

Ecological site R028AY324UT

Upland Shallow Loam (Utah Juniper - Singleleaf Pinyon)

Accessed: 05/17/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

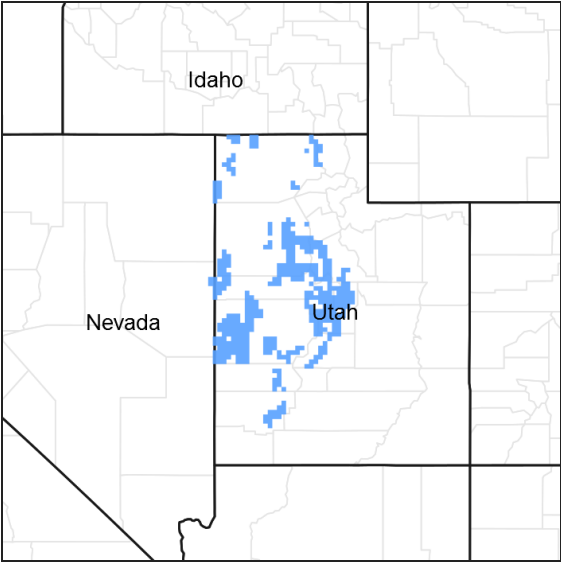


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 028A–Ancient Lake Bonneville

MLRA-D28A, Great Salt Lake Area, occurs in the eastern portion of the Basin and Range Ecological Province. This area is composed of nearly level basins located between widely separated mountain ranges that run mostly north and south. Basin edges are often bordered by gently sloping alluvial fans. The mountains are uplifted fault blocks with steep side slopes.

Associated sites

R028AY418UT	Mountain Loam (Bigtooth Maple)
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Similar sites

R028AY338UT	Upland Stony Loam (Pinyon-Utah Juniper)
R028AY320UT	Upland Shallow Hardpan (Pinyon-Utah Juniper)

Table 1. Dominant plant species

Tree	(1) <i>Juniperus osteosperma</i> (2) <i>Pinus monophylla</i>
Shrub	(1) <i>Artemisia nova</i> (2) <i>Purshia tridentata</i>
Herbaceous	(1) <i>Pseudoroegneria spicata</i> (2) <i>Poa nevadensis</i>

Physiographic features

This site occurs primarily on mountain slopes, lake terraces and escarpments at elevations between 4,900 to 7,800 feet. The site is found on slopes ranging from 20 to 70%, occurs on all aspects and produces medium to high amounts of runoff.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Mountain slope (3) Escarpment
Flooding frequency	None
Ponding frequency	None
Elevation	1,494–2,377 m
Slope	20–70%
Aspect	Aspect is not a significant factor

Climatic features

The climate of this site is dry subhumid and semiarid. It is characterized by cold, snowy winters and warm, dry summers. The average annual precipitation ranges from 11 to 16 inches. March and April are typically the wettest months with June, July and September being the driest. The most reliable sources of moisture for plant growth are the snow that accumulates over the winter, and spring rains. Summer thunderstorms are intermittent and sporadic in nature, and thus are not reliable sources of moisture to support vegetative growth on this site. The mean annual air temperature is 45 to 53 degrees.

Table 3. Representative climatic features

Frost-free period (average)	148 days
Freeze-free period (average)	176 days
Precipitation total (average)	406 mm

Influencing water features

Water Erosion Hazard: Severe to Very Severe

This site is not typically influenced by streams or wetlands.

Soil features

The soils for this site are shallow with bedrock typically within 20 inches of the soil surface. These soils formed in colluvium and residuum derived mainly from limestone and chert parent materials. The surface has very gravelly loam textures and is about 5 inches thick. Rock fragments may cover up to 50 percent of the soil surface. The volume of rock fragments in the soil profile ranges from 35 to about 60 percent. Soils are moderately slow to moderately rapidly permeable. Available water holding capacity is 1 to 2.8 inches. The soil moisture regime is xeric

and the soil moisture regime is mesic.

Soil Survey Area: Soil Components (Map units in parentheses)

Box Elder County - Eastern Part (UT602) Pass canyon (POE); Richmond (RMG2); Wheelon variant (WIG);

Table 4. Representative soil features

Parent material	(1) Colluvium—cherty limestone
Surface texture	(1) Extremely cobbly loam (2) Very gravelly silt loam (3) Very gravelly loam
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderate to moderately rapid
Soil depth	25–51 cm
Surface fragment cover <=3"	0–45%
Surface fragment cover >3"	11–37%
Available water capacity (0-101.6cm)	2.54–7.11 cm
Calcium carbonate equivalent (0-101.6cm)	0–30%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.6–9
Subsurface fragment volume <=3" (Depth not specified)	6–32%
Subsurface fragment volume >3" (Depth not specified)	12–39%

Ecological dynamics

This site is found in the Great Salt Lake Area of the Basin and Range Ecological Province. It developed under the natural ecological conditions found there, including the normal influences of native wildlife herbivory, fire and climate. Species composition is generally dominated by an overstory canopy of Utah juniper and singleleaf pinyon. Black sagebrush dominates the shrub layer. A mix of other shrubs including smooth horsebrush, alderleaf mountain mahogany and antelope bitterbrush commonly occur. Perennial herbaceous species occurrence and production is directly related to overstory canopy density with bluebunch wheatgrass, Nevada bluegrass and Indian ricegrass found most often.

Evidence indicates that this site historically maintained a fairly long burn cycle (100 years or more). Very old singleleaf pinyon and Utah juniper are common on most undisturbed sites. Over time, without fire, tree and shrub canopies increase in density, slowly reducing understory herbaceous vegetation. Following stand removing fire, perennial grasses and forbs flourish for a time, but without fire are again reduced.

Severe drought and insect damage can affect singleleaf pinyon in some locations, causing them to die out, often allowing Utah juniper to further increase. This event can also allow for an increase in shrubs and herbaceous species during periods when wetter years return.

Because of the sites steep slopes, stony, shallow soils and droughty aspect, it is rarely chained and or seeded to introduced forage species. Cheatgrass and annual forbs are most likely to invade this site.

As vegetative communities respond to changes caused by natural or manmade events that cause them to cross ecological thresholds, a return to previous states may not be possible. The amount of effort needed to affect desired vegetative shifts depends on a sites present biotic and abiotic features and the desired results.

The following State and Transition diagram depicts the most common plant communities found on this ecological site. It does not necessarily depict all the plant communities that can occur, but does show the most prevalent and repeatable. As more data are collected, some of these plant communities may be revised or removed, and new ones added. These descriptions capture the current knowledge and experience at the time of this revision.

State and transition model

State and Transition Model

State: Utah

Site Type: Rangeland

MLRA: D-28A – Great Salt Lake Area

R028AC324UT – Upland Shallow Loam (Pinyon/Utah Juniper)

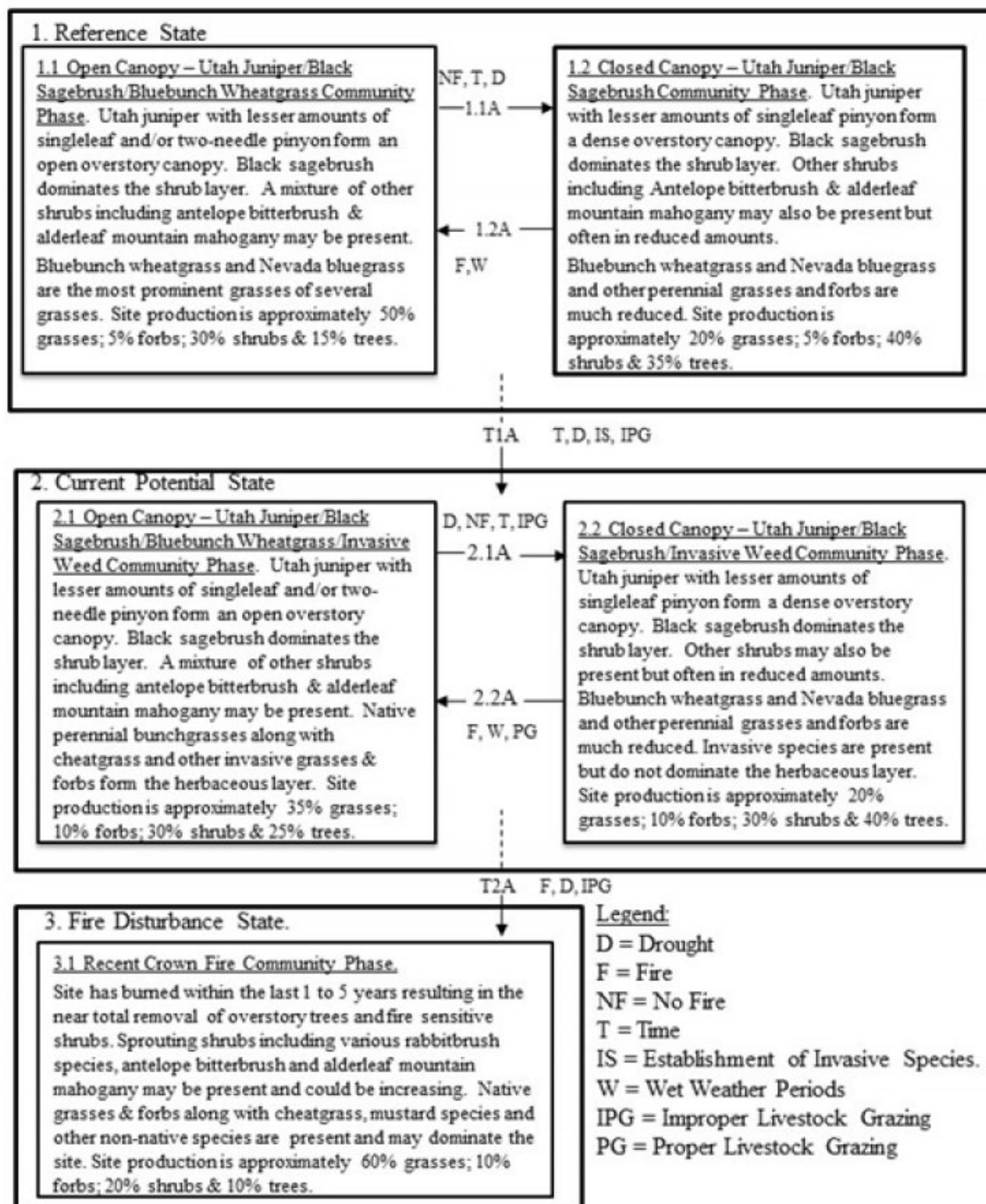
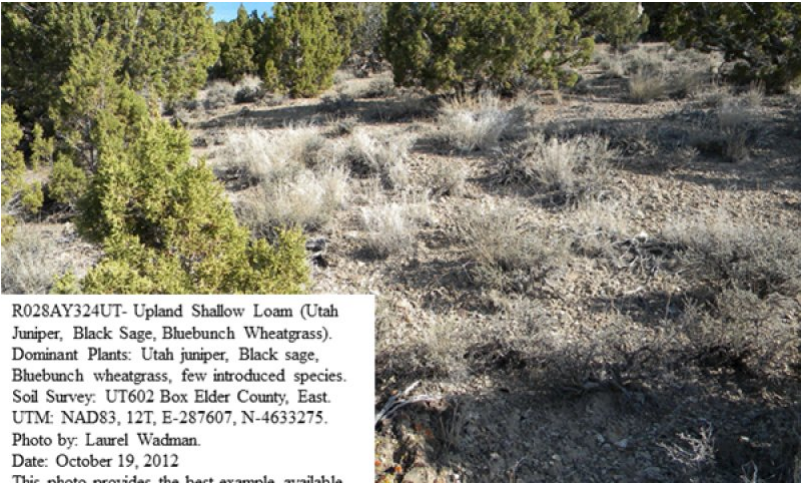


Figure 4. S&TM

Reference State

This state describes the various biotic communities that are expected to be found on this ecological site under natural conditions. This reference state has an overstory canopy of Utah juniper with lesser amounts of singleleaf and/or two-needle pinyon. The shrub layer is typically dominated by black sagebrush. A mixture of other shrubs including Wyoming big sagebrush, antelope bitterbrush and alderleaf mountain mahogany are commonly found. Bluebunch wheatgrass is the dominant herbaceous species with Nevada bluegrass and Indian ricegrass commonly occurring. Other native grasses, forbs, and shrubs will often produce a significant portion of vegetative composition in the plant community. This site occurs on 20 to 70% slopes on all aspects. It is usually found on mountain slopes, hills and escarpments. Its soils are shallow, well drained and extremely gravelly or cobbly loams in texture. The reference state is self-sustaining and resistant to change due to a good natural resilience to its natural disturbances. The primary natural disturbance mechanisms are wildlife population densities which can affect the shrub layer composition, weather fluctuations, and fire period. Definitions: Reference State: Natural plant communities as influenced by tree and shrub canopy densities, long term weather fluctuations, and periodic fire. Indicators: These communities are dominated by Utah juniper, black sagebrush and bluebunch wheatgrass. The density of the tree and shrub canopies determines the amount and composition of the other native species present in the community. Feedbacks: Natural fluctuations in weather patterns that allow for a self-sustaining tree, shrub and native grass community. Prolonged drought, an increase in fire frequency, or other disturbances may allow for the establishment of invasive species. At-risk Community Phase: All communities are at risk when native plants are stressed and conditions are created that may allow invasive plants to establish. Trigger: The establishment of invasive plant species.

Community 1.1
Open Canopy - Utah Juniper/Black Sage/Bluebunch Wheatgrass Community Phase.



R028AY324UT- Upland Shallow Loam (Utah Juniper, Black Sage, Bluebunch Wheatgrass). Dominant Plants: Utah juniper, Black sage, Bluebunch wheatgrass, few introduced species. Soil Survey: UT602 Box Elder County, East. UTM: NAD83, 12T, E-287607, N-4633275. Photo by: Laurel Wadman. Date: October 19, 2012. This photo provides the best example available.

Figure 5. Community Phase 1.1

This community phase is characterized by an open canopy of Utah juniper and singleleaf or two-needle pinyon. Black sage, Wyoming big sagebrush, antelope bitterbrush and alderleaf mountain mahogany are common understory shrubs. Commonly occurring grasses and grasslikes include bluebunch wheatgrass, Nevada bluegrass and Indian ricegrass. Other perennial grasses, shrubs, and forbs are also often present. Air dry composition of this site is approximately 50 percent grasses, 5 percent forbs, and 30 percent shrubs and 15% trees. Bare ground is variable (2-50%) depending on biological crust cover, which is also variable (1-25%) and surface rock fragments (10-70%). Biological crusts can vary from sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to those dominated by lichen and moss pinnacles as well as cyanobacteria in the site interspaces. The following tables provide an example the typical vegetative floristics of a community phase 1.1 plant community.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	84	224	364
Shrub/Vine	95	140	252
Tree	84	140	196
Forb	22	56	140
Total	285	560	952

Table 6. Ground cover

Tree foliar cover	10-20%
Shrub/vine/liana foliar cover	15-40%
Grass/grasslike foliar cover	10-30%
Forb foliar cover	3-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	—	—	—	—
>0.15 <= 0.3	—	—	—	—
>0.3 <= 0.6	—	35-45%	25-35%	0-10%
>0.6 <= 1.4	—	—	—	—
>1.4 <= 4	15-25%	—	—	—
>4 <= 12	—	—	—	—
>12 <= 24	—	—	—	—
>24 <= 37	—	—	—	—
>37	—	—	—	—

Community 1.2

Closed Canopy - Utah Juniper/Black Sagebrush Community Phase.

Mountain Plains: Utah juniper, black sage,
 Bluebunch wheatgrass, few introduced species.
 Soil Survey: UT602 Box Elder County, East.
 UTM: NAD83, 12T, E-287607, N-4633275.
 Photo by: Laurel Wadman.
 Date: October 19, 2012
 This photo provides the best example available of
 what a community phase 1.2 plant community
 might have looked like.



Figure 7. Community Phase 1.2

This community phase is characterized by a closed canopy of Utah juniper and singleleaf or two-needle pinyon. Black sage, Wyoming big sagebrush, antelope bitterbrush and alderleaf mountain mahogany are common understory shrubs. Bluebunch wheatgrass, Nevada bluegrass and Indian ricegrass are present in the herbaceous layer but are somewhat reduced. Other perennial grasses, shrubs, and forbs may also be present. Air dry composition of this site is approximately 20 percent grasses, 5 percent forbs, and 40 percent shrubs and 35% trees. Bare ground is variable (2-50%) depending on biological crust cover, which is also variable (1-25%) and surface rock fragments (10-70%). Biological crusts can vary from sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to those dominated by lichen and moss pinnacles as well as cyanobacteria in the site interspaces.

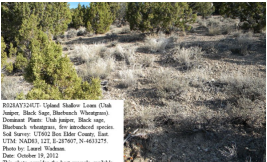
Table 8. Ground cover

Tree foliar cover	10-20%
Shrub/vine/liana foliar cover	15-40%
Grass/grasslike foliar cover	10-30%
Forb foliar cover	3-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 9. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	—	—	—	—
>0.15 <= 0.3	—	—	—	—
>0.3 <= 0.6	—	35-45%	25-35%	0-10%
>0.6 <= 1.4	—	—	—	—
>1.4 <= 4	15-25%	—	—	—
>4 <= 12	—	—	—	—
>12 <= 24	—	—	—	—
>24 <= 37	—	—	—	—
>37	—	—	—	—

Pathway 1.1A Community 1.1 to 1.2



Open Canopy - Utah Juniper/Black Sage/Bluebunch Wheatgrass Community Phase.



Closed Canopy - Utah Juniper/Black Sagebrush Community Phase.

This community pathway occurs when long-term drought and/or extended periods without fire allows canopies of Utah juniper and singleleaf pinyon to significantly increase. This closing canopy event causes understory vegetation to be reduced and eventually nearly eliminated from the site. Drought alone can also reduce native perennial grass production and eventually eliminate some species from the system. Improper livestock grazing during these periods can facilitate this process.

Pathway 1.2A Community 1.2 to 1.1



Closed Canopy - Utah Juniper/Black Sagebrush Community Phase.



Open Canopy - Utah Juniper/Black Sage/Bluebunch Wheatgrass Community Phase.

This community pathway occurs when weather patterns return to within normal ranges and some level of fire reduces Utah juniper and singleleaf pinyon, significantly opening the sites canopy. Insect damage on singleleaf pinyon can also cause its canopy to be reduced on this site. This more open canopy allows understory vegetation to recover and increase in production, and under some circumstances, flourish on the site. Proper livestock grazing during these periods can facilitate this process.

State 2 Current Potential State.

The Current Potential State is similar to the Reference Sate except that non-native species are now present. This state describes the plant communities that may or have become established on this ecological site under various successional sequences and disturbance conditions. This state typically has a well developed overstory canopy composed of Utah juniper with lesser amounts of singleleaf and/or two-needle pinyon. Black sagebrush often dominates the shrub layer. Wyoming big sagebrush, antelope bitterbrush and alderleaf mountain mahogany are

common shrub species. Bluebunch wheatgrass is the dominant herbaceous species with Indian ricegrass, Nevada bluegrass and other perennial grasses and forbs also commonly found in abundance. Cheatgrass, alyssum, various mustard species and other non-native species are present on the site and, under certain circumstances, may visually dominate the sites aspect. The primary disturbance mechanisms are the tree and shrub layer densities; the amount and kinds of invasive species present; weather fluctuations; and fire. The current potential state is still self-sustaining but may be losing its resistance to change due to the impact of disturbances with less resilience following those disturbances. Definitions: Current Potential State: Plant communities influenced by tree and shrub canopy density, long term weather fluctuations, and periodic fire. Invasive species are present in various amounts. Indicators: A community dominated by Utah juniper, black sagebrush and bluebunch wheatgrass. The density of the tree and shrub canopies determines the amount and composition of the other native and introduced grasses and forbs that may be present. Feedbacks: Natural fluctuations in weather patterns that allow for a self sustaining shrub and native grass community. Prolonged drought, more frequent fires, and/or other disturbances that may allow for the increase of invasive species. At-risk Community Phase: All communities are at risk when native plants are stressed and nutrients become available for invasive plants to increase. Trigger: A reduction of perennial grass and forb species combined with an increase of invasive plant species.

Community 2.1

Open Canopy - Utah Juniper/Black Sage/Bluebunch Wheatgrass/Invasive weed Community Phase.

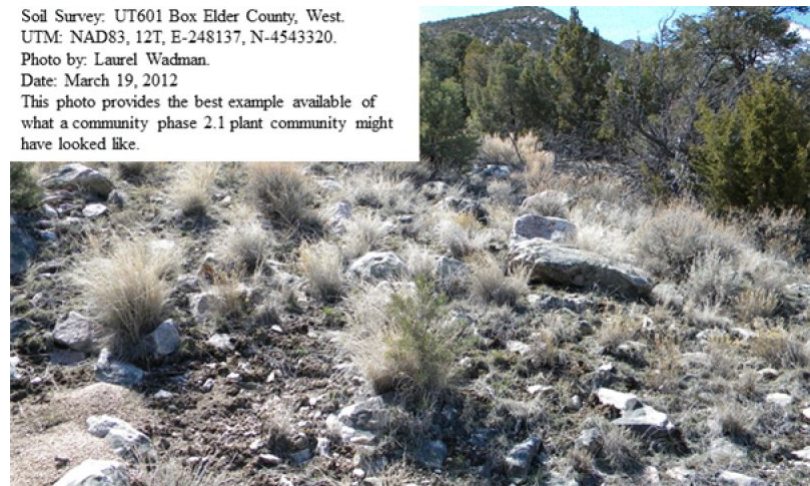


Figure 8. Community Phase 2.1

This community phase is characterized by an open canopy of Utah juniper and singleleaf or two-needle pinyon. Black sage, Wyoming big sagebrush, antelope bitterbrush and alderleaf mountain mahogany are common understory shrubs. Commonly occurring grasses and grasslikes include cheatgrass, bluebunch wheatgrass, Nevada bluegrass and Indian ricegrass. Non-native species are now present in the all plant communities and are expected to remain a permanent part of these communities. Air dry composition of this site is approximately 35 percent grasses, 10 percent forbs, and 30 percent shrubs and 25% trees. Bare ground is variable (2-50%) depending on biological crust cover, which is also variable (1-25%) and surface rock fragments (10-70%). Biological crusts can vary from sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to those dominated by lichen and moss pinnacles as well as cyanobacteria in the site interspaces.

Table 10. Ground cover

Tree foliar cover	10-20%
Shrub/vine/liana foliar cover	15-40%
Grass/grasslike foliar cover	10-30%
Forb foliar cover	3-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%

Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 11. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	—	—	—	—
>0.15 <= 0.3	—	—	—	—
>0.3 <= 0.6	—	35-45%	25-35%	0-10%
>0.6 <= 1.4	—	—	—	—
>1.4 <= 4	15-25%	—	—	—
>4 <= 12	—	—	—	—
>12 <= 24	—	—	—	—
>24 <= 37	—	—	—	—
>37	—	—	—	—

Community 2.2

Closed Canopy - Utah Juniper/Black Sagebrush/Invasive Weed Community Phase.

LOWMAN PLANTS: Utah juniper, black sage,
Bluebunch wheatgrass, few introduced grasses &
forbs.
Soil Survey: UT601 Box Elder County, West.
UTM: NAD83, 12T, E-409559, N-4638191.
Photo by: Laurel Wadman.
Date: November 23, 2012
This photo provides the best example available of
what a community phase 2.2 plant community might
have looked like.



Figure 9. Community Phase 2.2

This community phase is characterized by a closed canopy of Utah juniper and singleleaf or two-needle pinyon. Black sagebrush, Wyoming big sagebrush, antelope bitterbrush and alderleaf mountain mahogany are common understory shrubs. Cheatgrass, bluebunch wheatgrass, Nevada bluegrass and Indian ricegrass are present in the herbaceous layer but are much reduced. Non-native species are now present in the all plant communities and are expected to remain a permanent part of these communities. Air dry composition of this site is approximately 20 percent grasses, 10 percent forbs, and 30 percent shrubs and 40% trees. Bare ground is variable (2-50%) depending on biological crust cover, which is also variable (1-25%) and surface rock fragments (10-70%). Biological crusts can vary from sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to those dominated by lichen and moss pinnacles as well as cyanobacteria in the site interspaces.

Table 12. Ground cover

Tree foliar cover	10-20%
Shrub/vine/liana foliar cover	15-40%

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

Table 13. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	—	—	—	—
>0.15 <= 0.3	—	—	—	—
>0.3 <= 0.6	—	35-45%	25-35%	0-10%
>0.6 <= 1.4	—	—	—	—
>1.4 <= 4	15-25%	—	—	—
>4 <= 12	—	—	—	—
>12 <= 24	—	—	—	—
>24 <= 37	—	—	—	—
>37	—	—	—	—

Pathway 2.1A Community 2.1 to 2.2

Field Station: UT001 Box Elder County, Utah
UTM: NAD83, 12T, E-248137, N-4541320
Photo by: Laurel Nishize

Date: March 19, 2012
This photo provides the best example available of
what a community phase 2.1 plant community might
have looked like.



**Open Canopy - Utah
Juniper/Black Sage/Bluebunch
Wheatgrass/Invasive weed
Community Phase.**

UTM: NAD83, 12T, E-248137, N-4541320
Photo by: Laurel Nishize

Date: November 21, 2012
This photo provides the best example available of
what a community phase 2.2 plant community might
have looked like.



**Closed Canopy - Utah
Juniper/Black
Sagebrush/Invasive Weed
Community Phase.**

This community pathway occurs when long-term drought and/or extended periods without fire allows canopies of Utah juniper and singleleaf pinyon to significantly increase. This closed canopy causes understory vegetation to be reduced or nearly eliminated from the site. Drought and/or improper livestock grazing alone, or in combination, can also reduce native perennial grass production, and eventually eliminate them from the system. Non-native annuals may increase during these periods.

Pathway 2.2A Community 2.2 to 2.1



Closed Canopy - Utah Juniper/Black Sagebrush/Invasive Weed Community Phase.

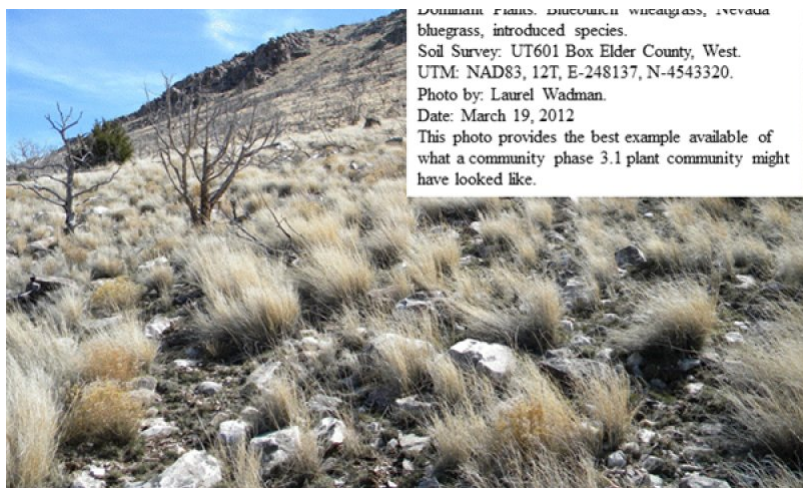
Open Canopy - Utah Juniper/Black Sage/Bluebunch Wheatgrass/Invasive weed Community Phase.

This community pathway occurs when weather patterns return to within normal ranges and some level of fire reduces Utah juniper and singleleaf pinyon, significantly opening the sites canopy. Insect damage on singleleaf pinyon can also cause it to be reduced on this site. This more open canopy allows understory vegetation to increase and under some circumstances, flourish on the site. Proper livestock grazing during these periods can facilitate this process.

State 3 Fire Disturbance State.

The Fire Disturbed State occurs when a recent crown fire has removed most of the Utah juniper and any pinyon trees present from the site. Black sagebrush and other fire sensitive species have also been removed or significantly reduced. The site has a herbaceous aspect with both native and non-native grass and forb species present. Fire resistant shrubs are typically recovering and are increasing in the communities associated with this state. The herbaceous vegetation communities associated with this state can be highly variable depending on the before fire conditions. Typically however, bluebunch wheatgrass is the dominant herbaceous species with Indian ricegrass, Nevada bluegrass and other perennial grasses and forbs commonly found. Cheatgrass, alyssum, various mustard species and other non-native species are often present on the site and, under certain circumstances, may visually dominate the sites aspect. The primary disturbance mechanisms intensity of the fire; the amount and kinds of native and non-native species present; weather fluctuations; and time since the fire occurred. This state may be losing self-sustainability or may be increasing its resistance to degradation due to the impact of fire and the before fire conditions. Definitions: Current Potential State: Plant communities influenced by recent crown fire and its impact on the tree and shrub canopy density, long term weather fluctuations, time since the fire occurred. Invasive species are present in various amounts. Indicators: A community dominated by herbaceous species. The kind and amounts of native and introduced grasses and forbs that may be present. Feedbacks: Natural fluctuations in weather patterns that allow for a self sustaining shrub and native grass community to develop. Prolonged drought, more frequent fires, and/or other disturbances that may allow for the increase of invasive species. At-risk Community Phase: All communities are at risk when native plants are stressed and nutrients become available for invasive plants to increase. Annual grasses and forbs that may shorten the sites fire period. Trigger: A reduction of perennial grass and forb species combined with an increase of invasive plant species.

Community 3.1 Recent Crown Fire Community Phase.



COMMUNITY PHASE 3.1 RECENT CROWN FIRE, NEVADA bluegrass, introduced species.
Soil Survey: UT601 Box Elder County, West.
UTM: NAD83, 12T, E-248137, N-4543320.
Photo by: Laurel Wadman.
Date: March 19, 2012
This photo provides the best example available of what a community phase 3.1 plant community might have looked like.

Figure 10. Community Phase 3.1

This community phase is created after fire has recently (typically 1 to 5 years) removed most of the Utah juniper and

singleleaf or two-needle pinyon from the site. Black sage, Wyoming big sagebrush, antelope bitterbrush and alderleaf mountain mahogany have also been reduced but may be slowly recovering. Commonly occurring grasses and grasslikes include cheatgrass, bluebunch wheatgrass, Nevada bluegrass and Indian ricegrass. Non-native species are present in the all plant communities and are expected to remain a permanent part and potentially dominate these communities. Air dry composition of this site is approximately 60 percent grasses, 10 percent forbs, and 20 percent shrubs and 10% trees. Bare ground is variable (2-50%) depending on biological crust cover, which is also variable (1-25%) and surface rock fragments (10-70%). Biological crusts can vary from sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to those dominated by lichen and moss pinnacles as well as cyanobacteria in the site interspaces.

Table 14. Ground cover

Tree foliar cover	10-20%
Shrub/vine/liana foliar cover	15-40%
Grass/grasslike foliar cover	10-30%
Forb foliar cover	3-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 15. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	—	—	—	—
>0.15 <= 0.3	—	—	—	—
>0.3 <= 0.6	—	35-45%	25-35%	0-10%
>0.6 <= 1.4	—	—	—	—
>1.4 <= 4	15-25%	—	—	—
>4 <= 12	—	—	—	—
>12 <= 24	—	—	—	—
>24 <= 37	—	—	—	—
>37	—	—	—	—

Transition T1A

State 1 to 2

This transitional pathway occurs when any combination of improper livestock grazing, prolonged drought or other disturbance causes the perennial herbaceous community to become significantly reduced allowing non-native species such as cheatgrass, alysium, Russian thistle and other invasive weeds to become established. Broom snakeweed may also increase during this time. Once invasive species occupy the site, a threshold has been crossed. Cheatgrass, however, has been known to become established in healthy communities on this site.

Transition T2A

State 2 to 3

This transitional pathway occurs when a major fire removes nearly all the Utah juniper and any pinyon present from the site. A combination of improper livestock grazing, prolonged drought or other disturbance can slow the expected recovery of the perennial herbaceous community, allowing non-native species such as cheatgrass, alysium, russian thistle and other invasive weeds to flourish. Broom snakeweed may also increase during this time. Fire tolerant shrubs will often recover quickly during these periods.

Additional community tables

Table 16. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	Primary Grasses			140–252	
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	62–135	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	17–67	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	17–67	–
4	Secondary Grasses			28–62	
	Grass, perennial	2GP	<i>Grass, perennial</i>	6–22	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	1–22	–
	Geyer's sedge	CAGE2	<i>Carex geyeri</i>	1–22	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	1–22	–
	needle and thread	HECO26	<i>Hesperostipa comata</i>	1–22	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	1–22	–
	saline wildrye	LESAS	<i>Leymus salinus ssp. salinus</i>	1–22	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	1–22	–
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	1–22	–
	muttongrass	POFE	<i>Poa fendleriana</i>	1–22	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	1–22	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	1–22	–
Forb					
2	Forbs			39–67	
	Forb, annual	2FA	<i>Forb, annual</i>	8–22	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	8–22	–
	littleleaf pussytoes	ANMI3	<i>Antennaria microphylla</i>	1–22	–
	Fendler's sandwort	ARFE3	<i>Arenaria fendleri</i>	1–22	–
	freckled milkvetch	ASLE8	<i>Astragalus lentiginosus</i>	1–22	–
	Hooker's balsamroot	BAHO	<i>Balsamorhiza hookeri</i>	1–22	–
	Wyoming Indian paintbrush	CALI4	<i>Castilleja linariifolia</i>	1–22	–
	sego lily	CANU3	<i>Calochortus nuttallii</i>	1–22	–
	Douglas' dustymaiden	CHDO	<i>Chaenactis douglasii</i>	1–22	–
	maiden blue eyed Mary	COPA3	<i>Collinsia parviflora</i>	1–22	–
	tapertip hawksbeard	CRAC2	<i>Crepis acuminata</i>	1–22	–
	roundspike cryptantha	CRHU2	<i>Cryptantha humilis</i>	1–22	–
	cushion buckwheat	EROV	<i>Eriogonum ovalifolium</i>	1–22	–
	shaggy fleabane	ERPU2	<i>Erigeron pumilus</i>	1–22	–

	ballhead ipomopsis	IPCOC3	<i>Ipomopsis congesta</i> ssp. <i>congesta</i>	1–22	–
	Bonneville pea	LABR	<i>Lathyrus brachycalyx</i>	1–22	–
	hoary tansyaster	MACA2	<i>Machaeranthera canescens</i>	1–22	–
	low beardtongue	PEHU	<i>Penstemon humilis</i>	1–22	–
	rock goldenrod	PEPU7	<i>Petradoria pumila</i>	1–22	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	1–22	–
	longleaf phlox	PHLO2	<i>Phlox longifolia</i>	1–22	–
	gooseberryleaf globemallow	SPGR2	<i>Sphaeralcea grossulariifolia</i>	1–22	–
	Pacific aster	SYCHC	<i>Symphyotrichum chilense</i> var. <i>chilense</i>	1–22	–
Shrub/Vine					
3	Primary Shrubs			78–168	
	black sagebrush	ARNO4	<i>Artemisia nova</i>	50–168	–
	alderleaf mountain mahogany	CEMO2	<i>Cercocarpus montanus</i>	11–67	–
	antelope bitterbrush	PUTR2	<i>Purshia tridentata</i>	11–67	–
5	Secondary Shrubs			22–45	
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0–34	–
	Utah serviceberry	AMUT	<i>Amelanchier utahensis</i>	0–34	–
	desert ceanothus	CEGR	<i>Ceanothus greggii</i>	0–34	–
	littleleaf mountain mahogany	CEIN7	<i>Cercocarpus intricatus</i>	0–34	–
	curl-leaf mountain mahogany	CELE3	<i>Cercocarpus ledifolius</i>	0–34	–
	yellow rabbitbrush	CHV18	<i>Chrysothamnus viscidiflorus</i>	0–34	–
	Nevada jointfir	EPNE	<i>Ephedra nevadensis</i>	0–34	–
	slender buckwheat	ERMI4	<i>Eriogonum microthecum</i>	0–34	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0–34	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–34	–
	Mexican cliffrose	PUME	<i>Purshia mexicana</i>	0–34	–
	mountain snowberry	SYOR2	<i>Symphoricarpos oreophilus</i>	0–34	–
Tree					
6	Trees			112–179	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	56–135	–
	twoneedle pinyon	PIED	<i>Pinus edulis</i>	22–56	–
	singleleaf pinyon	PIMO	<i>Pinus monophylla</i>	22–56	–

Animal community

--Wildlife Interpretation--

This ecological site, in its reference state, produces significant amounts of nutritious forage that was utilized by native herbivores including Rocky Mountain elk, mule deer and pronghorn antelope who lived here along with their associated predators. Although much of this site is presently different from the reference state, it is still very important as wildlife habitat. Other wildlife commonly observed using this site include mountain lions, rabbits, coyotes, badgers, and red fox's.

This site also provides habitat to raptors and other bird species including golden eagles, red-tailed hawks, ferruginous hawks, and several species of owls. Ringneck pheasant, sage grouse, chukars, and California quail are also commonly found.

--Grazing Interpretations--

This site provides good spring, fall, and winter grazing conditions for domestic livestock due to its accessibility and its supply of nutritious forage. The herbaceous plant community is primarily grasses, with the majority of canopy cover being attributed to bluebunch wheatgrass and Nevada bluegrass. Improper livestock grazing can cause these species to decrease while annual forbs, black sagebrush and rabbitbrush species increase.

When this site is stressed, cheatgrass, alyssum, Russian thistle and halogeton are likely to invade.

Hydrological functions

The soils associated with this ecological site are generally in Hydrologic Soil Group D due to the shallow depth (NRCS National Engineering Handbook). Runoff curves range from 80 to 89. These soils are saturated quickly due to high infiltration rates and shallow depth; once soils are saturated, run off potential is high. 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. Heavy grazing can alter the hydrology by decreasing plant cover and increasing bare ground. Fire can also affect hydrology, but its affect is variable. Fire intensity, fuel type, soil, climate, and topography can each have different influences. Fires can increase areas of bare ground and hydrophobic layers that reduce infiltration and increase runoff (National Range and Pasture Handbook, 2003).

Recreational uses

Recreation activities include aesthetic value and good opportunities for hiking, horseback riding, hunting, and off-road vehicle use. Due to the high erosion potential after a surface disturbance, care should be taken when planning recreational activities. Camp sites are usually limited due to lack of sheltering trees or rock outcrop.

Wood products

Utah juniper and singleleaf and/or two-needle pinyon can provide firewood and fence post where growth is sufficient and regulations allow for such use. The pinyon trees are a good source of pine-nuts.

Other products

None.

Other information

--Poisonous and Toxic Plant Communities--

Toxic plants associated with this site include woolly locoweed, broom snakeweed, and Russian thistle.

Woolly locoweed is toxic to all classes of livestock and wildlife. Locoweed is palatable and has similar nutrient value to alfalfa, which may cause animals to consume it even when other forage is available. Locoweed contains swainsonine (indolizidine 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 (Knight and Walter, 2001).

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 rain storm, during a drought, during periods with cool/cloudy days, and when growing on soils high in

nitrogen and low in sulfur and phosphorus. Nitrate collects in the 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--

Generally, as ecological conditions deteriorate and perennial vegetation decreases due to disturbance (fire, drought, off road vehicle overuse, erosion, etc.) annual forbs and grasses may invade the site. Of particular concern in semi-arid environments are annual invaders including cheatgrass, Russian thistle, alyssum 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 is difficult, but suppression may be possible.

On well developed Utah juniper and singleleaf pinyon communities, soils are often completely occupied by lateral roots which can inhibit the herbaceous understory as well as limit annual invasive species. Once these sites are disturbed and pinyon-juniper communities begin to decline, their increase or invasion is possible.

--Fire Ecology--

The ability for an ecological site to carry fire depends primarily on its' present fuel load and plant moisture content. Sites with small fuel loads will burn more slowly and less intensely than sites with large fuel loads. The Utah juniper and singleleaf and/or two-needle pinyon communities growing on shallow soils are quite unique. These trees can support stand-replacing fires, though historically, fires were likely a mixture of surface and crown fires with intensities and frequencies dependent on site productivity. Most research agrees that historic fire return intervals are at a minimum 100 years, indicating that fire may have not played an important role in short term community dynamics. Fires are more common when trees are stressed or dead due to drought and/or beetle infestations. Pinyon-juniper stands reestablish either by seeds dispersed from adjacent unburned patches or by unburned seeds found at the burn site. Continuous (every 20-40 years) burning of these ecological sites can result in shrub dominated communities, due to the relatively fast recovery of shrubs when compared to trees. If invasive annual grasses are allowed to establish, fires may become more frequent, inhibiting the site's ability to recover.

Type locality

Location 1: Juab County, UT	
Township/Range/Section	T15S R2W S36
General legal description	Map 87, P-6, PF14-4 Warm Springs Soil Survey, Needle Range- Beaver, Co. SE ¼ of the SW ¼, Section 36, Township 15S, Range 2W

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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)	Jack Alexander, Range Specialist, Synergy Resource Solutions, Inc.; Julia Kluck, Soil Scientist, Synergy Resource Solutions, Inc.; Shane Green, State Range Specialist, Utah NRCS; V. Keith Wadman, Great Basin Natural Resources Consulting, LLC.
Contact for lead author	Shane Green, Shane.Green@ut.usda.gov
Date	02/09/2010
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills few. This site is subject to rilling even in reference condition due to slope, erodible soils, and percent bare ground. Rill development may increase following large storm events, but should begin to heal during the following growing season. Frost heaving will accelerate recovery. Rill development may increase when run

inflow enters site from other sites that produce large amounts of runoff (i.e. steeper sites, slickrock, rock outcrop).

2. **Presence of water flow patterns:** Water flow patterns are common. Some are long (15-20'). They are generally very widely spaced (about 20-30' apart). Flow patterns occur in low places associated with microtopography commonly occurring on this site.
-

3. **Number and height of erosional pedestals or terracettes:** Plants may have small pedestals (1-3") where they are adjacent to water flow patterns, but without exposed roots. Terracettes should be few and stable. Terracettes should be small (1-3") and show little sign of active erosion. Some plants may appear to have a pedestal but rather than be formed by erosion, the only place litter accumulates and soil collects is at plant bases forming the appearance of a pedestal.

Well-developed biological crusts may appear pedestalled, but are actually a characteristic of the crust formation. Some plants may appear to have a pedestal but rather than be formed by erosion, the only place litter accumulates and soil collects is at plant bases forming the appearance of a pedestal.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 20-40% bare ground (soil with no protection from raindrop impact). Herbaceous communities are most likely to have lower values. As species composition by shrubs increases, bare ground is likely to increase. Poorly developed biological soil crust that is susceptible to raindrop splash erosion should be recorded as bare ground. Very few if any bare spaces of greater than 1 square foot.
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5. **Number of gullies and erosion associated with gullies:** No gullies present on site. A very few gullies may be present in landscape settings where they transport runoff from areas of greater water flow such as exposed bedrock. These gullies will be limited to slopes exceeding 10% and adjacent to sites where this runoff accumulation occurs. Any gullies present should show little sign of accelerated erosion and should be stabilized with perennial vegetation.
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6. **Extent of wind scoured, blowouts and/or depositional areas:** Very minor evidence of active wind-generated soil movement. Wind scoured (blowouts) and depositional areas are rarely present. If present they have muted features and are mostly stabilized with vegetation and/or biological crust. Gravel or desert pavement protects the site from wind scour.
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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 and wind movement. Very minor litter removal may occur in flow patterns and rills with deposition occurring at points of obstruction. The majority of litter accumulates at the base of plants. Some leaves, stems, and small twigs may accumulate in soil depressions adjacent to plants. Woody stems are not likely to move. On steep slopes (>30%), litter will move downhill to next obstruction.
-

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 an erosion rating of 4 or 5 under plant canopies and a rating of 3 to 4 in the interspaces with an average rating of 4 using the soil stability kit test.
-

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** This description is based on the modal soil (Amtoft ST-L, Moist, soil survey area: 608, Fairfield-Nephi). This site has 8 correlated soils, resulting in variation of each of these attributes. Unless working on a location with the modal soil, it is critical to supplement this description with the soil-specific information from the published soil survey.

Soil surface horizon is typically 8 inches deep. Structure is typically weak medium subangular blocky. Color is typically pale brown (10YR 6/3), brown (10YR 4/3) moist. An ochric horizon extends to a depth of 8 inches. An ochric horizon typically extends to a depth of 2 to 10 inches. The ochric horizon is a surface horizon lacking fine stratification and which is either light colored, or thin, or has a low organic carbon content, or is massive and (very) hard when dry. 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.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Vascular plants and any well-developed biological soil crusts (where present) 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. Crowns of trees and accumulating litter at base of trees appear to create a micro-topography that may enhance development of water flow patterns below the drip line of the canopy. Significant increases in pinyon-juniper canopy reduces understory vegetation and increases runoff.
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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. Lithic contact (the boundary with hard bedrock) may occur at about 17 inches. Naturally occurring soil horizons may be harder than the surface because of an accumulation of 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: Trees (Utah juniper/singleleaf pinyon) > Sprouting shrubs (alderleaf mountain mahogany, black sage) > Cool season perennial grasses (bluebunch wheatgrass, Nevada bluegrass, Indian ricegrass).

Sub-dominant: Sprouting shrubs, (antelope bitterbrush, green rabbitbrush) > Perennial Grasses, (prairie junegrass, muttongrass) > Perennial Forbs (gooseberryleaf globemallow).

Other: Biological soil crust is variable in its expression where present on this site and is measured as a component of ground cover. Forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

Additional: In the northern portion of the MLRA cool-season perennial grasses (Indian ricegrass, needle and thread) dominate. In the southernmost portion of the MLRA warm-season perennial grasses (galleta, sand dropseed) dominate. The two groups share dominance in the middle portion of the MLRA.

Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state (e.g. crested wheatgrass and Russian wildrye may substitute for mid stature cool season perennial native bunchgrasses.). Biological soil crust is variable in its expression on this site and is measured as a component of ground cover. Forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

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 recent mortality or decadence apparent in either the shrubs or grasses. Some bunchgrass and shrub mortality may occur during severe droughts, particularly on the shallower and coarser soils associated with this site.
-
14. **Average percent litter cover (%) and depth (in):** Litter cover includes litter under plants. Most litter will be fine litter. Depth should be 1-2 leaf thickness in the interspaces and up to 1/2" under canopies. Litter cover may increase to 20-30% following years with favorable growing conditions. Excess litter may accumulate in absence of disturbance. Vegetative production may be reduced if litter cover exceeds 40%.
-
15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Annual production in air-dry herbage should be approximately 500#/acre on an average year, but could range from 300 to 800#/acre during periods of prolonged drought or above average precipitation. Even the most stable communities exhibit a range of production values. Production will vary between communities and across the MRLA. Refer to the community descriptions in the ESD. Production will differ across the MLRA due to the naturally occurring variability in weather, soils, and aspect. The biological processes on this site are complex; therefore, representative values are presented in a land management context.
-
16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Cheatgrass, alyssum, mustard species, and annual forbs.
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17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce sexually or asexually, except in drought years. Density of plants indicates that plants reproduce at level sufficient to fill available resource. Within capability of site there are no restrictions on seed or vegetative reproductive capacity.
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