USDA Natural Resources
Conservation Service

Ecological site R035XC373AZ
Sandy Upland 10-14" p.z. Warm

Accessed: 05/13/2025

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.

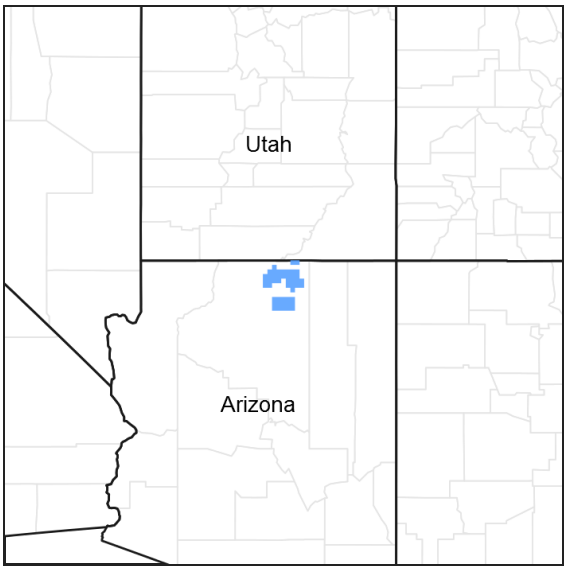


Figure 1. Mapped extent

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

This ecological site is found in Common Resource Area 35.3 – the Colorado Plateau Sagebrush – Grasslands.

The Common Resource Area occurs within the Colorado Plateau Physiographic Province. It is characterized by a sequence of flat to gently dipping sedimentary rocks eroded into plateaus, valleys and deep canyons. Elevations range from 4800 to 6700 feet and precipitation averages 10 to 14 inches. The elevation range is lower (about 4500 to 6000) on the western side of the Colorado Plateau along the Grand Canyon, and moves up about 500 to 800 feet higher on the eastern side in the areas of the Navajo and Hopi Indian Reservations due to rain shadow effects from the Kaibab Plateau and Mogollon Rim. Common vegetation in this region includes Wyoming big sagebrush, Utah juniper, Colorado pinyon - cliffrose, Mormon tea, fourwing saltbush, blackbrush Indian ricegrass, needle and thread, western wheatgrass Galleta, black grama, blue grama, and sand dropseed. Sedimentary rock classes dominate the plateau with volcanic fields occurring for the most part near its margin. The soil temperature regime is mesic and the soil moisture regime is ustic aridic.

Table 1. Dominant plant species

Tree	Not specified

Shrub	(1) *Coleogyne ramosissima* (2) *Ephedra cutleri*
Herbaceous	(1) *Achnatherum hymenoides*

Physiographic features

This site occurs on stabilized dunes, interdunes and sand sheets in dune fields and mesa summits. Sand sheets occurs in interdunes, on relatively flat plateaus, or on mesa summits.

This site occurs in the lower elevations and warmer south facing slopes in the common resource area that are preferred by blackbrush.

Table 2. Representative physiographic features

Landforms	(1) Sand sheet (2) Plateau (3) Interdune
Ponding frequency	None
Elevation	1,463–2,042 m
Slope	1–15%
Aspect	Aspect is not a significant factor

Climatic features

Winter summer moisture ratios range from 70:30 to 60:40. Late spring is usually the driest period, and early fall moisture can be sporadic. Summer rainds fall from June through September; moisture originates in the Gulf of Mexico and creates convective, usually brief, intense thunderstorm. Cool season moisture from October through May tends to be frontal; it originates in the Pacific and the Gulf of California and falls in widespread storms with longer duration and lower intensity. Precipitation generally comes as snow from December through February. Accumulations above 12 inches are not common but can occur. Snow usually lasts for 3-4 days, but can persist much longer. Summer daytime temperatures are commonly 95 - 100 F and on occasion exceed 105 F. Winter air temperatures can regularly go below 10 F and have been recorded below - 20 F.

Table 3. Representative climatic features

Frost-free period (average)	168 days
Freeze-free period (average)	193 days
Precipitation total (average)	356 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 sandy surface texture of the soil allows the site to capture the majority of both gentle winter storms and intense summer thunderstorms with little runoff.

Soil features

Soils on this site are deep to very deep. Surface textures range from fine sand to coarse loamy sand. These soils are excessively well drained with very low to low runoff. They are formed in alluvium and eolian deposits from sandstone and siltstone from Navajo sandstone and other Jurassic age formations. The upper surface horizons may be slightly or non-effervescent. Below the surface horizon, the soil becomes more effervescent with depth. Carbonate accumlations generally become strong to violently calcareous within 24" of the surface when treated with HCL acid.

Soil survey map unit components that have been correlated to this ecological site include:

SSA 707 Little Colorado River Area MU's 1 Mido, 32 Ustic haplocalcids & Mido;

SSA 711 Navajo Mountain Area MU's 10 Earlweed & Shoegame, 25 Mido (limy substratum), 26 & 43 Mido (loamy substratum), 26 Ustic hapolcalcids, 29 Mido & Pensom, 38 Earlweed.

Table 4. Representative soil features

Parent material	(1) Eolian sands–sandstone (2) Alluvium–siltstone
Surface texture	(1) Fine sand (2) Sand (3) Loamy sand
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained to excessively drained
Permeability class	Rapid
Soil depth	102–203 cm
Surface fragment cover <=3"	0–2%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	3.81–13.21 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.6
Subsurface fragment volume <=3" (Depth not specified)	0–10%
Subsurface fragment volume >3" (Depth not specified)	0%

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

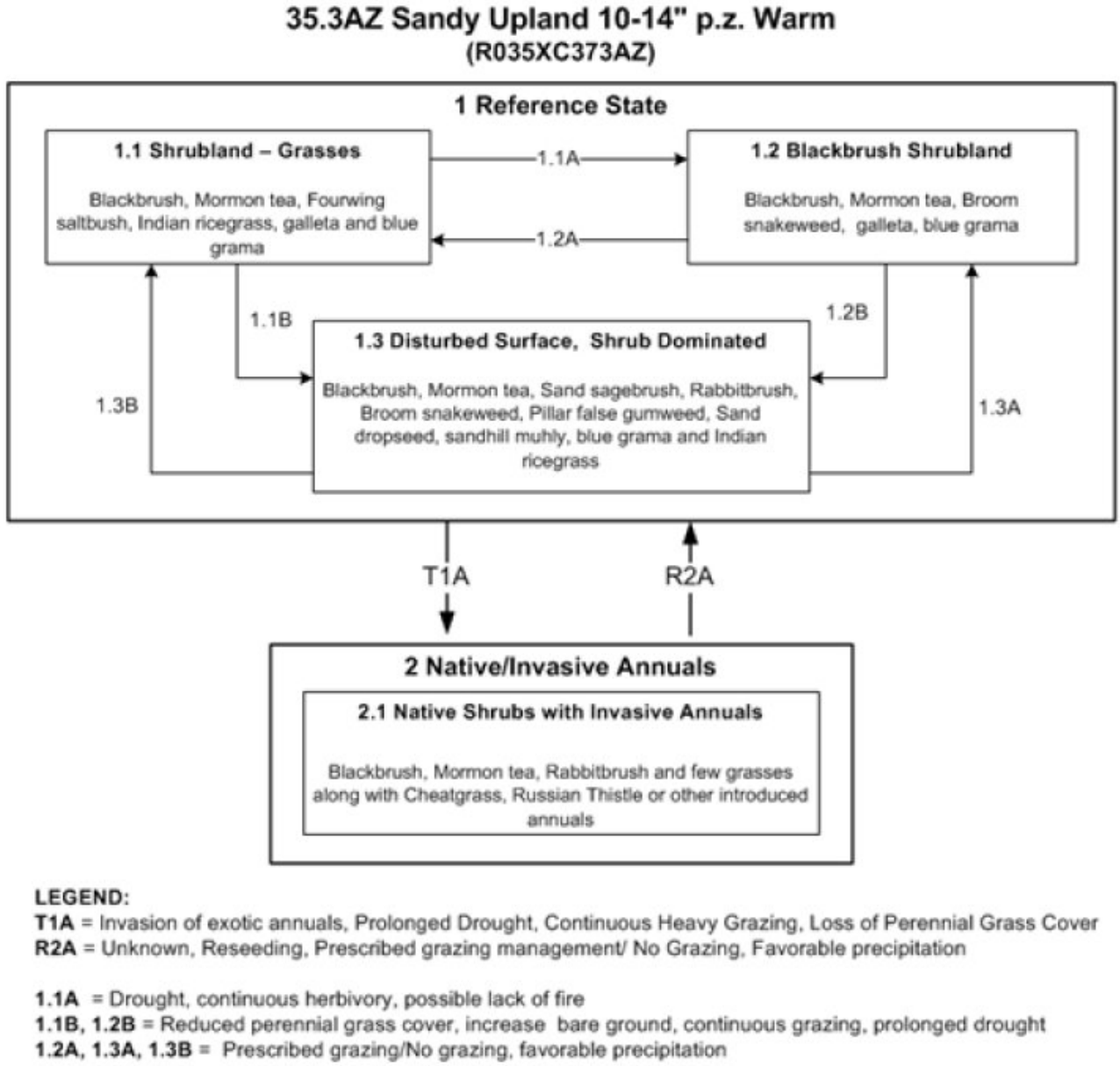


Figure 4. STM - R035XC373AZ

State 1
Reference State

The dominant aspect of this site is a low shrub canopy of blackbrush, fourwig saltbush and Mormon tea, mixed with perennial cool and warm season grasses and some forbs. Other shrubs include broom snakeweed, Greene rabbitbrush and sand sagebrush. Commonly seen grasses include Indian ricegrass, galleta, blue grama and dropseeds.

Community 1.1
Shrubland - Grasses

Figure 5. Low Elevation Site

Figure 6. Higher Elevation Site

Figure 7. Mid Elevation Site

The dominant aspect of this plant community is a low shrub canopy of blackbrush, fourwing saltbush and Mormon tea, mixed with perennial cool and warm season grasses and some forbs. Other shrubs include broom snakeweed, Greene rabbitbrush and sand sagebrush. Commonly seen grasses include Indian ricegrass, galleta, blue grama and dropseeds.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	202	314	426
Grass/Grasslike	73	112	151
Forb	6	17	28
Tree	–	6	11
Total	**281**	**449**	**616**

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	5-30%
Litter	10-20%
Surface fragments >0.25" and <=3"	0-5%
Surface fragments >3"	0-1%
Bedrock	0%
Water	0%
Bare ground	40-65%

Table 7. Soil surface cover

Tree basal cover	0-1%
Shrub/vine/liana basal cover	2-8%
Grass/grasslike basal cover	1-3%
Forb basal cover	0-2%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 8. Canopy structure (% cover)

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

Figure 9. Plant community growth curve (percent production by month). AZ3531, 35.3 10-14" p.z. all sites. Growth begins in the spring and continues through the summer..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	1	3	17	18	10	19	20	10	1	1	0

Community 1.2
Blackbrush Shrubland

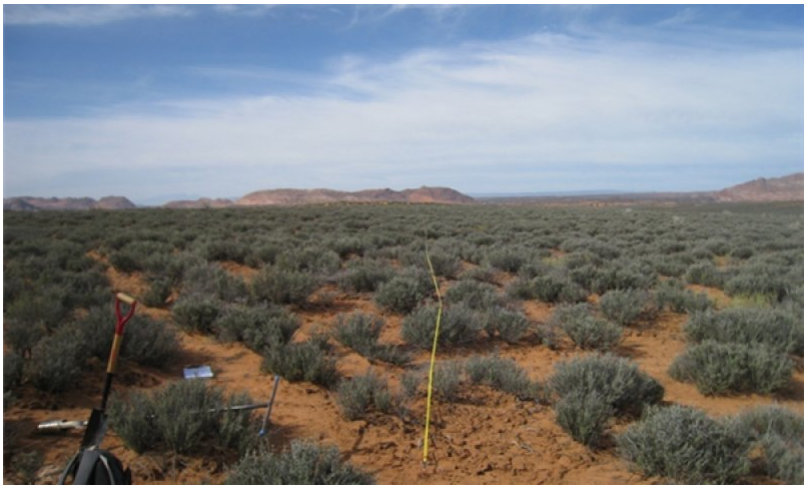


Figure 10. Blackbrush Shrubland

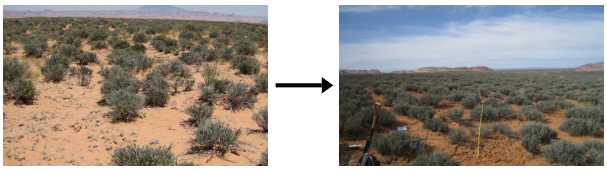
This plant community is characterized by a dense canopy of blackbrush with scattered shrubs like Mormon tea, broom snakeweed, yucca and rabbitbrush. There is a scattered understory of grasses and forbs. When surface disturbance is minimal this plant community has a moderate resistance to wind and water erosion due to high amounts of biological crust and shrub canopy.

Community 1.3
Disturbed Surface, Shrub Dominated

Figure 11. Disturbed Surface - Shrub Dominated

In this plant community there is a mix of shrubs and grasses along with a high percentage of bare ground. This site has a increase of blowouts and active deposition. Most blowouts are small and are stabilizing with grasses and forbs. Common shrubs include rubber rabbitbrush, sand sagebrush, Mormon tea, blackbrush, sand buckwheat, Greene rabbitbrush, snakeweed and false pillar gumweed. This plant community has a variety of grasses and forbs. Common grasses include sand dropseed, sandhill muhly, blue grama, Indian ricegrass and needle and thread.

Pathway 1.1A
Community 1.1 to 1.2

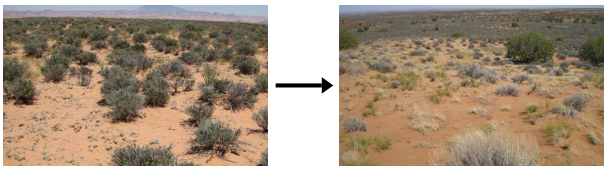


Shrubland - Grasses

Blackbrush Shrubland

Drought, long term winter dominated moisture patters, unmanged grazing and lack of periodic fire will reduce the perennial grasses and allow woody species to increase on the site.

Pathway 1.1B
Community 1.1 to 1.3

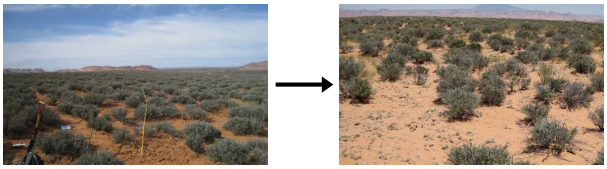


Shrubland - Grasses

Disturbed Surface, Shrub Dominated

Reduced perennial grass cover, increase bare ground/ frequent soil surface disturbance, unmanaged grazing, prolonged drought

Pathway 1.2A
Community 1.2 to 1.1



Blackbrush Shrubland

Shrubland - Grasses

Prescribed grazing/No grazing, favorable precipitation

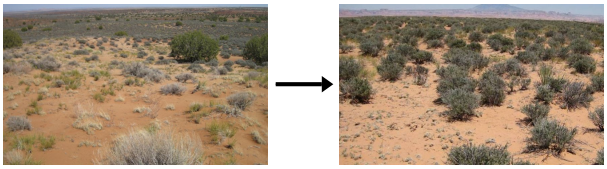
Pathway 1.2B
Community 1.2 to 1.3

Blackbrush Shrubland

Disturbed Surface, Shrub Dominated

Reduced perennial grass cover, increase bare ground/ frequent soil surface disturbance, continuous grazing, prolonged drought

Pathway 1.3B
Community 1.3 to 1.1

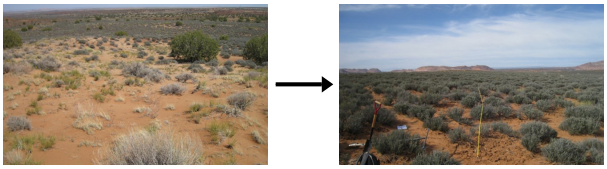


Disturbed Surface, Shrub Dominated

Shrubland - Grasses

Prescribed grazing/No grazing, favorable precipitation

Pathway 1.3A
Community 1.3 to 1.2



Disturbed Surface, Shrub Dominated

Blackbrush Shrubland

Prescribed grazing/No grazing, favorable precipitation

State 2
Native/ Invasive Annuals

The dominant aspect of this site is a mix of shrubs canopy and annual forbs and grasses. Common shrubs are Mormon tea, broom snakeweed, Greene rabbitbrush, blackbrush, rubber rabbitbrush. The herbaceous canopy is dominated by annual forb, both native and non-natives.

Community 2.1
Native Shrubs with Annuals

Figure 12. Shrubland with Invasive Annuals

In this phase the plant community has been changed through disturbances and invasion. The site has active soil erosion; blowouts are common and deposition is occuring around shrubs and trees, if presents. Large bare ground patches are common and connected. The vegetation is mostly comprised of scattered native shrubs along with occasional junipers and succulents. Blackbrush may or may not be present in this state. Common shrubs include rubber rabbitbrush, sand sagebrush, Mormon tea, Greene rabbitbrush, snakeweed and false pillar gumweed. Perennial grass cover has decline significantly or may be absent, while annual grasses and forbs have increased in cover. Introduced non-native annuals grasses and forbs are present and may be well established.

Transition T1A
State 1 to 2

Invasion of exotic annuals, Prolonged Drought, Continuous Heavy Grazing, Loss of Perennial Grass Cover

Restoration pathway R2A
State 2 to 1

This pathway may or not be possible, Reseeding of favorable shrubs and grasses, Prescribed grazing management/ No Grazing until grasses have established, Favorable precipitation

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Dominant Grasses**			67–123	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	22–67	–

	blue grama	BOGR2	*Bouteloua gracilis*	6–50	–
	James' galleta	PLJA	*Pleuraphis jamesii*	6–28	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	2–28	–
2	**Other Grasses**			6–28	
	Fendler's threeawn	ARPUF	*Aristida purpurea var. fendleriana*	0–11	–
	squirreltail	ELEL5	*Elymus elymoides*	0–11	–
	needle and thread	HECO26	*Hesperostipa comata*	0–11	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–11	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–6	–
	Grass, perennial	2GP	*Grass, perennial*	0–6	–
Forb					
3	**Forbs**			6–28	
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–11	–
	tansyaster	MACHA	*Machaeranthera*	0–11	–
	thicksepal cryptantha	CRCR3	*Cryptantha crassisepala*	0–9	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–9	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–9	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–7	–
	Forb, annual	2FA	*Forb, annual*	0–7	–
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–7	–
	shortstem lupine	LUBR2	*Lupinus brevicaulis*	0–7	–
	Ives' phacelia	PHIV	*Phacelia ivesiana*	0–4	–
	mountain misery	CHAMA	*Chamaebatia*	0–4	–
	rose heath	CHER2	*Chaetopappa ericoides*	0–4	–
	buckwheat	ERIOG	*Eriogonum*	0–4	–
	flatspine stickseed	LAOC3	*Lappula occidentalis*	0–4	–
	cryptantha	CRYPT	*Cryptantha*	0–4	–
	bulbous springparsley	CYBU	*Cymopterus bulbosus*	0–4	–
	little hogweed	POOL	*Portulaca oleracea*	0–4	–
	dock	RUMEX	*Rumex*	0–4	–
	annual Townsend daisy	TOAN	*Townsendia annua*	0–4	–
	globemallow	SPHAE	*Sphaeralcea*	0–2	–
	touristplant	DIWI2	*Dimorphocarpa wislizeni*	0–2	–
	pink funnel lily	ANBR4	*Androstephium breviflorum*	0–2	–
	milkvetch	ASTRA	*Astragalus*	0–2	–
	mustard	BRASS2	*Brassica*	0–2	–
	mariposa lily	CALOC	*Calochortus*	0–2	–
	sego lily	CANU3	*Calochortus nuttallii*	0–2	–
	mealy goosefoot	CHIN2	*Chenopodium incanum*	0–2	–
Shrub/Vine					
4	**Dominant Shrubs**			168–303	
	blackbrush	CORA	*Coleogyne ramosissima*	135–202	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	22–67	

	fourwing saltbush	ATCA2	*Atriplex canescens*	22–67	–
	Cutler's jointfir	EPCU	*Ephedra cutleri*	11–34	–
5	**Others Shrubs**			34–123	
	Greene's rabbitbrush	CHGR6	*Chrysothamnus greenei*	0–34	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–34	–
	rubber rabbitbrush	ERNAB2	*Ericameria nauseosa ssp. nauseosa var. bigelovii*	0–34	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	6–28	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–22	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–11	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–11	–
	Whipple cholla	CYWH	*Cylindropuntia whipplei*	0–11	–
	pinkflower hedgehog cactus	ECFE	*Echinocereus fendleri*	0–6	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–6	–
	pale desert-thorn	LYPA	*Lycium pallidum*	0–6	–
	grizzlybear pricklypear	OPPOE	*Opuntia polyacantha var. erinacea*	0–6	–
	Stansbury cliffrose	PUST	*Purshia stansburiana*	0–6	–
Tree					
6	**Tree**			0–11	
	Utah juniper	JUOS	*Juniperus osteosperma*	0–11	–

Animal community

This site is used for grazing by cattle, horses, sheep, and goats.

Hydrological functions

There no hydrologic features associated with this site.

Wood products

There is no potential for the production of wood products on this site.

Type locality

Location 1: Coconino County, AZ	
UTM zone	N
UTM northing	4072713
UTM easting	4772713

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

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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)	Kenneth Gishi
Contact for lead author	
Date	03/02/2011
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None to very few expected. The sandy surface textures and excessively drained nature of the soils should preclude the presence of rills. An occasional rill may occur in areas near or adjacent to exposed bedrock where concentrated water flows and accumulates.

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2. **Presence of water flow patterns:** A few widely scattered water flow patterns may be present. Water flow patterns on these soils are commonly less than 6 feet long, but may be longer on steeper slopes, generally occupying < 10% of the ground cover. Sites with well developed biological crust can provide additonal flow pathways for water, especially following intense storm events.

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3. **Number and height of erosional pedestals or terracettes:** None to few. Short pedestals(1/2") can form at the base of plants along rills or water flow patterns. Terracettes are mostly absent. Sites with well developed biological crust can be mistaken for pedestals. These are natural and not considered signs of site departure.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 30-60%. Functioning biological crust should not be counted as bare ground. Drought conditions may cause a short-term increase in bare ground.

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5. **Number of gullies and erosion associated with gullies:** None expected. An occasional gully may occur on steeper slopes near or adjacent to exposed bedrock where concentrated water flows and accumulates. These gullies should stabilzed with perennial herbaceous cover.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Wind scoured areas and blowouts should be stable. Some slight mounding around plant bases and small blowout areas may occur, especially during droughts, due to high wind erosion hazard of the soil. Mounding is mostly to occur around the base of long-lived perennial shrubs.

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7. **Amount of litter movement (describe size and distance expected to travel):** Most woody litter accumulates under plant canopies and bases. Some fine litter will move a short distances (<5') and accumulate in depressions and flow paths. Other fines will be removed form the site by wind.

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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):** Expected average values of 3-4 under plant canopies and 2-3 in the plant interspaces.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Surface depths generally range from 3-5" with a single grain, loose structure. Color is variable depending on parent material, but generally has hues of yellowish red (5YR) or light to strong brown (7.5YR)

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** A mixed canopy of shrubs and bunchgrasses along with scattered clumps of biological crust promote the greatest infiltration and least amount of runoff. Plant composition consists of about 65 percent shrubs, 25 percent grasses and 10 percent forbs.

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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):** None

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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: Evergreen shrubs (Blackbrush, Cutler's Mormon tea)

    Sub-dominant: Cool-season grasses > Warm-season grasses > forbs

    Other: trees and annual grasses

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** All plant functional groups are adapted to survival in all but the most severe droughts. Severe winter droughts affect shrubs and cool season grass the most. Severe summer droughts affect warm season grasses the most.

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

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 300-400 lbs/ac in an average year

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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: Cheatgrass, red brome, Russian thistle and other introduced annual are most likley to invade this site with or without disturbance. Blackbrush, broom snakeweed, rabbitbrush and juniper are native to this site, but all have the potential to increase and invade this site with disturbance.

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17. **Perennial plant reproductive capability:** All native perennial plants are adapted to the climate and are capable of producing seeds, stolons and rhizomes except during the most severe droughts.
