USDA Natural Resources Conservation Service

Ecological site R035XF603AZ
Clay Loam Upland 13-17" p.z.

Accessed: 07/17/2024

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.

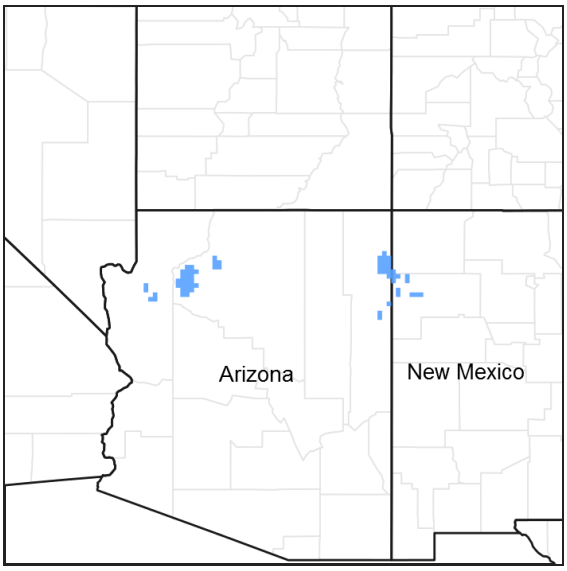

Figure 1. Mapped extent

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 occurs in Common Resource Area 35.6 - the Colorado Plateau Pinyon-Juniper-Sagebrush

The Common Resource Area occurs within the Colorado Plateau Physiographic Province. Elevations range from 5800 to 7300 feet and precipitation averages 13 to 17 inches per year. Vegetation includes pinyon, juniper, big sagebrush, cliffrose, Mormon tea, muttongrass, prairie junegrass, squirreltail, western wheatgrass, and blue grama. The soil temperature regime is mesic and the soil moisture regime is aridic ustic. At the upper end of this precipitation, it is not uncommon to find a surrounding of mesic ponderosa pine on north facing slopes opr large swales within the landscape, rock outcrop, and where more affective precipitation in the form of snow accumulates. 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.

Associated sites

DX035X02B611	**Clay Loam Upland 13-17" p.z. Gravelly (PIED, JUOS)** Found intermixed with the site.

F035XF613AZ	**Limestone Hills 13-17" p.z. (PIED, JUOS)** Found intermixed and/or towards the edge of cliffs.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata ssp. wyomingensis*
Herbaceous	(1) *Pascopyrum smithii* (2) *Bouteloua gracilis*

Physiographic features

The ecological site is located on fan terraces of undulating plateaus and on abandoned stream terraces that no longer benefit from moisture associated with the channel. The soil of the site is deep to very deep to any plant root restricting layer. The soil surface is generally gravelly clay loam. The subsurface horizons are clay loam and clay. The slope of the site generally ranges from 1 to 15 percent.

Table 2. Representative physiographic features

Landforms	(1) Plateau (2) Terrace (3) Fan
Flooding frequency	None
Ponding frequency	None
Elevation	1,768–2,225 m
Slope	1–15%
Aspect	Aspect is not a significant factor

Climatic features

The climate of this land resource unit is semiarid with warm summers and cool winters. The mean annual precipitation ranges from 13 – 17 inches, but it is very erratic, often varying substantially from year to year. The majority of the precipitation comes from October through April. This precipitation comes as gentle rain or snow from frontal storms coming out of the Pacific Ocean. Snow is common from November through February. Generally no more than a few inches of snow accumulates, melting within a few days, but may last a week or more. The remaining precipitation comes from July through September as spotty, unreliable and sometimes violent thunderstorms. The moisture for this precipitation originates in the Gulf of Mexico (and the Pacific Ocean in the fall) and flows into the area on the north end of the Mexican monsoon. Late May through late June is generally a dry period. The mean annual air temperature ranges from 47 to 49 degrees Fahrenheit (F). The frost-free period (air temperature > 32 degrees F) ranges from 113 to 144 days (@ 50 percent probability). Strong winds are common, especially in the spring.

Table 3. Representative climatic features

Frost-free period (average)	144 days
Freeze-free period (average)	160 days
Precipitation total (average)	432 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 clay loam 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

Soils are deep and very deep with surface textures ranging from fine sandy loam to clay loam and may have gravels to cobbles, too. Subsoil textures range from fine sandy loam to clay and there may be subsurface gravel or cobbles. Parent material is alluvium from metamorphic, igneous and sedimentary materials. Geologic formation is quaternary alluvium from Kaibab limestone, Frazier well gravel and Chinle formation. Available water capacity is high. Water erosion hazard is moderate to severe. Wind erosion hazard is slight to moderately high. Soils are non-saline, non-sodic with pH range of 6.1-8.4. Clay content ranges from 18 to 55%.

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

SSA-699 Hualapai-Havasupai Area: MU's 12, 27 Disterheff, 13 Jacques;

SSA-701 Grand Canyon Area MU 83 Disterheff;

SSA-712 Canyon de Chelly Area MU 3 Bayfield (family);

SSA-713 Chinle Area MU's 37 Pachic Haplustolls, 38 Pack, 53 Fikel;

SSA-715 Fort Defiance Area NM/AZ MU 78 Hosta.

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone and sandstone
Surface texture	(1) Gravelly loam (2) Fine sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Very slow to slow
Soil depth	152 cm
Surface fragment cover <=3"	0–40%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	17.78–25.4 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
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)	6.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–20%
Subsurface fragment volume >3" (Depth not specified)	0–10%

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

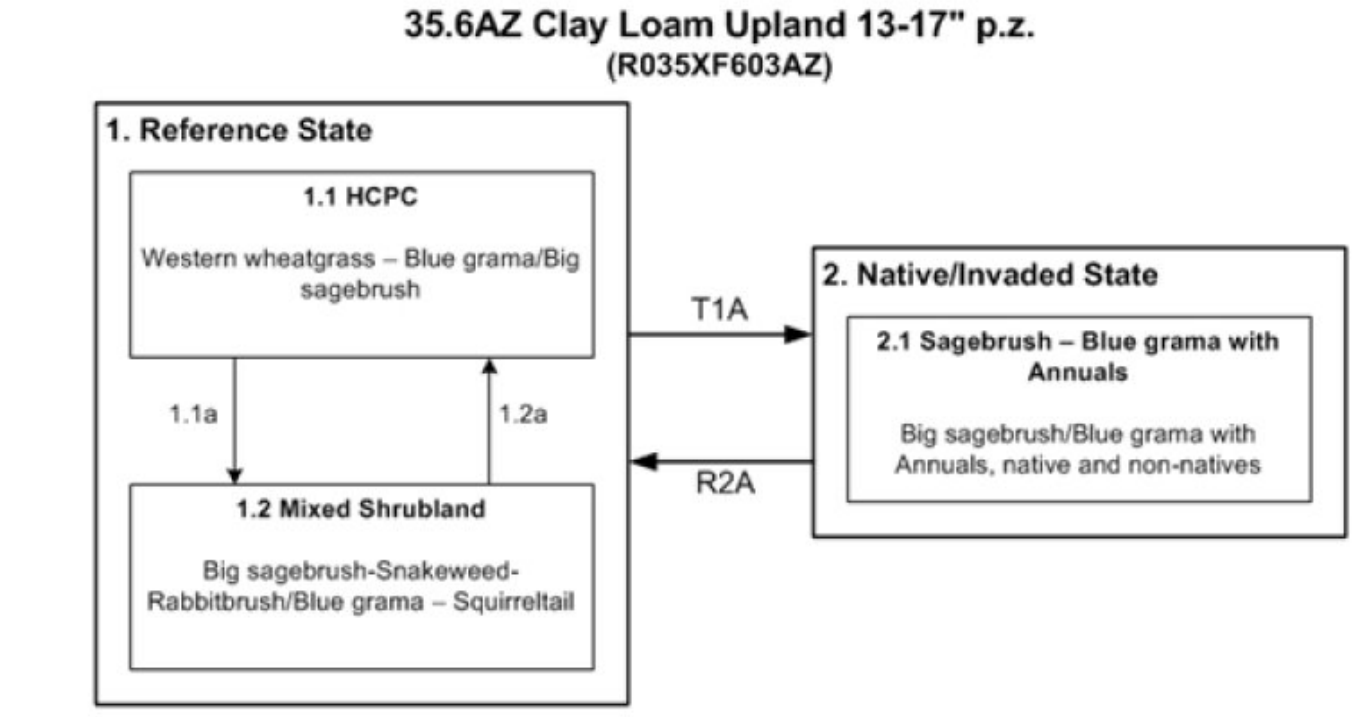

Figure 4. STM - R035XF603AZ

State 1
Reference State

The aspect of the reference state is a mixed grassland with scattered shrubs and a small percentage of forbs and few trees.

Community 1.1
Historic Climax Plant Community

The dominant aspect of the site is a grassland-shrub mix. Major grasses are western wheatgrass, bottlebrush squirreltail, blue grama and muttongrass. Wyoming big sagebrush or mountain big sagebrush is the major shrub. A few scattered Utah juniper may be present. With severe disturbance, Wyoming big sagebrush, mountain big sagebrush, broom snakeweed and fendler threeawn will increase; cheatgrass and annual weeds will invade.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	336	476	616
Shrub/Vine	112	191	269
Forb	11	34	56
Tree	6	28	45
Total	**465**	**729**	**986**

Table 6. Ground cover

Tree foliar cover	0-1%
Shrub/vine/liana foliar cover	0-1%
Grass/grasslike foliar cover	1-2%
Forb foliar cover	0%
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 7. Canopy structure (% cover)

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

Figure 6. Plant community growth curve (percent production by month). AZ3504, 35.3 10-14" p.z. bottlebrush squirreltail. Growth occurs in late winter, spring, and fall. Plants often remain green through the winter..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	5	15	35	25	10	0	0	5	5	0	0

Figure 7. Plant community growth curve (percent production by month). AZ3506, 35.6 13-17" p.z. blue grama. Growth occurs mostly in summer and early fall during the rainy season..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	10	15	25	30	15	0	0	0

Figure 8. Plant community growth curve (percent production by month). AZ3601, 35.6 13-17" p.z. western wheatgrass. Growth begins in the spring and continues into fall during the rainy season..

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

Figure 9. Plant community growth curve (percent production by month). AZ3602, 35.6 13-17" p.z. muttongrass. Most growth occurs in early to mid spring, plants may be green in the fall. Seed set occurs by summer..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	10	20	30	15	5	5	10	5	0	0

Figure 10. Plant community growth curve (percent production by month). AZ3603, 35.6 13-17" p.z. Wyoming big sagebrush. Most growth occurs in the summer. Seed set occurs in the fall..

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

Community 1.2
Mixed Shrubland

This plant community is characterized by a decline of perennial grasses and an increase of shrubs, especially half shrubs. There is a decline of grasses such as western wheatgrass, muttongrass, junegrass and a increase of blue grama, squirreltail and threeawns.

Pathway 1.1a
Community 1.1 to 1.2

Continuous wildlife/livestock grazing, drought, lack of fire

Pathway 1.2a
Community 1.2 to 1.1

Fire, Prescribed grazing or No grazing

State 2
Native/ Invaded State

The dominate aspect of this state is a shrubland with scattered short grasses. Dominate shrubs are big sagebrush and snakeweed with a understory of blue grama and a small percentage of native and non-native forbs.

Community 2.1
Sagebrush-Blue grama with Annuals

This plant community is characterized by a dominance of big sagebrush with blue grama and a small percentage of native and non-native annual grasses and forbs. These introduced annuals are not dominate, but are well established. Annuals can make up to 15% of the plant community composition.

Transition T1A
State 1 to 2

Establishment of non-native annual grasses and forbs. Continous heavy grazing. No fire. Big sagebrush invades the site and dominates the canopy. Lack of grass cover.

Restoration pathway R2A
State 2 to 1

This return pathway can occur through the reduction of the shrubs canopy either through fire, brush treatment (chemical/mechanical) and range planting, No grazing until grass recovery has occured.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Grasses**			336–616	
	western wheatgrass	PASM	*Pascopyrum smithii*	90–135	–
	blue grama	BOGR2	*Bouteloua gracilis*	90–135	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	45–90	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	45–90	–
	muttongrass	POFE	*Poa fendleriana*	45–90	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–28	–
	Fendler's threeawn	ARPUF	*Aristida purpurea var. fendleriana*	0–11	–
Forb					
2	**Forbs**			11–56	
	blue grama	BOGR2	*Bouteloua gracilis*	90–135	–
	Forb, perennial	2FP	*Forb, perennial*	11–22	–
	globemallow	SPHAE	*Sphaeralcea*	0–17	–
	Forb, annual	2FA	*Forb, annual*	0–17	–
	rose heath	CHER2	*Chaetopappa ericoides*	0–11	–
Shrub/Vine					
3	**Shrubs**			112–269	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	45–135	–
	muttongrass	POFE	*Poa fendleriana*	45–90	–
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	45–67	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	11–45	–
	southwestern rabbitbrush	CHPU4	*Chrysothamnus pulchellus*	11–28	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–28	–
	Fremont's mahonia	MAFR3	*Mahonia fremontii*	0–17	–
	longflower rabbitbrush	CHDE2	*Chrysothamnus depressus*	0–17	–
Tree					
4	**Trees**			6–45	
	prairie Junegrass	KOMA	*Koeleria macrantha*	45–90	–
	Utah juniper	JUOS	*Juniperus osteosperma*	6–45	–

Type locality

Location 1: Coconino County, AZ	
Township/Range/Section	T28 N. R8 W. S24
General legal description	Frazier Wells Quad. - Aubrey Valley area near Frazier Wells; Sec. 24, 25, and 36, T. 28 N., R. 8 W.; Hualapai Indian Reservation, Arizona

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.

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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)	Kevin Williams
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Date	04/10/2007
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None. Rills would not form due to gentle slopes (0-4%) and heavy vegetative cover.Runoff is medium.

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2. **Presence of water flow patterns:** None. Water patterns do not form due to gentle slopes (0-4%) and heavy vegetative cover. Runoff is medium.

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3. **Number and height of erosional pedestals or terracettes:** Some pedestals and terracette may form in areas where wind erosion potential is high, but would not form in most areas due to clay loamy and loamy soil surface textures.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground ranges from 20-40%. Available water capacity ranges from 9-11 inches, so this site has the potential to produce a high amount of plant cover.

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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):** Herbaceous and fine woody litter will be transported in water flow pathways. Coarse woody litter will remain under shrub and tree canopie.

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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):** Soil surface texture is usually clay loam bu may be a gravelly loam. Most soils have a moderate to very high shrink-swell property in the subsurface horizons. The presence of cracks could lead to low aggregate stability on the surface. When well vegetated these soils have a moderate to high resistance to both water and wind erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface structure is platy (moderate, thick) or granular (weak, fine). The thickness of the A-horizon is 3 inches. If is dark reddish brown in contrast to the horizon below it, which is reddish brown.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** This site is characterized by a relatively uniform distribution of mosly grasses and shrubs, with a few patches of trees in some areas. Canopy cover averages 25-50% (grasses > shrubs > forbs = trees). Basal cover averages 5-9% (grasses > shrubs > forbs > trees). Both cover values decrease during a prolonged drought. This type of plant community is only slightly effective at capturing and storing precipitation.

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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. aturally there would be no compaction layer, but these soils are easily compacted when wet and disturbed. Most of the soils may be easily compacted when wet due to the clay loam and clay textures, lack of rock ragments and occasional moisture from flooding. Most soils have a aturally granular surface structure.

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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: colonizing grasses >>

    Sub-dominant: shrubs > bunchgrasses > forbs > annual grasses

    Other:

    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 except during the most severe droughts. Severe winter drought affects shrubs and trees most. Severe summer drought affects grasses the most.

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14. **Average percent litter cover (%) and depth (in):** Of the litter amount, it would be expected that approximately 70-90%

would be herbaceous litter and approximately 10-30% would be woody litter. Litter amount increase durng the first few years of drought, then decrease in later years.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 400-650 lbs/ac dry years; 650-750 lbs/ac median years; 750-900 lbs/ac wet years.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Wyoming big sagebrush is native to the site and has the potenial to increase and dominate after heavy grazing and fire suppression. Broom snakeweed is native that has the potential to increase and dominate after a sagebrush fire and heavy grazing. Utah juniper is a native that may increase after heavy grazing and fire suppression. Cheatgrass is an exotic annual that is becoming endemic to the site regardless of management or fire frequency. It may become dominant after a sagebrush fire, even with conservative or no grazing.

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