USDA Natural Resources Conservation Service

Ecological site R035XY218UT
Semidesert Sandy Loam (Blackbrush)

Accessed: 04/19/2024

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.

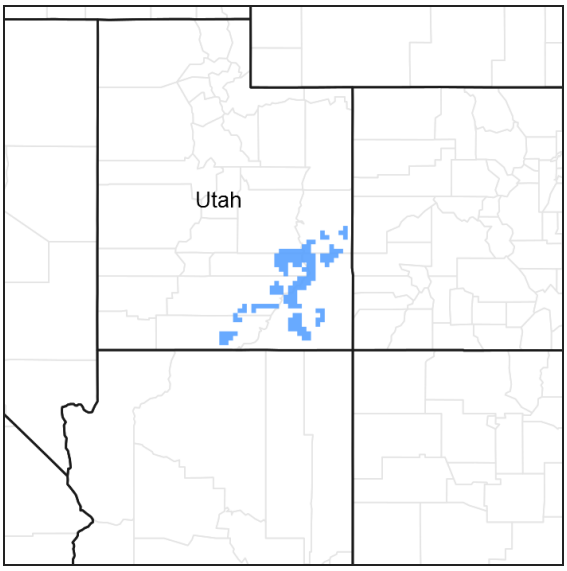


Figure 1. Mapped extent

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 the northern portion of MLRA 35, Colorado Plateau Province. It is found principally in the Canyon Lands and High Plateaus of Utah sections within that MLRA. This area has been stucturally uplifted over time while rivers flowing across it were cutting down into its bedrock. Areas of shale, sandstone, limestone, dolomite, and volcanic rock outcrop are found throughout the region.

Classification relationships

Semiarid Benchlands and Canyonlands, 20-c and Arid Canyonlands, 20-d. (Woods et al. 2001)

Colorado Plateau Semidesert Province (arid grassland zone), 313. (Baily 1995)

Associated sites

R035XY203UT	**Semidesert Bouldery Fan (Blackbrush)**
R035XY212UT	**Semidesert Sand (Fourwing Saltbush)**
R035XY215UT	**Semidesert Sandy Loam (4-Wing Saltbush)**

R035XY217UT	**Semidesert Sandy Loam (Spiny Hopsage)**
R035XY233UT	**Semidesert Shallow Sandy Loam (Blackbrush)**
R035XY236UT	**Semidesert Shallow Sandy Loam (Utah Juniper, Blackbrush)**
R035XY243UT	**Semidesert Stony Loam (Blackbrush)**

Similar sites

R035XY210UT	**Semidesert Sand (Blackbrush)** This site is very similar to site R035XY218UT; however it's soils will be sandier in the subsurface than soils associated with the sandy loam blackbrush site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Coleogyne ramosissima*
Herbaceous	(1) *Achnatherum hymenoides*

Physiographic features

This site occurs on pediments, structural benches, cuestas, hillslopes, mesas, ridges, alluvial fans, fan terraces, and plateaus. Elevations range from 4,300 to 7,300 feet. Run off is low and can be influenced by site micro-topography. This sites slopes typically range from 2-10% but it has been mapped on slopes up to 30%.

Table 2. Representative physiographic features

Landforms	(1) Mesa (2) Structural bench (3) Ridge
Flooding frequency	None
Ponding frequency	None
Elevation	4,300–7,300 ft
Slope	2–10%
Ponding depth	0 in
Water table depth	0 in
Aspect	Aspect is not a significant factor

Climatic features

The climate is characterized by hot summers and cool winters which can be slightly modified by local topographic conditions, such as aspect. Large fluctuations in daily temperature are common. The wettest months include July thru October and the dryest December thru February and June. Precipitation is variable from month to month and from year to year but averages between 9-11 inches. Snow packs are generally light and not persistent. (Utah Climate Summaries 2008)

Table 3. Representative climatic features

Frost-free period (average)	160 days
Freeze-free period (average)	150 days
Precipitation total (average)	11 in

Influencing water features

There are no water features influencing this site.

Soil features

The soils on this site range from moderately deep to very deep are moderately to well developed, they are well drained. The dry surface color varies from yellowish red to reddish brown to brown. Runoff is typically slow but can be higher on some soils, permeability is moderate to rapid. Soils on the sites in the reference state generally have moderate wind and water erosion potential. Coppice mounding is common. The soil temperature and moisture regimes are mesic and ustic aridic respectively.

Surface and subsurface textures are generally sandy loams, sands, and loamy sands. Soils are nonsaline and the water holding capacity is moderate. Surface rock fragments are rare, however where they do occur, they may show evidence of calcium deposits (small whiteish nodules).

Biological crust cover is characterized as weak, with light cyanobacteria and/or isolated moss clumps present with no continuity, or isolated pinnacles of lichen and moss with little continuity. In disturbed areas, rodent activity, water flow patterns, and blowout areas are more common. Utah juniper can invade this site and can create blowout areas. This site has been used in the following soils surveys and has been correlated to the following components:

UT624 – Grand County – Factory
UT631 – Henery Mountains Area – Factory, Milok, Bowdish
UT633 – Canyonlands Area – Newsrock
UT638 – San Juan County, Central – Milok
UT685 – Capital Reef National Park – Anasazi;
UT686 – Escalante Grand Staircase National Monument – Milok

Typical Soil Profile: (needs to change—same as 215)
A--0-4 inches; loamy fine sand; slightly calcareous; moderately alkaline
Bw--4-12 inches; loamy fine sand; slightly calcareous; moderately alkaline
Bk1--12-25 inches; fine sandy loam; strongly calcareous; moderately alkaline
Bk2--25-47 inches; fine sandy loam; strongly calcareous; moderately alkaline
C--47-60+ inches; gravelly loamy sand; slightly calcareous; moderately alkaline

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone (2) Residuum–sandstone and shale (3) Eolian deposits–sandstone and siltstone
Surface texture	(1) Sandy loam (2) Fine sand (3) Fine sandy loam
Family particle size	(1) Sandy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Very slow to rapid
Soil depth	20–60 in
Surface fragment cover <=3"	0–20%
Surface fragment cover >3"	0–5%
Available water capacity (0-40in)	3–4.6 in
Calcium carbonate equivalent (0-40in)	0–35%
Electrical conductivity (0-40in)	0–4 mmhos/cm

Sodium adsorption ratio (0-40in)	0–5
Soil reaction (1:1 water) (0-40in)	7.4–9
Subsurface fragment volume <=3" (Depth not specified)	0–30%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

This ecological site developed under Major Land Resource Area (MLRA) 35—The Colorado Plateau climatic conditions and included the natural influences of herbivory, fire and climate. This site occurs on the moderately deep to very deep, moderately developed soils. This sites plant species composition is generally dominated by blackbrush, however, native grasses and forbs are also commonly present on several community phases. Utah juniper (0-5% canopy cover) can be found invading on the moderately deep soil components of this site when it is in close proximity to a juniper ecological site.

An important natural disturbance regime consisted of infrequent fires that were likely ignited by both natural causes and Native Americans. When fire starts in this blackbrush community, it can spread easily when the right conditions are present due to the dense, close spaced nature of blackbrush. There are typically few forbs or grasses to provide fine fuels needed to carry fire in these communities, but it is still able to burn during extreme conditions such as high temperature, high wind velocity, and low relative humidity. Fire is more common in moister years when annual production of grasses of forbs is highest. Blackbrush communities have the highest cover of any desert shrub community, and fires typically result in stand replacement. Though historical documentation of fire return intervals are lacking, the historical fire regime is estimated to be from 35-100+ years (Anderson, 2001).

Another natural disturbance mechanism consists of fluctuating weather which can influence this sites soil/water/vegetation relationships. This fluctuation can facilitate the sites transition into different plant communities phases or cause the transition from one ecological state to another, depending on severity and duration.

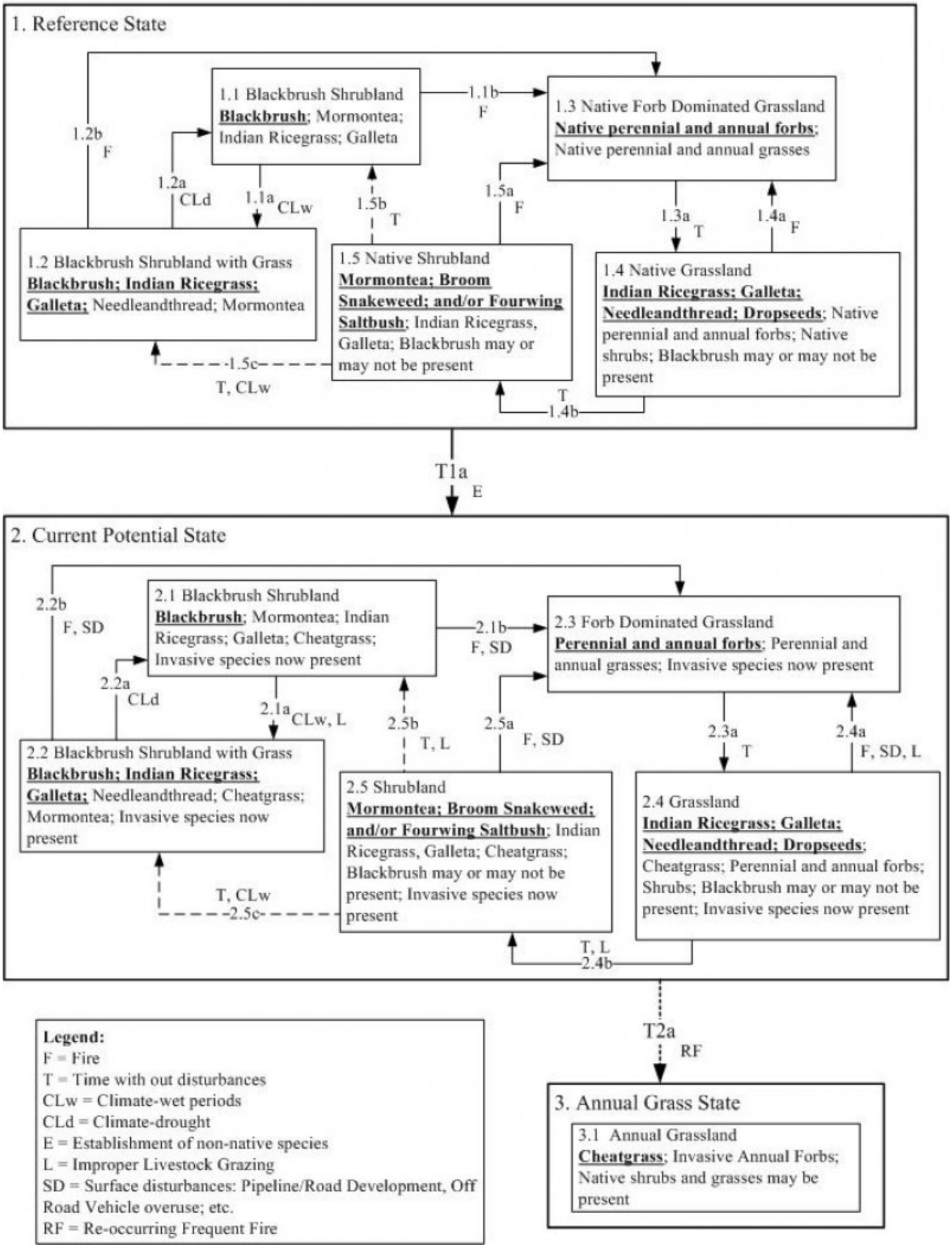
This ecological site has been grazed by domestic livestock since they were first introduced into the area, however, it is highly resistant to grazing due to the unpalatable nature of blackbrush. Therefore they have only minimally influenced the historic disturbance regime associated with this site. Improperly managed livestock grazing (continuous season long grazing, heavy stocking rates, etc.) over long periods of time however, may cause this site to depart from the reference plant community. When this occurs, native perennial grasses may decrease, allowing blackbrush increase in density often forming pure stands. Improper livestock grazing may also increase the chance of invasion by cheatgrass and invasive annual forbs however these species rarely increase to a point where they dominate in blackbrush communities.

As vegetative communities respond to changes caused by natural occurrences that allow them to cross ecological thresholds, a return to previous states may not be possible without major energy inputs. The amount of energy input needed to affect desired vegetative shifts depends on the present biotic and abiotic features and the desired results

The following State and Transition diagram depicts the most commonly occurring plant communities found on this ecological site. It does not necessarily depict all the plant communities that can occur, but it does show the most prevalent and repeatable. As more data are collected, some of these plant communities will be revised or removed, and new ones may be added. These plant communities capture the current knowledge and experience at the time of this revision. This model was developed using range data collected in 2006 and 2007 in Arches and Canyonlands National Park in Southeastern Utah. Both ocular and measured data was collected and utilized.

State and transition model

R035XY218UT—Semidesert Sandy Loam (Blackbrush)



State 1
Reference State

This Reference State was determined by the study of rangeland relic areas and areas protected from excessive disturbance and influences such as improper livestock grazing and high impact recreation. Literature reviews, historical accounts and observations of trends in plant community dynamics under a variety of sites has also been considered. Community phases, community pathways, other states, transitions, and thresholds, have been determined through similar studies and experience. The reference state represents the plant communities and ecological dynamics of the semidesert sandy loam, blackbrush site. This state includes the biotic communities that become established on the ecological site if all successional sequences are completed under the natural disturbance regime. The reference state is generally dominated by blackbrush, however depending on disturbance history, native grasses, forbs, or other shrubs may dominate the site. Utah juniper can naturally invade on the moderately deep soil components when the site is in close proximity to a juniper dominated ecological site. Due to the ability of Utah juniper to out compete other understory species on this site, blowout areas are common where this species occurs. Primary disturbance mechanisms include infrequent fire, climate fluctuations, and native herbivore grazing. The timing of these natural disturbances dictates the ecological dynamics that can occur. The reference state is self sustaining and resistant to change due to high resistance to natural disturbances and high resilience following natural disturbances. When these natural disturbances occur, the rate of recovery is quite variable depending on disturbance intensity. The reference state will naturally fluctuate between community phases 1.1 and 1.2, however once these sites are disturbed by fire, a return to these community phases may not be possible. Reference State: Plant communities influenced by infrequent fire, native herbivore grazing, and climate fluctuations. Indicators: A community dominated by blackbrush where native perennial grasses and forbs may also be present. Feedbacks: Natural fluctuations in climate that allow for a self sustaining blackbrush and native grass community. Stand replacing fires which may or may not fully recover to a blackbrush dominated community. Improper livestock grazing, more frequent fire, or other disturbance that may allow for the establishment of non-native species. At-risk Community Phase: All communities are at risk when native plants are stressed and nutrients become available for invasive plants to establish. Trigger: The establishment of non-native invasive plant species.

Community 1.1
Blackbrush Shrubland

Figure 4. Blackbrush Shrubland.

This community phase is generally represented by a pure stand of blackbrush, where trace occurrences of mormontea, Indian ricegrass, and James galleta are present, but not to exceed 10% canopy. Other perennial grasses, shrubs, and forbs may also be present and cover is variable. Bare ground varies between 10-50% depending on the amount of biological crust cover present which can range between 5-50%, and surface rock fragments of 0-20%. Biological crusts can occur on some sites as vary light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to sites with a dominance of lichen and moss pinnacles in the plant interspaces and cyanobacteria in the pinnacle interspaces. The following tables provide a typical example of the vegetative floristics of a community phase 1.1 plant community.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	150	200	250
Grass/Grasslike	40	80	120
Forb	25	50	100
Tree	0	5	10
Total	**215**	**335**	**480**

Table 6. Ground cover

Tree foliar cover	0-5%
Shrub/vine/liana foliar cover	20-40%
Grass/grasslike foliar cover	5-10%
Forb foliar cover	2-30%
Non-vascular plants	0%
Biological crusts	10-50%
Litter	5-10%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	10-45%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-5%	0-5%
>0.5 <= 1	–	5-10%	5-10%	5-10%
>1 <= 2	–	20-35%	0-5%	5-10%
>2 <= 4.5	0-5%	5-10%	0-5%	0-5%
>4.5 <= 13	0-5%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.2
Blackbrush Shrubland with Grass

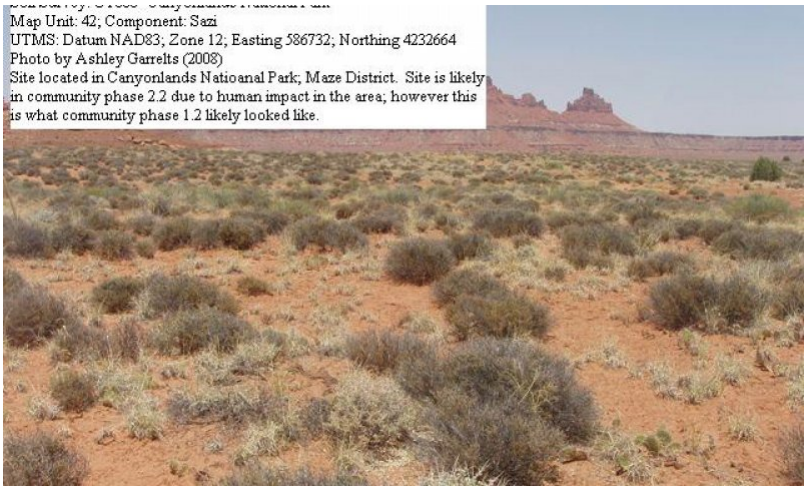


Figure 6. Blackbrush with Grass.

This community phase is characterized by a shrub canopy dominated by blackbrush, perennial native grasses are also present make up more that 10% canopy cover. Commonly seen grasses include Indian ricegrass, James galleta, needleandthread, six weeks fescue, and dropseeds, with many occurring solely in the shrub canopy. As grass cover increases up to 40% canopy cover, shrub interspaces are often filled. Other perennial grasses, shrubs, and forbs may also be present and cover is variable. Bare ground, rock fragments, and biological crust cover are very similar to community phase 1.1 in their variability and responses to each other. The following tables provide a typical example of the vegetative floristics of a community phase 1.2 plant community.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	100	200	300
Shrub/Vine	150	200	250
Forb	25	50	100
Tree	0	5	10
Total	**275**	**455**	**660**

Table 9. Ground cover

Tree foliar cover	0-5%
Shrub/vine/liana foliar cover	20-35%
Grass/grasslike foliar cover	10-40%
Forb foliar cover	2-10%
Non-vascular plants	0%
Biological crusts	10-50%
Litter	2-10%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	10-45%

Table 10. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-5%	0-5%
>0.5 <= 1	–	5-10%	5-10%	0-5%
>1 <= 2	–	20-35%	10-25%	5-10%
>2 <= 4.5	0-5%	5-10%	0-5%	–
>4.5 <= 13	0-5%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.3
Native Forb Dominated Grassland

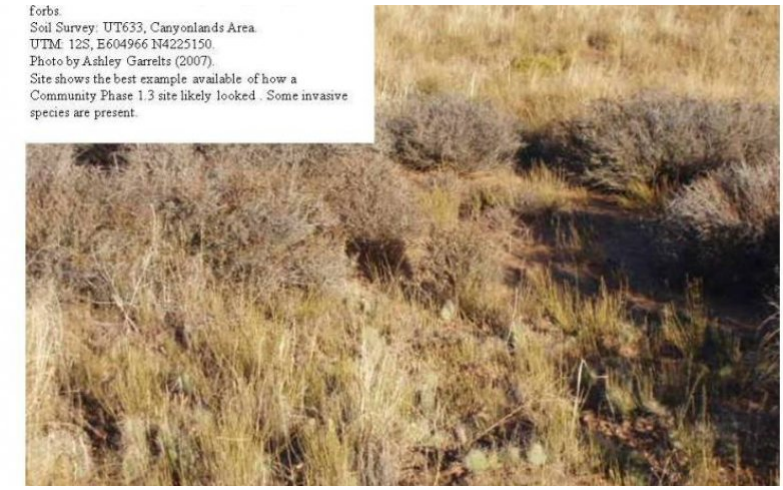


Figure 8. Native forb dominated grassland.

This community phase is characterized by a dominance of native perennial and annual forbs with some occurrence of native perennial and annual grasses. The species present greatly depend on site location and available seed source. Commonly seen forbs may include globemallow, buckwheat species, cryptantha, twinpod, scorpion weed, beakpod, and native mustards. Commonly seen grasses include James galleta, Indian ricegrass, needleandthread, and dropseeds. Bare ground is more common in this community phase, while biological crust cover decreases due to fire damage, recovery however is possible over time. Length of recovery time highly dependent upon the severity of the fire. Low-intensity fires do not remove all of the structure, which allows for faster re-establishment. Shrubs presence such as blackbrush increase fire intensity, which causes more damage to the biological crusts and lengthens the recovery period (USGS, 2006). Surface rock fragments remain similar to the previous two phases. The following tables provide a typical example of the vegetative floristics of a community phase 1.3 plant community.

Table 11. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Forb	150	200	250
Grass/Grasslike	50	100	150
Shrub/Vine	0	25	50
Total	**200**	**325**	**450**

Table 12. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-5%
Grass/grasslike foliar cover	10-25%
Forb foliar cover	30-50%
Non-vascular plants	0%
Biological crusts	2-25%
Litter	10-15%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	25-50%

Table 13. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-5%	5-10%
>0.5 <= 1	–	0-5%	5-10%	10-25%
>1 <= 2	–	0-5%	5-10%	10-25%
>2 <= 4.5	–	–	0-5%	0-5%
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.4
Native Grassland

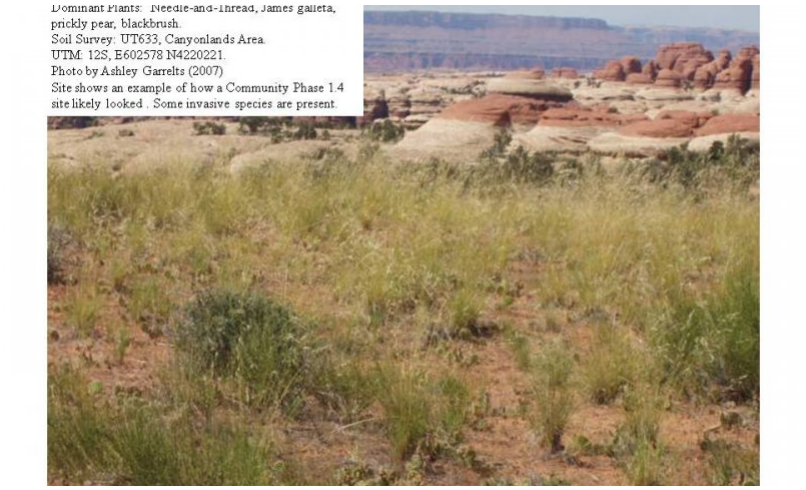


Figure 10. Native grassland.

This community phase is characterized by the dominance of native perennial grasses, with some occurrence of native perennial and annual forbs. Native perennial shrubs are entering the system and some blackbrush may be present. Blackbrush recovery is variable between sites. Some sites recover relatively quickly and blackbrush makes up a large portion of the canopy while on other sites recovery takes considerably longer (Callison, 1985 and West, 1983). Commonly occurring grasses include Indian ricegrass, James galleta, needle-and-thread, and

dropseed species. Biological soil crusts are beginning to recover and bare ground is decreasing, however cover is variable as in community phases 1.1 and 1.2. Surface rock fragments remain similar to the previous phases. The following tables provide a typical example of the vegetative floristics of a community phase 1.4 plant community.

Table 14. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	150	200	250
Forb	100	150	200
Shrub/Vine	0	25	50
Total	**250**	**375**	**500**

Table 15. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-5%
Grass/grasslike foliar cover	25-50%
Forb foliar cover	15-25%
Non-vascular plants	0%
Biological crusts	5-25%
Litter	10-15%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	25-50%

Table 16. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-5%	5-10%
>0.5 <= 1	–	0-5%	10-25%	10-15%
>1 <= 2	–	0-5%	10-25%	5-10%
>2 <= 4.5	–	–	5-10%	0-5%
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.5
Native Shrubland

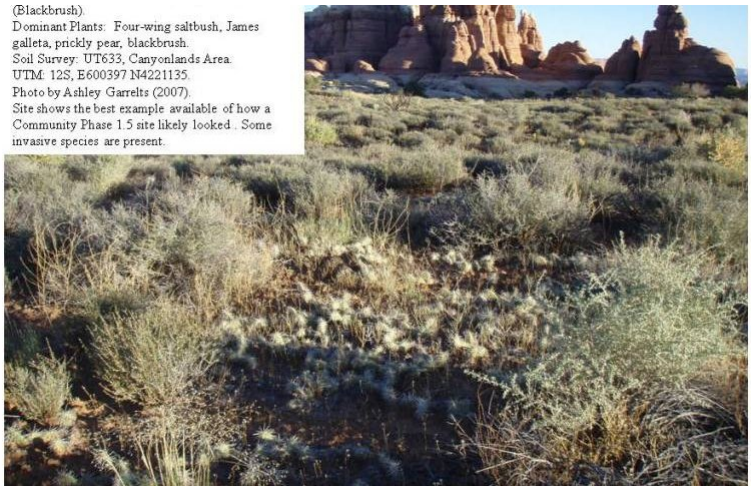


Figure 12. Native shrubland.

This community phase is characterized by a dominance of native perennial shrubs, blackbrush may also be present. The recovery of blackbrush is variable (Callison, 1985 and West, 1983), however native shrub recovery is relatively rapid (Callison, 1985). Commonly occurring shrubs include mormon tea, broom snakeweed, fourwing saltbush, and Thompson smokebush. The presence of these shrubs is highly dependent upon seed source and site location. Native perennial and annual grasses and forbs are also present but do not dominate the site. Commonly found grasses include Indian ricegrass and James galleta. Biological crust cover is typically recovering and cover is reaching pre-burn density. Bare ground is decreasing, and is similar to community phases 1.1 and 1.2. Surface rock fragments remain similar to the previous phases. The following tables provide a typical example of the vegetative floristics of a community phase 1.5 plant community.

Table 17. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	150	200	250
Grass/Grasslike	40	80	120
Forb	25	50	100
Tree	0	5	10
Total	**215**	**335**	**480**

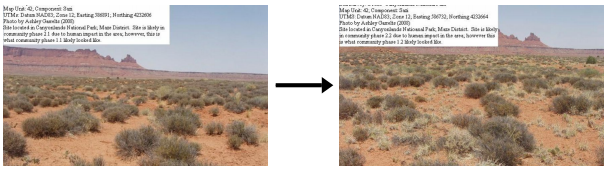
Table 18. Ground cover

Tree foliar cover	0-5%
Shrub/vine/liana foliar cover	20-40%
Grass/grasslike foliar cover	5-10%
Forb foliar cover	5-30%
Non-vascular plants	0%
Biological crusts	10-50%
Litter	5-10%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	10-45%

Table 19. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-5%	0-5%
>0.5 <= 1	–	5-10%	5-10%	5-10%
>1 <= 2	–	20-35%	0-5%	5-10%
>2 <= 4.5	0-5%	5-10%	0-5%	0-5%
>4.5 <= 13	0-5%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Pathway 1.1a
Community 1.1 to 1.2

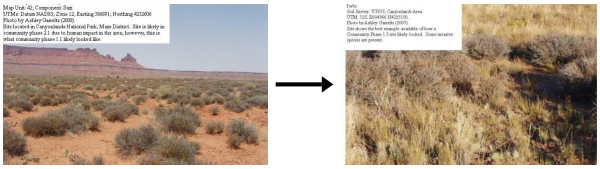


Blackbrush Shrubland

Blackbrush Shrubland with Grass

This pathway occurs when wetter than normal weather favors native perennial grass establishment, with minimal loss of the blackbrush canopy.

Pathway 1.1b
Community 1.1 to 1.3

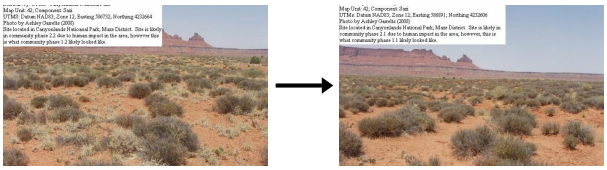


Blackbrush Shrubland

Native Forb Dominated Grassland

This pathway occurs when a fire or other natural disturbance removes blackbrush and allows for the establishment of native annual and perennial forbs and grasses.

Pathway 1.2a
Community 1.2 to 1.1

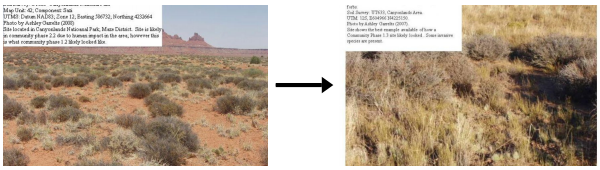


Blackbrush Shrubland with Grass

Blackbrush Shrubland

This pathway occurs when drier than normal weather patterns cause a decrease in the grass canopy, with little change in the blackbrush canopy.

Pathway 1.2b
Community 1.2 to 1.3



Blackbrush Shrubland with Grass

Native Forb Dominated Grassland

This pathway occurs when fire or other natural disturbance removes blackbrush and allows for the establishment of native annual and perennial forbs and grasses.

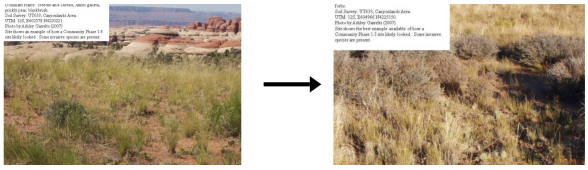
Pathway 1.3a
Community 1.3 to 1.4

Native Forb Dominated Grassland

Native Grassland

This pathway follows the natural succession of the blackbrush ecosystem after a fire. Native perennial grasses become more dominant, while native annual and perennial forbs become sub- dominant.

Pathway 1.4a
Community 1.4 to 1.3



Native Grassland

Native Forb Dominated Grassland

This pathway occurs when fire or other natural disturbance removes the grass canopy and allows for the dominance of native annual and perennial forbs.

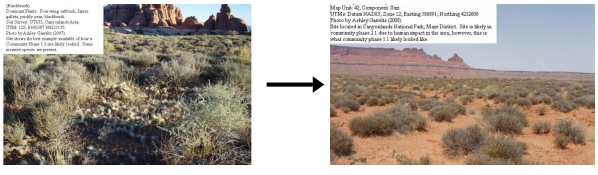
Pathway 1.4b
Community 1.4 to 1.5

Native Grassland

Native Shrubland

This pathway follows the natural succession of a blackbrush ecosystem after a fire. Native perennial shrubs become more dominant, while native annual and perennial grasses and forbs become less dominant.

Pathway 1.5b
Community 1.5 to 1.1



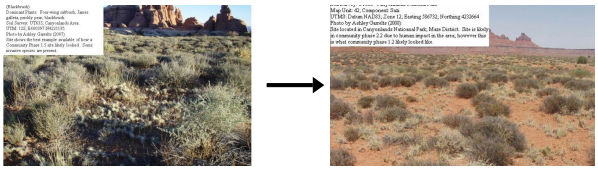
Native Shrubland

Blackbrush Shrubland

This pathway follows the natural succession of a blackbrush ecosystem after a fire. Blackbrush becomes dominant

while other plant species decrease to pre-burn levels. This pathway may take hundreds of years to accomplish and may not happen within management timeframes.

Pathway 1.5c
Community 1.5 to 1.2



Native Shrubland

Blackbrush Shrubland with Grass

This pathway follows the natural succession of a blackbrush ecosystem after a fire. Blackbrush becomes dominant while other plant species decrease to pre-burn levels. This pathway is typically accompanied by wetter than normal weather periods that allows for the continued establishment of native perennial grasses. This pathway may take hundreds of years to accomplish and may not happen within management timeframes.

Pathway 1.5a
Community 1.5 to 1.3

Native Shrubland

Native Forb Dominated Grassland

This pathway occurs when fire or other natural disturbance removes the shrub canopy and allows for the establishment of native annual and perennial forbs and grasses.

State 2
Current Potential State

The current potential state is similar to the reference state except that non-native, invasive species are now present in all community phases. This state is generally dominated by blackbrush, however, depending on disturbance history, native grasses, forbs, and/or other shrubs may dominate the site. Utah juniper can invade this state on the moderately deep soil components when the site is in close proximity to a juniper dominated ecological site. Due to Utah junipers ability to out compete associated understory plants, blowout areas are common where this species occurs. Primary disturbance mechanisms include infrequent fire, weather fluctuations, native herbivore grazing, domestic livestock grazing and surface disturbances such as road and pipeline development and off road vehicle (OHV) use. Timing of these disturbances dictates the ecological dynamics that will occur. The current potential state is still self sustaining; but is losing resistant to change due to lower resistance to disturbances and lower resilience following disturbances. When disturbances do occur, the rate of recovery is highly variable depending on severity. The current potential state will naturally fluctuate between community phases 2.1 and 2.2, however once the site is disturbed by fire or other surface disturbance, return to these community phases may not be possible. Current Potential State: Plant communities influenced by infrequent fire, native herbivore grazing, climate fluctuations, domestic livestock grazing, and other surface disturbances. Indicators: A community dominated by blackbrush where native perennial grasses and forbs may also be present. Non-native invasive grasses and forbs are now present. Feedbacks: Natural fluctuations in weather that allow for self sustaining blackbrush and grass communities. Improper livestock grazing which results in a decrease of the perennial grass canopy. Stand replacing fires, or other surface disturbances, which remove blackbrush and sites may or may not fully return to a blackbrush dominated community. Frequent fire or other disturbance that may allow for the dominance of annual grasses, such as cheatgrass. At-risk Community Phase: All communities are at risk as increased disturbance frequency allows for the dominance of annual grasses, such a cheatgrass. Trigger: Reoccurring fire that results in a dominance of cheatgrass.

Community 2.1
Blackbrush Shrubland

Figure 14. Blackbrush shrubland.

This community phase is generally represented by a nearly pure stand of blackbrush, trace amounts of mormon tea, Indian ricegrass, James galleta, and cheatgrass are present but do not exceed 10% canopy cover. Other grasses, shrubs, and forbs may also be present and cover is variable. Bare ground varies from 10 to 50% depending on the amount of biological crust cover present which can range from 5 to 50% and surface rock fragments which range from 0 to 20%. Biological crusts can occur on some sites as vary light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to sites with a dominance of lichen and moss pinnacles in the plant interspaces and cyanobacteria in the pinnacle interspaces. The following tables provide a typical example of the vegetative floristics of a community phase 2.1 plant community.

Table 20. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	150	200	250
Grass/Grasslike	40	80	120
Forb	25	50	100
Tree	0	5	10
Total	**215**	**335**	**480**

Table 21. Ground cover

Tree foliar cover	0-5%
Shrub/vine/liana foliar cover	20-40%
Grass/grasslike foliar cover	5-10%
Forb foliar cover	5-30%
Non-vascular plants	0%
Biological crusts	10-50%
Litter	5-10%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	10-45%

Table 22. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-5%	0-5%
>0.5 <= 1	–	5-10%	5-10%	5-10%
>1 <= 2	–	20-35%	0-5%	5-10%
>2 <= 4.5	0-5%	5-10%	0-5%	0-5%
>4.5 <= 13	0-5%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 2.2
Blackbrush Shrubland with Grass

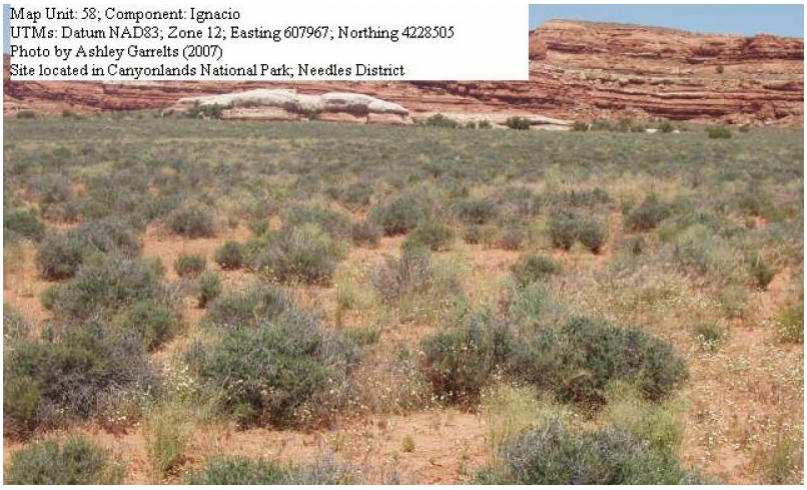


Figure 16. Blackbrush with grass.

This community phase is characterized by a blackbrush shrub canopy, grasses are also present makeup over 10% canopy cover. Commonly occurring grasses include Indian ricegrass, James galleta, needle-and-thread, six weeks fescue, dropseed species, and cheatgrass, with many occurring solely in the shrub canopy. As grass cover increases up to 40% canopy cover, shrub interspaces are filled. Other grasses, shrubs, and forbs may also be present and cover is variable. Bare ground, rock fragments, and biological crust cover are very similar to community phase 1.1 in their variability and responses to each other. The following tables provide a typical example of the vegetative floristics of a community phase 2.2 plant community.

Table 23. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	100	200	300
Shrub/Vine	150	200	250
Forb	25	50	100
Tree	0	5	10
Total	**275**	**455**	**660**

Table 24. Ground cover

Tree foliar cover	0-5%

Shrub/vine/liana foliar cover	20-35%
Grass/grasslike foliar cover	10-40%
Forb foliar cover	2-10%
Non-vascular plants	0%
Biological crusts	10-50%
Litter	2-10%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	10-45%

Table 25. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-5%	0-5%
>0.5 <= 1	–	5-10%	5-10%	0-5%
>1 <= 2	–	20-35%	10-25%	5-10%
>2 <= 4.5	0-5%	5-10%	0-5%	–
>4.5 <= 13	0-5%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 2.3
Forb Dominated Grassland

Figure 18. Forb Dominated Grassland

This community phase is characterized by a dominance of perennial and annual forbs with some occurrence of perennial and annual grasses. The presences of specific species greatly depend on area and seed source. Commonly occurring forbs may include globemallow, buckwheat species, cryptantha, twinpod, scorpion weed, beakpod, and native mustards. Commonly occurring grasses include galleta, Indian ricegrass, needle-and-thread, dropseed species, and cheatgrass Bare ground is more common in this community phase, while biological crust cover decreases, however recovery is possible over time. Length of recovery is highly dependent upon the type and

severity of the disturbance. Low-intensity disturbances that do not remove all of the site vegetative structure, allows for faster re-establishment while hgh intensity disturbances lengthen the recovery period (USGS, 2006). Surface rock fragments remain similar to the previous two phases. The following tables provide a typical example of the vegetative floristics of a community phase 2.3 plant community.

Table 26. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Forb	150	200	250
Grass/Grasslike	50	100	150
Shrub/Vine	0	25	50
Total	**200**	**325**	**450**

Table 27. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-5%
Grass/grasslike foliar cover	10-25%
Forb foliar cover	30-50%
Non-vascular plants	0%
Biological crusts	5-25%
Litter	10-15%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	25-50%

Table 28. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-5%	5-10%
>0.5 <= 1	–	0-5%	5-10%	10-25%
>1 <= 2	–	0-5%	5-10%	10-25%
>2 <= 4.5	–	–	0-5%	0-5%
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 2.4
Grassland

Figure 20. Grassland

This community phase is characterized by a dominance of grasses, with some occurrence of perennial and annual forbs. Shrubs are re-entering the system and blackbrush may or may not be present. Blackbrush recovery is variable between sites. Some sites recover relatively quickly, and blackbrush makes up a large portion of the canopy, while other sites take considerably longer it's re-establishment (Callison, 1985 and West, 1983). Commonly occurring grasses include Indian ricegrass, James galleta, needle-and-thread, dropseed species, and cheatgrass. Biological soil crusts are beginning to recover and bare ground is decreasing; however cover is variable similar to community phases 2.1 and 2.2. Surface rock fragments also remain similar to the previous phases. The following tables provide a typical example of the vegetative floristics of a community phase 2.4 plant community.

Table 29. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	150	200	250
Forb	100	150	200
Shrub/Vine	0	25	50
Total	**250**	**375**	**500**

Table 30. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-5%
Grass/grasslike foliar cover	25-50%
Forb foliar cover	15-25%
Non-vascular plants	0%
Biological crusts	5-25%
Litter	10-15%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	25-50%

Table 31. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-5%	5-10%
>0.5 <= 1	–	0-5%	10-25%	10-15%
>1 <= 2	–	0-5%	10-25%	5-10%
>2 <= 4.5	–	–	5-10%	0-5%
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 2.5
Shrubland

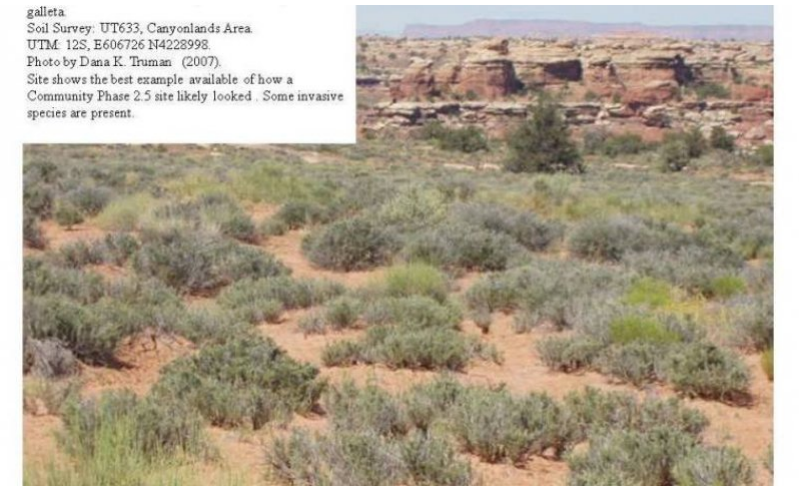


Figure 22. Shrubland

This community phases is characterized by a dominance of mixed shrubs, blackbrush may also be present. The recovery of blackbrush on this site is variable (Callison, 1985 and West, 1983) however, shrub recovery in general is relatively rapid (Callison, 1985). Commonly occurring shrubs include mormon tea, broom snakeweed, fourwing saltbush, and/or Wyoming big sagebrush. The presence of these shrubs is highly dependent upon available seed sources and site location. Perennial and annual grasses and forbs are present, but no longer dominate the site. Commonly seen grasses include Indian ricegrass, James galleta, and cheatgrass. Biological crust cover is typically still recovering and cover is reaching pre-burn density. Bare ground is decreasing and is similar to community phases 2.1 and 2.2. Surface rock fragments remain similar to the previous phases. The following tables provide a typical example of the vegetative floristics of a community phase 2.5 plant community.

Table 32. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	150	200	250
Grass/Grasslike	40	80	120
Forb	25	50	100
Tree	0	5	10
Total	**215**	**335**	**480**

Table 33. Ground cover

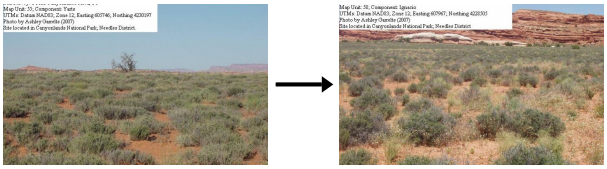
Tree foliar cover	0-5%

Shrub/vine/liana foliar cover	20-40%
Grass/grasslike foliar cover	5-10%
Forb foliar cover	5-30%
Non-vascular plants	0%
Biological crusts	10-50%
Litter	5-10%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	10-45%

Table 34. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-5%	0-5%
>0.5 <= 1	–	5-10%	5-10%	5-10%
>1 <= 2	–	20-35%	0-5%	5-10%
>2 <= 4.5	0-5%	5-10%	0-5%	0-5%
>4.5 <= 13	0-5%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Pathway 2.1a
Community 2.1 to 2.2



Blackbrush Shrubland

Blackbrush Shrubland with Grass

This pathway occurs as wetter than normal weather patterns favor grass establishment, with minimal loss of the blackbrush canopy.

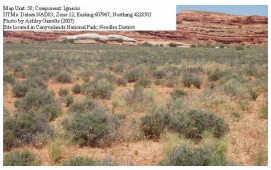
Pathway 2.1b
Community 2.1 to 2.3

Blackbrush Shrubland

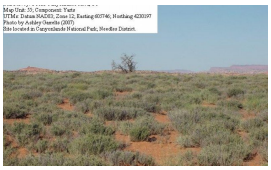
Forb Dominated Grassland

This pathway occurs when fire or other surface disturbance removes blackbrush and allows for the establishment of annual and perennial forbs and grasses.

Pathway 2.2a
Community 2.2 to 2.1



Blackbrush Shrubland with Grass



Blackbrush Shrubland

This pathway occurs as drier than normal weather patterns and improper livestock grazing cause a decrease in the grass canopy, with little change in the blackbrush canopy.

Pathway 2.2b
Community 2.2 to 2.3

Blackbrush Shrubland with Grass

Forb Dominated Grassland

This pathway occurs when a fire or other surface disturbance removes blackbrush and allows for the establishment of annual and perennial forbs and grasses.

Pathway 2.3a
Community 2.3 to 2.4

Forb Dominated Grassland

Grassland

This pathway follows the natural succession of a blackbrush ecosystem after fire. Grasses become more dominant, while annual and perennial forbs become less dominant.

Pathway 2.4a
Community 2.4 to 2.3

Grassland

Forb Dominated Grassland

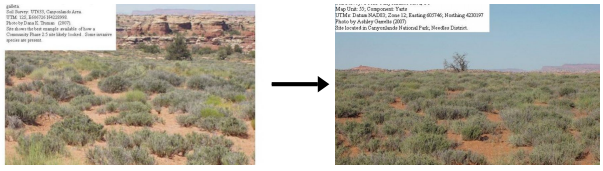
This pathway occurs when fire, improper livestock grazing or other surface disturbance removes the grass canopy and allows for the dominance of annual and perennial forbs.

Pathway 2.4b
Community 2.4 to 2.5

Grassland **Shrubland**

This pathway follows the natural succession of a blackbrush ecosystem after a fire but may also be caused by improper livestock grazing. Shrubs become more dominant, while annual and perennial grasses and forbs become less dominant.

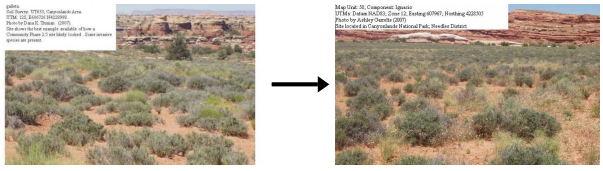
Pathway 2.5b
Community 2.5 to 2.1



Shrubland **Blackbrush Shrubland**

This pathway follows the natural succession of a blackbrush ecosystem after a fire but may also be caused by improper livestock grazing. Blackbrush becomes dominant while other plant species decrease to pre-burn levels. This pathway may take hundreds of years to accomplish and may not happen in a management timeframe.

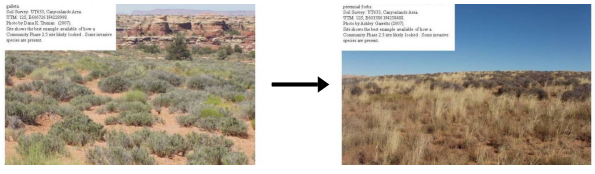
Pathway 2.5c
Community 2.5 to 2.2



Shrubland **Blackbrush Shrubland with Grass**

This pathway follows the natural succession of a blackbrush ecosystem after a fire. Blackbrush becomes dominant while other plant species decrease to pre-burn levels. This pathway is typically accompanied by wetter than normal periods that allows for the continued establishment of native perennial grasses. This pathway may take hundreds of years to accomplish and may not happen in a management timeframe.

Pathway 2.5a
Community 2.5 to 2.3



Shrubland **Forb Dominated Grassland**

This pathway occurs when fire or other surface disturbance removes the shrub canopy and allows for the establishment of annual and perennial forbs and grasses.

State 3
Annual Grass State

This state's ecological processes are driven by the dominance of cheatgrass, native and invasive plant species may or may not also be present. Cheatgrass dramatically affects the soil/plant/water relationships of a site. Once cheatgrass has invaded a site, the fundamental nutrient cycling processes, root pores, mycorrhizal associations, microbial species, and soil organic material change (Chapin et al. 1997; Belnap and Phillips, 2001). These

alterations may eventually create ecologically impoverished sites that are very difficult to restore diverse perennial herbaceous and woody communities. The competitiveness of cheatgrass and its ability to quickly establish after a disturbance make this state extremely resistance to change and resilient after a disturbance. Annual Grass State – Community phases maintained, in a self-sustaining manner, by frequent fire. Indicators: A site where ecological processes are driven by cheatgrass Feedbacks: A self sustaining disturbance regime of frequent fire.

Community 3.1
Annual Grassland

This plant community is characterized by a dominance of cheatgrass, other native species may be present but no longer drive the ecological dynamics of the site. Invasive forbs, such as Russian thistle, tansy mustard, and tumble mustard are often also present. Bare ground is minimal (5-15% cover) due to the increase in litter and cheatgrass' dense establishment. Fire can and will carry through this community. Biological crusts (1-5% cover) are characterized by light cyanobacteria in the interspaces. The following tables provide a typical example of the vegetative floristics of a community phase 3.1 plant community.

Table 35. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	200	500	800
Forb	50	75	100
Shrub/Vine	0	25	50
Total	**250**	**600**	**950**

Table 36. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-15%
Grass/grasslike foliar cover	60-80%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	1-5%
Litter	5-10%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	5-15%

Table 37. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	0-40%	0-5%
>0.5 <= 1	–	0-5%	0-50%	0-5%
>1 <= 2	–	0-10%	0-5%	0-5%
>2 <= 4.5	–	0-15%	0-5%	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Transition T1a
State 1 to 2

Transition from Reference State (State 1) to Current Potential State (State 2). This transition is from the native perennial warm and cool season grass understory in the reference state to a state that contains non-native species. Events include any combination of improper livestock grazing, prolonged drought, fire, surface disturbances, etc. Non-native invasive species such as cheatgrass however, has been known to invade intact perennial plant communities with little to no disturbance. Once non-natives are found in the plant community a threshold has been crossed.

Transition T2a
State 2 to 3

Transition from Current Potential State (State 2) to Annual Grass State (State 3). This unlikely transition is from the current potential state into a state dominated by cheatgrass. This transition occurs as events favor the increased establishment and dominance of cheatgrass. Typically this occurs as a series of fires which lead to an increase in cheatgrass and a subsequent decrease in the fire return interval. Once cheatgrass drives the ecological dynamics of the site a threshold has been crossed. This transition may or may not occur. Cheatgrass is not known to invade the blackbrush communities in the Colorado Plateau as readily as it does in the Mohave and the Great Basin. Many times cheatgrass will be abundant 15-20 years post disturbance, but will decrease back to pre-disturbance levels 20-35 years post disturbance (Callison, 1985). Cheatgrass doesn't seem to dominate these sites enough to cause a significant decrease in the fire return interval, which would allow cheatgrass to drive the ecological dynamics of this ecosystem.

Additional community tables

Table 38. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			100–200	
	blackbrush	CORA	*Coleogyne ramosissima*	100–200	–
3	**Sub-Dominant Shrubs**			50–100	
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–50	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–50	–
	mormon tea	EPVI	*Ephedra viridis*	0–20	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–20	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–20	–
	Cutler's jointfir	EPCU	*Ephedra cutleri*	0–20	–

	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–15	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–10	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–10	–
	Thompson's dalea	PSTH	*Psorothamnus thompsoniae*	0–10	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–10	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–5	–
Grass/Grasslike					
0	**Dominant Grasses**			5–40	
	James' galleta	PLJA	*Pleuraphis jamesii*	5–40	–
1	**Sub-Dominant Grasses**			40–75	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–20	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–10	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–10	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–10	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–5	–
	Grass, perennial	2GP	*Grass, perennial*	0–5	–
Forb					
2	**Forbs**			40–60	
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–40	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–35	–
	Forb, annual	2FA	*Forb, annual*	0–5	–
	Forb, perennial	2FP	*Forb, perennial*	0–5	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–5	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–5	–
	buckwheat	ERIOG	*Eriogonum*	0–5	–
	red dome blanketflower	GAPI	*Gaillardia pinnatifida*	0–3	–
	flaxflowered ipomopsis	IPLO2	*Ipomopsis longiflora*	0–3	–
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–3	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–3	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–3	–
Tree					
4	**Trees**			0–5	
	Utah juniper	JUOS	*Juniperus osteosperma*	0–5	–

Table 39. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			100–200	
	blackbrush	CORA	*Coleogyne ramosissima*	100–200	–
3	**Sub-Dominant Shrubs**			50–100	
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–50	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–50	–

	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–20	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–20	–
	Cutler's jointfir	EPCU	*Ephedra cutleri*	0–20	–
	mormon tea	EPVI	*Ephedra viridis*	0–20	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–15	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–10	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–10	–
	Thompson's dalea	PSTH	*Psorothamnus thompsoniae*	0–10	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–10	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–5	–
Grass/Grasslike					
0	**Dominant Grasses**			60–200	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	20–150	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	20–80	–
	James' galleta	PLJA	*Pleuraphis jamesii*	20–80	–
1	**Sub-Dominant Grasses**			0–130	
	blue grama	BOGR2	*Bouteloua gracilis*	0–50	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–25	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–25	–
	squirreltail	ELEL5	*Elymus elymoides*	0–10	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–10	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–5	–
Forb					
2	**Forbs**			40–60	
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–40	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–35	–
	Forb, annual	2FA	*Forb, annual*	0–5	–
	Forb, perennial	2FP	*Forb, perennial*	0–5	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–5	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–5	–
	buckwheat	ERIOG	*Eriogonum*	0–5	–
	red dome blanketflower	GAPI	*Gaillardia pinnatifida*	0–3	–
	flaxflowered ipomopsis	IPLO2	*Ipomopsis longiflora*	0–3	–
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–3	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–3	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–3	–
Tree					
4	**Trees**			0–5	
	Utah juniper	JUOS	*Juniperus osteosperma*	0–5	–

Table 40. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Forb					
0	**Dominant Forbs**			25–50	
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	25–50	–
2	**Sub-Dominant Forbs**			150–175	
	buckwheat	ERIOG	*Eriogonum*	0–50	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–25	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–25	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–15	–
	cleftleaf wildheliotrope	PHCRC	*Phacelia crenulata var. corrugata*	0–15	–
	Newberry's twinpod	PHNE5	*Physaria newberryi*	0–15	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–10	–
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–10	–
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
Grass/Grasslike					
1	**Grasses**			50–100	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	10–25	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	10–25	–
	James' galleta	PLJA	*Pleuraphis jamesii*	10–25	–
	spike dropseed	SPCO4	*Sporobolus contractus*	10–25	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	10–25	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	5–10	–
	Grass, perennial	2GP	*Grass, perennial*	5–10	–
Shrub/Vine					
3	**Shrubs**			0–25	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–5	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–5	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–5	–
	Cutler's jointfir	EPCU	*Ephedra cutleri*	0–5	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–5	–
	mormon tea	EPVI	*Ephedra viridis*	0–5	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–5	–
	Thompson's dalea	PSTH	*Psorothamnus thompsoniae*	0–5	–

Table 41. Community 1.4 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
0	**Dominant Grasses**			80–150	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	50–100	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	15–25	–
	James' galleta	PLJA	*Pleuraphis jamesii*	15–25	–
1	**Sub-Dominant Grasses**			50–120	
	spike dropseed	SPCO4	*Sporobolus contractus*	20–50	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	20–50	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	5–10	–
	Grass, perennial	2GP	*Grass, perennial*	5–10	–
Forb					
0	**Dominant Forbs**			25–50	
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	25–50	–
2	**Sub-Dominant Forbs**			100–125	
	buckwheat	ERIOG	*Eriogonum*	0–50	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–15	–
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	cleftleaf wildheliotrope	PHCRC	*Phacelia crenulata var. corrugata*	0–10	–
	Newberry's twinpod	PHNE5	*Physaria newberryi*	0–10	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–10	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–10	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–5	–
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–5	–
Shrub/Vine					
3	**Shrubs**			0–25	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–5	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–5	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–5	–
	Cutler's jointfir	EPCU	*Ephedra cutleri*	0–5	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–5	–
	mormon tea	EPVI	*Ephedra viridis*	0–5	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–5	–
	Thompson's dalea	PSTH	*Psorothamnus thompsoniae*	0–5	–

Table 42. Community 1.5 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
0	**Dominant Grasses**			5–40	
	James' galleta	PLJA	*Pleuraphis jamesii*	5–40	–
1	**Sub-Dominant G**			40–75	

1	**Sub-Dominant Grasses**			40–75	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–40	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–20	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–10	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–10	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–10	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–5	–
	Grass, perennial	2GP	*Grass, perennial*	0–5	–
Forb					
2	**Forbs**			40–60	
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–40	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–35	–
	Forb, annual	2FA	*Forb, annual*	0–5	–
	Forb, perennial	2FP	*Forb, perennial*	0–5	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–5	–
	buckwheat	ERIOG	*Eriogonum*	0–3	–
	red dome blanketflower	GAPI	*Gaillardia pinnatifida*	0–3	–
	flaxflowered ipomopsis	IPLO2	*Ipomopsis longiflora*	0–3	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–3	–
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–3	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–3	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–3	–
Shrub/Vine					
3	**Shrubs**			175–225	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–75	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–50	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–50	–
	blackbrush	CORA	*Coleogyne ramosissima*	0–50	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–35	–
	Thompson's dalea	PSTH	*Psorothamnus thompsoniae*	0–25	–
	Cutler's jointfir	EPCU	*Ephedra cutleri*	0–20	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–20	–
	mormon tea	EPVI	*Ephedra viridis*	0–20	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–15	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–10	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–10	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–10	–
Tree					
4	**Trees**			0–5	
	Utah juniper	JUOS	*Juniperus osteosperma*	0–5	–

Table 43. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)

Group	Common Name	Symbol	Scientific Name	(Lb/Acre)	(%)
Shrub/Vine					
0	**Dominant Shrubs**			100–200	
	blackbrush	CORA	*Coleogyne ramosissima*	100–200	–
3	**Sub-Dominant Shrubs**			50–100	
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–50	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–50	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–20	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–20	–
	Cutler's jointfir	EPCU	*Ephedra cutleri*	0–20	–
	mormon tea	EPVI	*Ephedra viridis*	0–20	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–15	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–10	–
	Thompson's dalea	PSTH	*Psorothamnus thompsoniae*	0–10	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–10	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–10	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–5	–
Grass/Grasslike					
0	**Dominant Grasses**			10–45	
	James' galleta	PLJA	*Pleuraphis jamesii*	5–40	–
	cheatgrass	BRTE	*Bromus tectorum*	5–10	–
1	**Sub-Dominant Grasses**			40–75	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–40	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–20	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–10	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–10	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–10	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–5	–
	Grass, annual	2GA	*Grass, annual*	0–5	–
	Grass, perennial	2GP	*Grass, perennial*	0–5	–
Forb					
2	**Forbs**			40–60	
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–40	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–35	–
	prickly Russian thistle	SATR12	*Salsola tragus*	0–10	–
	Forb, annual	2FA	*Forb, annual*	0–5	–
	Forb, perennial	2FP	*Forb, perennial*	0–5	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–5	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–5	–
	tansymustard	DESCU	*Descurainia*	0–5	–
	buckwheat	ERIOG	*Eriogonum*	0–5	–
	red dome blanketflower	GAPI	*Gaillardia pinnatifida*	0–3	–
	flaxflowered ipomopsis	IPLO2	*Ipomopsis longiflora*	0–3	–

	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–3	–
	tall tumblemustard	SIAL2	*Sisymbrium altissimum*	0–3	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–3	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–3	–
Tree					
4	**Trees**			0–5	
	Utah juniper	JUOS	*Juniperus osteosperma*	0–5	–

Table 44. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			100–200	
	blackbrush	CORA	*Coleogyne ramosissima*	100–200	–
3	**Sub-Dominant Shrubs**			50–1000	
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–50	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–50	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–20	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–20	–
	Cutler's jointfir	EPCU	*Ephedra cutleri*	0–20	–
	mormon tea	EPVI	*Ephedra viridis*	0–20	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–15	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–10	–
	Thompson's dalea	PSTH	*Psorothamnus thompsoniae*	0–10	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–10	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–10	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–5	–
Grass/Grasslike					
0	**Dominant Grasses**			60–200	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	20–150	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	20–80	–
	James' galleta	PLJA	*Pleuraphis jamesii*	20–80	–
	cheatgrass	BRTE	*Bromus tectorum*	5–15	–
1	**Sub-Dominant Grasses**			0–130	
	blue grama	BOGR2	*Bouteloua gracilis*	0–50	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–25	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–25	–
	squirreltail	ELEL5	*Elymus elymoides*	0–10	–
	Grass, annual	2GA	*Grass, annual*	0–10	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–10	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–5	–
Forb					
2	**Forbs**			40–60	

2	**Forbs**			40–80	
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–40	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–35	–
	prickly Russian thistle	SATR12	*Salsola tragus*	0–10	–
	tall tumblemustard	SIAL2	*Sisymbrium altissimum*	0–5	–
	Forb, annual	2FA	*Forb, annual*	0–5	–
	Forb, perennial	2FP	*Forb, perennial*	0–5	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–5	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–5	–
	tansymustard	DESCU	*Descurainia*	0–5	–
	buckwheat	ERIOG	*Eriogonum*	0–5	–
	red dome blanketflower	GAPI	*Gaillardia pinnatifida*	0–3	–
	flaxflowered ipomopsis	IPLO2	*Ipomopsis longiflora*	0–3	–
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–3	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–3	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–3	–
Tree					
4	**Trees**			0–5	
	Utah juniper	JUOS	*Juniperus osteosperma*	0–5	–

Table 45. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
0	**Dominant Grasses**			10–15	
	cheatgrass	BRTE	*Bromus tectorum*	10–15	–
1	**Sub-Dominant Grasses**			50–100	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–25	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–25	–
	James' galleta	PLJA	*Pleuraphis jamesii*	0–25	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–25	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–25	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–10	–
	Grass, annual	2GA	*Grass, annual*	0–5	–
	Grass, perennial	2GP	*Grass, perennial*	0–5	–
Forb					
0	**Dominant Forbs**			25–50	
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	25–50	–
2	**Sub-Dominant Forbs**			150–175	
	buckwheat	ERIOG	*Eriogonum*	0–50	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–25	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–25	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–15	–
	cleftleaf wildheliotrope	PHCRC	*Phacelia crenulata var. corrugata*	0–15	–
	Newberry's twinpod	PHNE5	*Physaria newberryi*	0–15	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–10	–
	prickly Russian thistle	SATR12	*Salsola tragus*	0–10	–
	tall tumblemustard	SIAL2	*Sisymbrium altissimum*	0–10	–
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–10	–
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	tansymustard	DESCU	*Descurainia*	0–10	–
Shrub/Vine					
3	**Shrubs**			0–25	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–5	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–5	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–5	–
	Cutler's jointfir	EPCU	*Ephedra cutleri*	0–5	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–5	–
	mormon tea	EPVI	*Ephedra viridis*	0–5	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–5	–
	Thompson's dalea	PSTH	*Psorothamnus thompsoniae*	0–5	–

Table 46. Community 2.4 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
0	**Dominant Grasses**			80–150	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	50–100	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	15–25	–
	James' galleta	PLJA	*Pleuraphis jamesii*	15–25	–
	cheatgrass	BRTE	*Bromus tectorum*	10–15	–
1	**Sub-Dominant Grasses**			50–120	
	spike dropseed	SPCO4	*Sporobolus contractus*	0–50	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–50	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–10	–
	Grass, annual	2GA	*Grass, annual*	0–10	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
Forb					
0	**Dominant Forbs**			25–50	
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	25–50	–
2	**Sub-dominant Forbs**			100–125	
	buckwheat	ERIOG	*Eriogonum*	0–50	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–15	–
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	cleftleaf wildheliotrope	PHCRC	*Phacelia crenulata var. corrugata*	0–10	–
	Newberry's twinpod	PHNE5	*Physaria newberryi*	0–10	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–10	–
	prickly Russian thistle	SATR12	*Salsola tragus*	0–10	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–10	–
	tall tumblemustard	SIAL2	*Sisymbrium altissimum*	0–5	–
	tansymustard	DESCU	*Descurainia*	0–5	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–5	–
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–5	–
Shrub/Vine					
3	**Shrubs**			0–25	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–5	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–5	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–5	–
	Cutler's jointfir	EPCU	*Ephedra cutleri*	0–5	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–5	–
	mormon tea	EPVI	*Ephedra viridis*	0–5	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–5	–
	Thompson's dalea	PSTH	*Psorothamnus thompsoniae*	0–5	–

Table 47. Community 2.5 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
0	**Dominant Grasses**			15–55	
	James' galleta	PLJA	*Pleuraphis jamesii*	5–40	–
	cheatgrass	BRTE	*Bromus tectorum*	10–15	–
1	**Sub-Dominant Grasses**			20–75	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–40	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–20	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–10	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–10	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–10	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–5	–
	Grass, annual	2GA	*Grass, annual*	0–5	–
	Grass, perennial	2GP	*Grass, perennial*	0–5	–
Forb					
2	**Forbs**			40–60	
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–40	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–35	–
	prickly Russian thistle	SATR12	*Salsola tragus*	0–5	–
	tall tumblemustard	SIAL2	*Sisymbrium altissimum*	0–5	–
	Forb, annual	2FA	*Forb, annual*	0–5	–
	Forb, perennial	2FP	*Forb, perennial*	0–5	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–5	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–5	–
	tansymustard	DESCU	*Descurainia*	0–5	–
	buckwheat	ERIOG	*Eriogonum*	0–5	–
	red dome blanketflower	GAPI	*Gaillardia pinnatifida*	0–3	–
	flaxflowered ipomopsis	IPLO2	*Ipomopsis longiflora*	0–3	–
	Esteve's pincushion	CHST	*Chaenactis stevioides*	0–3	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–3	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–3	–
Shrub/Vine					
3	**Shrubs**			175–225	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–75	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–50	–
	blackbrush	CORA	*Coleogyne ramosissima*	0–50	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–50	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–35	–
	Thompson's dalea	PSTH	*Psorothamnus thompsoniae*	0–25	–
	Cutler's jointfir	EPCU	*Ephedra cutleri*	0–20	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–20	–
	mormon tea	EPVI	*Ephedra viridis*	0–20	–

	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–15	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–10	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–10	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–10	–
Tree					
4	**Trees**			0–5	
	Utah juniper	JUOS	*Juniperus osteosperma*	0–5	–

Table 48. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
0	**Dominant Grasses**			400–500	
	cheatgrass	BRTE	*Bromus tectorum*	400–500	–
1	**Sub-Dominant Grasses**			5–100	
	James' galleta	PLJA	*Pleuraphis jamesii*	0–50	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–50	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–40	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–10	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–10	–
	Grass, annual	2GA	*Grass, annual*	0–5	–
	Grass, perennial	2GP	*Grass, perennial*	0–5	–
Forb					
2	**Forbs**			60–75	
	prickly Russian thistle	SATR12	*Salsola tragus*	0–50	–
	tansymustard	DESCU	*Descurainia*	0–50	–
	stickseed	LAPPU	*Lappula*	0–20	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–20	–
	cryptantha	CRYPT	*Cryptantha*	0–20	–
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	tall tumblemustard	SIAL2	*Sisymbrium altissimum*	0–10	–
Shrub/Vine					
3	**Shrubs**			0–25	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–5	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–5	–
	blackbrush	CORA	*Coleogyne ramosissima*	0–5	–
	Cutler's jointfir	EPCU	*Ephedra cutleri*	0–5	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–5	–
	mormon tea	EPVI	*Ephedra viridis*	0–5	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–5	–

Animal community

--Threatened and Endangered Species--
This section will be populated as information becomes available.

--Wildlife Interpretations--
Small herds of mule deer, pronghorn antelope, and desert bighorn sheep can be seen grazing/browsing on these sites, especially when near water sources and in the winter. These sites are also important winter areas for bighorn sheep, in many places, however, populations are small and will have little impact on the site.
The hot climate and lack of water favors small mammals, which have an easier time finding shelter, food, and water. Many species of rats, mice, squirrels, bats, and chipmunks can be observed, along with coyotes and foxes. On sites where Utah juniper is invading, or where Utah juniper sites are adjacent, birds are the most visible wildlife species that can be observed, sightings may be rare however, due to the sparseness of tree canopies. Species may include juniper titmice, scrub jays, pinyon jays, and black throated gray warblers, and sparrows. Lizards are the most visible and can be observed during the day. Species may include the northern whiptail, desert spiny, and the colorful western collard lizard. (NPS.gov, 2008)

--Grazing Interpretations--
This site provides very limited grazing for livestock. Blackbrush contains high levels of tannins, and has low available nutrition. When present, grasses, primarily Indian ricegrass and James galleta, provide good forage for livestock, however, these species are not always abundant enough to support many livestock. The site does provide fairly good browse for goats. Forage composition and annual production depend largely on yearly precipitation amounts and thus provide challenges for those making livestock grazing management decisions. Regardless of class of livestock, this sites carrying capacity is always low. A lack of available drinking water, can also influence its suitability for livestock grazing. Care should be taken to maintain the native perennial grasses and shrubs present on this site because they are hard to restore once gone.

Livestock grazing should be based on a science based management plan that includes an onsite resource inventory.

Hydrological functions

The soils associated with this ecological site are generally placed in Hydrologic Soil Group B. Their runoff potential is low and infiltration rates are moderate, depending on slope and ground cover/health (NRCS National Engineering Handbook). Hydrological groups are used in equations that estimate runoff from rainfall. These estimates are needed for solving hydrologic problems that arise in planning watershed-protection and flood-prevention projects and for designing structures for the use, control and disposal of water. In areas similar to the reference state where ground cover is adequate, infiltration is increased and runoff potential is decreased. In areas where ground cover is less than 50%, infiltration is reduced and runoff potential is increased. Heavy use by domestic livestock affects hydrology in two ways. Excessive trampling increases bulk density and breaks down soil aggregates. This results in decreased infiltration rates and increased runoff. Heavy grazing can also alter the hydrology by decreasing plant cover and increasing bare ground.

Fire can also affect hydrology, but the results are highly variable. Fire intensity, fuel type, soil, weather, and topography can each have different influences. Fires can increase areas of bare ground and hydrophobic layers that reduce infiltration and increase runoff. Different plant communities affect hydrology in different ways. Weedy communities alter the hydrology by changing the surface soil texture. Soil surfaces will typically become siltier which reduces infiltration and increases runoff potential. (National Range and Pasture Handbook, 2003)

Recreational uses

Recreational activities include aesthetic value and good opportunities for hiking, horseback riding, and off road vehicle use. Care must be taken not to disturb blackbrush communities because once it has been damaged or removed, it may be replaced by invasive forbs and grasses and may never be able to return to a functioning perennial plant community. Opportunities for camping are limited due to a lack of sheltering trees or rock outcrops, and difficulty of setting up a tent in a pure stand of blackbrush.

Wood products

Generally none; however a 1-2% cover of Utah Juniper is common on some sites and thus small caches of wood may be available for camp fires and rarely fence posts.

Other information

--Poisonous and Toxic Plant Communities--
Toxic plants associated with this site include freckled milkvetch, broom snakeweed and Russian thistle.

Freckled milkvetch is toxic to all classes of livestock and wildlife. This plant is palatable and has similar nutrient value to alfalfa which may cause animals to consume it even when other forage is available. Milkvetch contains swainsonine (indolizdine alkaloid) and is poisonous at all stages of growth. Poisoning will become evident after 2-3 weeks of continuous grazing and is associated with 4 major symptoms: 1) neurological damage, 2) emaciation, 3) reproductive failure and abortion, and 4) congestive heart failure linked with “high mountain disease”.

Broom snakeweed contains steroids, terpenoids, saponins, and flavones that can cause abortions or reproductive failure in sheep and cattle, however cattle are most susceptible. These toxins are most abundant during active growth and leafing stage. Cattle and sheep generally will only graze broom snakeweed when other forage is unavailable, typically in winter when toxicity levels are at their lowest.

Russian thistle is an invasive toxic plant, causing nitrate and to a lesser extent oxalate poisoning, which affects all classes of livestock. The buildup of nitrates in these plants is highly dependent upon environmental factors such as after a quick rain storm during a long drought, during periods with cool/cloudy days, and on soils high in nitrogen and low in sulfur and phosphorus. Nitrate collects in the plants stems and can persist throughout the growing season. Clinical signs of nitrate poisoning include drowsiness, weakness, muscular tremors, increased heart and respiratory rates, staggering gait, and death. Conversely, oxalate poisoning causes kidney failure. Clinical signs include muscle tremors, tetany, weakness, and depression. Poisoning generally occurs when livestock consume and are not accustomed to grazing oxalate-containing plants. Animals with prior exposure to oxalates have increased numbers of oxalate-degrading rumen microflora and thus are able to degrade the toxin before clinical poisoning can occur.

--Invasive Plant Communities--
As ecological condition deteriorates and perennial vegetation decreases due to disturbance (i.e., fire, over grazing, drought, off road vehicle overuse, erosion, etc.) annual forbs and grasses can invade this site. Of particular concern in semi-arid environments are annual invaders including cheatgrass, Russian thistle, kochia, halogeton, and annual mustards. The presence of these species will depend on soil properties and moisture availability, however, these invaders are highly adaptive and can flourish in many locations. Once established, complete removal of these species is difficult but suppression may be possible. In most of the Colorado Plateau area, cheatgrass is not known to invade blackbrush associations to the degree that it does on other sites in southwestern Utah and the Mojave Desert.

--Fire Ecology--
The ability for this ecological site to carry fire depends primarily on it's present fuel load and fine fuel moisture content. Sites with small fuel loads will burn more slowly and less intensely than sites with large fuel loads. A year of exceptionally heavy winter moisture can, however, generate sufficient fuels for fire to carry on this site by producing heavy stands of both perennial and annual forbs and grasses. When fires do occur, their effect on plant communities can be extreme due to the sites harsh environment and slow rate of recovery.

This ecological site is typically comprised of a dense or somwtimes scattered stand of low stature blackbrush with mostly bare interspaces. Blackbrush, because of its tinder-like nature, and resinous foliage, is a very flammable species and in areas with dense spacing can burn. Where either perennial or annual grasses or forbs are also present, fire frequencies could become shorter. Periods with high winds, high temperature and low humidity can increase the chances for fire to occur. (Callison, 1985). Blackbrush is a non-sprouter and is slow to re-establish on burned sites in Utah. Because of its apical dominance trait, twig removal through browsing or mechanical treatment can increase sprouting and new growth.

The fire regime for blackbrush communities in Utah is not well understood. Research has noted that a burned blackbrush site in Arizona has recovered, and in Nevada, fire in blackbrush communities has increased forage diversity. In these areas, a fire return interval has been suggested at 35-100 years. On some sites, blackbrush act act as a paleo-endemic species.

The use of fire as a brush management tool is not recommended on this ecological sites at the present time. Where

revetation is desired, other treatment methods could be used.

Inventory data references

The data collected in 2005-2008 were in conjunction with the soil survey update for Arches and Canyonlands National Park. The vegetation data was collected in associated with a soil pit and geo-referenced. All the data is stored as hard copy files and in electronic format in the NRCS Utah State Office.

Type locality

Location 1: Wayne County, UT	
UTM zone	N
UTM northing	4232664
UTM easting	586732
General legal description	This site is located in the Maze District of Canyonlands National Park; along the Maze Overlook Road. It is located in the Elaterite Basin USGS Quad.

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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)	Paul Curtis (BLM), Randy Beckstrand (BLM), Dana Truman (NRCS), Robert Stager (BLM), Shane A. Green (NRCS), V. Keith Wadman (NRCS Ret.). Contributors to 8/2008 revisions included: Ashley Garrelts (NRCS), Shane A. Green (NRCS).
Contact for lead author	shane.green@ut.usda.gov
Date	10/20/2008
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are not present in the reference state on the gentler slopes. Few rills present on slopes exceeding 10% and likely to form below adjacent exposed bedrock or water flow patterns where sufficient water accumulates to cause erosion. Rills present should be small, less than 6 feet in length. The number of rills can increase immediately following large storm events but should not persist more than one or two seasons due to coarse soil textures and frost-heave recovery.

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2. **Presence of water flow patterns:** The occurrence of water flow patterns is rare (0-3% cover) on all slopes in the reference state, and are typically less than 3 feet long. As slopes increase (>10%) water flow pattern occurrence (3-8%) and length (3-5ft) also increases. An increase in water flow patterns is also expected after disturbance events such as precipitation events and increased wildlife use, which increases the percent of bare ground and erosion potential.

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3. **Number and height of erosional pedestals or terracettes:** Plants may show little pedestalling, up to 4 inches for shrubs. Terracettes should be absent or few. Pedestals that occur are usually associated with natural wind erosion. Interspaces between well developed biological soil crusts may resemble pedestals but they are actually a characteristic of the crust formation.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** In the reference state bare ground ranges from 5 to 45%, depending upon community phase. Plant community phases 1.1, 1.2, and 1.5 typically have the most biological crust development and the least bare ground, while community phases 1.3 and 1.4 have minimal biological crust development and more bare ground due to disturbance recovery periods. Most bare ground is associated with water flow patterns. Areas with well developed biological soil crust should not be counted as bare ground. Areas with poorly developed biological soils crust that are interpreted as functioning as bare ground (therefore they would be susceptible to raindrop splash erosion) should be recorded as bare ground. This site can have up to 20% surface rock cover. Ground cover is based on first raindrop impact, and bare ground is the opposite of ground cover. Ground cover + bare ground = 100%.

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5. **Number of gullies and erosion associated with gullies:** Active gullies are generally nonexistent; however, stable gullies may occur in landscape settings where increased runoff may have accumulated (such as areas below exposed bedrock). Gully development is expected to be limited to steep slopes, show little sign of accelerated erosion, and be stabilized with perennial vegetation.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Slight wind generated soil movement is normal. Wind caused deposition at the base of shrubs and trees is stabilized by biological soil crusts, when present or litter Increased wind generated soil movement can occur after severe (multi-year) drought or severe wind events.. Areas that are invaded with scattered Utah juniper are more susceptible to blowouts, which may persist for long periods due to the aggressive competitive nature of the juniper, which limits immediately adjacent plant growth. Coppice mounding around perennial vegetation is common, especially around blackbrush plants. Increased wind generated soil movement can occur after severe wind events.

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7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place with some redistribution caused by water movement and wind. Fine litter (<¼ inch in diameter) may be moved up to 2-3 ft and usually occurs in water flow patterns and rills, with deposition occurring at obstruction. Sites with well developed crust cover such as plant community 1.3, may exhibit litter being trapped by the crust pinnacles. The majority of litter accumulates at the base of plants or in soil depression adjacent to the plant. Woody stems (those greater than ¼ inch in diameter) are not likely to move under normal conditions.

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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):** This site should have a soil stability rating of 4-5 throughout the site. Surface texture varies from fine sand to very fine sandy loam. As sites depart from the reference state to a state dominated by invasive annuals soil surfaces textures are expected to become siltier.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface varies from 0 to 5 inches. Structure is weak thin platy. Color is a yellowish red (5YR5/6) to a reddish brown (5YR5/4). An ochric (light colored) epipedon typically extends to a depth of 4 inches. The A-horizon would be expected to be more strongly developed under plant canopies. It is important if you are sampling to observe the A-horizon under plant canopies as well as the interspaces. Use the specific information for the soil you are assessing found in the published soil survey to supplement this description. e specific information for the soil you are assessing found in the published soil survey to supplement this description.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Vascular plants and/or any well developed biological soil crusts will break raindrop impact and splash erosion. Spatial distribution of vascular plants and interspaces between well developed biological soil crusts (where present) provide detention storage and surface roughness that slows runoff allowing time for infiltration. Interspaces between plants and any well developed biological soil crusts (where present) may serve as water flow patterns during episodic runoff events, with natural erosion expected in severe storms. When perennial grasses decrease, reducing ground cover and increasing bare ground, runoff is expected to increase and any associated infiltration reduced.

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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. A few soils have bedrock at about 30+ inches. Naturally occurring soil horizons may be harder than the surface because of an accumulation of clay or calcium carbonate and should not be considered as compaction layers.

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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: 100-200 lbs/ac season perennial grasses (e.g. Indian ricegrass and needleandthread)
    150-200 lbs/acre Blackbrush

    Sub-dominant: 50-100 lbs/ac warm season perennial grasses (e.g. Galleta, blue grama, and dropseeds)
    10-20 lbs/acre other shrubs (e.g. Mormontea, Fourwing Saltbush, and Shadscale)

    Other: Other forbs, shrubs, grasses, and trees (e.g. Utah Juniper)

    Additional: Perennial and annual forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions. Biological crusts (lichen, moss, and cyanobacteria) should be present but are variable based on plant community and state. In the reference state biological crust cover is characterized by cyanobacteria, pinnacled lichen, and moss with little continuity. Typically moss and lichen clumps will be concentrated under the plant canopy and cyanobacteria will be found in the interspaces.

    Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** During years with average to above average precipitation, there should be very little mortality or decadence apparent in either shrubs or grasses. During and following drought blackbrush may appear dead, due to leaf drop and many plant may die during a multi-year drought. Some (up to 20%) perennial bunch grass mortality is expected during severe drought

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14. **Average percent litter cover (%) and depth (in):** Litter cover (including under plants) ranges from 15-20%, nearly all of which should fine litter. Variability is due to the herbaceous production differences from one year to the next. Depth is generally 1 leaf thickness in the interspaces and up to ¼ inch under plant canopies. Litter can increase up to over 20% immediately following leaf drop or after favorable conditions increase native annual forb production.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Annual production ranges from 250-400 lbs/acre on 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:** Known invasive species include cheatgrass (Bromus tectorum), broom snakeweed (Gutierrezia sarothrae), tansy mustard (Descurainia pinnata), annual stickseed (Lappula sp.), annual Cryptantha (Cryptantha sp.), and Russian thistle (Salsola tragus).

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17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce sexually or asexually in most years, except in drought years.

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18. **Supporting Data:** NRCS (Dana Truman/Ashley Garrelts) 2006-2008 ESD data from Arches and Canyonlands National Parks.
