2	–
	Sonoran indigo	INSP	*Indigofera sphaerocarpa*	0–2	–
	beloperone	JUCA8	*Justicia californica*	0–1	–
	Arizona water-willow	JUCA9	*Justicia candicans*	0–1	–
	heartleaf goldeneye	VICO	*Viguiera cordifolia*	0–1	–
	showy goldeneye	HEMUM	*Heliomeris multiflora var. multiflora*	0–1	–
10	**Deciduous shrubs**			2–30	
	blackwood	ACME	*Acacia melanoxylon*	10–30	–
	sensitive partridge pea	CHNIL	*Chamaecrista nictitans ssp. nictitans var. leptadenia*	10–30	–

	Esteve's pincushion	CHST	*Chaenactis stevioides*	10–30	–
	pine forest larkspur	DEGR	*Delphinium gracilentum*	10–30	–
	New Mexico ticktrefoil	DENE	*Desmodium neomexicanum*	10–30	–
	Abert's buckwheat	ERAB2	*Eriogonum abertianum*	10–30	–
	purple morning-glory	IPCA2	*Ipomoea capillacea*	10–30	–
	Greene's bird's-foot trefoil	LOGR4	*Lotus greenei*	10–30	–
	whitestem blazingstar	MEAL6	*Mentzelia albicaulis*	10–30	–
	garden vetch	VISAN2	*Vicia sativa ssp. nigra*	10–30	–
	Tahitian kidneywood	EYOR	*Eysenhardtia orthocarpa*	0–20	–
	rosary babybonnets	COGL8	*Coursetia glandulosa*	0–15	–
	coralbean	ERFL7	*Erythrina flabelliformis*	1–15	–
	ocotillo	FOSP2	*Fouquieria splendens*	1–5	–
	catclaw acacia	ACGR	*Acacia greggii*	0–2	–
	catclaw mimosa	MIACB	*Mimosa aculeaticarpa var. biuncifera*	0–2	–
	velvetpod mimosa	MIDY	*Mimosa dysocarpa*	0–2	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–2	–
	yellow trumpetbush	TEST	*Tecoma stans*	0–1	–
	Graham's mimosa	MIGR2	*Mimosa grahamii*	0–1	–
	milfoil wattle	ACMI	*Acacia millefolia*	0–1	–
	Wright's beebrush	ALWR	*Aloysia wrightii*	0–1	–
	pale desert-thorn	LYPA	*Lycium pallidum*	0–1	–
	cliff fendlerbush	FERU	*Fendlera rupicola*	0–1	–
11	**Evergreen shrubs**			1–15	
	goldenhead	ACAMP	*Acamptopappus*	2–10	–
	giant hyssop	AGAST	*Agastache*	2–10	–
	annual agoseris	AGHEH	*Agoseris heterophylla var. heterophylla*	2–10	–
	onion	ALLIU	*Allium*	2–10	–
	weakleaf bur ragweed	AMCO3	*Ambrosia confertiflora*	2–10	–
	carelessweed	AMPA	*Amaranthus palmeri*	2–10	–
	pink funnel lily	ANBR4	*Androstephium breviflorum*	2–10	–
	western rockjasmine	ANOC2	*Androsace occidentalis*	2–10	–
	woolly angelica	ANTO	*Angelica tomentosa*	2–10	–
	tuber anemone	ANTU	*Anemone tuberosa*	2–10	–
	Watson's dutchman's pipe	ARWA	*Aristolochia watsonii*	2–10	–
	chaparral asphead	ASHI3	*Aspicarpa hirtella*	2–10	–
	dwarf milkweed	ASIN14	*Asclepias involucrata*	2–10	–
	Lemmon's milkweed	ASLE13	*Asclepias lemmonii*	2–10	–
	horsetail milkweed	ASSU2	*Asclepias subverticillata*	2–10	–
	dense ayenia	AYMI	*Ayenia microphylla*	2–10	–
	lyreleaf greeneyes	BELY	*Berlandiera lyrata*	2–10	–
	scarlet spiderling	BOCO	*Boerhavia coccinea*	2–10	–
	firecrackerbush	BOTE2	*Bouvardia ternifolia*	2–10	–
	bearded grasspink	CABA	*Calopogon barbatus*	2–10	–

	bearded grasspink	CABA	*Calopogon barbatus*	2–10	
	fringed redmaids	CACI2	*Calandrinia ciliata*	2–10	–
	castilla	CASTI	*Castilla*	2–10	–
	graceful sandmat	CHHY2	*Chamaesyce hypericifolia*	2–10	–
	narrowpod sensitive pea	CHLIK	*Chamaecrista lineata var. keyensis*	2–10	–
	heal and draw	CHNU2	*Chaptalia nutans*	2–10	–
	New Mexico thistle	CINE	*Cirsium neomexicanum*	2–10	–
	mala mujer	CNAN	*Cnidoscolus angustidens*	2–10	–
	field bindweed	COAR4	*Convolvulus arvensis*	2–10	–
	scrambled eggs	COAU2	*Corydalis aurea*	2–10	–
	anil falso	COCAC6	*Coursetia caribaea var. caribaea*	2–10	–
	American wild carrot	DAPU3	*Daucus pusillus*	2–10	–
	oakwoods prairie clover	DAVES	*Dalea versicolor var. sessilis*	2–10	–
	western tansymustard	DEPI	*Descurainia pinnata*	2–10	–
	wedgeleaf draba	DRCU	*Draba cuneifolia*	2–10	–
	Torrey's craglily	ECFL	*Echeandia flavescens*	2–10	–
	miniature woollystar	ERDI2	*Eriastrum diffusum*	2–10	–
	Wright's eryngo	ERHE3	*Eryngium heterophyllum*	2–10	–
	wild dwarf morning-glory	EVAR	*Evolvulus arizonicus*	2–10	–
	harlequinbush	GAHEG	*Gaura hexandra ssp. gracilis*	2–10	–
	Wright's milkpea	GAWR	*Galactia wrightii*	2–10	–
	pineywoods geranium	GECA3	*Geranium caespitosum*	2–10	–
	El Paso gilia	GIME	*Gilia mexicana*	2–10	–
	tufted globe amaranth	GOCA	*Gomphrena caespitosa*	2–10	–
	small matweed	GUDED	*Guilleminea densa var. densa*	2–10	–
	telegraphweed	HEGR7	*Heterotheca grandiflora*	2–10	–
	English ivy	HEHE	*Hedera helix*	2–10	–
	prairie sunflower	HEPE	*Helianthus petiolaris*	2–10	–
	camphorweed	HESU3	*Heterotheca subaxillaris*	2–10	–
	pygmy bluet	HOWR	*Houstonia wrightii*	2–10	–
	redstar	IPCO3	*Ipomoea coccinea*	2–10	–
	lilacbell	IPTU3	*Ipomoea turbinata*	2–10	–
	ragged nettlespurge	JAMA	*Jatropha macrorhiza*	2–10	–
	Arizona poppy	KAGR	*Kallstroemia grandiflora*	2–10	–
	Coulter's horseweed	LACO13	*Laennecia coulteri*	2–10	–
	Fendler's bladderpod	LEFE	*Lesquerella fendleri*	2–10	–
	shaggyfruit pepperweed	LELA	*Lepidium lasiocarpum*	2–10	–
	intermediate pepperweed	LEVIM	*Lepidium virginicum var. medium*	2–10	–
	smooththroat stoneseed	LICO7	*Lithospermum cobrense*	2–10	–
	Lewis flax	LILE3	*Linum lewisii*	2–10	–
	stiffstem flax	LIRI	*Linum rigidum*	2–10	–
	shrubby deervetch	LORI3	*Lotus rigidus*	2–10	–
	bajada lupine	LUCO	*Lupinus concinnus*	2–10	–
	roving sailor	MAAN9	*Maurandella antirrhiniflora*	2–10	–

	roving calic	MAAN5	*Maurandella antirrhiniflora*	2–10	
	hoary tansyaster	MACA2	*Machaeranthera canescens*	2–10	–
	slender goldenweed	MAGR10	*Machaeranthera gracilis*	2–10	–
	manyflowered monkeyflower	MIFL2	*Mimulus floribundus*	2–10	–
	little redstem monkeyflower	MIRU	*Mimulus rubellus*	2–10	–
	lemon beebalm	MOCIA	*Monarda citriodora ssp. austromontana*	2–10	–
	green carpetweed	MOVE	*Mollugo verticillata*	2–10	–
	Arizona mousetail	MYCU	*Myosurus cupulatus*	2–10	–
	Texas toadflax	NUTE	*Nuttallanthus texanus*	2–10	–
	desert evening primrose	OEPR	*Oenothera primiveris*	2–10	–
	Drummond's woodsorrel	OXDR	*Oxalis drummondii*	2–10	–
	Florida pellitory	PAFL3	*Parietaria floridana*	2–10	–
	Oak Creek ragwort	PAQU8	*Packera quercetorum*	2–10	–
	phacelia	PHACE	*Phacelia*	2–10	–
	ivyleaf groundcherry	PHHE4	*Physalis hederifolia*	2–10	–
	phlox	PHLOX	*Phlox*	2–10	–
	sweetscent	PLODO	*Pluchea odorata var. odorata*	2–10	–
	woolly plantain	PLPA2	*Plantago patagonica*	2–10	–
	winged milkwort	POHE	*Polygala hemipterocarpa*	2–10	–
	little hogweed	POOL	*Portulaca oleracea*	2–10	–
	shrubby purslane	POSU3	*Portulaca suffrutescens*	2–10	–
	cottonbatting plant	PSST7	*Pseudognaphalium stramineum*	2–10	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	2–10	–
	Texas snoutbean	RHSET	*Rhynchosia senna var. texana*	2–10	–
	chia	SACO6	*Salvia columbariae*	2–10	–
	slimleaf plainsmustard	SCLI12	*Schoenocrambe linearifolia*	2–10	–
	mountain ragwort	SEPA2	*Senecio parryi*	2–10	–
	spreading fanpetals	SIAB	*Sida abutifolia*	2–10	–
	catchfly	SILEN	*Silene*	2–10	–
	New Mexico fanpetals	SINE	*Sida neomexicana*	2–10	–
	silverleaf nightshade	SOEL	*Solanum elaeagnifolium*	2–10	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	2–10	–
	jewels of Opar	TAPA2	*Talinum paniculatum*	2–10	–
	Fendler's meadow-rue	THFE	*Thalictrum fendleri*	2–10	–
	Hopi tea greenthread	THME	*Thelesperma megapotamicum*	2–10	–
	clasping Venus' looking-glass	TRPE4	*Triodanis perfoliata*	2–10	–
	Fort Huachuca vervain	VEGR2	*Verbena gracilis*	2–10	–
	neckweed	VEPE2	*Veronica peregrina*	2–10	–
	Sonoran scrub oak	QUTU2	*Quercus turbinella*	0–5	–
	pointleaf manzanita	ARPU5	*Arctostaphylos pungens*	1–5	–
	desert ceanothus	CEGR	*Ceanothus greggii*	0–5	–
	hairy mountain mahogany	CEMOP	*Cercocarpus montanus var. paucidentatus*	0–5	–

	Correll's snakewood	COCO11	*Condalia correllii*	0–2	–
	Florida hopbush	DOVI	*Dodonaea viscosa*	0–2	–
	desert olive	FOSH	*Forestiera shrevei*	0–2	–
	Wright's silktassel	GAWR3	*Garrya wrightii*	0–2	–
	common hoptree	PTTRA	*Ptelea trifoliata ssp. angustifolia*	0–2	–
	redberry buckthorn	RHCR	*Rhamnus crocea*	0–2	–
	evergreen sumac	RHVIC	*Rhus virens var. choriophylla*	0–2	–
	Pringle manzanita	ARPR	*Arctostaphylos pringlei*	0–2	–
12	**Succulents**			5–135	
	sacahuista	NOMI	*Nolina microcarpa*	1–100	–
	common sotol	DAWH2	*Dasylirion wheeleri*	1–10	–
	Palmer's century plant	AGPA3	*Agave palmeri*	1–10	–
	cactus apple	OPEN3	*Opuntia engelmannii*	0–5	–
	Schott's yucca	YUSC	*Yucca ×schottii*	0–5	–
	tulip pricklypear	OPPH	*Opuntia phaeacantha*	0–2	–
	dollarjoint pricklypear	OPCH	*Opuntia chlorotica*	0–2	–
	smallflower century plant	AGPA5	*Agave parviflora*	0–2	–
	Schott's century plant	AGSC3	*Agave schottii*	0–2	–
	walkingstick cactus	CYSP8	*Cylindropuntia spinosior*	0–1	–
	Parry's agave	AGPAP5	*Agave parryi ssp. parryi*	0–1	–
	scarlet hedgehog cactus	ECCOC	*Echinocereus coccineus var. coccineus*	0–1	–
	pinkflower hedgehog cactus	ECFEF3	*Echinocereus fendleri ssp. fendleri*	0–1	–
	white fishhook cactus	ECIN2	*Echinomastus intertextus*	0–1	–
	Leding's hedgehog cactus	ECLE2	*Echinocereus ledingii*	0–1	–
	rainbow hedgehog cactus	ECRI3	*Echinocereus rigidissimus*	0–1	–
	spinystar	ESVI2	*Escobaria vivipara*	0–1	–
	candy barrelcactus	FEWI	*Ferocactus wislizeni*	0–1	–
	Graham's nipple cactus	MAGR9	*Mammillaria grahamii*	0–1	–
	Macdougal's nipple cactus	MAHEM	*Mammillaria heyderi var. macdougalii*	0–1	–
	Parry's agave	AGPA4	*Agave parryi*	0–1	–
Tree					
13	**Trees**			100–600	
	Emory oak	QUEM	*Quercus emoryi*	50–250	–
	Arizona white oak	QUAR	*Quercus arizonica*	50–150	–
	Mexican blue oak	QUOB	*Quercus oblongifolia*	0–100	–
	Arizona rosewood	VACA5	*Vauquelinia californica*	0–25	–
	Mexican pinyon	PICE	*Pinus cembroides*	0–20	–
	border pinyon	PIDI3	*Pinus discolor*	0–20	–
	alligator juniper	JUDE2	*Juniperus deppeana*	0–15	–
	oneseed juniper	JUMO	*Juniperus monosperma*	0–2	–

Animal community

The plant community on this site is suitable for grazing by all classes of livestock at any season. Due to the presence of cool season grasses, perennial forbs and evergreen browse species, this site is especially well suited to winter-spring grazing when nearby upland areas are deficient in protein. Steep slopes, cobbly surfaces and areas of rock outcrop limit grazing distribution on this site. Fencing large areas of this site from adjacent uplands and grazing during the cool season will allow effective management of its forage resources. The site tends to have water in canyons during the winter and spring. Mountain lion predation on calves can be severe. Grazing dry cows and/or yearlings in the cool season and moving the cows off as they calve will help avoid lion predation. Annual goldeneye can cause poisoning in the fall following years with wet winter-spring seasons. Locoweed can cause problems in dry springs following wet fall-winter seasons.

This site provides excellent habitat for Coues whitetail deer and javalina. Natural water occurs infrequently as springs or seeps. Water developments are very important to the larger mammals using this site, as well as numerous bird and small mammal species. Agave Palmeri occurs scattered throughout areas of this site and is a primary food source for the endangered lesser long-nosed bat during its June-August flowering period. Natural fires are important for many species on this site to maintain a balance between trees, shrubs, grasses and forbs.

Hydrological functions

With shallow soils and hard bedrock this site is a good producer of runoff.

Recreational uses

Hunting, hiking, horseback riding, prospecting, camping, photography and bird watching

Wood products

Oak species and juniper furnish fuel-wood, posts and stays. Rosewood, manzanita and kidneywood furnish hobby woods.

Other products

Beargrass for fiber, agave and sotol for mescal making, decomposed granite for decorative rock, acorns (bellotas) for food

Inventory data references

Range 417s include 4 in excellent condition and 3 in good condition

Type locality

Location 1: Cochise County, AZ	
Township/Range/Section	T21S R19E S33
General legal description	SE 1/4 of section, Ft Huachuca - mouth of Blacktail Canyon
Location 2: Graham County, AZ	
Township/Range/Section	T10S R24E S2
General legal description	Safford FO - O Bar O Ranch - Stockton Pass
Location 3: Pinal County, AZ	
Township/Range/Section	T17S R8E S31
General legal description	SW 1/4 of Section - Tucson FO - Anvil Ranch - Posito Canyon
Location 4: Cochise County, AZ	

Township/Range/Section	T16S R29E S10
General legal description	NE 1/4 corner of section - Willcox FO - Crossed J Ranch
Location 5: Pinal County, AZ	
Latitude	32° 60′ 89″
Longitude	110° 77′ 22″
General legal description	In the town limits of Oracle, Ariz. Just south of the junction of Evergreen and American streets. Burned in 1985. Un-grazed for 35 years.

Other references

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Approval

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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)	Wilma Renken, Dan Robinett, Linda Kennedy (revision) Dave Womack, Dan Robinett, Tom Reis, Emilio Carrillo
Contact for lead author	USDA-NRCS Tucson MLRA Soil Survey Office
Date	02/17/2005
Approved by	Byron Lambeth

Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** North and South aspects: No rills.

   Note: When evaluating range health on this ecological site, aspect and slope affect expected reference conditions and should be factored into evaluation. Revision to original reference sheet incorporates reference conditions described from north- and south-facing aspects with 25% slope, 12 years post-burn (Ryan Fire).

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2. **Presence of water flow patterns:**
   North aspect: very short (5ft), discontinuous, almost indistinguishable among high cobble/gravel/vegetation cover.
   South aspect: common (5-15% of area), short (<5ft) and discontinuous and rock/gravel armored.

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3. **Number and height of erosional pedestals or terracettes:**
   North aspect: pedestals uncommon on perennial grasses; terracettes common, 2-3 ft. apart with 2-4" elevation difference.
   South aspect: pedestals uncommon on perennial grasses; terracettes common, 2-3 ft. apart with 2-4" elevation difference.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**
   North aspect: 5-10% bare ground evenly distributed among gravel/rock cover; non-vegetated areas are scarce. After fire, 25-30% bare ground is observed.
   South aspect: 10-15% bare ground evenly distributed among gravel/rock cover; After fire, 25-30% bare ground is observed.

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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):** North and South aspects: Fine litter moving less than 1 foot, coarse litter stays in place.

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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):** North and South aspects: No difference between canopy-protected and unprotected soil slake values. All values rated as 5s and 6s.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** North and

South aspects: Soil surface horizon 0-3" depth, very gravelly sandy loam, granular structure. Dark colored, 7.5 YR 3/2 moist, 7.5YR 5/2 dry.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**
    North aspect: Perennial grasses are well-dispersed across site with basal cover 5-12%. Foliar cover is 35-40% perennial grasses and 5-10% Emory oak.
    South aspect: Perennial mid-grasses dominant with an evenly dispersed short-grass community. Basal cover of perennial grasses is 4-10%. Foliar cover of perennial grasses is 30-45%.

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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):** North and South aspects: No compaction. Clayey (argillic) horizon at 3" 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:
    North aspect: Warm season mid-grasses.
    South aspect: Warm season mid-grasses > short-grasses

    Sub-dominant:
    North aspect: trees > low shrubs > perennial forbs
    South aspect: low shrubs (mimosa spp) > perennial forbs

    Other: succulents

    Additional: Annual forbs and annual grasses fluctuate with precipitation and can flourish for a season post-burning

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** North and South aspects: Perennial grass decadence increases with time since last fire. 12 years post-burning, both aspects exhibit some perennial grasses decadence, little mortality seen.

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14. **Average percent litter cover (%) and depth (in):** North aspect, 45% litter cover; South aspect, 15% litter cover (at present)

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 524 lbs/ac. in a below average year; 1240 lbs/ac. in an average year; 1985 lbs/ac. in an above average year. North aspect annual production is slightly higher than south aspect, 1200 #/ac (north aspect) and 1000 #/ac (south aspect) observed in year with average rainfall.

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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 lovegrass, Boer lovegrass, yellow bluestem, mesquite, wait-a-bit mimosa

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17. **Perennial plant reproductive capability:** Not impaired. Warm season perennial grass seed production highly dependent upon the amount and timing of summer monsoons.
