USDA Natural Resources
Conservation Service

Ecological site R035XB210AZ
Loamy Upland 6-10" p.z.

Accessed: 05/21/2025

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.

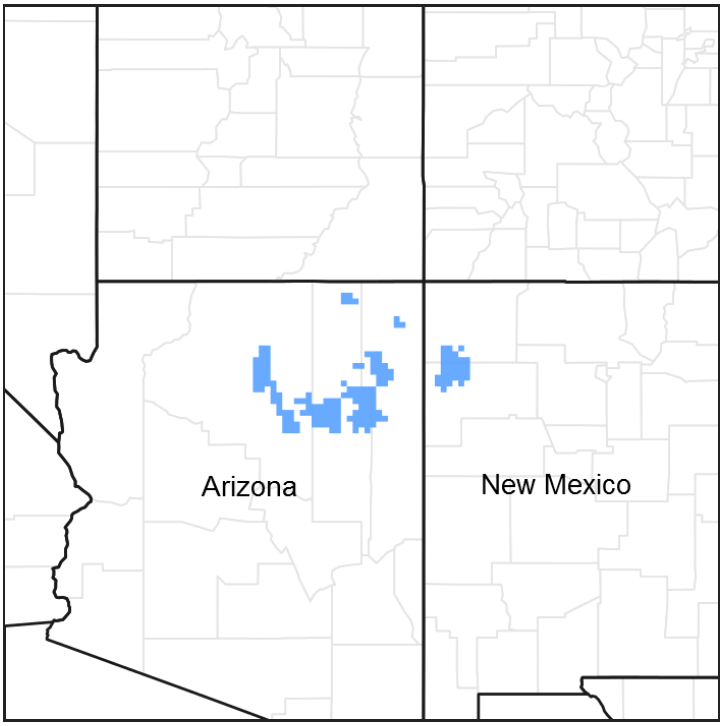

Figure 1. Mapped extent

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): 035X–Colorado Plateau

“PROVISIONAL ecological site concepts developed and described. See Project Plan [insert Project Plan Name] for more details and related milestones.”

This ecological site occurs in Land Resource Area 35.2 - the Colorado Plateau Shrub – Grasslands

Elevations range from 3800-5800 feet and precipitation averages 6 to 10 inches per year. Vegetation includes shadscale, fourwing saltbush, Mormon tea, blackbrush, Indian ricegrass, galleta, blue grama, and black grama. The soil temperature regime is mesic and the soil moisture regime is typic aridic. This unit occurs within the Colorado Plateau Physiographic Province and is characterized by a sequence of flat to gently dipping sedimentary rocks eroded into plateaus, valleys and deep canyons. Sedimentary rock classes dominate the plateau with volcanic fields occurring for the most part near its margin.

Ecological site concept

Enter the following note into the box for the ESC:
“ATTENTION: This ecological site meets the requirements for PROVISIONAL (if not more). A provisional ecological site is established after ecological site concepts are developed and an initial state-and-transition model is drafted. A provisional ecological site typically will include literature reviews, land use history information, legacy data (prior approved range site descriptions, forage suitability groups, woodland suitability groups, etc.,) , and includes some soils data, and estimates for canopy and/or species composition by weight,. A provisional ecological site provides the conceptual framework of soil-site correlation for the development of the ESD. For more information about this ecological site, please contact your local NRCS office.”

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex canescens* (2) *Krascheninnikovia lanata*
Herbaceous	(1) *Bouteloua eriopoda* (2) *Sporobolus airoides*

Physiographic features

This site occurs in an upland position on mesas, fans, structural benches and plains. It neither benefits significantly from run-in moisture from adjacent areas nor does it suffer from excessive loss of moisture from runoff, unless denuded of its vegetative cover. It is on gently sloping to rolling plains and slopes rangeing from 1 to 15 percent, but can have slopes up to 25 percent for short distances.

Table 2. Representative physiographic features

Landforms	(1) Fan (2) Mesa (3) Plain
Flooding frequency	None to rare
Elevation	1,158–1,768 m
Slope	1–15%
Aspect	Aspect is not a significant factor

Climatic features

The area has a very dry and windy climate that is hot in the summer and cold in the winter. Average annual precipitation is from 6 to 10 inches. The soil moisture regime is typic aridic and the soil temperature regime is mesic. A slight majority of the precipitation arrives during the late fall, winter, and early spring. This winter season moisture originates in the Pacific Ocean and arrives as rain, or sometimes snow, during widespread frontal storms of generally low intensity. The majority of the snow falls from December through February, but rarely lasts more than a few days. The driest period is from late May to early July. Summer rains occur from July through September during brief intense local thunderstorms. The rain is sporadic in intensity and location. Windy conditions are common year round with the strongest most frequently in the spring.

Table 3. Representative climatic features

Frost-free period (average)	181 days
Freeze-free period (average)	207 days
Precipitation total (average)	254 mm

Influencing water features

The soil moisture on this ecological site comes from precipitation. The site does not benefit significantly from run-on moisture. The loamy surface texture of the soil allows the site to capture the majority of the winter storms and the light to moderate summer storms if the site has good vegetative cover. Intense summer thunderstorms will produce runoff, reducing the amount of effective rainfall.

Soil features

The soils in this site are moderately deep or deep to any plant root restricting layers. The surface horizons have textures fine sandy loam to sandy clay loam with various amounts of gravel on the surface. The surface layers are about 2 to 8 inches thick. The subsurface horizons have textures ranging from loam to clay loam with coarse fragments ranging

from 10 to 60 percent by volume. The substratum, which occurs at depths of 15 to 36 inches, ranges from loamy to very gravelly sand and in some soils has a strong accumulation of lime. These soils can absorb and hold all the moisture the climate supplies if a good plant cover is present. The moisture regime is Typic Aridic and the temperature regime is Mesic.

Typical taxonomic units include:

Coconino County Central (AZ631)- MU 5 Torriorthents;
Little colorado River Area (AZ707)- MU's 10 Grieta, 12 Seeg, 14 Hatknoll, 19 Jeddito, 58 Bluechief;
Navajo Mountain (AZ711)- MU's 54 Typic Haplargids
Chinle Area (AZ713) - MU's 30 Monue, 31 Redhouse, 33 Nakai;
Fort Defiance Area (NM/AZ)(AZ715) MU's 41 Ives, 60 Mesa family, 64 Bluechief, 92 Redlands, 93 Redlands family, 112 Bluechief, 119 Tewa;
Shiprock NM (717) - MU's 195 Tewa, 270 Fruitland, 210, 290, 295, 155 Mesa, 210, 528 Mack, 303 Snapill, 500 Whit, 511 Redlands.

Table 4. Representative soil features

Parent material	(1) Alluvium–pyroclastic rock (2) Eolian deposits–sandstone and shale
Surface texture	(1) Fine sandy loam (2) Loam (3) Sandy clay loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately slow to moderate
Soil depth	102–152 cm
Surface fragment cover <=3"	5–20%
Available water capacity (0-101.6cm)	7.62–12.7 cm
Calcium carbonate equivalent (0-101.6cm)	5–15%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4

Subsurface fragment volume <=3" (Depth not specified)	10–60%

Ecological dynamics

An ecological site is not a precise assemblage of species for which the proportions are the same from place to place or from year to year. In all plant communities, variability is apparent in productivity and occurrence of individual species. Spatial boundaries of the communities; however, can be recognized by characteristic patterns of species composition, association, and community structure. The historic climax plant community for this ecological site has been described by sampling relict or relatively undisturbed sites and/or reviewing historic records. The historic climax plant community is the plant community that evolved over time with the soil forming process and long term changes in climatic conditions of the area. It is the plant community that was best adapted to the unique combination of environmental factors associated with the site.

Natural disturbances, such as drought, fire, grazing of native fauna, and insects, are inherent in the development and maintenance of these plant communities. The effects of these disturbances are part of the range of characteristics of the ecological site. Fluctuations in plant community structure and function caused by the effects of natural disturbances help establish the boundaries and characteristics of an ecological site. They are accounted for as part of the range of characteristics of the ecological site. Recognizable plant community phases are identified in the reference state of the ecological site. Some sites may have a small range of variation, while others have a large range. Some plant community phases may exist for long periods of time, while others may only occur for a couple of years after a disturbance.

Deterioration of the plant community, hydrology, or soil site stability on an ecological site can result in crossing a threshold or potentially irreversible boundary to another state, or equilibrium. This can occur as a result of the loss of soil surface through erosion, the loss of the stability of the site due to disturbances that cause active erosion on the site, increases in the amounts and/or patterns or runoff from rainstorms, changes in availability of surface and subsurface water, significant changes in plant structural and functional types, or the introduction of non-native species. When these thresholds are crossed, the potential of the ecological site to return to the historic climax plant community can be lost, or restoration will require significant inputs . There may be multiple states possible for an ecological site, determined by the type and or severity of disturbance.

The known states and transition pathways for this ecological site are described in the state and transition model. Within each state, there may be one or more known plant community phases. These community phases describe the different plant community that can be recognized and mapped across this ecological site. The state and transition model is intended to help land users recognize the current plant community on the ecological site, and the management options for improving the plant community to the desired plant community.

Plant production information in this site description is standardized to the annual production on an air-dry weight basis in near normal rainfall years.

State and transition model

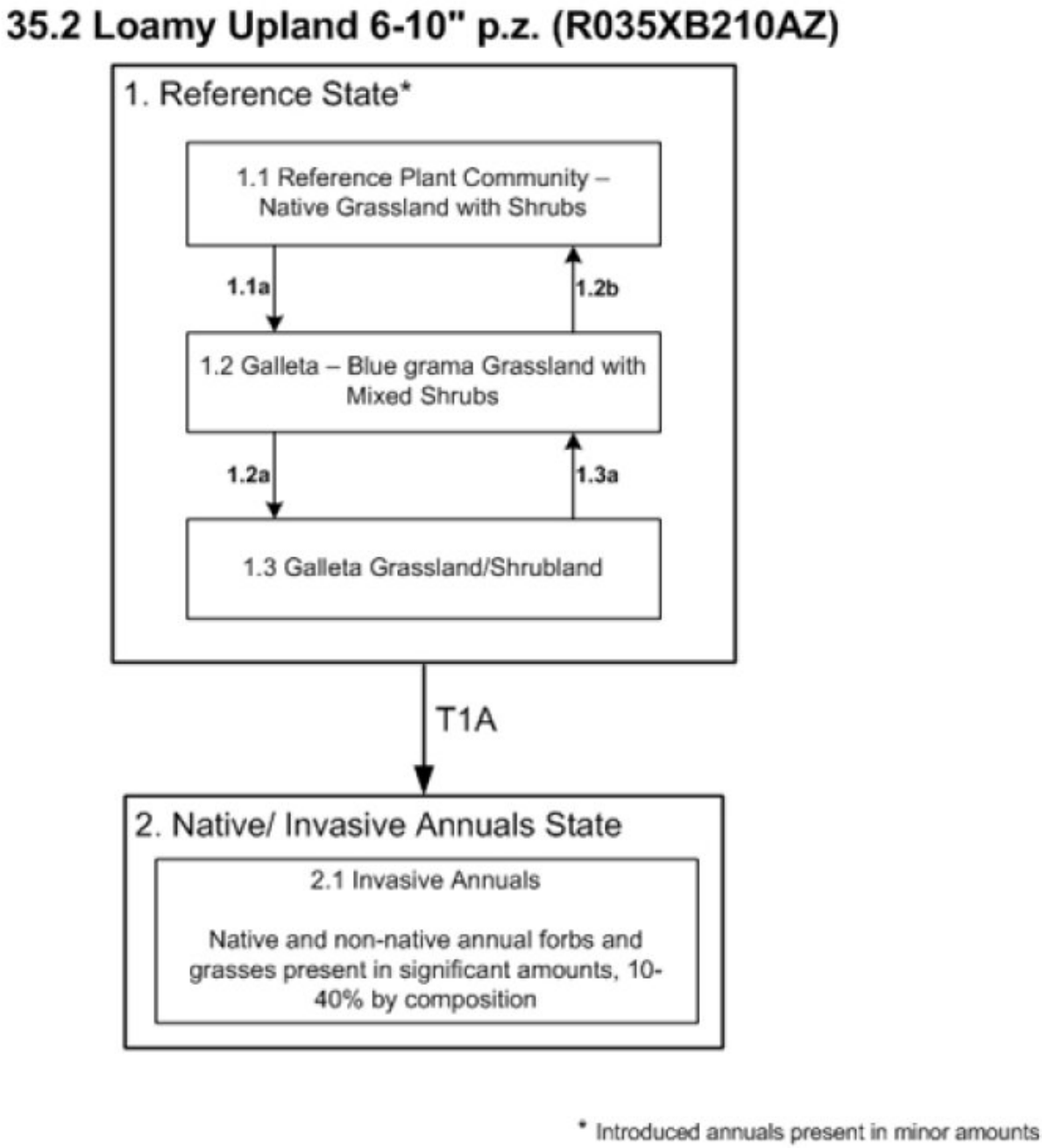

Figure 4. State and Transition Model – R035XB210AZ

State 1
Reference State

The reference state plant community (1.1) is a grassland with mid and short grasses mixed with shrubs and a relatively small percentage of forbs and annuals. With disturbances the plant community becomes a grassland/shrubland. Plant species most likely to invade or increase on this site with disturbances are rabbitbrush, broom snakeweed, annuals, cacti, and wooly groundsel. Unmanaged grazing during the winter

and spring periods will decrease the cool season grasses, which are replaced by lower forage value grasses and shrubs.

Community 1.1
Reference Plant Community - Native Grassland with Shrubs

This plant community is made up primarily of mid and short grasses mixed with shrubs and a relatively small percentage of forbs and annuals. The plant community has a mixture of both cool and warm season grasses. Dominant species in this plant community are black grama, alkali sacaton, blue grama, Indian ricegrass, fourwing saltbush, winterfat and Mormon tea. There may be a presence of introduced annuals, but in minor amounts.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	297	465	583
Shrub/Vine	84	129	168
Forb	11	22	34
Total	**392**	**616**	**785**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0%
Grass/grasslike foliar cover	0%
Forb foliar cover	0%
Non-vascular plants	0%
Biological crusts	0%
Litter	20-35%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	30-40%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-1%	0-3%	0-2%
>0.15 <= 0.3	–	0-3%	0-12%	0-1%
>0.3 <= 0.6	–	0-3%	0-6%	–
>0.6 <= 1.4	–	0-1%	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Figure 6. Plant community growth curve (percent production by month). AZ5203, 35.2 6-10" p.z. alkali sacaton. Growth begins in the spring, most growth occurs in the summer, goes dormant in the fall..

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

Figure 7. Plant community growth curve (percent production by month). AZ5211, 35.2 6-10" p.z. fourwing saltbush. Growth begins in spring and continues through the summer. Seed stalk extension occurs in summer with seed set in the fall..

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

Community 1.2
Galleta - Blue grama Grassland with Mixed Shrubs

This plant community is characteried by a dominance of grasses with scattered shrubs and forbs. The dominant grasses are galleta, blue grama, alkali sacaton with other native grasses in lesser amounts. Common shrubs include fourwing, winterfat, snakeweed, Mormon tea and other native shrubs in lesser amounts. In this plant community there may be a presence of introduced annuals, but in minor amounts.

Community 1.3
Galleta Grassland - Shrubland

This plant community is characterized by a grassland/shrubland with a dominance of galleta, blue grama, alkali sacacton, winterfat and Mormon tea with lesser amounts of snakeweed and fourwing saltbush. Grass composition has declined with an increase of

shrubs. In this plant community there may be a presence of introduced annuals, but in minor amounts.

Pathway 1.1a
Community 1.1 to 1.2

Unmanaged grazing, drought

Pathway 1.2b
Community 1.2 to 1.1

Prescribed grazing or time without disturbances, favorable climatic conditions.

Pathway 1.2a
Community 1.2 to 1.3

Unmanaged grazing especially in fall/spring periods, continued drought.

Pathway 1.3a
Community 1.3 to 1.2

Prescribed grazing or reduced disturbance, favorable periods of moisture, seed source for more desirable forage species.

State 2
Native/ Invasive Annuals State

Community 2.1
Invaded Annuals

Figure 8. Loamy Upland - Invasive Annuals

This plant community is characterized by the increase of native and introduced annuals. This site typically has a reduced shrub component, but has some perennial warm season grasses. Common grasses include galleta, alkali sacaton and blue grama. Annuals most common on the site include Russian thistle, tansy mustard, scorpion weed, stickseed, cheatgrass, false buffalograss and sixweeks fescue. Annuals can make up to 40% of the plant community.

Transition T1A
State 1 to 2

Establishment and invasion of introduced annual forbs and grasses, unmanaged grazing, drought

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
0	**Dominant Grasses**			370–488	
	black grama	BOER4	*Bouteloua eriopoda*	90–163	–
	alkali sacaton	SPAI	*Sporobolus airoides*	90–157	–
	blue grama	BOGR2	*Bouteloua gracilis*	34–95	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	34–95	–
	James' galleta	PLJA	*Pleuraphis jamesii*	34–95	–
1	**Other Grasses**			28–118	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–22	–
	needle and thread	HECO26	*Hesperostipa comata*	0–22	–
	Grass, perennial	2GP	*Grass, perennial*	0–22	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–22	–
	threeawn	ARIST	*Aristida*	0–11	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–11	–
	ring muhly	MUTO2	*Muhlenbergia torreyi*	0–11	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–11	–
	Grass, annual	2GA	*Grass, annual*	0–11	–
Forb					

Forb					
2	**Forbs**			6–39	
	globemallow	SPHAE	*Sphaeralcea*	0–9	–
	Forb, annual	2FA	*Forb, annual*	2–9	–
	Forb, perennial	2FP	*Forb, perennial*	4–9	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	3–9	–
	ring muhly	MUTO2	*Muhlenbergia torreyi*	3–9	–
	rose heath	CHER2	*Chaetopappa ericoides*	0–6	–
	annual Townsend daisy	TOAN	*Townsendia annua*	0–6	–
	western tansymustard	DEPI	*Descurainia pinnata*	0–2	–
	buckwheat	ERIOG	*Eriogonum*	0–2	–
	flatspine stickseed	LAOC3	*Lappula occidentalis*	0–2	–
	whitestem blazingstar	MEAL6	*Mentzelia albicaulis*	0–2	–
	phacelia	PHACE	*Phacelia*	0–2	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–2	–
	milkvetch	ASTRA	*Astragalus*	0–2	–
	sego lily	CANU3	*Calochortus nuttallii*	0–2	–
Shrub/Vine					
4	**Common Shrubs**			62–123	
	fourwing saltbush	ATCA2	*Atriplex canescens*	31–62	–
	jointfir	EPHED	*Ephedra*	18–31	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	18–31	–
5	**Ocassional Shrubs**			11–39	
	rabbitbrush	CHRYS9	*Chrysothamnus*	6–17	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	6–17	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	2–11	–
	Whipple cholla	CYWH	*Cylindropuntia whipplei*	2–11	–
6	**Other Shrubs**			6–34	
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–6	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–6	–

	buckwheat	ERIOG	*Eriogonum*	0–6	–
	menodora	MENOD	*Menodora*	0–6	–
	threadleaf ragwort	SEFL3	*Senecio flaccidus*	0–6	–
	spineless horsebrush	TECA2	*Tetradymia canescens*	0–6	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–6	–

Animal community

This site is suitable for yearlong grazing by either cows and calves or stockers. Accessibility is usually very good because stock tanks can be built in these areas. Erosion is not a hazard unless the vegetational cover has been severly reduced.

There is relatively poor diversity within the plant community of this site. Because of the grass component, the site is dominated by grassland wildlife species. However, the site is transitory to almost all species because of the proximity of water.

Recreational uses

The site is located on gently rolling plains and outwash fans and terraces.

The site has a variety of spring and summer flowers following good moisture periods. It consists of open grasslands with scattered shrubs giving it good aesthetic appeal.

Winters are cold, however, relatively mild spring, fall and summer months are attractive to recreationists.

Activities include hunting, cross-country riding, photography, hiking, rock collecting, and wildlife observation.

Type locality

Location 1: Navajo County, AZ	
Township/Range/Section	T17N R20E S6
General legal description	McLaws ranch, Sec 6, T17N, R20E, near Holbrook

Other references

Updates and revisions for this ESD were conducted as part of a 2007-2012 Interagency Technical Assistance Agreement between the Bureau of Indian Affairs–Navajo Region and the NRCS-Arizona.

Contributors

Ken Gishi
Larry D. Ellicott
Peter Lefebvre
Steve Barker

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)	Dean Schlichting, Kenneth Gishi
Contact for lead author	State Rangeland Management Specialist, NRCS-Arizona State Office, Phoenix, AZ
Date	10/17/2008
Approved by	Byron Lambeth
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** No rills on slopes <5%. A few minor rills may form on slopes greater than 5% due to moderate permeability and moderate runoff characteristics of the soils.

---

2. **Presence of water flow patterns:** Water flow patterns are infrequent, short (1 to 2 meters), and poorly developed. They may become more common on steeper slopes due to slow to moderate permeability and medium runoff characteristics of the soils.

---

3. **Number and height of erosional pedestals or terracettes:** Pedestals of ½" to 1" are rare to infrequent and often associated with water flow patterns. Terracettes are absent. Both may be more developed and common during a drought, due to moderate wind erosion hazard of

the soils. High wind erosion hazard occurs on the soils with a surface texture of loamy sand or sandy loam.

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground ranges from 30-40%. Soils have an average available water capacity of 7-9 inches, which makes the site moderately productive. There should be a moderate amount of bare ground. Drought may cause an increase in bare ground.

---

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

---

6. **Extent of wind scoured, blowouts and/or depositional areas:** No blowouts are present or this site. Some small mounding around plant bases common, especially during droughts, due to high wind erosion hazard of the soil

---

7. **Amount of litter movement (describe size and distance expected to travel):** Most herbaceous litter will be transported by wind and in water flow pathways, while a small percentage stays in place. Fine woody litter and duff will accumulate under shrub canopies.

---

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil aggregate stability ratings should average 3-4 under plant canopy and 2-3 in the interspaces. Soil surface textures range from sandy loam to clay loam, but most textures are fine sandy loam, sandy clay loam and loam. There is usually less than 10% cover of rock fragments on the surface, but some surface horizons can be gravelly. When well vegetated, soils have a moderate resistance to water erosion and moderate to high resistance to wind erosion.

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil structure is mostly granular (weak to moderate, very fine and fine) with some platy (weak, thin and medium) and sub angular blocky (weak, fine to medium). Surface thickness ranges from 2-8 inches, but is mostly 2-4 inches. Color is typically reddish brown to brown, but can vary depending on parent material.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** This site is characterized by mid and short grasses, shrubs, forbs with a trace of cacti and yucca. Canopy cover averages 30-40% (70% grasses, 25% shrubs, 5% forbs). Basal plant cover averages 10-20% (10-15% grasses, 2-3% shrubs, 1-2% forbs). Both cover values decrease during a prolonged drought. This type of plant community is moderately effective at capturing and storing precipitation.

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. Due to loamy and clay loam textures, most of the soils can be compacted when wet, if there are no rock fragments in surface horizons. Some surface horizons are naturally platy.

---

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: warm season bunchgrasses(20-40%)

    Sub-dominant: shrubs(15-25%) >= warm season colonizing grasses(15-25%) > cool season bunchgrasses(10-15%) >>

    Other: forbs(1-5%) > cacti(Trace)

    Additional:

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** In a normal year up to 10% of grasses and shrubs die off. During and after drought years there can be up to 20% die off of shrubs and grasses. Severe winter droughts affect shrubs and cool season grasses the most. Severe summer droughts affect the warm season grasses the most.

---

14. **Average percent litter cover (%) and depth (in):** Average percent litter cover 20 - 35% and depth 1/8”inch. Within plant interspaces litter ranges from 5 to 15 % cover with no real depth, while under shrub canopies it ranges from 25 to 50% cover with depths from 1/8 to 1/4

inch thick.

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Average annual production on this site is expected to be 500 to 600 lbs/ac. in a year of average annual precipitation.

---

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:** Mormon tea, broom snakeweed, prickly pear and Whipple cholla cactus are all native to the site, but have the ability to increase and dominate the area after disturbances. Russian thistle and cheatgrass are exotic annuals that have the ability to increase and dominate the site after ground disturbance.

---

17. **Perennial plant reproductive capability:** All plants native to this site are adapted to the climate and are producing seeds, stolons and rhizomes in all but the most severe droughts.
